

Market potential report for cultivated seaweeds in existing seaweed food markets

Interreg 2 Seas Mers Zeeën European Regional Development Fund

Mountainview

as part of the Interreg 2 seas ValgOrize project, January 2021

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Preface

This report is part of the Interreg 2 seas project ValgOrize. In it, North Sea Farms are leading the study on valorisation aimed at supporting and accelerating the development of a technically and commercially viable seaweed supply chain for food applications, and the development of a roadmap towards sustainable production of micro-algae for food applications.

The project is coordinated by Flanders Research Institute for Agriculture and Fisheries (BE). It includes 10 other partners among which Flemish Institute for Technological Research (BE), Royal Netherlands Institute for Sea Research (NL), HZ University of Applied Sciences (NL), Zeewaar BV (NL), University of Littoral Côte d'Opale (FR), University of Lille (FR), University of Greenwich (UK), Marine Biological Association of the United Kingdom (UK) and Nausicaa (FR). The ValgOrize project runs for a period of 4 years. It started in 2018 and is funded by Europe via the Interreg 2 Seas Programme. For more information about the project, visit <u>https://www.interreg2seas.eu/en/ValgOrize</u>

This report is a co-production of Anke Bergmans from Mountainview Research and several team members of North Sea Farmers; Lotte Bronswijk, Marlies Draisma, Eef Brouwers, Femke Prins and Koen van Swam. As a community of businesses with a passion for seaweed, North Sea Farmers work towards positive climate impact. By growing a sustainable seaweed sector, we aim to improve biodiversity, reduce carbon emissions and be part of the circular economy. We are a non-profit organisation with an ANBI status. For more information, visit <u>https://www.northseafarmers.org/</u>

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Disclaimer

All data that has been collected is used for purposes of the Interreg 2 seas ValgOrize project and only to the context it is necessary to fulfil those purposes. North Sea Farmers attempts to work only with reliable and accurate data. However, North Sea Farmers do not give any warranty or other assurance to the content of the material appearing in this report. Furthermore, no rights can be derived from this publication.

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0.1 About ValgOrize

This report is part of the Interreg ValgOrize project for the European Union. The project aims at enhancing innovation in the algal sector, by creating an interdisciplinary platform for sustainable production of flavoursome, high quality algal foods that meet the requirements of the European market. The project comprises of 6 work packages:

- Work Package 1: Macroalgae cultivation; optimized macroalgal growth conditions (quality, reproducibility and reliability) for best food parameters.
- Work Package 2: Microalgae cultivation; optimization of cultivation methods for maximal productivity and yield of biochemicals and markers of taste.
- Work Package 3: Acceptance of the produced micro/macroalgal biomass and algae products for consumption; assessing algal safety, quality (as food product), optimal taste, product development, sustainable/zero waste.
- Work package 4: Valorisation; support and accelerate the development of a technically and commercially viable seaweed supply chain for food applications, and the development of a roadmap towards sustainable production of micro-algae for food applications.
- Work Package 5: Project management
- Work package 6: Communication





0.2 Work package 4

This report is part of Work Package 4: Valorisation; support and accelerate the development of a technically and commercially viable seaweed supply chain for food applications, and the development of a roadmap towards sustainable production of micro-algae for food applications. Within the work package, the results and insights as obtained in WP1, 2 and WP3 will be valorised. This specific report constitutes the required deliverable D4.2.1 'Market potential report for cultivated seaweeds in existing seaweed food markets' as part of activity A4.2 'Market potential report for cultivated seaweeds in existing and future seaweed food markets'.

North Sea Farmers are responsible for Work Package 4. Furthermore, Flanders Research Institute for Agriculture and Fisheries, Flemish Institute for Technological Research, University of Greenwich and Zeewaar are involved in the Work Package. And North Sea Farmers wants to thank all other partners and observer partners who contributed and shared their insights in various interviews for this report.



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0.3 Introduction

Unfortunately, in Europe and the Netherlands, the availability of quantified and accurate seaweed market data is limited. Monitoring and reporting processes are not (yet) in place in this young sector. Reports from the Food and Agriculture Organization are not up to date and do not cover the entire European Union. Most of the time, other studies build upon these data. This makes it difficult to assess the barriers, drivers and overall progress of the sector. North Sea Farmers are convinced that reliable market data is essential for the further development, growth and professionalisation of the seaweed sector in Europe and the Netherlands.

Scope and objective

The overall objective of this report is to assess the market potential for seaweeds in existing and future food markets. Furthermore, North Sea Farmers aims to determine to what extent these markets could be supplied with locally cultivated seaweed; being a sustainable, short chain supply instead of imports.

