The European market potential for seaweed or marine algae

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The demand for edible seaweeds (or marine algae) is increasing in Europe. Seaweeds have many beneficial properties that can cater to European consumers. An increasing demand for supplements in Europe, rising health-consciousness and a growing demand for alternative proteins are major drivers of the edible seaweed market in Europe.

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1. Product description

Seaweed refers to a number of species of macroscopic, multicellular and marine algae which grow along rocky shorelines around the world. Seaweed varies in colour from red to black.

Edible seaweed is divided into several categories such as red algae, green algae and brown algae. Most edible seaweed is marine seaweed, which is part of many coastal cuisines. In general, seaweed is high in iodine and fibre. Algae are photosynthetic, eukaryotic organisms that can be unicellular, or multicellular organisms. Microalgae are single-celled algae that may exist independently or in colonies. They consist of unicellular algal species. Table 1 shows a list of the most common edible seaweeds and microalgae.

Table 1: Common edible seaweed

Red algae	Green algae	Brown algae	Blue-green algae
Carola (Callophyllis spp.)	Chlorella (Chlorella sp.)	*Kelp (Laminariales)*	
Carrageen moss (Mastocarpus stellatus)	Gutweed (Ulva intestinalis)	Arame (Eisenia bicyclis)	Aphanizomenon flos-aquae
Dulse (Palmaria palmata)	Sea grapes or green caviar (Caulerpa lentillifera)	Badderlocks (Alaria esculenta)	Arthrospira platensis (Spirulina)

Eucheuma	Sea lettuce (Ulva spp.)	Cochayuyo (Durvillaea antarctica)	
Eucheuma spinosum		Ecklonia cava	
Eucheuma cottonii		Kombu (Saccharina japonica)	
Gelidiella (Gelidiella acerosa)		Oarweed (Laminaria digitata)	
Ogonori (Gracilaria)		Sea palm Postelsia palmaeformis	
Gracilaria edulis		Sea whip (Nereocystis luetkeana)	
Gracilaria corticata		Sugar kelp (Saccharina latissima)	
Grapestone Mastocarpus papillatus		Wakame (Undaria pinnatifida)	
Hypnea		Hiromi (Undaria undarioides)	
Irish moss (Chondrus crispus)		Grapestone (Mastocarpus papillatus)	
Laverbread (Porphyra laciniata/Porphyra umbilicalis)		*Fucales*	
Gim (Pyropia, Porphyra)		Bladderwrack (Fucus vesiculosus)	
Nori (Porphyra)		Channelled wrack (Pelvetia canaliculata)	
		Hijiki or Hiziki (Sargassum fusiforme)	

		Limu Kala (Sargassum echinocarpum)	
		Sargassum	
		Sargassum cinetum	
		Sargassum vulgare	
		Spiral wrack (Fucus spiralis)	
		Thongweed (Himanthalia elongata)	
		Ectocarpales	
		Mozuku (Cladosiphon okamuranus)	

Source: Wikipedia

In this report, we are focusing on spirulina and chlorella, as they present an opportunity for exporters from developing countries. Both spirulina and chlorella are becoming popular among European consumers.

In recent years, there is an increasing demand for blue-green microalgae such as spirulina and chlorella. They have antioxidant, anti-inflammatory, anti-allergenic and anti-viral properties. There are around 7,500 species of green-blue algae; they are the most primitive life forms and have been consumed by humans throughout history. Blue-green algae contains numerous bioactive components such as carotenoids, linoleum acid, phycocyanin, iron, phosphorus, chlorophyll and fibres.

Spirulina and chlorella are common forms of blue-green algae. Although they are classified as micro-algae, they are commonly referred to as seaweed. They are part of medicine in Japan, Mexico and some African countries. Spirulina and chlorella are cultivated instead of wild-harvested. Their production involves safety and control mechanisms.

Spirulina is a biomass of a blue-green algae or cyanobacteria. The most common species of spirulina are *Spirulina platensis* (SP), *Spirulina maxima* (SM) and *Spirulina fusiformis* (SF). Human consumption of spirulina dates back to the 14th century.

Scientists are looking at spirulina as part of the solution to malnutrition and food security. Spirulina consists of 65% protein. The type of protein is similar to animal protein, but it is high in polyunsaturated fats.

