



Circular & Sustainable Algae

The way to a sustainable economy



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University: Novia University of Applied Sciences
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Preface

This report provides stakeholders with information and material to understand the C&S Algae principle and using the information in further stages of the project. The project is supported by the supervisor Andreas Willfors.

The circular and sustainable algae document has been developed by four exchange students of Novia University of Applied Sciences. The project functions as the main project for the exchange students in name of the European project semester. Novia University of Applied Sciences provided the project in collaboration with the Erasmus+ association. The project is not financed and has purely been created for personal development for the European exchange students.

The following subjects are evaluated in the report: Chapter 1 contains the introduction phase of the report. Chapter 2 consists the methods and techniques which are used to create the report and get input for the report. Chapter 3 encloses the SWOT-analysis where the strengths, weaknesses, possibilities and threats are discussed. Chapter 4 is named the algae possibilities model. It is an extension of the SWOT-analysis. The influence on the planet, people and profit sectors are described in the triple-p-model in chapter 5. A simplified model of the C&S Algae can be found in chapter 6. In chapter 7 algae food and benefits have been described in general. In chapter 8 the combination of the algae food and biogas production is documented. The chemical reactions and background of algae is formulated in chapter 9. Considering all the factors that have an influence on the productivity of algae in combination with an influence model have been documented in chapter 10. Chapter 11 contains marketing concepts and brands that have been created in collaboration with master marketing students of the University of Vaasa. To enlighten the commercial part of C&S Algae, a business model has been created in chapter 12, to determine the revenue model and financing the start-up. The conclusion and recommendation of the final report can be found in chapter 13. The last chapter contains the project management information. Additional information is positioned in the appendixes of this report.

This report is developed for external stakeholders, professors, lecturers and students of Novia University of Applied Sciences. The C&S Algae project group wants to give a special appreciation to Andreas Willfors and Roger Nylund for the support during the project.

Vaasa, Finland 12-12-2018.

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Summary

The Transalgae project of the Nordic countries works on a fossil free future by using algae to develop renewable energy sources. This process includes several steps and each department works on a different subject. These subjects include different techniques for cultivation, harvesting, producing oil through extraction with HTL and producing biogas through anaerobic digestion. Many people are working on their own part of the project, therefore the C&S Algae project is asked to clarify the Transalgae project. Furthermore acting as consultants for the marketing students of Vaasa University, customers and stakeholders to understand and be aware of the possibilities of algae.

To do so, a certain amount of information was gathered about circular economy and the process of biofuel out of algae. Several models have been used to explain and clarify the business and chemical process of algae into food and fuel. Weekly meetings took place with Andreas Willfors the supervisor, where the achievements and expectations were discussed.

In the algae possibility model the opportunities and possibilities of the C&S project is positioned. Explaining the sustainable opportunities about algae the triple-P-model is used. It explains the possibilities for a better environment for the People, Planet and Profit. A simplified model was created to understand the circular economy. The chemical background of algae is explained using a detailed chemical flow chart showing the process from algae cultivation until the production of the end products. A SWOT-analysis was made to visualize and determine the strengths, weaknesses, opportunities and threats.

Furthermore, this report includes the possibilities for combining macro- and micro algae cultivation. The benefits for macro algae as food will be explained as well as the different species of macro algae. During the workshops with the marketing student of University of Vaasa branding concepts have been created, these have been put together in chapter eleven. The C&S Algae report will be closed by a conclusion and recommendations for further research.

For project management, the Belbin test was done by each project member. The cost, communication, quality, risk, change, and human resource management tasks is found in the project management chapter.



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1. Introduction

The Circular & Sustainable Algae project is linked to the overall Transalgae project, a cross-border cooperation in the Botnia-Atlantica region. The C&S Algae project has different stakeholders and collaborations including the University of Vaasa and Novia University of Applied Sciences. The mission with the C&S Algae project is to find innovative solutions for renewable energy and product concepts from macro algae which are cultivated in the Nordic climate. The project group will participate in branding new algae products, design the roadmap of the algae and finally to understand and support the C&S Algae principle.

The C&S Algae project is offered within the European Project Semester by Novia University of Applied Sciences and the University of Vaasa. In the first phase the goal is to develop sustainable business models for microalgae cultivation. In the second phase the EPS students focus on the production processes of macro algae food concepts in collaboration with marketing students of the University of Vaasa. The EPS project group must combine their skills to consult and support master marketing students of the University of Vaasa (Willfors, Algae cultivation , 2018). Connected goals are increasing skills with technical knowledge working within a multicultural environment. The end results of this project should include:

- new algae food concepts,
- a roadmap for the algae-based products
- introduce the C&S principle to the stakeholders.

In general, the EPS project is divided in two separate researches with two reports. The first report is the midterm report containing information and models about sustainable business models for micro algae cultivation. The midterm report must connect with the final report, which focuses on production processes of macro algae cultivation. The final report should deliver algae-based product concepts in collaboration with the marketing students of the Vaasa University. To realize the objectives as described in the paragraphs above, the project group developed a structured way of working. This was done by defining sub-objectives that must be reached to achieve their final goals. The visualization and a clear description of the project structure can be found in Appendix 1.



2. Methods

The assignment description of the C&S Algae project is explained in the section below. A clear comprehensible picture of the C&S Algae project was made for stakeholders, lecturers and students. For the conclusion of the project a mission, vision and objectives were developed to set a goal for the final report. The report includes a project management part as well as the technical and economical part. Therefore, several research methods and techniques have been used briefly explained in this chapter.

Research Methods

The main task for the final report and the conclusion of the project was to create a circular and sustainable economy model for the Ostrobothnia region. In this model a possible combination of micro- and macroalgae cultivation is explained with focus on algae-based food brands and biogas production.

Preparing for the workshops with the marketing students and for the final report further reading and literature research had been done. Focussing on macroalgae, also known as seaweed, and gathering information about edible seaweeds and algae-based food. The final report is written in a time frame of approximately fifteen weeks based on the results of the midterm report and the outcomes of the workshop. A work breakdown structure (WBS) and dictionary derived from the new mission and vision. The WBS was developed to see which tasks needed to be done, and by whom.

To clarify the project several models are used such as the updated triple-p- and circular economy model and the algae possibilities model. Further chapters give summaries about edible seaweeds and a possible combination of the productions of micro- and macroalgae respectively food and biogas. To give an insight into the chemical processes the chemical background of microalgae and the cultivation influence factors are explained.

The economical part is described by marketing concepts for seaweeds and set up with the marketing students of the University of Vaasa. The business model shows the necessary factors to be considered when the project is commercialised.

3. SWOT-analysis

This chapter will provide insight of the current phase of the TransAlgae project in the Ostrobothnia region. By using a SWOT-analysis in combination with a confrontation matrix, a well substantiated analysis can be formed. To develop a clear visualization, the project group linked the SWOT-analysis with a confrontation matrix and developed a bar chart. In the bar chart every subject is weighed with the same number rating as in the confrontation matrix. The bar chart will clarify the analysis of each subject that has been used in the SWOT-analysis.

3.1 General information

In the figures below, the SWOT-analysis has been worked out and applied to the current phase of the TransAlgae project. A SWOT-analysis shows what the structural competitive advantage (SCA) of the project in the current market is. The SWOT-analysis will give a clear picture of which points, and competences the project in a structural sense distinguish itself from the competition. Especially the aspects that are linked to the project are focused on the long term, and are relevant in the eyes of the market and customers. This relevance is expressed in willingness of the market and customers to pay extra for the products. In combination with the confrontation matrix, the diagram also shows the influences that the elements have on each other. Ending a SWOT-analysis can be a useful tool to reflect on how the project is positioned. Especially the pitfalls of the project can provide a good eye-opener as described in the models below (Kleijn H., 2016).

Table 1 SWOT-analysis

Business Plan Analysis

SWOT							
Strengths of the project		Weaknesses of the project		Market opportunities		Market threats	
1	A lot of knowledge	1	Communication	1	Large potential market	1	Many competitive companies with other innovative solutions
2	Many professors who work on their part of the project	2	Exchange of information	2	CO2 reduction	2	Biofuel will not be a fuel for the future
3	Innovative and sustainable technology	3	Many intermediaries	3	Circular economy process	3	Weather/climate changes
4	Great diversity (moderate risk)	4	Much uncertainty in certain fields (knowledge)	4	Sustainability	4	Many diverse materials and chemicals in waste water
5	Many financial support of different businesses	5	Errors in development / withholding information	5	Great diversity of end products	5	No acceptance by the customer



Table 2 Confrontation Matrix

		Strengths					Weaknesses				
		1	2	3	4	5	1	2	3	4	5
		A lot of knowledge	Many professors who work on their part of the project	Innovative and sustainable technology	Great diversity (moderate risk)	Many financial support of different businesses	Communication	Exchange of information	Many intermediaries	Much uncertainty in certain fields (knowledge)	Errors in development / withholding information
Opportunities	1 Large potential market	5	1	5	5	3	3	5	3	0	1
	2 CO2 reduction	1	0	5	0	1	0	0	0	0	1
	3 Circular economy process	5	1	3	3	1	1	3	5	3	1
	4 Sustainability	1	1	5	1	1	1	1	1	3	1
	5 Great diversity of end products	1	1	3	5	3	1	3	3	1	1
Threats	1 Many competitive companies with other innovative solutions	1	1	1	0	5	3	5	3	1	3
	2 Biofuel will not be a fuel for the future	1	1	1	1	1	3	3	1	3	1
	3 Weather/climate changes	1	1	3	1	1	1	1	3	5	5
	4 Many diverse materials and chemicals in waste water	1	1	1	1	1	1	1	1	3	5
	5 No acceptance by the customer	1	1	3	1	3	3	1	1	3	1

Legend

Large amount of similarity: 5

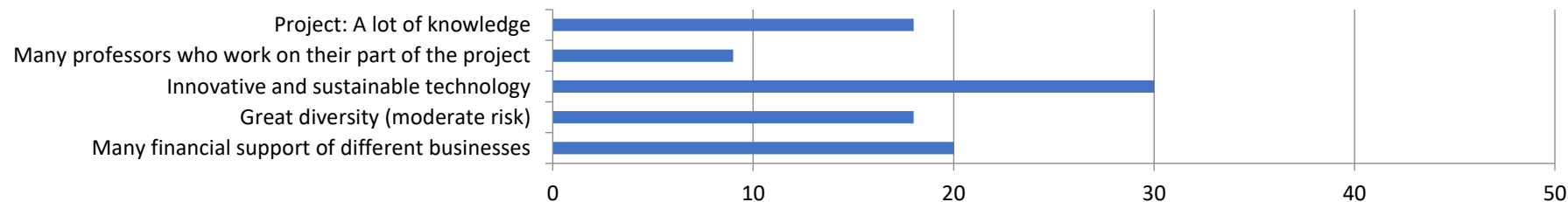
Medium amount of Similarity: 3-1

No similarity: 0

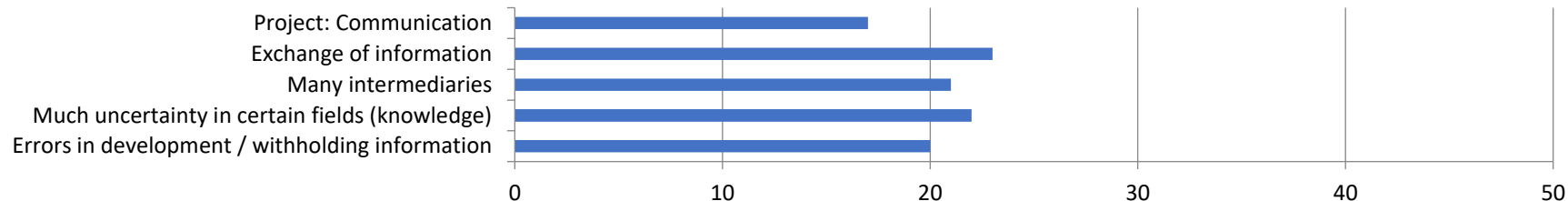


Table 3 SWOT Bar chart

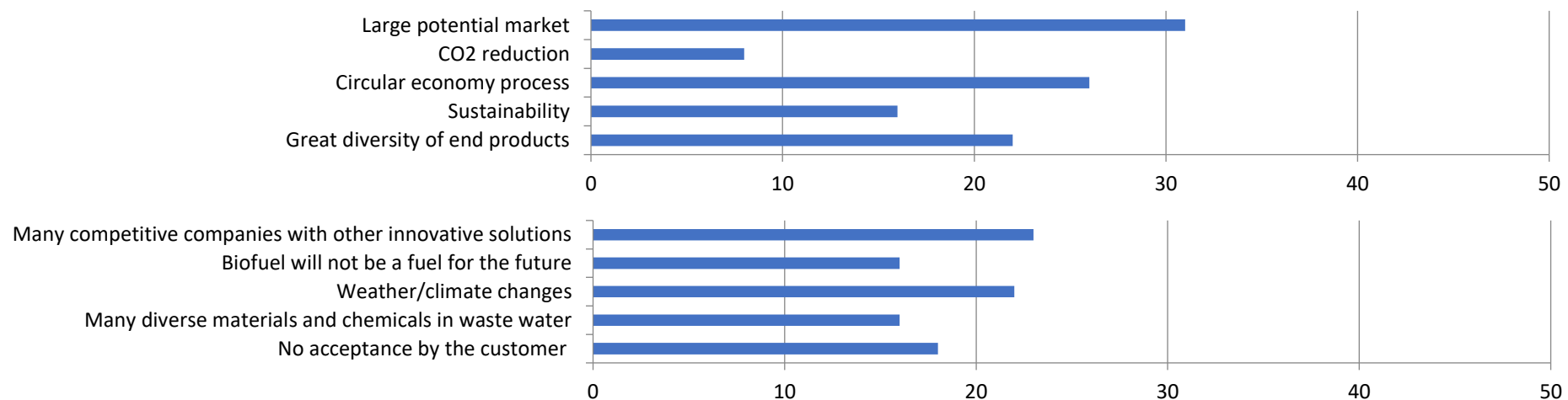
Strengths



Weaknesses



Threat Opportunities





3.2 Analysis

The results of the confrontation matrix are shown in the figures above. The key points will be discussed and explained more detailed.

The strongest subject of the TransAlgae project is the innovative and sustainable technology that has been developed. The TransAlgae project focuses on a diverse quantity of modern technologies that all have a sustainable character. For example, the biogas, biofuel, wastewater filtration, nutrition's, algae-based food and CO₂ reduction (Berg, 2018). All the products are based on the TransAlgae principle, and have a positive effect on the environment.

The major weakness of the TransAlgae project, according to the confrontation matrix, is the exchange of information. In the current phase of the TransAlgae project, a wide group of the different project leaders of the organizations participating professors are working on the TransAlgae project. Each organization focuses on a different part of the project. The exchange of information is a weakness, because the organizations does not share all their information. Since the exchange of information is broadly comprehensive, there is confusion between the professors of these organizations. The confusion was noticed during this seminar where professors had questions for other colleagues (Willfors, Algae cultivation , 2018).

The main opportunity is the large potential market for the algae-based products. The innovative and sustainable products can cover a large area of the future market. The TransAlgae products are innovative, and within the upcoming year the world will focus on improving the environment. Every year this market will grow, and the possibilities of the TransAlgae are promising.

The major threat for the TransAlgae market are the many competitive companies with other innovative solutions. Also, the weather and climate changes will affect the market and the use of the TransAlgae based products. Both subjects can become a major challenge in the upcoming years of development.



4. Algae opportunities

In this chapter a sustainable model is described that has been developed by the EPS project group. The main goal of this model is to give an understandable view of the elements which are part of the C&S Algae project. The model will give an understanding about future possibilities while using the whole circular principle. Because the combination of the TransAlgae- and C&S Algae -principle is difficult to understand for external stakeholders.

4.1 Possibilities model

The model that is attached below is the algae possibilities model. This model has been designed by using the format of the TransAlgae principle. Eventually the C&S Algae principle could be formed by the visualization of the possibilities model. The upper side of the figure represents the objectives that have been formed during the analyzing phase of the SWOT-analysis. The large potential market can be divided in the objectives underneath. Those objectives give an explanation to the question “why the C&S Algae principle is positioned as a large market potential?”. The last objective can be pointed out as the main reason of the possibilities.