Research questions

- What is the market potential for cultivated seaweeds in the identified existing and potential seaweed for food markets?
- What are the key success factors for transitioning to a sustainable seaweed supply in Europe?





0.4 Research design

To get a complete overview of the market potential for local cultivated seaweed as food, information was gathered on the following topics:



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Information was gathered by combining qualitative and quantitative methods from various sources:



Desk Research

Sources on market information and trends in seaweed and food markets

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Experts interviews

42 interviews with professionals in the food sector



Community survey on market estimation

60 respondents from the ValgOrize network





0.6 Scope

	IN SCOPE	OUT OF SCOPE
TYPE	seaweed	micro-algae
APPLICATION	food products, additives (hydrocolloids)	feed, biostimulants, pharma,nutraceuticals, cosmetics, biofuels, bio-packaging
MARKET	main focus: 2 seas region: United Kingdom, The Netherlands, Belgium, France secundairy focus: other European countries	markets outside of Europe

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1. Global seaweed production & market



1.0 In this chapter

The global seaweed production & market explained:

- Summary
- Global seaweed production
 - Global seaweed production per type
 - Most produced species globally
 - Origin of the seaweed
 - Ratio cultivation and wild harvest
- Global seaweed market
 - Global seaweed market for human consumption

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- Application: food products
- Application: hydrocolloids
- In sum: key takeaways

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1.1 Global seaweed production & market - summary

Global production of seaweed



- 32,4 million tonnes (wet weight, 2018)
- 53% red seaweeds
- 46% brown seaweeds
- 1% green seaweeds



Origin of seaweed

95% of seaweed comes from Asian coutries 97% is is obtained through cultivation

Global market for seaweed



\$ 13.3 billion (€ 10.9 billion) total seaweed market (2019)

- 77% seaweed for human consumption
- \$ 10.2 billion (€ 8.4 billion) seaweed for human consumption



Largest market share

- Asia 61%
- North-America 19%
- Europe 10%
- Other 10%



Growth

Expected yearly growth: between 7% and 12%





Sources: 10, 20, 23, 33, 34, 35, 36, 37





1.2 Global seaweed production

Global production of seaweed 2000-2018

The seaweed production has tripled since 2000, but growth seems to flatten since 2015. This is caused by a stabilization of the production of tropical species in South-East Asian countries.

On the other hand, farming of coldwater species is still in its infancy and rising. North-America, Europe and South America are exploring the possibilities of local cultivated seaweeds with known and new species which can open new markets and opportunities.



Volume of produced seaweed in million tonnes (wet weight)

Sources: 10, 20, 33







1.2.1 Global seaweed production per type

Global production of seaweed, specified for red, brown and green seaweeds



Red seaweeds are responsible for most of the growth and since 2015 more red seaweeds were produced than brown seaweeds. This is mostly due to a major increase in the carrageenan producing species (in particular *Eucheuma*) and the agar producing species (*Gracilaria*).

Sources: 10, 20







1.2.2 Most produced species globally

Eight species make up for 99% of the global seaweed production.

Red seaweeds cover just over half of the global produced volumes, brown seaweeds make up for the other part. Green seaweeds are a niche, with less than 1% of the seaweed market.

Eucheuma sp.(a source of carrageenan) and *Saccharina japonica*, known as Kombu, are the most produced species.

Seaweed production by species



Sources: 10







1.2.3 Origin of seaweed

Almost all seaweeds on the global market are produced in Asia with China and Indonesia as main producers.



Seaweed production by country (value in USD)

Seaweed production by country (volume in tonnes)



China Indonesia Japan Republic of Korea Phillippines other

China Indonesia Japan Repulic of Korea Phillippines other

Sources: 33

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1.2.4 Ratio cultivation and wild harvest

World wide: 97% of the seaweed production is obtained by cultivation.

Production of seaweed cultivated and wild harvested – world market 2018

Production of seaweed worldwide

32.4 million tonnes (fresh weight, 2018)

- 31.4 tonnes of seaweed were cultivated through aquaculture ٠ (97%)
- 0.9 tonnes were wild harvested (3%) ٠



Sources: 20, 37

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1.3 Global seaweed market

The global market for seaweed is estimated at \$ 13.3 billion (€ 10.9 billion) in 2019.

The regions with the largest market share are:

- Asia 61%
- North-America 19%
- Europe 10%
- Other 10%

The global market for seaweed is expected to grow yearly between 7% and 12%

Global seaweed markets share per region (in %)





Sources: 20, 23, 36





1.3.1 Global seaweed market for human consumption



The global seaweed market is estimated at \$ 13.3 billion (€ 10.9 billion) in 2019. Thereof, 77% is used for human consumption.