Spirulina is high in vitamin B12 and is recommended as a supplemental source of this vitamin to vegans. However, some research shows that the human body cannot digest the B12 vitamin in spirulina. Nonetheless, it is considered a sustainable source of protein which can be used as a meat alternative. It is also a good source of

iron and zinc, while it can also be used as a treatment for anaemia.

Spirulina has the highest concentration of the antioxidant evercetin; it can be used to alleviate the symptoms of sinusitis and asthma. It can be also used to relieve inflammation associated with arthritis, as it contains phycocyanin.

Figure 1: Natural health products containing spirulina in the European market

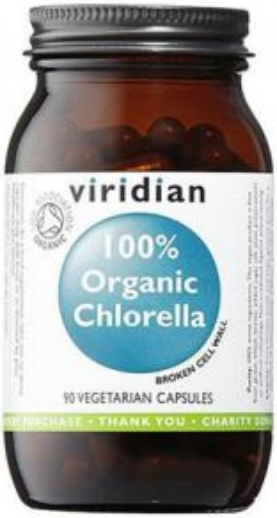
Source: Various

Chlorella is a genus of green algae that have a spherical shape. The cultivation of chlorella involves relatively limited resources. Some of the main applications of the genus *Chlorella* are in biofuels (biodiesel, biomethane and biohydrogen), cosmetics (skincare), supplementary foods (polyunsaturated fatty acids), pigments (carotenoids and chlorophyll) and waste-water treatments (reduction of chemical oxygen demand and bioremediation).

There are many nutritional benefits of chlorella. It contains around 50% complete protein with around 70% net protein digestibility. It can be used to detoxify the body of heavy metals such as cadmium, lead, mercury and uranium. Other benefits include boosting the immune system, having antioxidant properties, improving the glucose uptake in cells, reducing blood pressure, improving insulin resistance, preventing gastric ulcers, reducing fibromyalgia pain and protecting against radiation poisoning.

Chlorella is high in chlorophyll, B vitamins, vitamin E, folate, calcium, magnesium, zinc, potassium, iron and phosphorus. It also contains trace minerals such as omega-3 fatty acids, while it has mucopolysaccharides, beta-carotene and nucleic acids as well.

Figure 2: Natural health products containing chlorella in the European market



Source: Various

All algae mentioned in table 1, including Spirulina and chlorella, are traded under HS code 1212210000, which refers to seaweeds and other algae fit for human consumption. The only exception is Aphanizomenon flos-aquae, which is commercially processed into supplements. This report examines spirulina and chlorella applications in the health products industry within Europe.

Tips:

- Familiarise yourself with the beneficial properties spirulina and/or chlorella offer the health product industry. For example, spirulina's high protein and vitamin content.
- Inform European buyers about your spirulina and/or chlorella's beneficial properties when approaching them along with displaying this information on your company website and marketing materials. This is likely to increase your chances of entering the European market.
- Conduct research on the health benefits of seaweeds. Visit websites such as sciencedirect.com and NCBI or platforms such as Google Scholar to look for scientific papers.

2. What makes Europe an interesting market for seaweed?

Europe is an attractive market for seaweed from developing countries. Seaweeds such as spirulina and chlorella can capitalise on some of the new trends in the alternative protein market. The increasing demand for natural and high-quality supplements in Europe has created an opportunity for seaweed exporters in developing countries. There is increasing demand for nutraceuticals, as well as a growing vegan and vegetarian population in Europe. As a result, there are good opportunities for spirulina and chlorella in the European market.

Around 70 percent of spirulina is produced in China, India and Taiwan. Other producers include the United States, Thailand, Pakistan, South Africa and Myanmar. The production of spirulina is also promoted by various government initiatives in India and South Africa. Producers in developing countries have opportunities to export spirulina. Chlorella is produced in open ponds in countries such as Germany, Japan, China, the Czech Republic and Taiwan. Annual production is estimated to be about 5,000 tonnes.

Exporters of spirulina and chlorella from developing countries may face competition from large-scale producers in countries like China. Thus, exporters from developing countries should ensure the quality of their product is always of high quality and consistent. Doing so can help compete against spirulina and chlorella that is

marketed at low prices.