The figure points out the incoming resources, that are required to deliver the well-known end products, are positioned on the output side. Focusing on the input, the C&S Algae principle only uses waste streams and sustainable elements as food. Those waste streams can be formed in a large circular economy process. Every part within this stream of processes can be controlled, and gives contribution to a sustainable output. What can be pointed out is that in most models the external output is not being mentioned. The external deliveries are formed by using this whole principle and its waste streams after the use of the algae processes (Willfors, Biofuel Region, 2017). In fact, those waste streams have a positive and useful influence on the environmental problems. The positive external deliveries are visualized in figure 1 below.

In the end, this model can be used to inform outsiders about the major possibilities that the C&S Algae project can provide to the community and the environment. The model gives an understandable way of thinking about the possibilities. The upcoming chapters will focus on each process and resource used in the figure below.

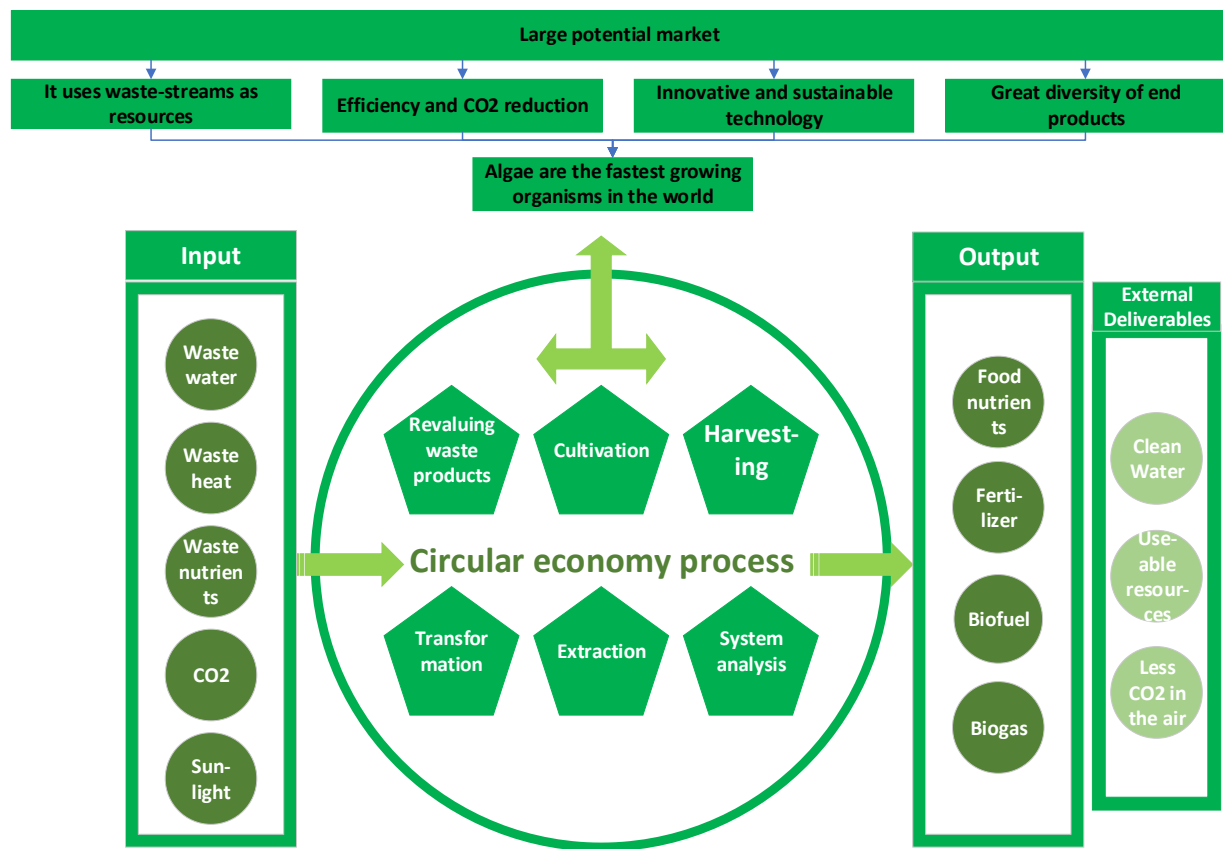


Figure 1 Possibilities model



5. Triple-P-model

The Triple-P-model or Triple Bottom Line includes three P's: People, Planet and Profit. These are three dimensions respectively social, environmental and economical. The model is used for sustainable development and for corporate social responsibility. The model identifies in which way algae business could contribute to the people, planet and economy. The social dimension stands for the care of employees within and outside the company: the whole society. There is a good working environment and employees have chances for development and own responsibility. The Planet stands for a proactive setup concerning natural environment and helping to solve environmental issues which the company can have influence on. The profit part is about creating something of economic value by producing goods and offering services. It is important that these three dimensions are balanced for the quality of life can be guaranteed for future generations. (Jonker, 2018)

5.1. People

The people or social part is based on the advantages an implementation of an algae-based circular economy would bring to the people and society.

Implementing the algae principle means several social benefits to the people in the Ostrobothnia region starting with creating new and sustainable jobs as they are settled in a sustainable industry. Furthermore, the local job markets are supported and can offer new and variable jobs in the algae industry which results in a decreasing unemployment rate. These jobs are also long term oriented as sustainability is an issue still being current in many years and Finland wants to build up a countrywide circular economy until 2025. The jobs offered by the algae industry shall additionally increase female labor participation rate and contribute to equality in workforce. Mainly medium and small sized companies will be supported by the expansion of the job markets creating additional new infrastructure for them. Regarding daily life of the people the algae industry contributes to an improved life quality and well-being as it has a positive impact on the environment and long term regarded reducing CO₂ emissions. This happens during algae cultivation for food production what brings healthy algae-based food products to the people.



5.2. Planet

The environmental bottom line is about producing biogas, biodiesel and food out of algae. The concept seems to be an alternative solution for the use of fossil fuel, which has a significant impact on environmental issues. There are various parameters to be taken into consideration. Such as the use of chemicals and sources, the energy needed for the systems and reactors to work, transportation of raw materials and end products, but also what happens to the product when it reaches the end of its lifecycle.

The cultivation of algae is strongly depending on the location and its climate. In the Ostrobothnia region the seasons are highly different from one another, making it hard for algae to grow. Especially during winter time when there is hardly solar radiation. In this case greenhouses are required, but these will need energy to produce light, and to keep a certain level of temperature.

A broad base for cultivating algae is waste water and its nutrients (nitrogen, phosphorus and carbon). Something to take into consideration is where to build the system relative to the water source. Preferable close to each other, otherwise transport or pipes and pumps are needed, these will need fuel and energy which has a negative impact on the environment. Water within the process could be recycled, therefore the input of waste water will be reduced. Besides waste water, waste heat can be used; this heat can come for example from power generations or paper mills.

Two systems can be used for the cultivation of micro algae, namely a race way pond (open system) or a photo-bioreactor (PBR, closed system). This PBR can be controlled so the environment for the algae to grow in is at its optimum. But therefore, this system requires much more energy than the raceway pond. Which is a shallow pond and uses solar radiation and the carbon dioxide from the air to grow algae.

Speaking for the environment an open pond would be better but taking the climate of the Ostrobothnia region in consideration a PBR system would be better. As can be read above, during winter time in the Nordic countries there will be a greenhouse needed for the use of an open pond, this greenhouse will need energy to keep the water on temperature and produce radiation.

For the harvest of algae there are diverse types of separation techniques that can be used, such as centrifugation, sedimentation and flocculation. Centrifugation is the most common technique used. Although when it is the only technique being used it costs much energy to harvest a small number of algae, therefore the other techniques are applied to make the harvest more efficient.



Flocculation is a technique where chemicals are added to form solid substances which than can be filtrated out of the system. In this case extra chemicals will be needed; the use of other chemicals will not be appropriate for the environmental aspect. These chemicals will be in a waste stream, and therefore need another process to be cleaned.

Biogas is formed through anaerobic digestion and contains methane and carbon dioxide. This biogas can be used to produce electricity and heating but could also be transformed into biomethane. Biomethane can be used as transport fuel. It would be ideal for the environment if biofuel could substitute fossil fuel. It also helps the environmental issues since the algae uses carbon dioxide, light and nutrients to produce its biomass, the use of CO₂ will help to reduce global warming. Also, this biofuel has a low CO₂ emission.

Concluded can be said that the process of biofuel out of algae has many benefits. Biofuel helps to reduce the use of fossil fuel; this biofuel has a low CO₂ emission compared to the emission of fossil fuel. Algae can be used to produce food and pharmaceutical products. During anaerobic digestion fertilizer is produced, this can be used on land or can be recycled in the process for its nutrients. Photosynthesis uses CO₂ to form algae instead of producing CO₂. The use of CO₂ in the process helps reduce global warming. This process does not compete with the food industry. Another benefit is that the process is bio-based meaning that biomass is used as raw material, it is ideally suited to replace the fossil raw materials. Besides that the process is bio-based, its products can also be biodegradable, another benefit for the environment. The entire process requires a lot of heat and energy but seeing the pros and cons of this process, it can be said that the overall picture will be better for the environment. Especially when compared to the processes that are being used now to get the same results. (Raphael Slade, 2013)

5.3. Profit

The profit part is based on the economic and fiscal advantages that algae business could bring. This is mainly based on future revenue when the implementation of algae cultivation is adapted. Due to the hype of circular economy, the concept of algae has a potential global market and developing industry. There are a couple of headlines that makes algae a profitable concept. These are explained in this part of the triple-P-model (Langdong, 2010).

5.3.1 Large market scale

Many occasions ensure the business world to delve into the circular economy strategy instead of using fossil fuels and creating more waste than product. The concept of keeping as much materials as possible in the process and using the waste is desired for assorted reasons. The image of the company, creating less waste, makes more profit and environmental thoughts accompany the circular economy thought. This is where algae cultivation comes in as an



extension of the circular economy concept. As an addition the algae could be used as fuel for machines in the process, logistics, algae food production, algae fabrics et cetera. The various application areas make algae interesting for business but that is not the main cause that makes algae a profitable concept. The idea and process behind algae cultivation and utilisation makes it interesting for the current and future market because of the growing waste in the world (T.J & I.C, 2010). This waste problem will become very big in the future, in 30 years this will grow with 70% compared to the waste pile at this moment. Especially China would become a big market, the waste pile of this country will double in 2050 (NOS, 2018). In summary the algae concept could reach a large market with a lot of application areas and used globally, provided that the implementation in the Ostrobothnia region will be successful.

5.3.2 Convert waste into profit

Another innovative and remunerative vision is seeing materials that are originally marked as waste convert into a useful product. By using waste water that has a considerable quantity just as algae, the vision of waste will be converted into a useful source to make profit. The algae contain nutrients that can be used for biogas and food. But the application areas of algae could be of greater extension. There can be clothes of algae fabric, packaging of products, cosmetics, eco services and chemicals. The global product market of algae is estimated to be four billion dollars in 2018 and grow to 5.2 billion dollars in five years (Berg, 2018). Algae protein and dietary supplements have the highest growth rate from all the application areas. The current trends of veganism, health and sustainable business give algae a boost to become even more profitable in the future. Concluding the potential of algae as a cradling of profit is shaped by the following aspects: huge quantity, several application markets and the demand of sustainable products are causes of a high market potential.

5.3.3 Innovative business model

The old-fashioned way of business is selling a product; however, this does not fit in with the business of the future. This is where the opportunity arises to get more profit out of algae. By selling a service to your customers there are several advantages pertaining to only selling the product (Johnston, 2018). Firstly, you can add services to your offerings, when you only sell products you are limited to a certain product that you can sell. This is an example of scalability that you can keep on expanding. Secondly when a business operates in algae cultivation it has a unique selling proposition when selling a service instead of a product. Companies that rival in the same market and selling the same products have limited number of ways in which they differentiate themselves from the competition. A service company can create several ways in which it differentiates itself from the competitors. Finally, with a service revenue model the



relation between the company and the customer is focussed on a long-term relation. This will emerge in a contract between the producer and client that results in a monthly income for the company. An example for algae could be a contract for a company to provide them with biofuel for the production machines and transport. The company does not only sell the algae but also the delivery and maintenance of the biofuel. Also, the infrastructure of the pipes at the company could be part of the service. Concluding a service revenue model would be the best strategy for companies that want to step into the algae business (Johnston, 2018).



6. Algae food and benefits

In this chapter the main elements of algae food are described. The general information about macro algae species can be found in the first paragraph. In the following paragraphs the species are explained. The last paragraph contains the information about the human health and the future potentials of the algae food industry.

6.1 General Macro algae species

Algae based food is currently becoming the new worldwide super food. Many different universities and enterprises are currently researching the possibilities of algae-based food. The most important question is why we should use macro algae? To give a good explanation, it is important to look at the whole circular process of algae cultivation. In short terms, algae food contains a lot of healthy nutrients for the human body. Also, the consumption of algae food is environmental friendly and has big sustainable possibilities (Wageningen University and Research, sd). By comparing macro algae consumption with other food products, the benefits of algae-based food are huge. Currently researchers know that algae are one of the fastest growing organisms. Macro algae can use waste streams as their food. Macro algae can be defined as large aquatic photosynthetic plants. Other well used terms for macro algae is seaweeds. Macro algae can grow by the process of photosynthesis in the chlorophyll of the algae. Chlorophyll are the essential pigments of the macro algae that can receive sunlight. Sunlight in combination with nutrients, carbon dioxide and water are needed to realize photosynthesis. The macro algae receive the nutrients out of the water. Currently researchers can define three types of macro algae, brown seaweed, green seaweed and red seaweed. These marine algae have a vital role in the carbon capture on planet earth. For most people the service, functions and possibilities of seaweed is still a real underestimated value that planet earth provides. Seaweeds and planktons combined producing around 70% of the oxygen on planet earth (Diana Nelson, sd).

6.2 Brown Algae

Brown algae can be defined as brown seaweeds and contains a large group of multicellular macro algae. Brown seaweed are mainly located in low temperature waters around the Northern Hemisphere. According to researchers there are around 2000 species of brown seaweed on the planet (Wageningen University and Research, sd). Brown seaweed mainly grows between 0 and 40 meters under the water surface. Brown seaweed contains like other seaweeds a lot of nutrition's. Focussed on the dry weight, brown seaweed contains between



3-15% of protein as visualised in table 4. The brown seaweeds are important for the environment for especially the carbon fixation. For human consumption brown algae is healthy because brown algae contain a lot of valuable vitamins, antioxidants and minerals. Especially brown seaweed is healthy for the iodine, iron, magnesium, vitamin B-2, vitamin B-9 and vitamin B-12 (Advances in Food and Nutrition Research, 2011).

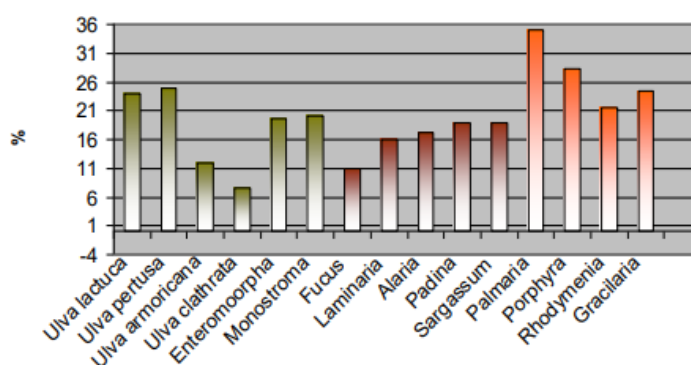
6.3 Green Algae

Green algae can be defined as green seaweeds and is part of the Chlorophyta division. Green seaweeds are mainly located in freshwaters usually attached to submerged wood and rocks. According to researchers there are around 1200 species of green seaweed on the planet (Wageningen University and Research, sd). Green seaweed mainly grows between 0 and 15 meters under the water surface. Green seaweed contains a lot of nutrition and is widely consumed in many different countries. Focussed on the dry weight, green seaweed contains between 9-26% of protein as visualised in table 4. Green seaweed has a vital role for the environment, because green seaweed is a source of food and oxygen for especially aquatic organisms. Green seaweeds also are important in the study of the evolution of plants. Green seaweeds did change well during the past. Also, for human consumption green algae is healthy because green algae contain lots of valuable vitamins, proteins, antioxidants and minerals. Especially green seaweed is healthy for vitamin A, C, E and K, along with folate, zinc, sodium, calcium and magnesium (Advances in Food and Nutrition Research, 2011).