The global seaweed market for human consumption is estimated at a value of 10,2 billion dollar (8.4 billion euro) in 2018. The use of seaweed for food products is by far the largest part of this market. Hydrocolloids cover approximately 11% of the market.





Sources: 10, 20, 23, 34, 35

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1.3.2 Application: Food products

In Asia seaweed has been a common part of the everyday diet for centuries. Since Asian cuisine is getting more and more known in the rest of the world, consumers from western countries are getting used to seaweed as food as well.

Currently three species dominate the edible seaweed market: Kombu (*Saccharina* and *Laminaria*), Nori (*Porphyra*), and Wakame (*Undaria*). However, there are many other seaweed species that can enter the food product market which can provide diversification and unlock new markets.

The food products market opportunities for seaweed are very divers and vary from a small percentage of seaweed in a product to 100% seaweed products.



Kombu

35% of produced volume



Nori

9% of produced volume



Wakame

7% of produced volume



Sources: 10





1.3.3 Application: Hydrocolloids

Global market for seaweed hydrocolloids in million dollars (million euro's) 2018



Hydrocolloids are used in many types of food, specifically for their thickening and gelling properties. Hydrocolloids are for example used in dairy products, candy, bakery, beverages, processed meat products, jams and sauces.

Of the total hydrocolloids market, approximatly 10% comes from seaweed. Carrageenan is the most used seaweed hydrocolloid, followed by alginates and agar.

Seaweed hydrocolloids are produced from an extensive variety of seaweed species from around the world, with China and Indonesia being the largest producers.

The hydrocolloids market is a mature market that expects a steady growth of approximatly 5% yearly.

Sources: 34, 35







1.9 In Sum: Key takeaways



The global seaweed market is estimated on \$13,3 billion value and 32,4 million tonnes (fresh weight).



77% of the global seaweed market is used for human consumption. The 2 main applications of seaweed for human consumption are food products and hydrocolloids.



China is the main producing country, followed by Indonesia, Japan and Republic of Korea. These countries make up for 95% of the total global production.



97% of the world wide seaweed is obtained by cultivation.



The global seaweed sector expects a yearly growth between 7% and 12%.







2. European seaweed market overview

2.0 In this chapter



The European seaweed market explained:

- Summary
- European seaweed production
- European seaweed market for human consumption
 - Application: food products
 - Application: hydrocolloids
- In sum: key takeaways







2.1 European seaweed market – summary

Production of seaweed in Europe



300,000 tonnes (fresh weight, 2018)

Origin of seaweed in Europe



1,450 tonnes of seaweed were obtained through cultivation (0,5%)

294,744 tonnes were harvested from the wild (99,5%)

Market of seaweed for human consumption in Europe



\$ 1.02 billion (€ 0.84 billion)10% of the global market (2018)

Sources: 19, 20, 33, 36







2.2 European seaweed production

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The seaweed cultivation in Europe is still in start-up phase. The most recent numbers from 2015 show that less than 1% of the European seaweed supply is obtained through cultivation.

Production of seaweed in Europe

300,000 tonnes (fresh weight, 2015)

- 1,450 tonnes of seaweed were obtained through cultivation (0,5%)
- 294,744 tonnes were harvested from the wild (99,5%)

Europe produces less than 1% of the global production volume of seaweed.

Ratio cultivated and wild harvested seaweed in Europe (2015)



cultivated harvested

Sources: 19, 33



2.3 European seaweed market for human consumption



The European seaweed market for human consumption is estimated at a value of 1.02 billion dollar in 2018. This is 10% of the global market of seaweed for human consumption. Three quarters of this market consist of red seaweeds.

\$ 1.02 billion dollar (€ 0.84 billion) seaweed for human consumption



Sources: 1, 2, 29, 31, 32, 36





2.3.1 Application: food products

- In Europe, seaweed is not only applied to Asian foods, but it is extensively applied in a wide range of food products. For example as a source of umami, salt replacement, flavour enhancer, alternative (plant-based) source of protein, or sustainable alternative ingredient.
- European entrepreneurs are very innovative when it comes to the development of new seaweed products, to meet the demands of European consumers.
- In food products, in particular a wide range of brown seaweed species are being used.