Figure 3 and 4 show the imports of edible seaweeds to Europe from 2015 to 2019. Over this period, the volume of imported seaweed for human consumption from outside the EU fluctuated; the volume of imports from outside the EU decreased by 21.4 percent from 2015 to 2019. Several other species of seaweeds and algae are traded under HS code 1212210000; this does not reflect the volume of spirulina and chlorella imported exclusively over this period. In addition, lack of supply, which can be due to factors such as poor weather conditions and low harvests, impacts the volume of imports to the European market. However, European demand for edible seaweed and algae is expected to increase in the coming years.

The value of imported seaweed for human consumption from outside of the EU increased by 8.9 percent from 2015 to 2019. This increase is because of rising demand and the undersupply of edible seaweed in Europe, which has increased prices. The demand for imports is expected to increase because of the increasingly health-conscious lifestyle among European consumers.

Spirulina is viewed as a sustainable and high-quality replacement for meat protein. There are an estimated 75 million vegans and vegetarians currently living in Europe. A recent consumer study showed that European consumers are willing to change their habits to eat more plant-based foods. Due to a growing vegan and vegetarian population in Europe, demand for spirulina is expected to increase in the coming years. The European plant protein market was worth USD 5.8 billion in 2018, with it expected to reach USD 9.5 billion by 2027.

The European nutraceutical market was estimated to be worth USD 59.3 billion in 2018, and it is expected to increase at a compound annual growth rate of 6.9 percent from 2019 to 2027, to reach USD 108 billion in 2027. As cases of lifestyle-related illnesses in Europe rise, consumers are looking at preventive measures to improve their health.

Life expectancy of the European population is also increasing, and consumers are looking at new ways to stay healthy as they age. High disposable incomes enable them to invest in high-quality nutraceutical products. Nutraceuticals are therefore becoming a part of many consumers' everyday life.

The demand for spirulina and chlorella is growing in Europe according to industry sources. The European market for spirulina is forecast to grow at a compound annual growth rate of 8.7% between 2019 and 2025.

According to Market Data Forecast, the global chlorella market is expected grow by a compound annual growth rate of 6.4% percent from 2020 to 2025 to reach USD 210.5 million by 2025. Chlorella is in demand because of its health properties; it has the ability to help remove heavy metals and ash content from the human body.

The rise in the demand for health and wellness products is expected to drive sales of highly nutritious algae, such as spirulina and chlorella. Exporters of spirulina and chlorella should make the most of demand for high-quality edible seaweeds in the European market. Many importers face quality problems with cheap spirulina and chlorella imported from China. European importers therefore place a lot of emphasis on quality because of stringent EU regulations and consumer demand for high-quality products. The importance of this factor is expected to grow in the coming years.

Tips:

- Ensure that you always export a high-quality consistent spirulina and/or chlorella product because this is what buyers expect. Failing to do so could result in the termination of your business relationship with European buyers.
- See CBI market statistics and outlook to get more information about the demand for natural

ingredients for health products on the European market.

- See CBI study 7 tips for finding buyers in the natural ingredients for health products sector because it provides practical guidance on finding European buyers on the European market.

3. Which European countries offer the most opportunities for seaweed?

European countries offering seaweed exporters in developing countries the most opportunities are in the UK, France, Germany, Austria, Italy and Belgium. The UK imports the majority of seaweed in Europe, with France following in second place. The UK and France are leading importers because of their significant health product industries. In addition, many British ethnic food manufacturers use seaweed.

Table 2 gives the leading importing markets of seaweed for human consumption to Europe.

Table 2: Leading importers of seaweed for human consumption, 2015-2019

2019	000 Tonnes	% Change Volume (2015-2019)	mEUR	% Change Value (2015-2019)	Exporters	Important Market Players	
UK	6.3	-9%	11.4	-17%	Spain (83.1%)	Super Nutrients, Indigo Herbs	
France	1.9	-42%	7.8	-18%	Chile (47.5%), Ireland (16.6%)	Neixra, Solgar France	
Germany	1.1	-17%	7.6	78%	Netherlands (32.0%), Ireland (19.6%), China (10.3%)	Dr. Behr GmbH, Bio Import Europa	
Austria	1.0	-2%	3.9	34%	Germany (79.8%), Italy (10.0%)	LEMBERONA Handel GmbH	

Italy	0.5	0%	5.2	-6%	Ireland (35.7%), Germany (13.7%), China (13.1%)	Consonni Bioalghe Srls	
Belgium	0.4	17%	3.4	52%	Netherlands (48.7%), France (21.35), China (17.0%)	Brands of Nature	

Source: Eurostat

UK

The UK was the largest importer of seaweeds and other algae fit for human consumption in Europe in 2019. From 2015-2019, British imports decreased in volume and value. Over this period, the volume of imports decreased by 9 percent. Over the same timeframe, from 2015-2019, the value of British imports decreased by 17 percent to reach EUR 11.4 million. In 2019, 85.6 percent of British imports of edible seaweed for human consumption came from intra-EU trade.