6.4 Red Algae

Red algae can be defined as red seaweed and is part of the Eukaryote division. Red seaweeds are generally found in shallow waters, but red seaweeds can withstand low-light conditions in deep water. Many red seaweed species can be found in the North Atlantic Ocean. According to researchers there are around 6000 species of red seaweed on the planet (Wageningen University and Research, sd). Red seaweed mainly grows between 0 and 90 meters under the water surface. Red seaweed

Table 4 Seaweed protein values



contains many nutrition's and is mostly consumed in Asia. Focussed on dry weight, red seaweed contains between 21-47% of protein as visualised in table 4. Red seaweed is a major source of food and oxygen for organisms. Red seaweed is healthy because red seaweed

contains many valuable vitamins, proteins, minerals and antioxidants (Advances in Food and Nutrition Research, 2011).

6.5 Nutrients

Many different seaweed species contain a lot of nutrients. The amount of nutrients fluctuates a lot because of the species, the weight and the external effects of the environment. Some external effects are the amount of sunlight, depth of the algae in the water, the amount of nutrition's in the water, the temperature and climate changes. The amount of nutrition's varies if the macro algae is dried or wet. Table 5 gives an indication about all the nutrition components of a piece of seaweed.

As is visualised in the table 5. The possibilities of seaweed are huge because it contains a wide range of components. The

applications of the nutrients in seaweed is advanced and, in many industries, seaweed can be used as a resource. Despite that seaweed contains much nutrition's, the number of calories is low (Wageningen University and Research, sd). The combination between the huge amount of nutrients and the small number of calories makes seaweed/macro algae a super food. But it really depends on which macro algae is used.

6.6 Human health and macro algae food

Momentarily there is growing demand for macro algae that contains a lot of nutrients as described above. In many articles macro algae is positioned as a healthy food with a lot of health benefits. In many scientific reports macro algae have a big health potential on a wide amount of illnesses. But macro algae also have some negative effects while consuming. It is known that especially red algae have some side effects like the chance of high blood pressure and it could make the blood thin (Livestrong, 2017). This is because of the amount of vitamin K that macro algae could contain. It is possible that macro algae can contain heavy metals or residue of medicines. This is possible because the water where the macro algae are growing could contain these parts. Especially if the macro algae are harvested in open ponds or in the sea, these macro algae could be exposed on these elements. Heavy metals and residue of medicines can have a bad influence on the human health while consuming. To prevent the

Table 5 Seaweed components

Components	Application
Proteins	Food and feed
Minerals -iron -calcium -phosphor -copper -zinc -magnesium -iodium	Food, Personal Healthcare
Vitamines: A,C,,B6,B12,B3,B1,B9 B5	Food, Pharmacy and Personal
Carageenan (E 407) Processed Eucheuma seaweed (E407a)	Food
Alginates (E400-405) - Alginate acid (E400) - Sodium alginate (E401) - Potassium alginate (E402) - Ammonium alginate (E403) - Calcium alginate (E404)	Food, Personal Healthcare
Agar (E406)	Food
Fucoxanthine	Anti-oxidant
Polyphenols	Anti-oxidant
Fucoidan	Pharmacy
Mannitol	Food
Iodine	Food, Pharmacy
Carbohydrates	Biofuel
Fatty acids	food



negative side effects or the risk of exposure of heavy metals or medicine residue.

Regulations need to be created by the government for the maximum intake of a certain macro algae. Also, regulations about cultivation and harvesting should be created. At last more research is required about effects of macro algae on the human body. Within this way the negative effects of macro algae could be formed, and people can be aware of these elements.



7. Circular economy C&S Algae

The following chapter explains a simplified possibility of an algae-based circular economy linked to the circular economy in Finland to be established in 2025.

The Finnish government decided to establish a circular economy in Finland starting in 2016 and finishing in 2025. There are five areas in the roadmap in which the circular economy shall be implemented. Two of these areas are about a sustainable food system and the focus area on transport and logistics considering replacement of fossil fuels and non-fossil alternatives. In both areas algae have the potential to contribute to reach the set goals.

The food area in the roadmap is about recycling nutrients to increase biomass and minimize eutrophication by reducing nutrients entering waterways. This can be done using the existing nutrients to cultivate microalgae in waste water streams as explained in the following chapter 8. Macroalgae cultivated offshore as already done along the Norwegian coastline can use the remaining nutrients in the water to grow. The cultivation of microalgae leads to the area of transport and logistics in which biogas anaerobically digested from microalgae can work as non-fossil fuels and replace fossil fuels. (Sitra, 2016)



8. Combining production of food and biogas

The following chapter explains the possible combination of food and biogas production based on algae. Therefore, the cultivation processes for micro- and macro-algae are explained to highlight the possible links between the processes.

The productions of food and biogas are not directly linked together. The arising waste streams in waste water treatment plants in municipalities can be used for the cultivation of microalgae. The water cleaned by the algae during cultivation is released from the treatment plants after various interim stages to the ocean. There it contributes to grow seaweed in offshore areas. Microalgae use the nutrients in the waste water for growing and prevent subsequently eutrophication in the sea. (Prof. E. Meers, 2017)

There are two possibilities for cultivating microalgae. One possibility is to grow them directly in arising waste water streams as can be seen in figure 2. A laboratory study was conducted on this topic with the local wastewater treatment plant in Vaasa. Waste water streams of municipalities are used to grow microalgae in them and to be cleaned thereby. The algae are anaerobically digested resulting in biomethane and digestate as products. The digestate can be used in agriculture as fertilizer to produce food however resulting in waste water streams. The biogas produced during anaerobic digestion can contribute energy and heat for further cultivation of microalgae. The water cleaned during micro algae cultivation can be released into the ocean. (Aberystwyth University, University of Southampton, 2018)

The other way of cultivation is to cultivate microalgae in the digestate of food and farm waste after being anaerobically digested. Excess waste nutrient (digestate) produced from anaerobic digestion of food and farm waste is then used to cultivate algal biomass for animal feed and other products of value. A report about the research on that was released by the university of Swansea in January 2018. (Swansea University, 2018)

Macro algae, also known as seaweed, are cultivated in ocean- and seawaters. To combine micro algae cultivation with macro algae cultivation, a flow chart is created to oversee the possibilities for a circular economy (see figure 2). The clean water from micro algae cultivation which is released into the ocean is indirectly used to cultivate macro algae. These macro algae are used for food and pharmaceutical production. This production of these food and pharmaceutical products has waste water streams and therefore can be used for micro algae

cultivation. As said before the biogas can be used as energy. To make the circle complete the waste streams from the food production of agriculture can again be used for micro algae cultivation.

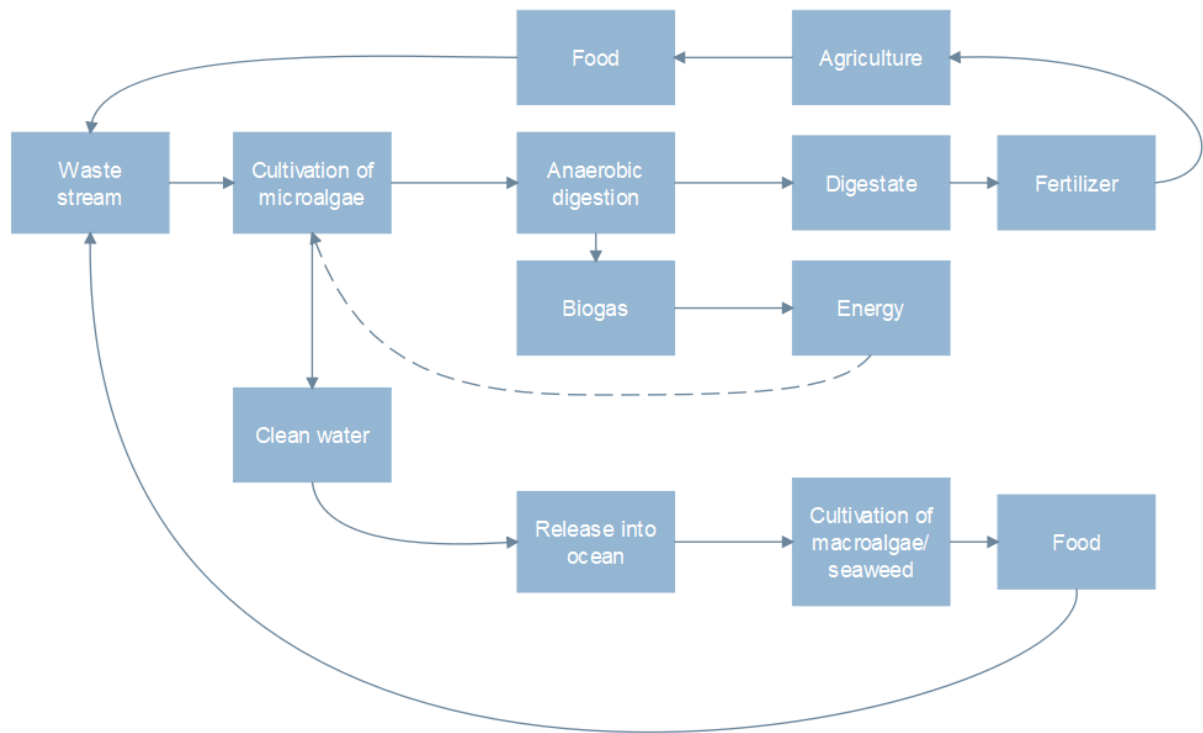


Figure 2 Circular economy of algae cultivation



9. Chemical background

This chapter contains the chemical background of algae. The cultivation of micro- and macro algae and the different steps for harvesting these algae are explained more detailed, as well as the extraction method the hydrothermal liquefaction and what happens during anaerobic digestion. Furthermore, a chemical flow chart can be seen at the end of this chapter to see where chemicals or raw materials are added, when which steps are taken and where the products are formed.

9.1 Cultivation process

Algae are photosynthetic organisms which grow in water. Solar radiation is needed as an energy source to grow. Algae are autotrophic, meaning they build their biomass from inorganic components: water (H_2O), carbon dioxide (CO_2), nitrogen (N) and phosphorus (P). The supply of carbon dioxide and solar radiation are the most important parts for fast growth of the algae.

Algae grow through the process named photosynthesis. During photosynthesis solar radiation turns water and carbon dioxide into oxygen and sugars, algae uses these sugars to grow. The oxygen is a product of photosynthesis and must be released in the air, if there is too much oxygen in the process it reduces the photosynthesis and thereby reduces the algae growth. The temperature of the water is also of interest, depending on the type of algae it would be between 15 and 35 degrees Celsius.

Influencing the amount of nutrients (nitrogen and phosphorus) in the cultivating system is relatively simple, the availability of solar radiation and the efficiency of the algae who uses that light is the most limited factor. (Janssen, 2013) (Raphael Slade, 2013)

The cultivating process of photosynthesis works for both micro- and macro algae the same. The difference between these algae is that micro algae is a single cellular organism and is relatively hard to remove from water. Macro algae is a multicellular organism and has so called plant like characteristics. Due to these differences the way of cultivating is different, micro-algae can be cultivated in open-raceway ponds (open system) or in a photo bioreactor (closed system).

The open system which can be used, is open to the air which makes it easy for the algae to absorb carbon dioxide from the air. In this case there is no extra source/input of carbon dioxide needed. In this pond a paddle wheel is installed to circulate the water preventing



sedimentation. These ponds are kept shallow for optical absorption and self-shadow can cause limited solar radiation and thereby influence the growth of algae. (Willfors, Biofuel Region, 2017)

Another system is a photo-bioreactor (PBR) which is an enclosed system with a series of transparent tubes or plates. The temperature, solar radiation, nutrient and carbon dioxide absorption can be controlled, so that the environment for the algae to grow in is at its optimum, where this is not possible for the race way pond. For a visual representation see figure 3.

For the harvest of micro algae there are diverse types of separation techniques that can be used, such as centrifugation, sedimentation and flocculation. These type of separation techniques are used for separation of liquid and solid mixtures. All explained in the following chapters.

Biogas is formed through anaerobic digestion and contains methane and carbon dioxide. Biomethane can be upgraded and formed into biofuel which can be used as transport fuel.

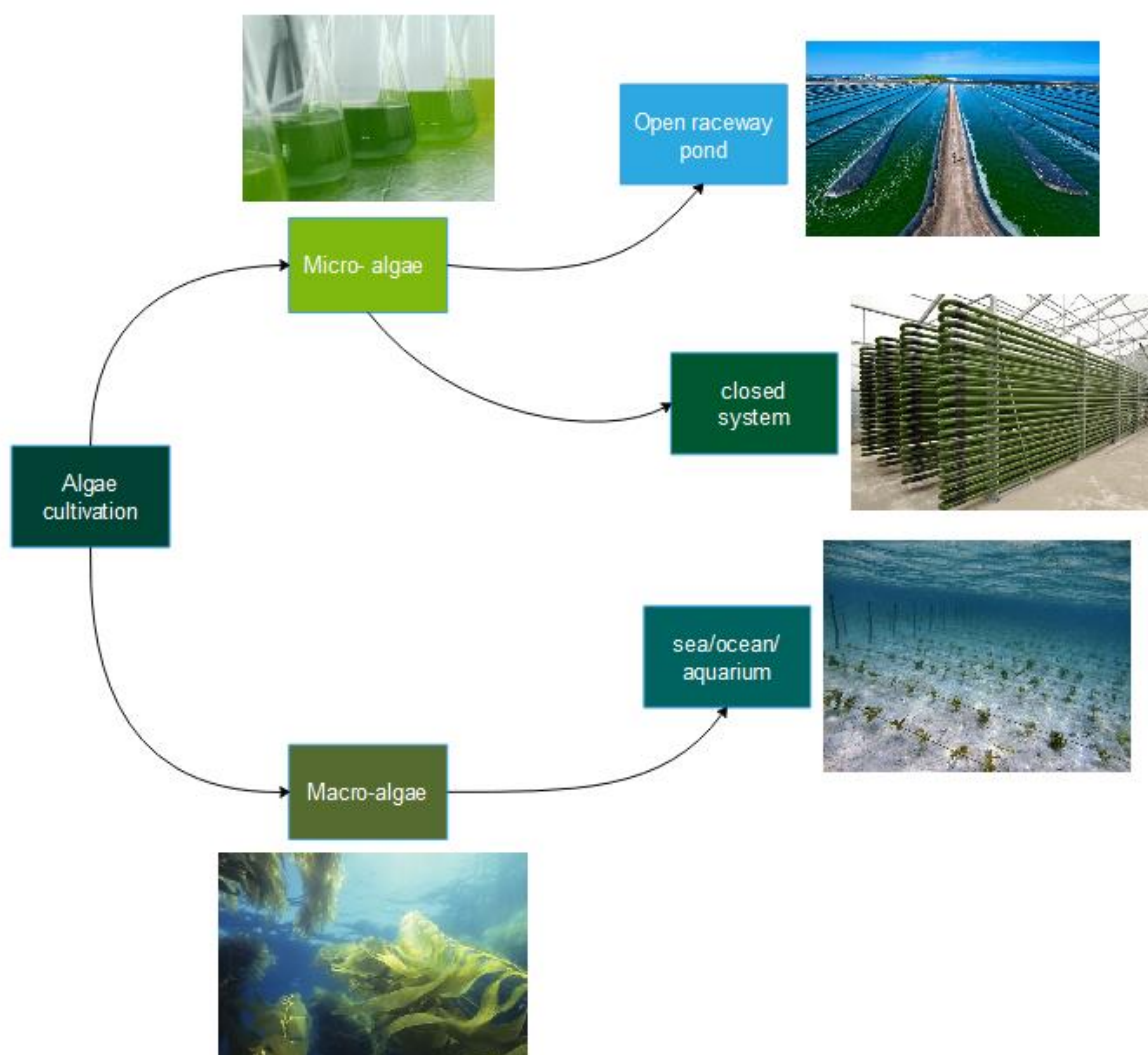


Figure 3 Algae cultivation

9.2 Harvesting of micro algae

For the harvesting of algae several techniques are used in the following order flocculation, sedimentation and centrifugation. There is no efficient way where only one technique is used, because centrifugation will cost too much energy for the number of algae it delivers. The density of algae and water are close to each other meaning that the algae will not sink nor float, therefore it is challenging to harvest the algae and several techniques are needed. (Willfors, Biofuel Region, 2017)

9.2.1 Flocculation

During flocculation a chemical is added which will bond with the algae. This changes the density and condition of the algae. Figure 4 shows how flocculation works. The first tube shows the micro-algae in the water, in the second tube a chemical (the flocculants) is added. In the third tube can be seen that the algae are bonding to the flocculants and in the fourth

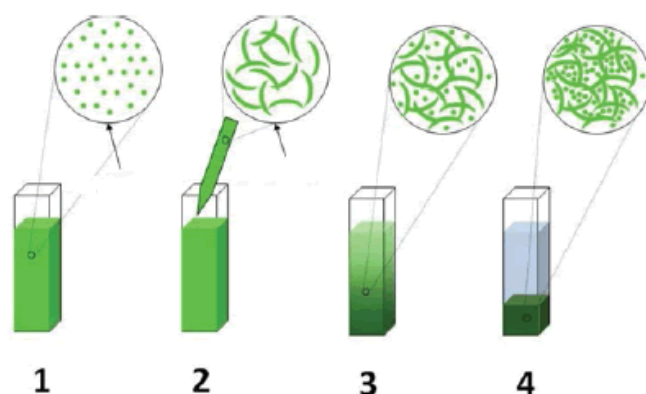


Figure 4 Flocculation of algae (Ghaly, 2015)

and last tube all the algae is flocculated. (Krunal K. Mehta, 2018)

9.2.2 Sedimentation

Sedimentation is mainly allowing the substances in a fluid to settle at the bottom of a tank, there will be formed two layers: substances on the bottom and water as can be seen in Figure 5.