Most important seaweed species for the European food product market (text colour indicates the colour of the seaweed species):

- Atlantic wakame/ Winged kelp Alaria esculenta
- Rock weed/ Knotted wrack Ascophyllum nodosum
- Irish moss Chondrus crispus
- Bladderwrack Fucus vesculosus
- Slender wart weed Gracilaria sp.
- Sea spaghetti Himanthalia elongata
- Oarweed Laminaria digitata
- Dulse Palmaria palmata
- Nori/ Purple laver/ Laverbread Porphyra sp.
- Royal Kombu/ Sugar kelp Saccharina latissima
- Sea lettuce Ulva sp.
- Wakame Undaria pinnatifida



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2.3.2 Application: hydrocolloids

- France, Portugal and Spain are the main producers of seaweed hydrocolloids in Europe.
- The price of seaweed hydrocolloids produced in Europe is generally higher than those produced in Asia, but European hydrocolloids are perceived to provide higher quality.
- The vast majority of seaweed hydrocolloid production takes place outside Europe (in Indonesia & China), which is why most seaweed hydrocolloids for the European market are imported.
- European demand for hydrocolloids is driven by increasing sales of processed and packaged foods, as well as organic and vegan products (carrageenan and agar are being used in plant-based milks and as a gelatine substitute in vegan products)
- Germany, Spain, the UK, France, the Netherlands and Belgium are the leading importers of seaweed hydrocolloids in Europe.

Most important seaweed species for European hydrocolloid production (text colour indicates the colour of the seaweed species):

- Agar: Gracilaria sp. & Gelidium sp.
- Alginate: Ascophyllum nodosum, & Laminaria sp.
- Carrageenan: Chondrus crispus

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Sources: 6, 16

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2.4 In sum: Key takeaways





European seaweed market is estimated at 1.02 billion dollars (€ 0.84 billion)



Production of European seaweed is marginal compared to the world market. Europe produces 300.000 tonnes, which is less than 1% of the global volume of 32.4 million tonnes.



In Europe 99% of the seaweed comes from wild harvesting, this is contrary to the global market where 97% comes from cultivation



There are numerous opportunities in European food product market. On the other hand, the hydrocolloids market is more saturated.







3. Potential of European cultivated seaweed for the food market



3.0 In this chapter

The potential of the European seaweed market for food explained:

- Potential EU seaweed market for human consumption
- Potential local (EU) cultivated seaweeds
- Potential applications local cultivated seaweeds
- Promising countries in Western Europe
 - Belgium
 - France
 - The Netherlands
 - United Kingdom
- In sum: Key takeaways

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3.2 Potential EU seaweed market for human consumption



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Research shows the potential of the European seaweed market in three scenarios.

In the moderate scenario the European seaweed market for human consumption can grow to almost 2.5 billion dollars (2 billion euros) in 2030. In the high ambition scenario, the market can even grow to a 3.4 billion dollars (2.8 billion euros) industry.

The most potential is expected in the food products market.



Scenario's:

- Conservative ambition level: minimal change to current demand trends, policies and cost trajectories.
- Moderate ambition level: isolated changes in demand trends, policies and cost trajectories that positively impact the context for the seaweed industry in Europe
- High ambition level: significant changes, including favorable policy environments, considerable economies of scale, further cost efficiencies from technological innovations, and strengthening advantageous consumer trends.



3.3 Potential for local (EU) cultivated seaweed

Looking at the potential of local cultivated seaweed in Europe for food applications. In the high ambition scenario 24% from the demand could come from European suppliers.

European seaweed food market potential – estimation 2030 in million dollars (million euro's) – high ambition scenario

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Potential market share



imported, mainly fromAsia

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3.4 Potential applications for local (EU) cultivated seaweed



Food products

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The highest potential for local cultivated seaweed can be found in the food products market. There is a demand for seaweed as food in Europe and with the trends for healthy and plant-based food, the demand will only increase.

Because the food applications for seaweed are numerous, the potential is huge. Besides, the versatility makes it easy to be agile and to respond to new trends with seaweed products. However, because of its divers applications, food producers and retailers are not always sure how to market seaweed.

One of the main distinctive features of local cultivated seaweed is its freshness, which matches with the demand for healthy, fresh and local food.

Hydrocolloids

The market for hydrocolloids is a mature market that expects steady grow. The market is already saturated and more difficult to enter with new products.

European seaweed can only compete with its Asian competitors if the quality is high enough to make up for the higher price.

To enter the hydrocolloids market a consistent supply and quality is necessary.

Nutraceuticals

Because of the healthy image of seaweed, the nutraceutical market is another relevant market for seaweed. Seaweed capsules are already on the market, but market information is scarce and more research is needed in order to indicate the potential for local cultivated seaweed.