The UK has a fast-growing vegan population. Research by the Vegan Society discovered that the number of vegans in the UK quadrupled from 2014 and 2019 to reach about 600,000. The British vegan population is expected to increase in the coming years. In 2019, 23 percent of new UK food product launches were labelled vegan, an increase of 6 percent from 2018.

The UK is a leading importer of edible seaweed for human consumption in Europe and is likely to remain so in the forthcoming years. Brexit (Britain's exit from the EU) is likely to disrupt the supply of spirulina and chlorella. Especially in the event of a no-deal scenario, which is where a deal is not reached with the EU. Renegotiating trade deals with countries currently supplying seaweed is likely to take some time.

France

France was the second largest importer of edible seaweed for human consumption in Europe in 2019. Between 2015 and 2019, the volume and value of French imports decreased at a double-digit rate. During this period, the volume of French imports decreased by 42 percent to reach almost 1,800 tonnes in 2019. The value of French imports decreased by 18 percent between 2015 and 2019. Extra-EU trade accounted for 71.9 percent of French imports in 2019, a decrease of 12.4 percent from 2015. Chile was the leading exporter of edible seaweed for human consumption to France in 2019.

France is significant producer and supplier of edible seaweed. France supplies the rest of Europe with seaweed mainly grown in Brittany, a region that has an established seaweed production industry. French production of macroalgae was 80,000 tonnes in 2019. However, despite strong domestic production, France is still reliant on imports. Nexira is the main importer, while Solgar is an important producer of seaweed supplements.

In 2019, the French food supplement market was worth EUR 1.9 billion, growing by 1.3 percent from the previous year. In 2020, the French food supplement market has been growing, with it expected to continue growing in the coming years. Exporters of spirulina and/or chlorella from developing countries should therefore

take advantage of this opportunity to target French buyers, especially since demand for spirulina and chlorella is expected to increase in the future.

Germany

In 2019, Germany was the third-largest importer of edible seaweed for human consumption in Europe. From 2015 and 2019, the volume of German imports decreased by 17 percent to 1,100 tonnes in 2019. Over the same period, the value of German imports increased by 78 percent to almost EUR 7.6 million in 2019. Intra-EU imports of edible seaweed for human consumption to Germany had a share of 81 percent in 2019.

Germany has one of the largest consumer markets for conventional and organic products in Europe. In recent years, veganism in Germany has expanded rapidly, with the country having an estimated 814,000 vegans in 2019. Germany's vegan population is expected to continue growing in the coming years. In recent years, the German food market has seen significant growth in vegan food products and restaurants.

There are some chlorella producers in Germany: Aglomed, RO-V-AL and Agrinova are important producers. Organic chlorella is gaining popularity in Germany. There is also some production of spirulina in Germany. The German-French company AKAL Food produces Ecocert-certified spirulina. Compared to chlorella production, spirulina production requires higher temperatures. Thus, exporters of spirulina from developing countries that have better natural conditions to produce spirulina have an advantage over European countries.

German demand for high-quality edible seaweed is expected to increase in the coming years. Demand for organic spirulina and/or chlorella is expected to rise as Germany has one of the largest organic food markets in Europe. Thus, exporters of spirulina and/or chlorella in developing countries should consider certifying their products to meet German demand for organic products.

Austria

Austria was the fourth largest importer of edible seaweed for human consumption in Europe in 2019. The volume of Austrian imports decreased by 2 percent from 2015 to 2019 to reach over 1,000 tonnes in 2019. However, from 2015 to 2019, the value of Austrian imports increased by 34 percent to reach over EUR 3.9 million in 2019. Intra-EU trade accounted for 91.6 percent of Austrian imports in 2019, with Germany being the main European exporter to Austria.