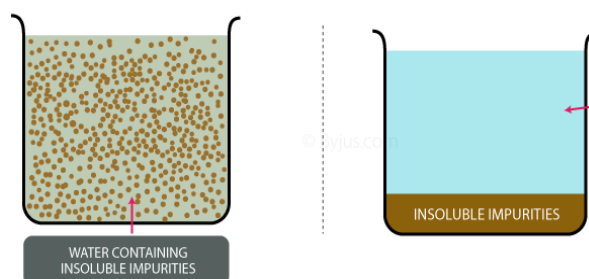


Figure 5 Sedimentation (Sedimentation, 2018)

In this case the algae sink to the bottom due to the added flocculants. Sedimentation happens from tube three to four in Figure 4. The algae can be removed from the bottom of the tank. (Speight, 2016)

9.2.3 Centrifugation

During centrifugation the mixture of water and algae is being rotated and due to the difference of mass density with the effect of centrifugal forces the algae is separated from the water. In Figure 6 the principal of centrifugation is shown. The algae taken from the bottom of the sedimentation tank still contains water, centrifugation is used to remove that water for as much as

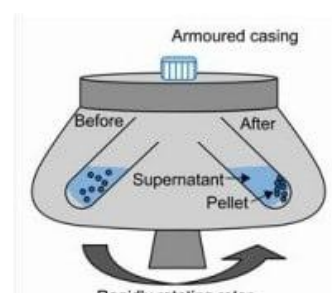


Figure 6 Centrifugation (Fisher, 2018)



possible. This substance is put in the centrifuge, the centrifuge will be rapidly rotating around its axis. Due to the centrifugal force the heaviest materials (in this case the algae) in the substance will go the outside of the centrifuge and is called pellet. The water is being called supernatant, can also be seen in Figure 6. (Packo Lamers, 2013)

9.3 Extraction

Extraction is a separation technique where two immiscible liquids are used to isolate components of a mixture based on their differences in solubility. There are diverse types of extraction, in this case Liquid Extraction (LLE) is applied. Other extraction techniques are solid-liquid extraction (SLE), solid-gas extraction (SGE) and liquid-gas extraction (LGE), which technique is used depends on which phase the raw materials are in. In this case there will be only liquid, therefore LLE is used. The product extracted is mainly lipids.



Figure 7 Liquid Extraction (Lebedev, 2018)

During LLE there are two immiscible liquids mixed. The substances in these liquids will divide between the two liquids based on their affinity and chemical potential for the liquid phase. Due to the layers of liquids that will form, one layer can be extracted from the other, as can be seen in Figure 7. In this case the oil will be extracted from its cells. The algae will be dried and adapted with solvent. The liquid fraction in the remaining biomass is removed, and the extracted lipids from the algae remain. The solvent can be distilled from the oil. (Babetta L. Marrone, 2018) (Oostenbrink, 2017)

9.4 Hydrothermal Liquefaction

The difference between extraction and hydrothermal liquefaction (HTL) is that with HTL there is no need for the biomass to dry, it can be used still wet. A similarity with HTL is that it also produces bio-oil, but the technique applied is different. (Babetta L. Marrone, 2018)

HTL produces this bio-oil, also known as biocrude, using high pressures (50-200 atm) and elevated temperatures (250-400 °C). It exploits the properties of superheated fluids for reducing mass transfer resistances. (Jerome A. Ramirez, 2015)

9.5 Anaerobic Digestion

Anaerobic digestion consists of 4 steps, in the following order hydrolysis, fermentation also called acidogenesis, acetogenesis and methanogenesis. (GLW Energy, 2018)



9.5.1 Hydrolysis

During the hydrolysis the complex organic compounds break down into sugars, amino acids and fatty acids. (GLW Energy, 2018)

9.5.2 Fermentation

During the fermentation the sugar turns into organic acids, gases and alcohols, in an anaerobic environment (anaerobic = without any oxygen). (GLW Energy, 2018)

9.5.3 Acetogenesis

During acetogenesis H_2 , CO_2 and acetic acid are formed out of acids and alcohols. (GLW Energy, 2018)

9.5.4 Methanogenesis

During methanogenesis H_2 , CO_2 and acetic acids are formed into methane and CO . (GLW Energy, 2018)

9.6 Harvesting macro algae

The harvesting for macro algae is rather easy compared to the harvesting process of micro algae. Because of the plant like characteristics of macro algae this seaweed can just be removed from the sea using nets. When cultivated using ropes, the ropes can be removed from the sea with the attached seaweed on it.

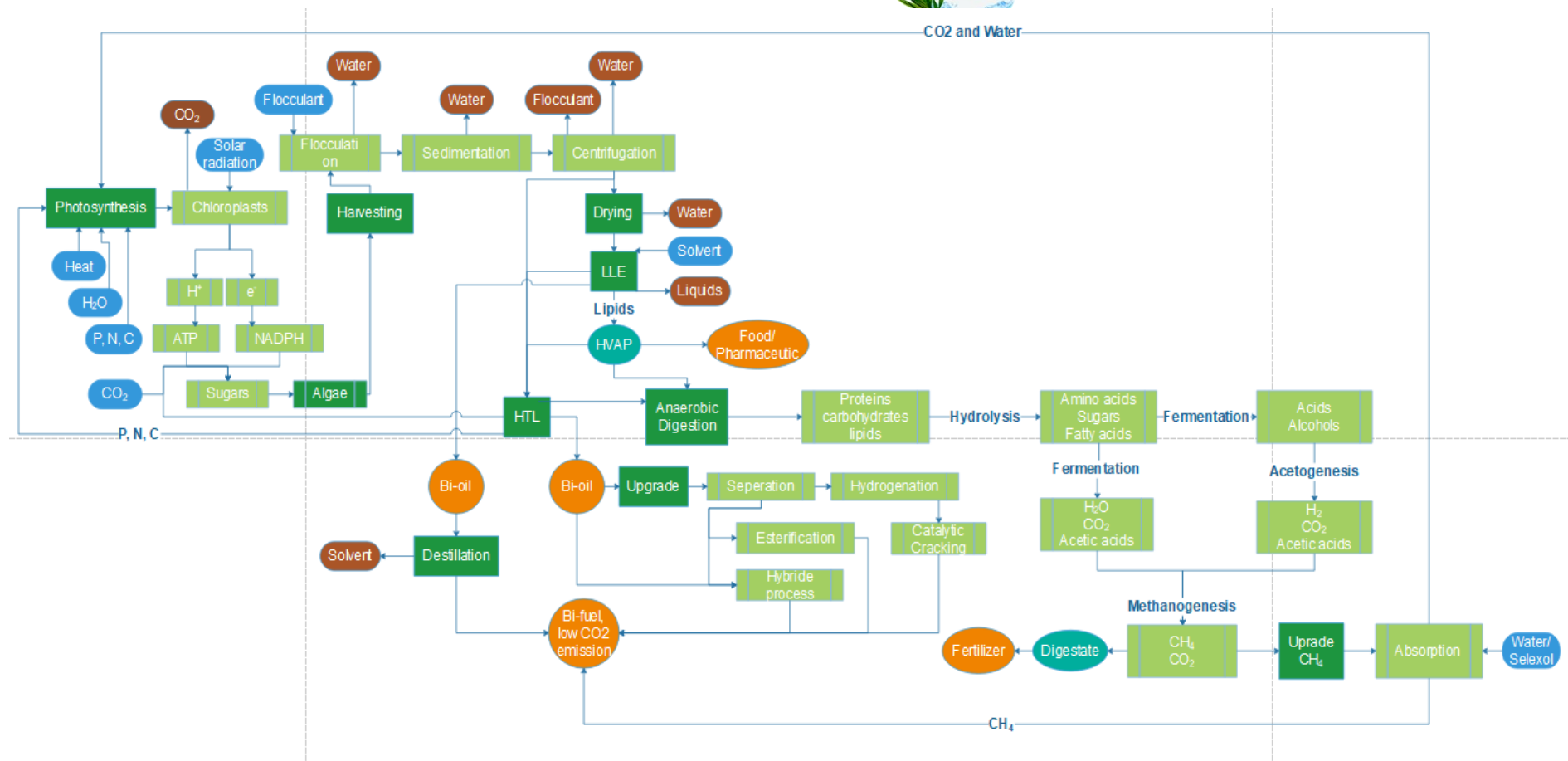


Figure 8 Chemical Flow Chart



10. Cultivation influence factors

To gain the most out of algae cultivation there are several factors which need to be considered. These parts determine the quality and quantity of the algae cultivation. When the cultivation is done for instance with the ideal temperature, the cultivation will fetch the optimal number of algae. This chapter will inform mainly about the different influence factors but does not go into detail about the influence of metal stress and other factors.

10.1 Carbon dioxide and light intensity

When the amount of CO₂ has an optimal quantity, the advance of lipids production of micro algae gets enlarged. The optimal amount of CO₂ depends on the specie of the algae. For instance, the common algae *Vulgaris* will be cultivated under the ideal circumstances of 8% CO₂, the lipid productivity is 29,5 mg L⁻¹ day⁻¹ (Zhu, 2017). Another factor that is important for the optimal amount of lipids is the light intensity. When the light intensity is adequate and sufficient, it benefits the production of microalgal lipids. However limited or saturated light intensity will give a negative effect on the microalgae production. This is a weakness for the Ostrobothnia region, as it is an area with less solar radiation during a year.

10.2 Temperature

The temperature is another essential factor that influences the algae cultivation. Under ideal circumstances, the microalgal and the lipid production increases. The optimal temperature depends on the specie of the microalgae. For most species an ideal temperature lies around 25°C. Overall the optimal temperature varies from 20°C up to 30°C. To determine on which temperature the algae should be cultivated, there is a table that consults about the temperature that should be used for the distinct species (Zhu, 2017).

Table 6 Microalgae temperature (Zhu, 2017)

Microalgae	Temperature (°C)
Chlorella vulgaris	25
Monoraphidium sp.	25
Chlorella zofingiensis	25
Ankistrodesmus falcatus	20
Chlorella lobophora	20
Chlorella protothecoides	28
Parachlorella kessleri	20-30
Scenedusmus sp.	25

10.3 Salinity stress

Salinity stress affects the physical and biochemical characteristics of microalgae. The salinity pressure that is created in the cells, results in a higher lipid value. However, a salinity level that is too high will reduce the lipid growth and change the shape and structure of the microalgal cells. This is caused by the water pressure between the cells and the media. The highest fatty content of 47% in dried weight was achieved with 13g L⁻¹ NaCl (Zhu, 2017). The optimal level of pressure should be determined before cultivating.

10.4 Metal stress

The metal stress is also a factor that has influence on the lipid production and the growth of microalgae. Magnesium, calcium and iron stress contribute to the increase of the total lipid content. For example, the Scenedesmus sp. microalgae lipid content could be increased by 47% when using the iron, magnesium and calcium stress in combination with cultivating in a dark environment. Cultivating the chlorella microalgae specie under copper exposure, results in a higher lipid concentration (Zhu, 2017). However, the metal stress should not be too high because it would trigger possible damage to the algal cells.

10.5 Visualization of the influence factors

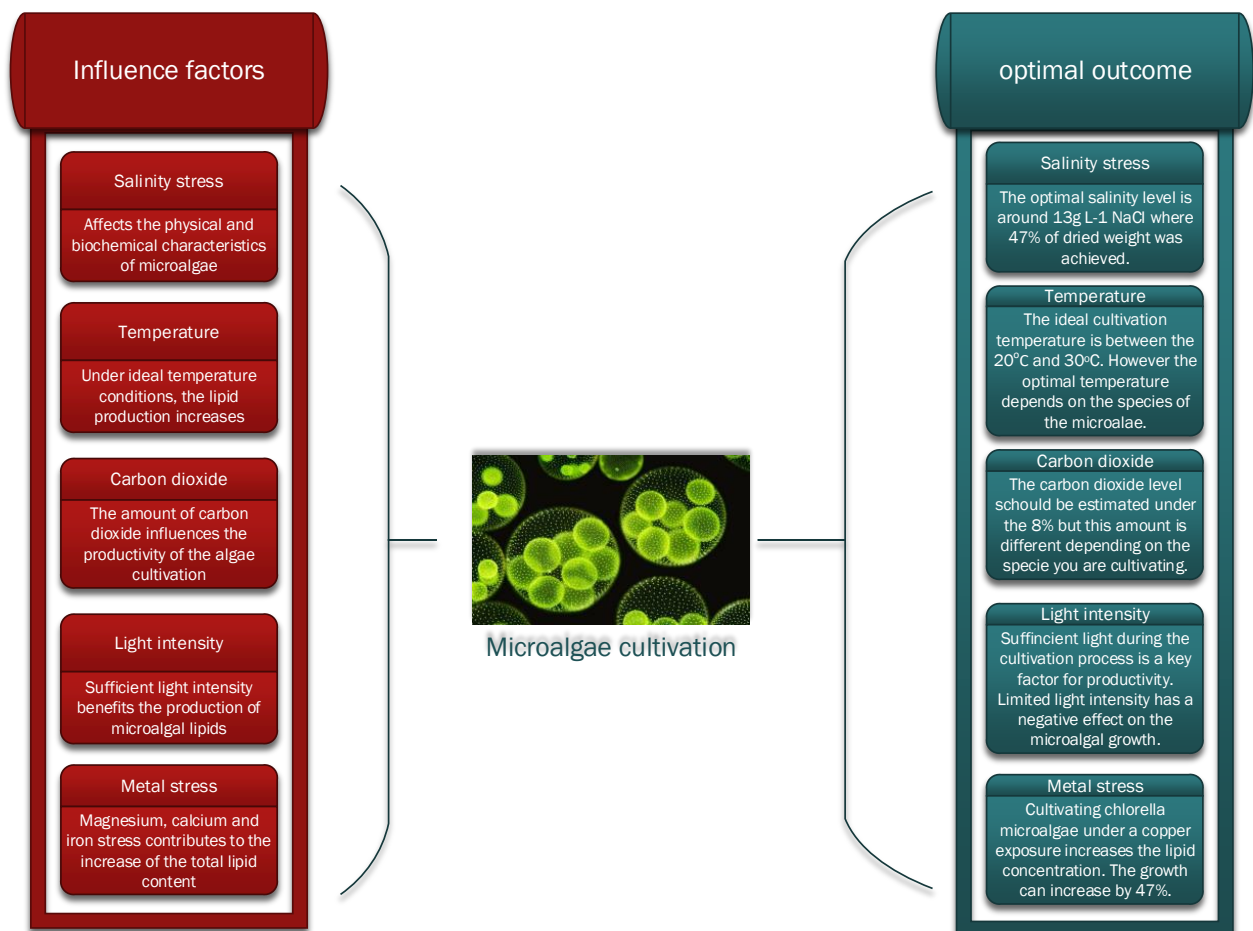


Figure 9 Influence factors

11. Macro algae concepts

In collaboration with the marketing students, the C&S Algae project group created different concepts of macro algae products. The C&S Algae project group contributed by giving technical insights to the marketing students about eatable algae and the overall process when using algae as food. This chapter focusses on the different concepts that could be commercialized in the Ostrobothnia region. The different concepts include algae rye chips, protein powder, Dulse Algae meat replacer, algae protein shot and algae granola.

11.1 Green Gold Concept

Green Gold is the brand name of the seaweed snacks producer from Scandinavia. The first line of products includes algae chips produced in a sustainable way to maintain and develop a sustainable economy. Sustainability and diligent care for the environment is the key vision of Green Gold.