3.5 Promising countries in Western Europe

This study focusses on the countries around the 2 seas region: The United Kingdom, The Netherlands, Belgium and France. In all four countries there is potential for local cultivated seaweed, but all with different angles. This potential will be further elaborated on the next pages.

Other countries that are promising for local cultivated seaweed are Germany because of the market size and Spain, Norway, Ireland and Denmark, because of their history with seaweed and because these countries are already experimenting with local and/or cultivated seaweed.





3.5.1 Belgium



- Belgium has a rich traditional cuisine and the food service industry is mainly serving traditional Belgian and French food. Seaweed is not a common ingredient in the Belgian kitchen.
- There is, similar to other Western European countries, a growing market for healthy and plant-based food. The government is raising awareness for a healthy diet to increase the public health.
- Belgians have a more wait-and-see mentality which makes them less open to innovative food than other countries in the 2 seas region. However, the health conscious and plant-based consumers might accept seaweed as a relevant addition to their diet.





3.5.2 *France*



- France has a very strong culinary culture in which traditional local food plays an important role. Seaweed is not a standard ingredient in the French cuisine, but due to wild harvest traditions in Brittany French consumers are somewhat familiar with seaweed as food. Combined with the fact that seafood is very common on the menu, the French might be open to seaweed as food.
- The French cuisine has a good reputation worldwide and chefs are always looking for high quality ingredients. With the local, plant-based and health trends seaweed can provide an attractive and new ingredient in the French cuisine.
- The French are known for their chauvinistic attitude. This makes the French market appealing for local produce, such as seaweeds cultivated at the French coast.

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3.5.3 The Netherlands



- The Netherlands does not have a strong culinary culture. Typical to the Dutch cuisine are the many foreign influences, which stem from its colonial past. The Asian cuisine, among other things, is integrated into the Dutch food culture. Besides, the traditional Dutch cuisine is not of a high culinary level, so most restaurants serve non-Dutch food. This makes the Dutch consumer open to new kinds of foods and flavours in restaurants.
- Dutch consumers highly appreciate convenience. This leads to growth in packaged food and in takeaway and home delivery food. Besides, the Dutch are known for their cost-consciousness and they are looking for low priced food.
- From a business perspective The Netherlands is perceived as a highly innovative country. The countries reputation on highly efficient agriculture and as a front runner on water management make The Netherlands an attractive country for collaboration on seaweed innovation.





3.5.4 United Kingdom



- In the UK there is a clear trend towards more local produced food. The government has set a goal on self sufficiency and producers respond to the patriotic culture with branding their products as locally produced.
- Besides, there is a strong focus on healthy food. The UK has a high level of obesity and related diseases. The government is focussing on improving a transition to a more healthy diet to increase the health of its residents. Besides, like in other countries there is a trend to more plant-based food.
- The UK has a strong fishery sector. This can be a challenge and an opportunity for the seaweed sector. On the one hand, the seaweed sector has to be careful not to get in the way of fishery. But from a consumers perspective seaweed and fish make a good combination, which makes a collaboration appealing.
- The UK does not have a strong culinary culture and consumers eat a lot of highly processed food. Seaweed might be a type of food that consumers have to get used to. Because of the strong fish sector, this might be the entrance for seaweed on the British plate.





3.6 In sum: Key takeaways

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In 10 years the European seaweed sector for food can grow to a market of 2,8 billion euro. In this high ambition scenario European cultivated seaweed should be able to cover 24% of this demand.



There are numerous opportunities for the application of seaweed in food products. It has potential to further grow and innovate to meet European consumer demands.



The hydrocolloid market is more mature and therefore more saturated with Asian suppliers. European hydrocolloids are distinctive in their quality, which is perceived very high.



Countries in the 2 seas region are all open for seaweed as food, but all for different reasons and with different angles.







4. Key success factors

4.0 In this chapter

For accessing the key succes factors of transitioning to European cultivated seaweeds, we made use of the DROC analysis method. This method is ofted used in market researches to get a better understanding of the market. In this particular case, it helped to get an overview of the larger trends, movements and developments to which seaweed relates, and the specific opportunities and challenges working with seaweed.

The drivers, restrains, opportunities and challenges for transitioning to local, cultivated seaweeds for food in Europe are unfolded in this chapter.







4.1 DROC analysis

🕎 Drivers

Underlying developments (e.g. trends and policy developments) that can accelerate growth for local cultivated seaweed

P Restraints

Underlying developments (e.g. trends and policy developments) that can slow down growth for local cultivated seaweed

Opportunities

The possibilities to fulfill a consumer need with local cultivated seaweed

Challenges

The threats to fulfill a consumer need with local cultivated seaweed





4.2 Drivers

A window of opportunity is more attention for sustainable produced food and healthy food. This can be a driver for the European market for cultivated seaweeds.