Austria does not have a large consumer market, but it has high levels of awareness and health consciousness. The popularity of spirulina and chlorella amongst Austrian consumers is expected to increase in the coming years because of this trend. This presents an opportunity to exporters of spirulina and/or chlorella in developing countries. Lemberona Handel GmbH is one of the leading importers of organic edible seaweeds. Spirulix and Ecoduna are domestic manufacturers of spirulina and chlorella.

Italy

Italy was the fifth largest importer of edible seaweed for human consumption in Europe. The volume of Italian imports stayed relatively stable from 2015 to 2019, with it reaching almost 500 tonnes in 2019. However, over the same period, the value of Italian imports decreased by 6 percent to almost EUR 5.2 million in 2019. Intra-EU imports of edible seaweed for human consumption to Italy had a share of 77.4 percent in 2019.

Italian demand for high-quality spirulina and chlorella is predicted to increase in the coming years. Growing awareness of health issues is likely to be the major driver. Italy has one of the largest consumer markets in Europe, and its market for organic products is also one of the largest. Thus, exporters of spirulina and/or chlorella should capitalise on this trend by getting organic certification for their product.

Belgium

In 2019, Belgium was the sixth largest importer of edible seaweed for human consumption. From 2015 to 2019, both the volume and value of Belgian imports increased. Over this period, the volume of Belgian imports

increased by 17 percent to reach over 400 tonnes. Over this period, the value of Belgian imports increased by 52 percent to over EUR 4.2 million in 2019.

Intra-EU imports accounted for 80.7 percent of edible seaweed for human consumption imports to Belgium, an increase of 3.3 percent from 2015. In 2019, the Netherlands, followed by France and then China were the main exporters to Belgium. Belgium is an important re-exporter of natural ingredients in Europe.

The versatility of edible seaweed, such as its high vitamin and mineral content, their antiviral, antimicrobial and antifungal properties, as well as its high protein content makes it a great ingredient for health products. The markets with the most potential for exporters of seaweed for human consumption are in Western Europe, as they have the largest conventional and organic food markets. Consumers in these Western European countries tend to have higher levels of awareness and are also more likely to purchase high-quality products for their health and wellbeing.

There is growing popularity of edible seaweeds for human consumption, such as spirulina and chlorella in the European market. The demand is predicted to increase in the coming years. A growing vegan population, as well as ageing population in Europe, increasingly health-conscious European consumers and the growing sustainable production of spirulina and chlorella are major drivers behind this.

Lack of supply and quality issues concerning spirulina and chlorella are obstacles to market growth in Europe. In addition, the production methods requiring carbonated water and artificial light, which incur higher costs and lead to higher prices, are key factors restraining chlorella supply. Low consumer awareness of chlorella's health benefits is also limiting market growth.

Tips:

- Focus on Western European countries when exporting spirulina and/or chlorella as these countries import the largest volumes of edible seaweed for human consumption. In addition, Western European countries also have the largest supplement markets, and have robust processing sectors.
- Get your spirulina and chlorella certified. By obtaining organic certification for your spirulina and/or chlorella you can increase your chances with European buyers. Visit the IFOAM website for further information on EU organic certification.

4. Which trends offer opportunities on the European market?

The demand for seaweeds such as chlorella and spirulina in Europe is driven by various factors. Seaweeds are a sustainable source of high-quality protein and offer a wide range of nutritional benefits. The production of seaweed also puts less of a strain on resources and offers a sustainable solution to meet the nutritional needs of the European population.

Growing demand for plant-based protein

Europe has a growing market for plant-based proteins as consumers are increasingly seeking plant-based foods. Currently there are an estimated 75 million vegans and vegetarians living in Europe, with a recent consumer study revealing European consumers are willing to change their eating habits to plant-based foods. According to Google Trends, interest in 'veganism' increased sevenfold between 2014 and 2019.

The vegan and vegetarian population in Western European country markets such as the UK and Germany is expected to increase in the coming years. This presents an opportunity to exporters of spirulina and/or chlorella in developing countries. The perceived positive health impacts of a vegan diet along with ethical and environmental concerns are the key drivers for consumers to shun meat. For example, meat production has a

high environmental impact as it requires intensive use of resources, particularly land and water, and it is a significant generator of greenhouse gases.