11.1.1 Customer and market analysis

The success of a product depends on good research to determine where the opportunities for the algae market are. A good market analysis can show where the gap in the market is

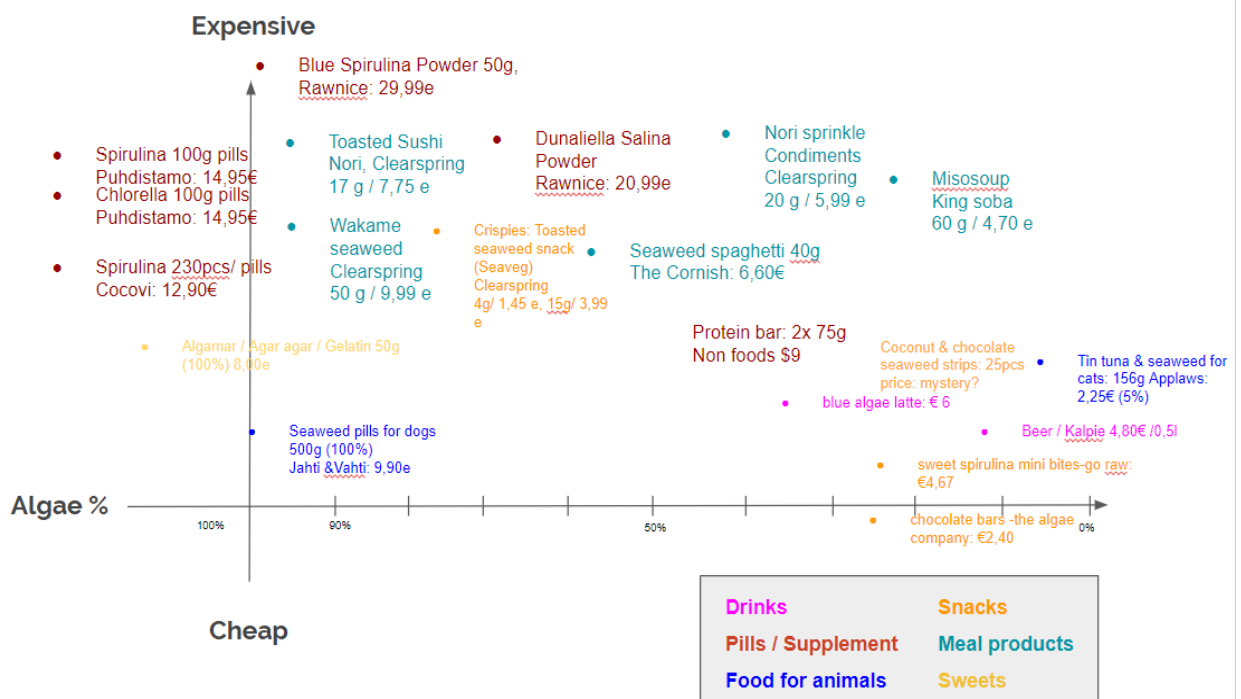


Figure 10 Market analysis

positioned. Figure 10 shows the market analysis that Green Gold executed before its existence.



The outcome of this market analysis confirmed for the project group that there is a gap in the algae snack sector. Nevertheless, more research is needed to know what kind of product will succeed in this market. The next step was to think about the customer groups. Three potential customer groups are divided with diverse needs. To determine these needs, the project group interviewed customers of the three groups. The outcome of the customer research is shown in table 7.

Once the market analysis and the customer analysis are done, the project group moved forward to rough versions of the product itself. Not only the product but also the way it is produced is important for the brand Green Gold. The next chapter shows the production process of algae rye chips.

Table 7 Customer grouping

Customer grouping for chips

*"Rye chips are an allowed delicacy"
(trend product in Finland, Estonia,
Sweden, Norway)*

Common in all customer groups

All like salted snacks

Used to buying basic snack products ex. chips, peanuts, crackers

Customer Group 1: Healthy people People who want to eat chips in a healthy way Better choices for normal chips	Customer Group 2: Heavy snack consumers Offer an option to shift unhealthy products for more healthier products	Customer Group 3: Vegans / vegetarians / Diet Add options to the regular offering (sweet potato chips, carrot chips) Many chips/snacks contain milk/lactose - vegans can't eat	Motivations to buy: • Different age people (hypothesis that younger buy more atm) • People who value quality over price > willingness to pay • People with high knowledge of the benefits • Early adopters, who always like to be the first one to consume, test and give feedback • Trendsetters for example organic food etc •
Segments of GROUP 1 • Sport fanatics • Fitness trend -people • People that don't like regular chips -> open for alternatives • People who want to eat good quality snacks	Segments of GROUP 2 • Daily basis eaters • Addiction • nicolas • People that just want to eat nice food no matter the nutritions	Segments of GROUP 3 • People that only eat plant-based food • People with different food allergies (gluten-free, non-milk..)	

11.1.2 The product

Green Gold algae chips come in two variants and three different flavours. The first group is chips made from algae and rye. The algae that are used for this product are spirulina. Due to the high value of salt in these algae there is no need to put extra salt in the product resulting in less ingredient costs. Nevertheless, the taste should be compensated with a taste of rye to cover the dominant taste of algae. To balance the taste, the ratio of algae and rye is 10% spirulina to 50% rye. The other ingredients depend on the flavour of the chips. The three different flavours are: Wasabi, sea salt and at last sour cream and onion. The second product is made from oat instead of rye and has the same flavours. The difference between the rye and the oat chips is the shape, the taste and the structure of the product. To adapt to the Scandinavian culture of gluten free food, Green Gold products are all gluten free and on top of that also vegan.



Figure 11 Green Gold product concepts



Figure 13 Poster Green Gold concept

11.2 RedVeg Concept

RedVeg is a Finnish brand which sells dulse (Palmaria Palmata) products. With dulse having a taste compared to that of bacon, the slogan for RedVeg was created: “Give up meat, not the taste”. The concept of RedVeg is to create a healthy and sustainable product using macro algae as a raw material.



Figure 14 Logo RedVeg Brand

11.2.1 The Product

The concept of RedVeg includes a product family that consists of three various products, namely algae crunches, slices and pulled algae. RedVeg dulse products have a smoky and savory flavor, such as bacon, without the unhealthy effects of processed meat. All the products are made of pure dulse which is harvested from the oceans waters. Then dried to give it the crispy texture, and to make sure that the products retain their quality for a longer period.

Algae crunches are dried dulse which can be used as a flavoring for dishes and salads. The dulse is pulverized making it easy to use as a spice. The algae slices are dried algae as well but in a crisps size shape and can be used as it is. When these dulse slices are fried it tastes like bacon which can, for example, be used for breakfast. The pulled algae can be used in vegan burgers, tortilla's and nachos as a meat replacer.

These RedVeg products are packed in biodegradable packages made from recycled paper from Finland, and the plastic parts of the packaging are produced from algae itself which makes it biodegradable. All this to maximize the sustainability of the product, and to reduce waste. The products are sold in local grocery stores to bring tasty vegan solutions closer to the consumers.



Figure 15 RedVeg Product packaging

The functional and rational values of these products are that it is easy to buy and to cook with. The bacon-like taste of dulse lowers the barrier of trying plant-based protein, which makes it easier to switch from meat to a meat substance. The symbolic and emotional values are a positive emotional experience from 'doing a good thing' and being part of a conscious community by eating healthily by choice.

11.2.2 Consumers

The target group of RedVeg is mainly vegans, vegetarians, experimental home cooks and consumers who are willing to try plant-based protein sources without needing to compromise the taste. To understand the consumers, three personas were created. To sum it up the first persona's living style is Experimental Emily, 25 years old, omnivorous and eating healthy. She is not willing to give up meat completely, is keen on trying new products and aware of environmental issues. The second persona is William Vegan, 23 years old, and wants to reduce waste. He is interested in animal rights and has followed a plant-based diet for four years, also looking for more options to consume proteins. The last persona is Experimental Eva, 50 years old, has two children and wants to offer them a more sustainable and nutritional food options daily. She wants to make sure that her children have a good world to live in.



Figure 16 Poster RedVeg



11.3 Healthical Concept

Healthical is a Finnish brand which sells health products. The concept of Healthical is to create a healthy and sustainable product using algae as a raw material.

11.3.1 The Products

The Healthical concept contains two products made from algae. One is a protein drink sold as algae shot. The other product is granola containing algae.

The Healthical Shot helps to recover from training or workout. It is also a step forward to an increased health as the shot contains various vitamins and is rich in proteins. As an emotional value proposition the shot offers a good feeling of using a healthy product that doesn't harm the environment and nature. The natural ingredients and easily recyclable packaging of the product mirrors the personality of its users. The products on the market contain usually animal ingredients such as milk, but Healthical Shot is totally vegan and contains only natural ingredients, which also expresses the personality of its user through the veganism.

The main purpose of granola offered by Healthical is to take away the hunger. Further it offers mental images and feelings about being a part of saving the nature and the earth's future. That means for the customers that they are starting the change and they have a significant role in it. Granola package is made from recycled cardboard and the price is a little bit higher than of other products as it offers a new way to eat algae and starts a profound change for the environment. Customers consume it because of being a symbol of changing the future.



Figure 17 Poster Healthical concept



11.3.2 Consumers

The target group of Healthical is mainly athletes and trainers who have an interest in healthy nutrition and an awareness of the environment. To figure out which needs the target group has several people were interviewed. These people were athletes doing casual and professional workout as well as trainers. Another group was the group of vegetarians and vegans to gather also their opinions about and attitudes towards algae products. The interviews of the athletes showed that there is a need for tasty products for a fast recovery after training with a high quality. Consequently, the products should contain enough vitamins and be ecologically friendly as well. The outcome from the interviewed vegetarians was the need to have an alternative for getting proteins and a great open-mindedness towards algae-based products.



11.4 Ocean powder

Ocean powder is a new Finnish foodbrand that developed a new plant based protein powder based on Algae. Algae is internationally known as becoming the new super food due to its many health benefits. Ocean powder is a special protein powder that contains a lot of proteins, but also a lot of vitamins and antioxidants. The combination of all these benefits makes the product unique and widely applicable. Ocean powder is a real one of a kind, because algae protein content has not been utilized effectively yet in algae products, so there is a market gap.



Figure 19 Ocean powder logo

11.4.1 The Products

Ocean powder creates powder supplements since we are using algae from the oceans and refining them into high-protein and -vitamin powders. The products of Ocean powder give new possibilities to add powder to beverages for daily products, in order to receive all vitamins and proteins that are needed for the human body. The sustainable and multi-functional powders is suitable for an extensive variety of applications. Currently algae is seen as one of the most influencing organic ingredients right now. The most valuable feature of the products are the possibilities to combine healthiness, ecologically and sustainability in food beverages.



Figure 20 Ocean powder product

Ocean powder has developed three main products to create a brand. All the products are sold in recyclable and environmentally friendly packages. The first product is Ocean Algae Protein. This product is a mixture of green Ulva algae (20%) and soy protein (80%). The product mainly contains a lot of proteins which are fully based on plants. In combination with the high amount of vitamins and antioxidants this product is a good addition for consumers. The second product is Ocean Algae Vegan. This product is a mixture of multiple algae species and soy protein. The product contains a lot of vitamins and is fully based on plants. The combination of proteins, vitamins and antioxidants makes this product a healthy. The third product is Ocean Algae Plus+. This product is a mixture of red algae and soy proteins. The product differs from the others since it contains a lot of vitamin K, which helps to thin blood on a natural base. Also, the product contains a lot of other vitamins, antioxidants and proteins.

The company is named Ocean powder. The name represents the algae that we cultivate in the sea. The sea is the most valuable source for not only the company but also for the world.



Therefore, Ocean powder has made a collaboration with The Ocean Clean Up.

This nonprofit organization developed a sustainable system to clean the ocean. To make a difference in the world, Ocean powder donates a certain percentage of the profits each year to this nonprofit organization.

11.4.2 Consumers

Ocean powder defines three major target groups that the brand will focus on.

Sportiacs (18-40 years old)

The Sportiacs can be defined as a target group that does a lot of sports and athletics. This group has a mobile lifestyle and is focused on eating healthy during their daily activities. Sportiacs wants to be active whenever possible, and has a genuine care of the environment. This target group takes diligent care of their own health, but also care about their relatives and people close to them. Sports is a major factor in their life, but it doesn't have to be part of their profession. Ocean powder has developed Ocean Algae Protein for this group of consumers.

Greenish (20-50 years old)

The Greenish is a target group that has a sustainable lifestyle. They care about the nature and are often vegan or vegetarian, this group uses a lot of plant-based products during their daily life. The Greenish care about other's wellbeing and they want to be socially active all the time. They also have strong opinions, and want to have effect on the things they care and value. Ocean powder has developed Ocean Algae Vegan for this group of consumers.

Goldies (60+ years old)

This target group contains consumers with an older age that are not stuck with their habits. This group wants to try new ways to live their lives more sustainable than before. Since this target group is significantly older than the other consumers, they might have health issues like for instance thicker blood. One of the main benefits, of protein and vitamin K supplements, is that red algae products can thin their blood on a natural base. Ocean powder has developed Ocean Algae Plus+ for this group of consumers.



CUSTOMER GROUPS

GREENISH, AGE: 20-30

- Sustainable lifestyle, cares about nature, social, is vegetarian/veganises a lot of plant products daily life

SPORTY, AGE: 18-30

- Does a lot of sports or any kind (does not just include the "fitness" people) and has a mobile lifestyle wants to eat healthy and keep him/herself nourished during outdoor activities

GOLDIES, AGE: 40+

- They have concern about the status of planet and environmental want to be part of the change. They have open mind to new experiments (foods, supplements, medicines) they would take care of their self at the old days and have high values towards climate change

OCEAN powder

VEGAN PROTEIN SUPPLEMENT WITH ALGAE

- Vegan protein supplement with health benefits of algae
- High in algae (ulva 20%) mixed with soy protein (80%)
- Has every aminoacids that consumer needs
- Good source of minerals like iron, magnesium, iodine, sodium, selenium, B-vitamin and beta-carotene
- Can be used on daily basis for example in smoothies, 1 scoop or as it is blended with water
- Powder does not include any added flavours, mild taste
- Is packed in a recycled paper bag
- Net weight: 500g/16oz
- Serving size: 0.5 - 1 dl per day

CONCEPT AND BRANDING

- Protein supplements are popular trend at the moment
- Ocean Powder offers an easy way to get extra protein to consumers' diet in a sustainable way
- Ocean Powder is 100% vegan protein, and at the moment there are only few vegan protein supplement on the market
- In addition protein is a good option to non-vegan consumers because it includes lots of vitamins, omega 3 and antioxidants
- Protein supplements market worth is expected to grow \$21.5 billion by 2025
- Plant-based products are expected to display fastest growth

POSITIONING AND COMMUNICATION

- The product is positioned as a high-end product, it is little more expensive and has better quality than its competitors
- It is also positioned as sustainable, organic and environmental product
- It stands out from its competition with the health benefits that algae provides
- Visual packaging includes info about the health benefits and vegan mark
- Raising awareness about algae products and the health benefits nutritional therapists
- Marketing channels: Blogs, cooperation, expos, magazines, Instagram

Figure 21 Poster Ocean powder

12. Business model

12.1 Start-up financing

When a company wants to operate in an energy market it needs a way of financing the market penetration project. The renewable energy market is characterised by many risks, uncertainty and many new participants. The plant-based snack market has the same characteristics in which case it needs the same approach. Moreover the plant-based snack market is a booming industry with a lot of new competitors, however it is an innovation when it comes to algae snacks. These kind of products are rare especially in the regular supermarkets. The leverage ownership flip and pay-as-you-go, is a good option to finance such a project and reduce the risk of losing too much money.