Global changes

- Growing world population combined with scarcity of fertile agricultural land leads to a **shift towards alternative food**
- In Western countries consumers transition from animal based proteins to **plant based proteins**
- In Western countries lifestyle diseases like obesity become more common due to unhealthy diets and high life expectancy. This requires a need for more **consciousness about food and health** with consumers.



Governmental influence

- World wide and in the EU governments are stimulating more sustainable food production. In the EU this is captured in The Green Deal, a program with the goal of becoming a climate neutral continent in 2050. The agriculture needs to reduce its methane- and CO2-emission and use of chemical pesticides. More specifically the biodiversity strategy and Farm-to-Fork-strategy stimulate a more inclusive way of looking at land and sea and more sustainable agriculture.
- The high cost of medical care caused by lifestyle diseases is a reason for countries to create awareness of the importance of a healthy diet.

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Consumer consciousness

- Consumers are becoming more aware of the impact of food on their own health and on the planet. This leads to a variety of trends in the food sector and growing markets for plant-based food, locally produced food, organic food, natural food and healthy food.
- Consumers call for more transparency about their food and technology makes it possible to provide food chain information. This leads to more awareness on where food comes from and how it is produced.

Convenience food

- Consumers spent less and less time in preparing food and they ask for convenience food. The result of this demand can be seen in the growing market for pre-cut, packaged and prepared food.
- The **food delivery market** is growing rapidly, bringing existing and new types of meals to consumers.
- Beside convenience food, consumers are open to try **new types of food** that are not standard on the menu.



4.3 Restraints

Brexit, food safety regulations and reputational issues can slow down the growth of the local cultivated seaweed sector

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Brexit

- Brexit leaves UK and Europe in great uncertainty of how the European trade will look like after Brexit.
- For EU countries it can have negative impact on trading with UK which can slow down the market development for local cultivated seaweed. For UK, on the other hand, it can accelerate locally produced seaweed for more selfsufficiency in its food supply



Food safety regulations

- The novel food regulations make it difficult and time consuming for new food products to enter the market
- Food legislation for seaweed is under development, yet which leaves producers and buyers with uncertainty



Complexity of food additives

- The complexity of the food sector makes it difficult for consumers to determine what is healthy and unhealthy. This often results in very **simplified conclusions about good and bad food**.
- Consumers are for example **cautious with E-numbers** because these are perceived as unhealthy, nonetheless the actual ingredient of the E-number.
- Food scandals can get much media attention. This media attention is often a simplified story and can be harmful for the sector. This makes new food additives vulnerable for reputation issues.



4.4 Opportunities

The two largest opportunities for locally cultivated seaweed are seaweed as a healthy food component and seaweed production as a sustainable alternative for traditional agriculture



Healthy food or food alternative

- Consumers perceive **seaweed as healthy food** making this a very suitable ingredient to add to a healthy diet
- Consumers are looking for plant-based alternatives for meat, and functional ingredients like gelatine. The plantbased market is growing every year and consumers appreciate the growing variety in this market
- More consumer consciousness also leads to a growing organic market. Food with no chemical additives and with no use of pesticides is growing more market share changing from a niche to a more common part of the food market.



Growing markets for takeaway and food delivery

Because seaweed is a new ingredient for most European consumers most of them first need to gain experience with eating seaweed. The restaurant industry is an obvious way to get to know the product before using seaweed in the kitchen themselves. The growing industry of **food delivery can be a gateway for seaweed to the plate of the consumer**.

Sustainable alternative way of agriculture

- The Green Deal of the EU shows a very clear need for more sustainable agriculture. Local cultivation of seaweed provides a solution for food production without land use, without pesticides and without the use of fresh water.
- The local cultivation of seaweed provides a solution for the food processing industry that wants to shorten their supply chain and use more locally produced ingredients. Also consumers have a preference for shorter supply chains and local foods because of sustainability and supports for the local economy.
- Buyers in the food processing industry perceive European seaweed as high quality and safer than alternatives from outside EU where there might be less regulations on ecological and social impact of seaweed farming
- Consumers are more aware of the impact of their food and are looking for alternatives with more control over the origin of their food. Covid-19 has accelerated this trend because of awareness to support local businesses that are struggling. The farm-to-fork initiatives have grown. These platforms could be an opportunity to sell local seaweed. Because seaweed tells a story not only to be a healthy ingredient but also to provide a solution for the food and climate challenges it is an attractive and inspiring product for these platforms to show their diversity and positive impact.