To capitalise on this opportunity, exporters of spirulina and/or chlorella in developing countries should familiarise themselves with their beneficial health properties and what they offer to the health product industry. In particular, its high protein content. Exporters should inform potential European buyers about spirulina and/or chlorella's high protein content, and how it is ideal for vegan and vegetarian products. Exporters should also give this information on their marketing materials and company website.

Tips:

- Stay up to date with the latest vegan trends by visiting websites and associations such as the Vegan Society and the Vegetarian Society, which provide information about veganism and vegetarianism respectively.
- Inform potential European buyers about seaweed as a sustainable and high-quality protein source. Use statistics and scientific data to show how seaweed compares with meat and other types of plant-based protein. Use this information in your marketing materials.
- Read the CBI study on exporting plant proteins for health products to Europe, which provides information on regulations and competition.

Sustainable production of seaweed

Demand for environmentally and socially produced products is increasing across Europe. European consumers and retailers are putting more pressure on companies to ensure their products are made according to environmental and social standards. Environmental and social aspects are becoming more important to European buyers as they seek to meet consumer and retailer demand.

Aside from its nutritional benefits, seaweed offers several environmental benefits. Seaweeds absorb CO2 from the atmosphere and reduces the acidification of water. Seaweed production is also less resource intensive on resources such as agricultural land and water. It can also provide an alternative livelihood to coastal communities. With the majority of fisheries depleted, seaweed cultivation presents employment opportunities.

The sustainability aspect of seaweed production will gain importance in the future. As European consumers look for environmentally friendly products, seaweed's low environmental footprint will become more attractive to European buyers and consumers. The Chinese company Inner Mongolia Rejube Biotech exports to the European market; it is one of the largest producers of spirulina and chlorella in China. The company produces on an industrial scale, with more than 1,100 tonnes of food-grade spirulina powder and over 100 tonnes of spirulina tablets a year on 630,000 square meters.

To capitalise on this opportunity, exporters of spirulina and/or chlorella in developing countries should adopt environmentally and socially friendly policies, methods and practices. They should look at adopting a Corporate Social Responsibility policy for their production process. Exporters should create a marketing story concerning the sustainable production of their product, which should be informed to European buyers and displayed on their marketing materials and company website. Doing so is likely to increase the appeal of spirulina and/or chlorella on the European market, particularly when the importance of sustainable production is increasing.

Tips:

- Consider obtaining certification that demonstrates that you uphold environmental and social responsibilities. The most relevant certification in this sector is ASC-MSC Seaweed Standard.
- Create and ensure that you clearly communicate your marketing story about the sustainable

production of your spirulina and/or chlorella.

Increase in chronic diseases within Europe

Europe's population is ageing at a high rate, according to the 2019 Edition of the Ageing Europe Report published by Eurostat. An ageing European population leads to an increase in chronic diseases as higher life expectancy does not always equate to better health. The European Society of Cardiology's 2019 annual report revealed cardiovascular diseases are the leading cause of mortality and disease in Europe. Cardiovascular diseases cause 45 percent of all deaths in Europe and 37 percent of all deaths in the EU.

Thus, many Europeans, particularly the older population, are increasingly incorporating nutritional supplements into their diets to reduce the negative effects of ageing on their overall health as well as improving their immune systems. This presents opportunities to exporters of microalgae such as spirulina and chlorella in developing countries, due to their nutritional profile and ability to alleviate symptoms of various chronic diseases.

To capitalise on this opportunity, exporters in developing countries should familiarise themselves with their spirulina and/or chlorella's health properties. In particular, its nutritional profile, such as its rich source of protein and vitamin K. Exporters should also promote its beneficial properties on their marketing materials along with informing potential European buyers. Doing so is likely to increase your chances of entering the European market.

Tips:

- Do not make any medicinal claims for seaweeds for health products when approaching potential European buyers and / or on your marketing materials. Instead, focus on its nutritional profile and value. Use scientific research and data to support claims you make, as this gives you credibility.
- Familiarise yourself with EU health claims regulations and ensure you are compliant with them. See the list of permitted health claims under the EU law.
- Visit websites such as NutraIngredients to stay up to date with trends in nutrition and supplements.
- Review CBI study what requirements must natural ingredients for health products comply with to be allowed on the European market, because it provides information about mandatory requirements and additional buyer requirements to enter the European market.

This study was carried out on behalf of CBI by Ecovia Intelligence.