The leverage ownership flip and pay-as-you-go model also called pay-go is a model that shows the ways of financing the project. In this model the tax investor makes contribution before the project begins, a portion may be deferred until the project receives production tax credits, which are initially allocated to the investor, though a great amount of capital is paid to the developer as an equity contribution. This serves as a guarantee when the project does not perform well. The PPA stands for power purchase agreement which means it contains a long-term debt up to 18 years. This way of financing is the best option when it comes to a competitive market with risks and uncertainty regarding the innovative product that is being positioned in the market. The model itself is visualized in Figure 16 (greenrhinoenergy)

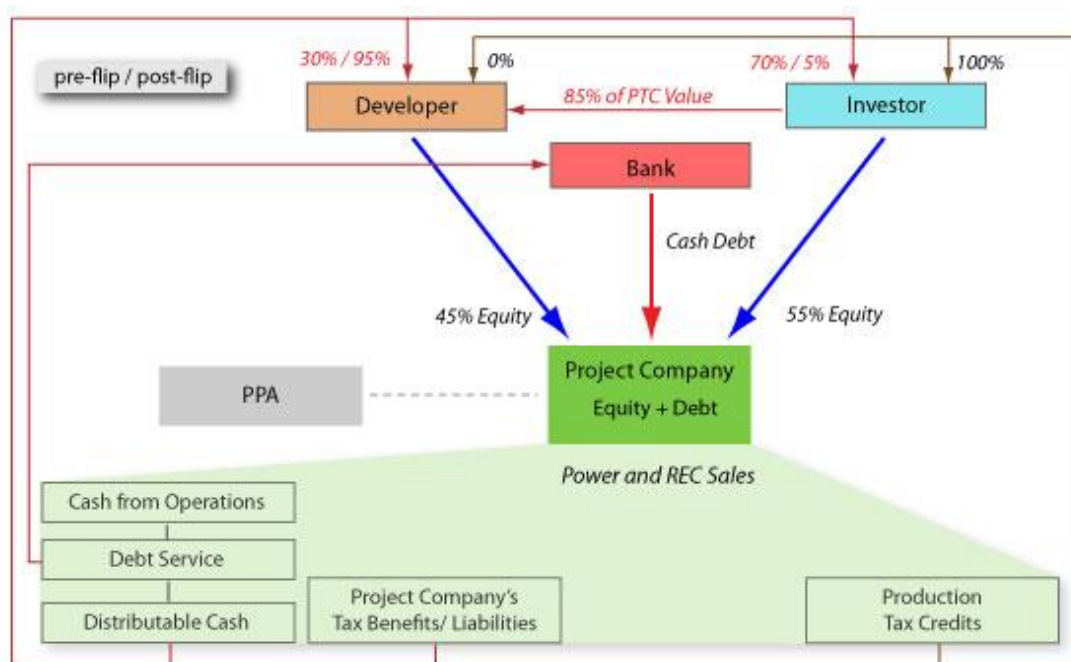


Figure 22 Project Cashflow (greenrhinoenergy)



12.2 Business model for micro algae

The business model gives a clarifying image about the eleven most crucial factors when a company wants to commercialise the C&S Algae project. The main reason of the business model is to give information about all the factors that needs to be taken into consideration. The business model is visualized in the following model and will be explained in the next chapters (investopia, 2018).

Table 8 Business model

Key partners - Potential customers - Key suppliers - Key information sources - stakeholders	Key activities - Algae cultivation - Algae harvesting - transformation	Value proposition - Value added - Need of the customer - Sustainability products	Customer relationships Communication with different segments	Customer segments - Food sector - Energy sector - Medical sector - Industrial sector - Needs of the customer - priorities
	Key resources - Algae - Cultivation material - Digestor - Harvesting material		Channels - Marketing strategy - Distribution strategy	
Revenue stream - Energy contract - fuel - Macroalgae for food		Cost structure - Cultivation machines - Harvesting costs - Supporting material - Employees - Business premises		
Social & environmental costs - Human health - Eutrophication - Displacement of local fauna		Social & environmental benefits - Reducing waste - Using sustainable resources - Using land unsuitable for traditional agriculture		



12.2.1 Customer segments

The main segments where algae could be commercialised are the food and biofuel sectors. However, there are many more application areas that should be taken into consideration. For instance, the industrial sector is a profitable sector to sign energy contracts with the companies of the B2B (business to business) market. The medical sector could also be a possible market in the future when algae could be used for medical purposes. Although all these markets have immense potential there should be a prioritization made of which segments have the best potential. For now, the microalgae for biofuel and macroalgae for food are the most profitable segments. When the adaptation of the algae is in a further stage, the algae can be used for several segments.

12.2.2 Customer relationships

Due to the different segments where algae are used as a sustainable product, it should be communicated in a proper way to the stakeholders. The food sector needs a different approach than the energy sector. In both sectors it must be dealt with the B2B market and the B2C (business to customer) market. For instance, it is important for the B2B that the product can be produced in high volume, delivered in time and is sustainable. The B2C market is more interested in the health benefits of the products and the price. The way of operating with the customers is also an essential part of maintaining a good relationship with your clientele. The B2B market demands a very personal and intensive contact. However, for the B2C market it is sufficient to inform the costumers from a distance.

12.2.3 Channels

The channels include both the marketing strategy and the distribution strategy. The marketing strategy for the B2B market should include participation in energy/food fairs with a C&S Algae stand, advertisement in B2B magazines and sponsorships for car races. The marketing strategy for the B2C market should take care in a unique way. Advertisement through social media, sponsorships with cooking programs and lobbying with the politics to promote the renewable energy source in every household should result in a higher sale.

12.2.4 Value proposition

The demand of sustainable resources that supports the circular economy is already at an elevated level and will only expand in the future to a stage where it is obligated to only use renewable energy and sustainable products. The value that is added to the product is basically purifying the algae and cultivating it, so it can be used as biofuel or food. The elements within this process stay within the process so there is minimum of waste. This circular economy fundamental fits well with the demand of the customer (investopia, 2018).



12.2.5 Key partners

The most important partner in the starting phase of the commercialisation of C&S Algae is the investor that is prepared to financially support the start-up. Also, the costumers of the micro and macro algae are essential to make the algae business work. As mentioned before these costumers have different concerns and should be approached in diverse ways. The suppliers of the semi-finished products and cultivation material are also partners that are decisive for the business. In the case of algae there is a promising opportunity to use the government as a marketing boost for commercialising algae. Due to the aim of governments to pass on mostly renewable energy in the future, the algae business could get boosted and adapted into the future culture of energy use.

12.2.6 Key activities

The key activities for turning algae into a useful product are divided in three steps: cultivation, harvesting and transformation. Cultivation contains the elements of combining waste water and nutrients with waste heat and CO₂. If the cultivation phase is finished the harvesting can begin. The harvesting phase will continue with transformation into biogas, bio oil or a high value-added product like food supplements.

12.2.7 Key resources

The production resources contain the algae, waste water, waste heat and CO₂. For the cultivation of algae, it is the best option to outsource it if open ponds systems are not used, especially in the beginning when there is not much money in the company. For the harvesting part there should be bought harvesting machines that turn the algae into value added products. A big production hall for the harvesting or outside if open ponds are the way of cultivating. The other considerable resource is distribution of the products. Depending on the market there should be an efficient system of logistical matters because of the prohibitive costs.

12.2.8 Revenue streams

A possible revenue strategy could be an energy contract with the B2B market where the company provides the client with energy for their production hall and production machines. Another important value stream is the gas stations. Negotiate with big gas companies such as Shell could result in a big source of income and acceptance for biofuel. Macroalgae could also turn into a valuable business when commercialising the product into the culture. The way to do so is getting the product into the supermarkets, restaurants and TV shows. Due to the healthy background of algae in combination with the upcoming trends of a healthy life this market could become profitable (ecommerce-digest, 2018).



12.2.9 Cost structure

The cost structure is divided in two parts: variable and constant costs. The variable costs contain the production resources like algae and employee costs. The constant costs are the rent of the business premises, and the production machines. On the other hand, the costs of employees could be constant when there are no temporary workers and the production machines are partly variable depending on the time they are harvesting and use energy.

12.2.10 Social & environmental benefits

Turning algae into a business has influence on the environment and the social life. Starting with the benefits, the sustainable products that are used stay in the process cycle and are used repeatedly. No fossil resources are used within the algae production plan. As a result, the waste that is produced during the production process is minimized and thereby suits the recent and future demand of sustainable production methods. Another environmental benefit expresses itself in the area that is used for cultivation. Using land that is unsuitable for traditional agriculture so there is no variance with other competitors, is a social and an environmental benefit.

12.2.11 Social & environmental costs

Besides the benefits there are also some social and environmental costs. First of all there is a risk for the human health when using waste water. Although the water can be filtered there are molecules that are difficult to filter like medicines. This is an example of a possible threat when cultivating and harvesting algae. One of the other main risks comes down to the biodiversity when cultivating on a high scale. Organisms in the water rely on the oxygen that the algae produce. When cultivating on an industrial scale it has a negative impact on the biodiversity. The impact of this phenomenon depends on the scale of cultivating, when there is a controlled process then the damage will be limited. Finally, the biofuel production has met with the controversy as to displacement of food crops for production of fuel. A reduction of land that is needed for the growth of algae is one of the key selling point.



13. Conclusion and recommendations

Considering all mentioned aspects, algae have a great market potential due to their diverse possibilities of usage. This is shown in the SWOT-analysis which identified several strengths and opportunities containing innovativeness and sustainability. The mission with the C&S Algae project was to find innovative solutions for renewable energy and product concepts from macro algae which are cultivated in the Nordic climate. The outcome of this mission is mentioned in this chapter.

The Triple-P-model pointed out the advantages of algae for the economy of Finland, the employees working in the sector and the positive effects on the environment. Algae effect the environment in a positive way by reducing the CO₂ pollution in the air and using nutrients in waste water during the water purification for growing. These characteristics show the circular character and the opportunity to turn waste into products. Consequently, algae can be used in a circular economy which gives algae the possibility to contribute to Finland's circular economy aimed to be established in 2025.

A recommendation is to increase the technical and information exchange between the specialists working on the topic in Sweden, Norway and Finland. Norway and Sweden are already cultivating algae; Norway has its pilot sites for macro algae in their coastal areas and Sweden having algal activities in an industrial scale and selling algae for medical purposes.

The workshop with the marketing students has also shown a great market potential for macro algae. Interviews have shown open-mindedness of people towards algal products.

Additionally, there should be further research on algae and implementing algae in daily life to gain greater market areas. Research is also important to figure out how algae can be grown in an industrial scale in the Nordic climate and especially in the Ostrobothnia region. Another point is to work together with and not against other companies using symbiosis between them by e.g. combining food and biogas production and using waste water streams for cultivating algae.

14. Project management

In the following chapter the project management tasks can be seen for our project. Starting with the different Belbin roles within our project group. Followed by the several management tasks such as cost, communication, quality, risk and change management.

14.1 Belbin team roles

Adrian Schneller

The result of the Belbin test isn't surprising with the emphasis on the parts of shaper, plant, monitor and implementer.

The shaper needs challenging work means not so suitable for routine work. I also can show his potential under pressure. The plant also refers to my personality as I am often very unorthodox in finding solutions but thereby also imaginative.

As being a monitor as well I am sober and rationally driven in my decisions and doing things with a strategy in mind. Especially for working this is useful and practical to think in a rational way. When working the monitor is also discerning and accurate and wants to have things done properly.

The implementer is a disciplined worker and efficient in what he is doing. He is also a reliable making him a viable colleague when pressure and stress are increasing.

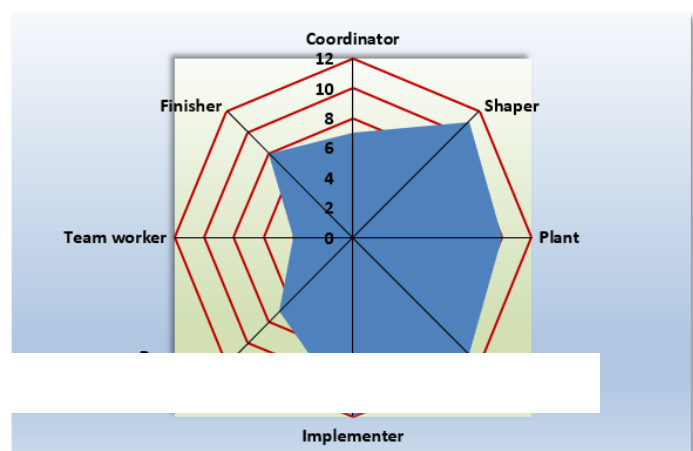
Overview

	Coordinator	Shaper	Plant	Monitor	Implementer	Team investigator	Team worker	Finisher
1	1	1	2	2	3	1	0	0
2	1	2	2	2	2	0	0	1
3	0	1	2	2	1	1	1	2
4	0	2	1	1	2	1	1	2
5	1	2	1	2	1	1	1	1
6	2	1	2	2	1	1	0	1

Figure 23 Belbin results Adrian Schneller

think

act



Corinne van den Brink

The results of the Belbin test showed that I am the shaper and the plant when working in a project group. A shaper provides the necessary drive to ensure that the team keeps moving and does not lose focus or momentum. The plant tends to be highly creative and good at solving problems in unconventional ways. I do find myself in the shaper but not that much in the plant. I can be creative, but I am not absent-minded or forgetful. I do think I could be more free-thinking/creative than others while working in a project group. For the shaper I can be aggressive/bad-humoured when things must be done, and people or things are blocking the way to get there. Also, I am not scared to say what I think which people might get offended. But on the other side I have like the shaper the drive to 'overcome obstacles'.

Overview

	Coordinator	Shaper	Plant	Monitor	Implementer	Resource investigator	Team worker	Finisher
1	1	1	2	1	2	0	1	2
2	1	2	2	1	2	0	1	1
3	2	2	1	0	0	2	2	1
4	0	2	1	1	3	1	2	0
5	3	2	3	0	0	2	0	0
6	0	1	0	3	0	2	1	3
7	0	2	3	0	2	2	0	1
Tot	7	12	12	6	9	9	7	8
think				act				

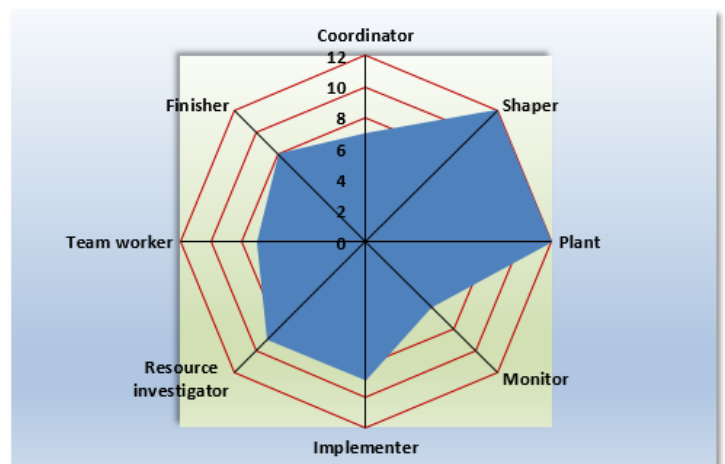


Figure 24 Belbin results Corinne van den Brink

Max Mallant

During the lesson of Project management, the EPS group got introduced with the Belbin-test. I was already experienced with the Belbin test because I have done this test multiple times. During my study program in The Netherlands project management is important and I have already a decent amount of experience with this work field. Every 10 weeks we are compulsory to develop and work on a project at a certain company. To work in an effective way together it is important to have a good insight of your capacities and the capacities of your team members. While working in project teams it is valuable to work efficient and deliver a high quality of work. The Belbin-test is a useful tool that will understand and translate your capacities. These results can help the project group during the whole project.

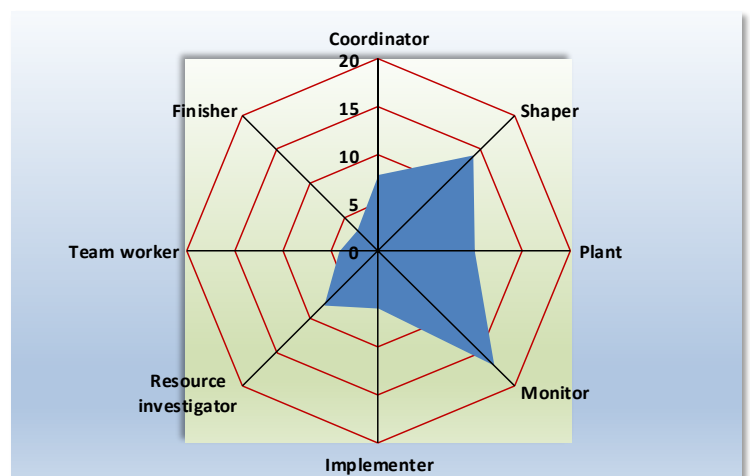
Personally, I already knew where my strengths are and on what parts I need to improve. My strongest sides are monitor, shaper and plant. These key-elements are usually connected with the task of a project leader or chairman. Most of the projects I am the chairman or the project leader and in some cases I'm not because I want to improve my other capacities.