4.5 Challenges

The main challenges are consistency in volumes and increasing the consumers demand



Consistency in volumes and quality

- The food processing industry demands consistency in both volume and quality. Production processes are stringently and there is no room for variability in quality of the product. To sell to this market volume and quality need to be stable
- Prices of local cultivated North sea seaweed are higher than Asian competition. Other properties need to be able to compensate for this difference in price.



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Buyers insecurities

- Potential high levels of contaminants & iodine cause food safety constraints
- Negative publicity for carrageenan* has led to confusion on what is an what is not safe to use. This led to suspicion among buyers and therefore reduced sales
- There is little prove for health claims and the level of sustainability of seaweed

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Consumers not used to seaweed as food yet

- There is no clear explicit consumer demand for seaweed. This requires creativity in the marketing of the product on the consumer's side
- Consumers are not sure about taste. A study among Dutch consumers show that consumers associate seaweed with both good and bad taste. Consumers who actually have experienced the taste of seaweed mostly like it.
- **Consumers do not know how to use seaweed**. Seaweed is often consumed in restaurants or in takeaway food. Home cooked seaweed is not yet widespread
- Seaweed can be placed in multiple categories. Supermarkets often do not know where to best place seaweed and because of that consumers do not know where to find seaweed.

*Food additives like carrageenan and agar have come under the spotlight in recent years because of safety concerns. There have some studies published that indicate carrageenan may cause ulceration in the large intestine and ulcerative colitis, colorectal and liver cancer, inflammation, as well as fetal toxicity and birth defects. Carrageenan is also banned in baby food products, such as baby formula. Source: 6



4.6 In sum: Key takeaways



European consumer trends like the demand for healthy food and plantbased alternative proteins can increase demand for seaweed in food



Governmental programs as The Green Deal and national programs to stimulate more sustainable food production and healthy food can drive local seaweed cultivation



The main focus for growth should be in increasing the demand for local cultivated seaweed in the European market and increasing production volumes to meet this demand and to achieve cost efficiency







5. Conclusion

5.0 Conclusion

The current global market

The global seaweed market represents a value of \$ 13,3 billion (€ 10.9 billion) Approximately 77% is used for human consumption. Seaweed as food is used in multiple applications, which for the purpose of this report are categorized in three markets:

- Food products in which seaweed is a substantial component
- Seaweed as a functional ingredient (with hydrocolloids as main application)
- Nutraceuticals where seaweed is for example offered as a food supplement.

The food products market is by far the largest market covering an estimated 88% of the value. Hydrocolloids make up for 11% of seaweed for food. The value of the nutraceuticals market is hard to estimate, because it is often combined with other pharmaceutical applications.

Asian countries are by far the largest producer of seaweed; 95% of the seaweed is cultivated in Asia.

The current EU market

Interreg

2 Seas Mers Zeeën

The European seaweed supply is small compared to Asian producers. In 2018 European countries produced 300.000 tonnes of seaweed, less than 1% of the global production of 32 million tonnes. In contrary to the global seaweed supply, in Europe 97% of seaweed comes from wild harvesting.

Seaweed is a growth market in Europe

The global seaweed market is expected to grow. Several sources expect a yearly growth between 7% and 12%. The largest growth is expected for food product applications.

Also in Europe, the potential is large: it is estimated that in 10 years the European seaweed market for human consumption can grow to a market of 2,8 billion euro. In this high ambition scenario European cultivated seaweed should be able to cover 24% of this demand.

Close to home: seaweed from the North Sea

Based on the above conclusions, the future for local cultivated seaweed looks bright. However, the cultivation of European seaweed is just getting started with several start-ups experimenting with offshore cultivation. To match supply and (potential) demand on the European market, there are still some crucial steps to take.

North Sea Farmers has identified the key drivers and opportunities for transitioning to European, cultivated seaweeds and identified one crucial main success factor and three secondary success factors to unlock the potential of a European, sustainable seaweed food market. These findings are summarised on the following pages.



5.1 Key success factors

Sustainable food production

With the growing world population, climate change challenges and scarcity of fertile land for agriculture, governments are in search of solutions for sustainable food supply. The European Green Deal and more specifically the Common Agricultural Policy CAP aims to ensure that EU agriculture is socially, economically and environmentally sustainable. Local cultivated seaweed is a perfect answer to this need. Besides, it fulfills the consumers need to more local consumption and shorter supply chains.

High quality of European seaweed

European produced seaweed is appreciated for its high quality and the safe and controllable production. When it comes to the production, buyers value local produced seaweed because it is more traceable and controllable and there is more guarantees that it is produced in a sustainable way in terms of environment and social responsibility.