Why I am a monitor is mainly because I am open minded and look objectively to a certain problem or process. I base my opinions on arguments and really look to the strategic point of the arguments I give to a certain problem. Why I also am a shaper that is because, I work better on pressure and like to work hard. I don't mind spending extra time on my work because, I want to be challenged. That is also why I am following this study program because I want to step out of my comfort zone and learn of these challenges. Also, the role of a plant really suits me because I am always thinking about solutions for certain problems. By staying objectively to certain problems and combine this with thinking in solutions you can develop

Overview

	Coordinator	Shaper	Plant	Monitor	Implementer	Team worker	Finisher	
1	1	1	3	1	2	1	1	0
2	1	2	2	2	1	1	0	1
3	1	1	3	2	0	2	1	0
4	1	1	2	1	0	2	2	1
5	0	5	0	3	1	0	0	1
6	0	1	0	5	2	2	0	0
7	4	3	0	3	0	0	0	0
Tot	8	14	10	17	6	8	4	3
	think				act			

Figure 25 Belbin results Max Mallant



creative solutions. Think differently and focus on adding value will really help you in demanding situations.

Zowie Segers

The results of my Belbin test were not that surprising for me. I could find myself in the outcome of a team worker, shaper and resource investigator. I can compare myself with a team worker because I can work together very well by listening to my team and from that point give my own input without bringing down the ideas of the team. In that way the collaboration within the team is the most efficient. Also, the resource investigator is one of the roles I fill in for the team. Finding the best information and think about innovative ideas is one of the things I am good at while working on a report. Making people enthusiastic with latest ideas and insight is a skill that is useful during the collaboration. Skills of the shaper are working in a structured way and keep moving forward with the project. Always keep your eyes on the main goal of the project and not go behind the scope and make sure your team keeps their vision on the main goal. I don't really have a part that stands out in the negative way. The lowest score is a 7 for implementer, probably because I am good at delegating tasks to the team. Overall the results are a good representation of my skills and flaws.

Overview

	Coordinator	Shaper	Plant	Monitor	Implementer	Resource investigator	Team worker	Finisher	
1	1	1	1	1	2	1	2	1	
2	1	2	2	1	1	1	1	1	
3	1	1	1	1	1	1	2	2	
4	1	1	1	1	1	1	2	2	
5	2	1	1	1	1	1	2	1	
6	0	2	0	2	1	1	2	2	
7	2	2	2	1	0	1	1	1	
Tot	8	10	8	8	7	10	11	8	
	think				act				

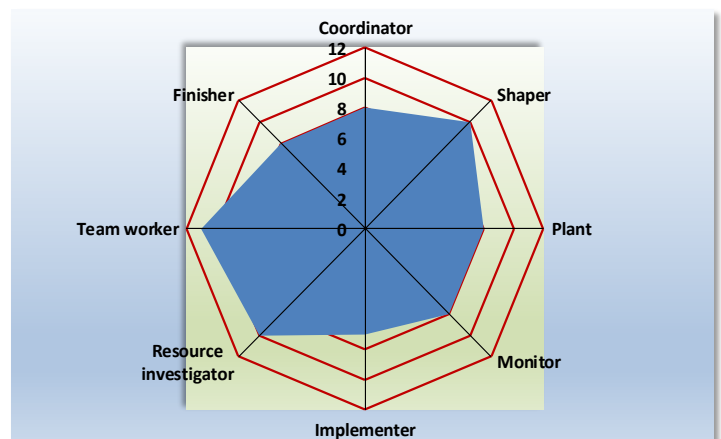


Figure 26 Belbin results Zowie Segers

14.2 Cost management

During this project no costs were made besides the working hours by each group member. Each member of the project timed the hours spend on the project, the (guest) lectures and language courses included. The guideline was to make 37.5 hours a week, the total sum of the hours made by all group members is 2168. Since an hourly rate of 40€/h was considered the total costs of the project would be €86.720. In Tables 9 and 10 the hours made by each member can be seen. In Figure 25 the graph for the earned value is shown. Here can be seen how the hours are spend over the weeks.

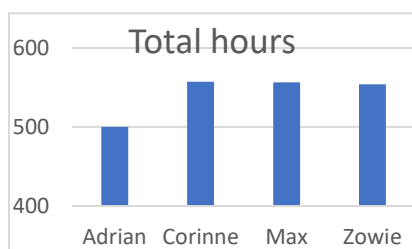
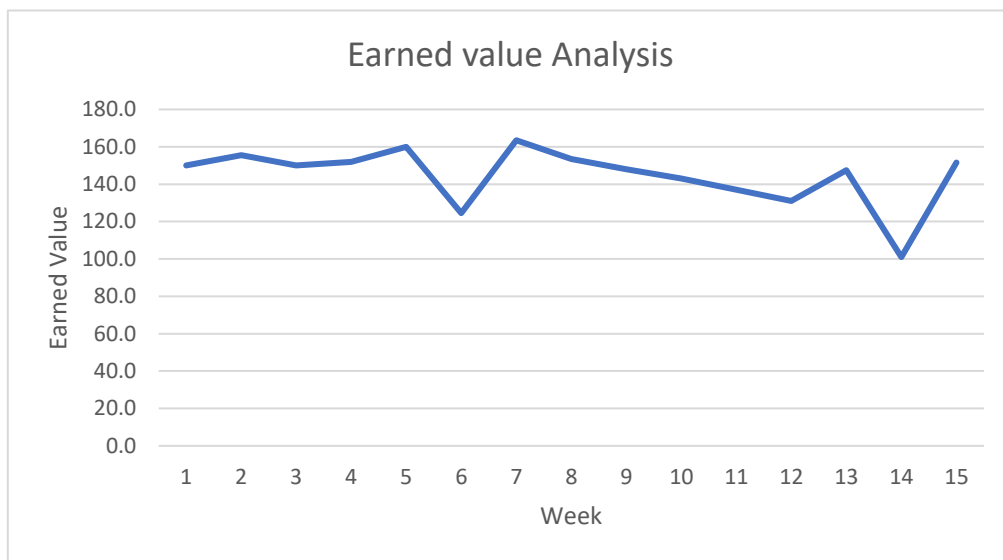


Table 9 Total hours bar chart

	Total hours
Adrian	500
Corinne	557,5
Max	556,5
Zowie	554
Total hours	2168

Table 10 Total hours made

14.3 Communication management

To guarantee a frictionless project process it is essential to put emphasis on the exchange and flow of communication. This includes the communication between the project team itself and towards the mentioned stakeholders as can be seen in Figure 22.

Due to that a regular turn in meetings with Andreas Willfors, the whole project team and the marketing students must be ensured for the exchange of information, to make decisions or to discuss further steps. To face unexpected challenges the team members, must be flexible to take part in spontaneous emergency meetings.

To secure not only personal conversation a Dropbox folder has been installed to enable all team members to archive their work done or files worked out for the project and make them visible for everyone.

Consequently, an internal communication plan, as can be seen in Table 11, was set up to make sure that the information exchange takes place.

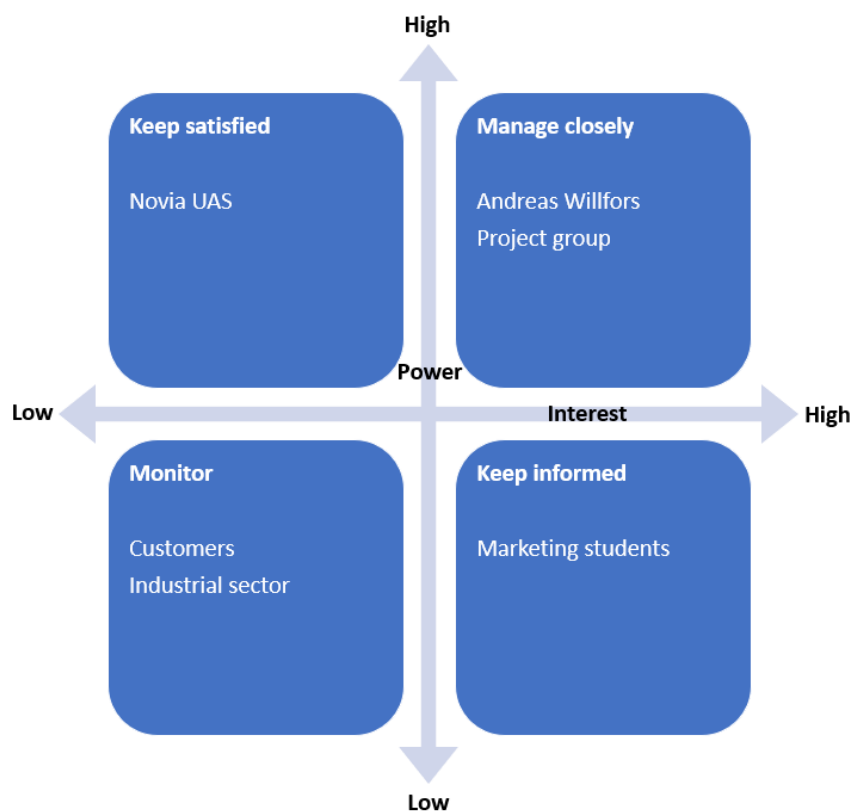


Figure 28 Power/interest grid

Table 10 Communication model

Stakeholder	Information given	Phase	Mode	Time
Andreas Willfors	progress report	all phases	meeting	weekly
project group	constant exchange of information and communication between team members	all phases	meeting, WhatsApp group	daily
marketing students	provide needed information	after definition phase	C&S Algae workshops, meeting	weekly
Novia UAS	general information	after definition phase	final report	once
customers	general information	after definition phase	homepage	permanently
industrial sector	general information	after definition phase	homepage	permanently



14.4 Quality management

During this project a mid-term report, a final report and a branding concept were delivered. The quality of these reports should be as expected according to the report standards of Novia UAS. The English writing should be of quality as well.

Since this is a project with four members, each member should feel and be responsible for their given tasks. Using the work breakdown structure (WBS) dictionary where every task is explained, helps containing the quality and of each chapter. This WBS also includes who is responsible for which task and when the task should be finished. Another thing the WBS shows is which task are already done, which are in progress or which have not been started yet.

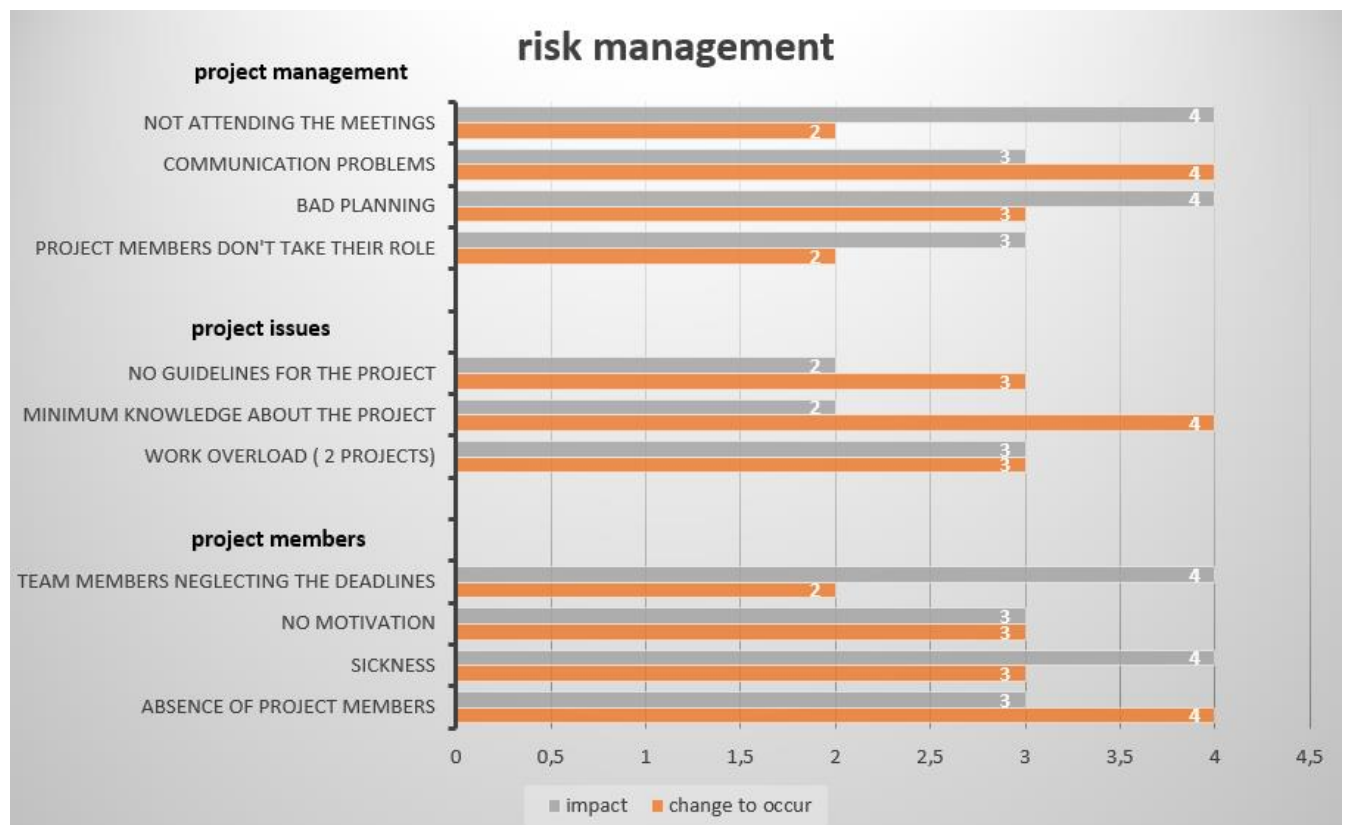
A good thing is to check and read another one its parts to prevent grammar faults and to correct potential wrong sentences. What is helpful as well is an agreement on layout, such as letter type and -size, line distance, alignment and headline texts. In this case to prevent extra work, since everyone does the layout correctly.

Besides this agreement communication is extremely important, within the project group itself and towards the supervisor and potentially external people. Communication is done via mail, WhatsApp and there is a Dropbox file to share all created documents with others.

14.5 Risk management

Risk management is a tool to define the possible risk that could occur during the project. There are 2 elements that define the risk: change that the risk occurs and the impact of the risk. The risks with a high change to occur and an elevated risk should be prevented. This could be discussed during meetings where the project members can address their concerns. The risks with a low change to occur and a minimal impact are mostly accepted, there are no follow up actions for those risks. In Table 12 the risks are mentioned along with the change and the impact.

Table 11 Risk management



14.6 Change management

Change management in projects is about how to deal with changes in a project when they occur. It deals with questions such as who the responsible person is and if the change should be accepted or be rejected. The areas which can be affected by changes are shown in Figure 20.

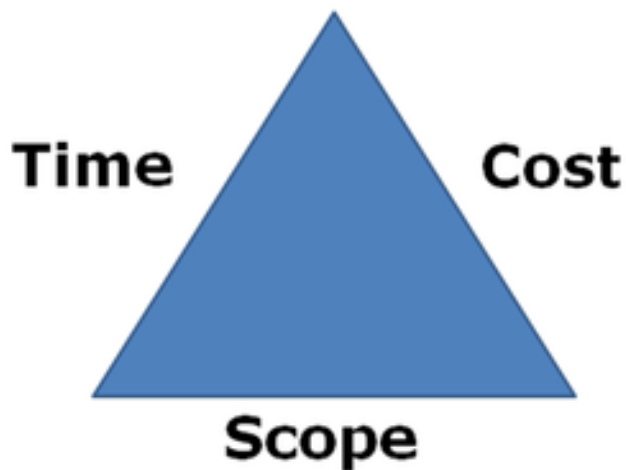


Figure 29 Project Management Triangle

Applied to the C&S Algae project the scope dimension can experience changes. Possible changes are an expansion of the issues research shall be done on, new topics to work on or new aspects within a topic that should be considered. The dimensions cost and time are fixed as there is no budget for the project group and the team members are not paid for their work. The time is also fixed as the dates for the midterm presentation, the workshops with the marketing students and the final presentation are known from the beginning.

The responsibility for changes lies within the whole team. If changes occur, they are discussed in the weekly meetings together with the supervisor Andreas Willfors and it will be discussed about the acceptance or rejection of the changes. To enable a frictionless change management communication is essential guaranteed by the communication plan.

In the project changes occurred with the workshop with the marketing students concentrating on macro algae instead of microalgae. The change was accepted and added to the previous scope. This did not lead to a time problem and contributed even to a broader understanding of the algae topic as it complemented the previous research on microalgae.