Interreg

2 Seas Mers Zeeën



Changing diets in western Europe

Consumers are becoming more health conscious which results in the need for more healthy food. This is driven by two generations: Millennials are referred to as the most health-conscious generation, and they are willing to try new superfoods with health benefits. Next to that, baby boomers are health conscious because of the high life expectations and lifestyle diseases that come at higher age. In some European countries, governments have a strong focus on this topic with programs to stimulate healthy diets. Besides, the growing awareness of the impact of food on climate change and on animal welfare creates a shift to more plant-based proteins as alternative for animal proteins.

Perception of seaweed as healthy

Consumers perceive seaweed as a healthy ingredient. The supplement market has helped to establish seaweed as a healthy ingredient, as well as the stories about Asian cuisine as a healthy diet. Therefore, seaweed can be an answer to the consumers need for healthier and plant-based food.



5.2 Insights in how to unlock the potential of seaweed for food

Value chain collaboration

Unlock the full potential of local cultivated seaweed by further researching and showcasing the applicability of European species and collaborate within the seaweed value chain. Value chain collaboration and knowledge sharing is important in the development of a sustainable and reliable seaweed supply chain.

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2 Seas Mers Zeeën

Consumer focus

Increase the demand for local cultivated seaweed by drawing attention to the benefits of seaweed as food. Respond to consumers food trends and consumer needs by marketing seaweed as a healthy, plant-based, local and sustainable product.

Provide consistent supply

Scale up to provide high volumes and consistency in quality and supply (opportunity for high quality certified seaweed in larger volumes). With higher production volumes, prices will decrease which is needed to compete with Asian alternatives.

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Connect supply & demand

Make it easier for suppliers and buyers to connect. There is a demand for seaweed and local cultivated seaweed has advantages compared to Asian alternatives, but if local offer is not visible on the market, buyers will turn to Asian alternatives that are easy and cheap to purchase.





6. Appendices



Research goal

The goal of this study is to gain insight in the market for local cultivated seaweed as food in the European 2 seas region. This study is part of the European Interreg ValgOrize project.

Research question:

• What is the market potential for cultivated seaweeds in the identified existing and potential seaweed for food markets?

Research phases

- Desk research (sources in next appendix)
- Interviews (sources in next appendix)
- Survey among seaweed community Europe (question set-up in next appendix)

Fieldwork

• Research period: September – December 2020

Analysis and reporting:

- For the analysis we derived insights on the food markets, applications and countries from the various sources. Only insights that are found in more than one sources are reported.
- In this report for context we started with a decription of the world market before focussing on the European market
- On pages with specific numbers on market size and predictions, sources are reported. All other information in the report comes from several sources combined.
- For comparison on commercial market size alle numbers are reported in dollars (as is the default on global market information) and in Euro's (for the European market). The conversion is based on the exchange rate on January 20th 2020.



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6.3 Sources – community survey

Community survey

- The community survey is shared with the seaweed network of all ValgOrize partners
- The fieldwork period was from 28/10/2020 28/12/2020
- A total of 63 participated in the survey, of which 14 seaweed producers, 20 seaweed buyers and 29 other profissionals involved in the seaweed sector

Community survey - set-up

The goal of the community survey was to collect the information and knowlegde from the European seaweed network. Depending on the role of the respondent in this network (seaweed producer, buyer or other), the respondents were asked different questions.

Survey set-up:

- Background information on respondent and organisation
- Seaweed production companies: Information on current production size
- Seaweed buyers: Current use and buy of seaweed
- Other groups than producers and buyers: Knowledge of current seaweed market
- Market growth estimation
- Trends



6.4 Sources - interviews

Interviews

In total we conducted 42 interviews with professionals in the food industry with a variety of roles and companies.

- The Vegetarian Butcher
- KFC
- Nestle
- Lloyd register foundation
- Givaudan
- LNV Landbouwattachee UK
- LNV landbouwattachee France
- New Now Next
- Unilever
- LNV landbouwattachee Belgium
- Schuttelaar BV
- And 31 other food professionals

Interview protocol expert interviews

The goal of the interviews was to gain information on what the potential is for local cultivated seaweed in the food processing industry. The questions were divided in these categories. For interviewees that did not work in the food processing industry directly, we adjusted some questions.

Interview set-up:

- Introduction & practical announcements
- Introduction of interviewee and organisation
- How does purchasing/new product design process go?
- Familiarity with and experience with seaweed
- Explanation of seaweed
- Potential for seaweed in organisation
- Potential for seaweed in the market in general
- Closing remarks