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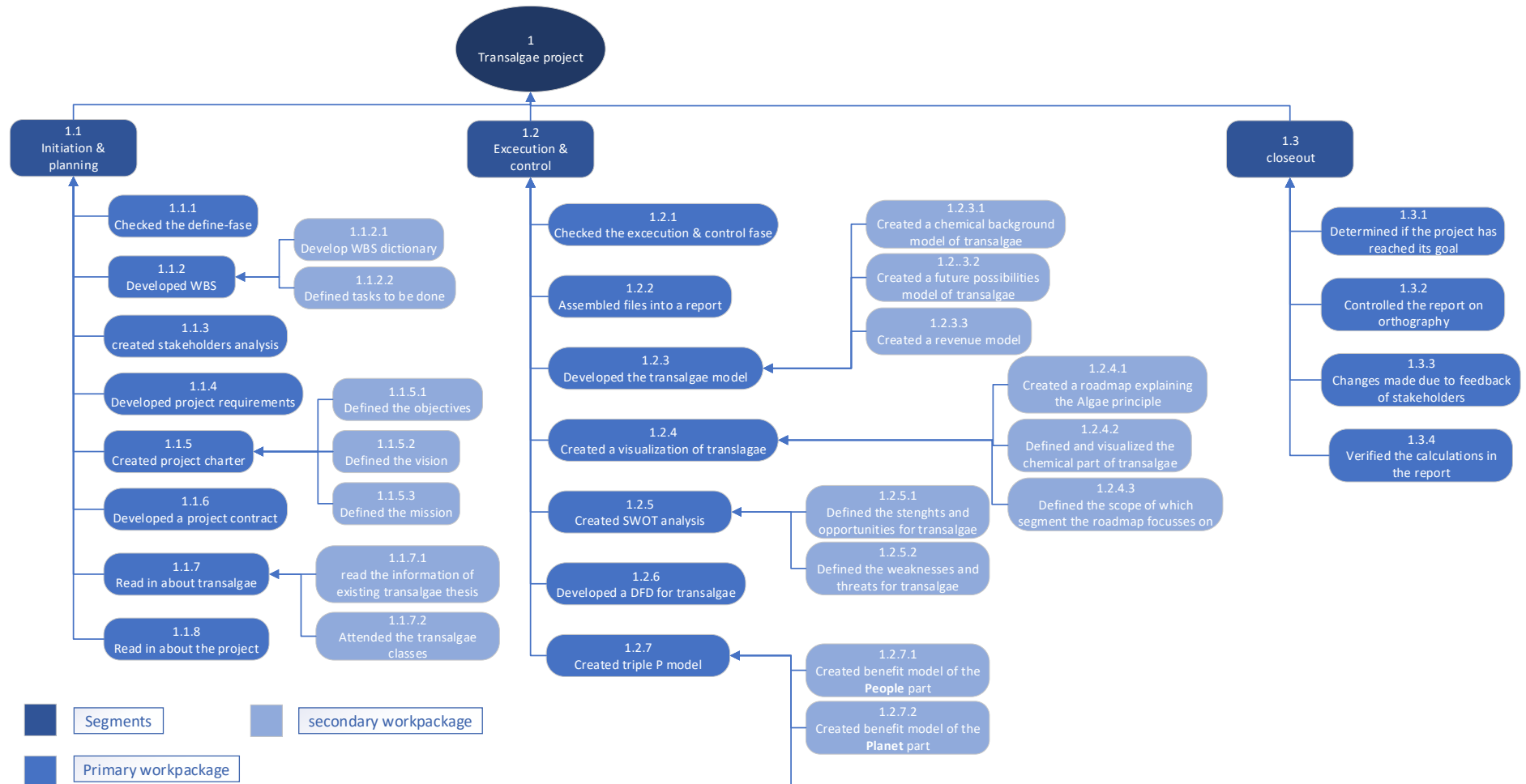
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Appendix 1 WBS and WBS dictionary

WBS:





WBS dictionary midterm report:

1	activity title	description	responsibility	status	delivery date	actual delivery date
1.1	initiation & planning	the initiation & planning phase is the collective name of all the activities that are focussed on exploring the working fields of the project and defining and structure the project	whole team	done	16-9-2018	15-9-2018
1.1.1	checked the define phase	control the whole define phase on wrong information and grammar	whole team	done	17-9-2018	15-9-2018
1.1.2	develop WBS	the making of a work breakdown structure to define the tasks for the project	Zowie	done	12-9-2018	11-9-2018
1.1.2.1	develop WBS dictionary	to define the tasks in detail and connect the responsible persons for tasks	Zowie	done	14-9-2018	14-9-2018
1.1.2.2	define tasks to be done	brainstorm and write down the tasks that need to be done to complete the project	whole team	done	9-9-2018	9-9-2018
1.1.3	create stakeholders analysis	creating a stakeholders analysis to see which parties we need to involve during the project	Adrian	done	9-9-2018	7-9-2018
1.1.4	develop project requirements	to define the project more in detail as addition to the project charter	Zowie	done	12-9-2018	12-9-2018
1.1.5	create project charter	to define the project a project charter needs to be made	Adrian	done	9-9-2018	9-9-2018
1.1.5.1	define the objectives	write down the objectives as milestones for the project	whole team	done	9-9-2018	9-9-2018
1.1.5.2	define vision	defining the vision of the project	whole team	done	9-9-2018	9-9-2018
1.1.5.3	define mission	defining the mission of the project in order to meet the expectations	whole team	done	9-9-2018	9-9-2018
1.1.6	develop a project contract	create a project contract in order to make the collaboration between the team members prosperous	Corinne	done	12-9-2018	11-9-2018
1.1.7	read in about algae	inform ourselves with information linked to the project	whole team	done	12-9-2018	12-9-2018
1.1.7.1	read the information of existing Transalgae thesis	gain information with the help of already existing reports about Transalgae	whole team	done	12-9-2018	10-9-2018
1.1.7.2	attend the Transalgae classes	gain information during the Transalgae lessons	whole team	done	12-9-2018	12-9-2018
1.1.8	read in about the project	read and define the project information	whole team	done	7-9-2018	7-9-2018
1.2	execution & control	in this phase the project group will execute the ideas and thoughts of the project in order to meet the project goal	whole team	done	19-10-2018	19-10-2018
1.2.1	check the execution & control fase	looked over the whole execution & control phase in order to find false information and grammar mistakes	whole team	done	19-10-2018	19-10-2018
1.2.2	assemble files into a report	assemble all the files into one busines report	whole team	done	19-10-2018	19-10-2018
1.2.3	develop the C&S Algae model	assemble all the models into one algae cultivation model that meets the expectations of the project	Corinne, Max, Zowie	done	19-10-2018	17-10-2018
1.2.3.1	create a chemical background model of C&S Algae	creating a model that defines the chemical background of algae cultvation in order to clarify the process for the stakeholders	Corinne	Done	19-10-2018	11-10-2018
1.2.3.2	create a future possibilities model of C&S Algae	using the SWOT-analysis as a tool to create a model that defines the future possibilities that algae contains	Max	done	19-10-2018	17-10-2018
1.2.3.3	create a revenue model	to give some insight in the possible ways to earn money with algae cultivation a revenue model needs to be made	Zowie	done	10-10-2018	10-10-2018
1.2.4	create a visualization of C&S Algae	make a visualization of algae cultivation in order to explain the principle to stakeholders	Adrian	Done	12-10-2018	2-10-2018
1.2.4.1	create a roadmap explaining the C&S Algae principle	create a roadmap	Adrian	Done	4-10-2018	1-10-2018
1.2.4.2	define and visualized the chemical part of C&S Algae	make the chemical side of C&S Algae visual and thereby visual for the stakeholders	Corinne	Done	30-9-2018	1-10-2018
1.2.4.3	define the main influence factors for algae cultivation	defining the factors that have to be taken into account when cultivating algae and giving tips to avoid a negative outcome	Zowie	done	30-9-2018	29-9-2018
1.2.5	create a SWOT-analysis	make a SWOT-analysis in order to get information about the strenghts, weaknesses, possibilities and threats of C&S Algae	Max	done	21-9-2018	21-9-2018
1.2.5.1	define the stenghts and opportunities for transalgae	brainstorm about the strenghts and opportunities of the algae cultivation	Max	done	18-9-2018	17-9-2018
1.2.5.2	define the weaknesses and threats for C&S Algae	brainstorm about the weakness and threats of the algae cultivation	Max	done	18-9-2018	17-9-2018
1.2.7	create triple-p-model	create a triple-p-model in order to give information about the sustainability of algae cultivation	Adrian, Corinne, Zowie	done	22-9-2018	22-9-2018
1.2.7.1	create benefit model of the People part	write down the sustainability of algae cultivation linked to the people part	Adrian	done	21-9-2018	19-9-2018
1.2.7.2	create benefit model of the Planet part	write down the sustainability of algae cultivation linked to the planet part	Corinne	done	21-9-2018	18-9-2018
1.2.7.3	create benefit model of the Profit part	write down the sustainability of algae cultivation linked to the profit part	Zowie	done	21-9-2018	19-9-2018
1.3	closeout	the last tasks that needs to be done to complete the project	whole team	done	21-10-2018	21-10-2018
1.3.1	determine if the project has reached the goal	check with the mission and the conclusion of the report if the project goal is achieved	whole team	done	21-10-2018	21-10-2018
1.3.2	control the report on orthography	check the report on grammar faults	whole team	done	21-10-2018	21-10-2018
1.3.3	changes made due to feedback of stakeholders	improve some parts of the report as result of the potential feedback we got from out stakeholders	whole team	done	21-10-2018	21-10-2018
1.3.4	verify the calculations in the report	check if all the calculations are correct	whole team	done	21-10-2018	21-10-2018



WBS dictionary final report:

	project mission	combining micro- and macro algae cultivation within a circular economy, focussed on creating algae based food brands.	project team	Adrian Schneller, Corinne van den Brink, Max Mallant, Zowie Segers		
	project supervisor	Andraes Willfors	Date			
nr	part	description	responsibility	status	delivery date	actual delivery date
	final report					
1	front + cover page	creating an appealing headpage and frontpage with the necessary information included	Zowie	done	27-11-2018	26-11-2018
2	table of content +tables & figures	the table of content with a logical order of the chapters	Zowie	done	5-12-2018	27-11-2018
3	preface	short summary about the background of the project: 1st part: who is the project group and why the project. Part 2: the goal of the project. Part 3: word of thanks. End with place and our names.	Max	done	5-12-2018	28-11-2018
4	summary	summary about the project and how we executed it. also our solution for the main goal should be included	Corinne	done	5-12-2018	1-12-2018
5	1. introduction	description about the project, the goal of the project and the project approach (around 1 A4)	Zowie	done	5-12-2018	2-12-2018
6	2. methods and techniques	chapter in which we describe the project approach and which resources we used. Important part is to describe every chapter in brief	Adrian	done	5-12-2018	3-12-2018
7	3. Swot analysis	general about project	Max	done	28-11-2018	28-11-2018
8	4. algae opportunities	(algae possibilities model)	Max	done	28-11-2018	28-11-2018
9	5. triple p	adjust to the final report!	Zowie	done	5-12-2018	3-12-2018
10	6. circular economy	adjust to the final report!	Adrian	done	5-12-2018	3-12-2018
11	7.algae food and benefits	new chapter	Max	done	28-11-2018	28-11-2018
12	8. combining production of food and biogas	new chapter	Corinne	done	5-12-2018	3-12-2018
13	9. chemical background	adjust to the final report!	Corinne	done	5-12-2018	3-12-2018
14	10. efficient algae cultivation (micro & macro)	(influence factors)	Zowie	done	5-12-2018	4-12-2018
15	11. marketing brands	2 best marketing concepts. Explanation from sea to your plate	Everyone	done	5-12-2018	2-12-2018
16	12. business model	adjust to the final report!	Zowie	done	5-12-2018	4-12-2018
17	13. conclusion and recommendations	remove the old one in the report and put in the new one	Adrian	done	5-12-2018	4-12-2018
18	14. project management	all the project management files	Corinne	done	5-12-2018	4-12-2018
	14.1 Risk management	Risk analysis as explained on the powerpoint from the lecture		done	5-12-2018	4-12-2018
	14.2 Change management	change analysis as explained on the powerpoint from the lecture		done	5-12-2018	4-12-2018
	14.3 Quality management	quality analysis as explained on the powerpoint from the lecture		done	5-12-2018	4-12-2018
19	bibliography	everybody check if they have used all source referations and put them in the report!!!!	Zowie	done	5-12-2018	4-12-2018
	appendix chapters					
1	project schedule and wbs + dictionary		Max and Zowie	done	5-12-2018	4-12-2018
2	website logo and business card		Max, Zowie and Adrian	done	5-12-2018	4-12-2018
3	Circular model		Max	done	5-12-2018	4-12-2018
4	agenda		Max	done	5-12-2018	4-12-2018
5	minutes of meetings		Corinne	done	5-12-2018	4-12-2018
6	reflection		Everyone	done	5-12-2018	4-12-2018



Appendix 2 Website, Logo and Business Card



**ADRIAN SCHNELLER
CORINNE VAN DEN BRINK
MAX MALLANT
ZOWIE SEGERS**

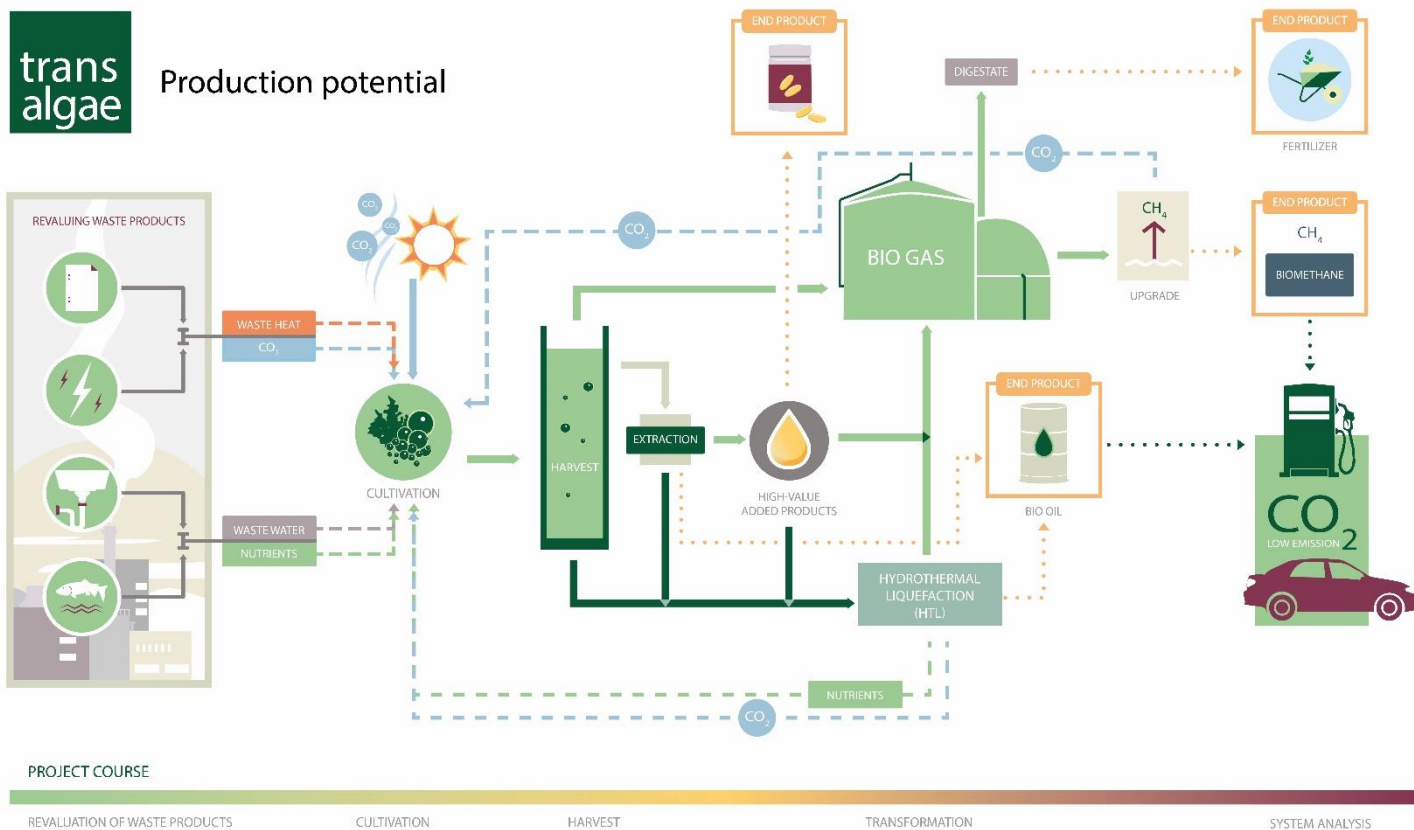


WWW.CSALGAE.WORDPRESS.COM

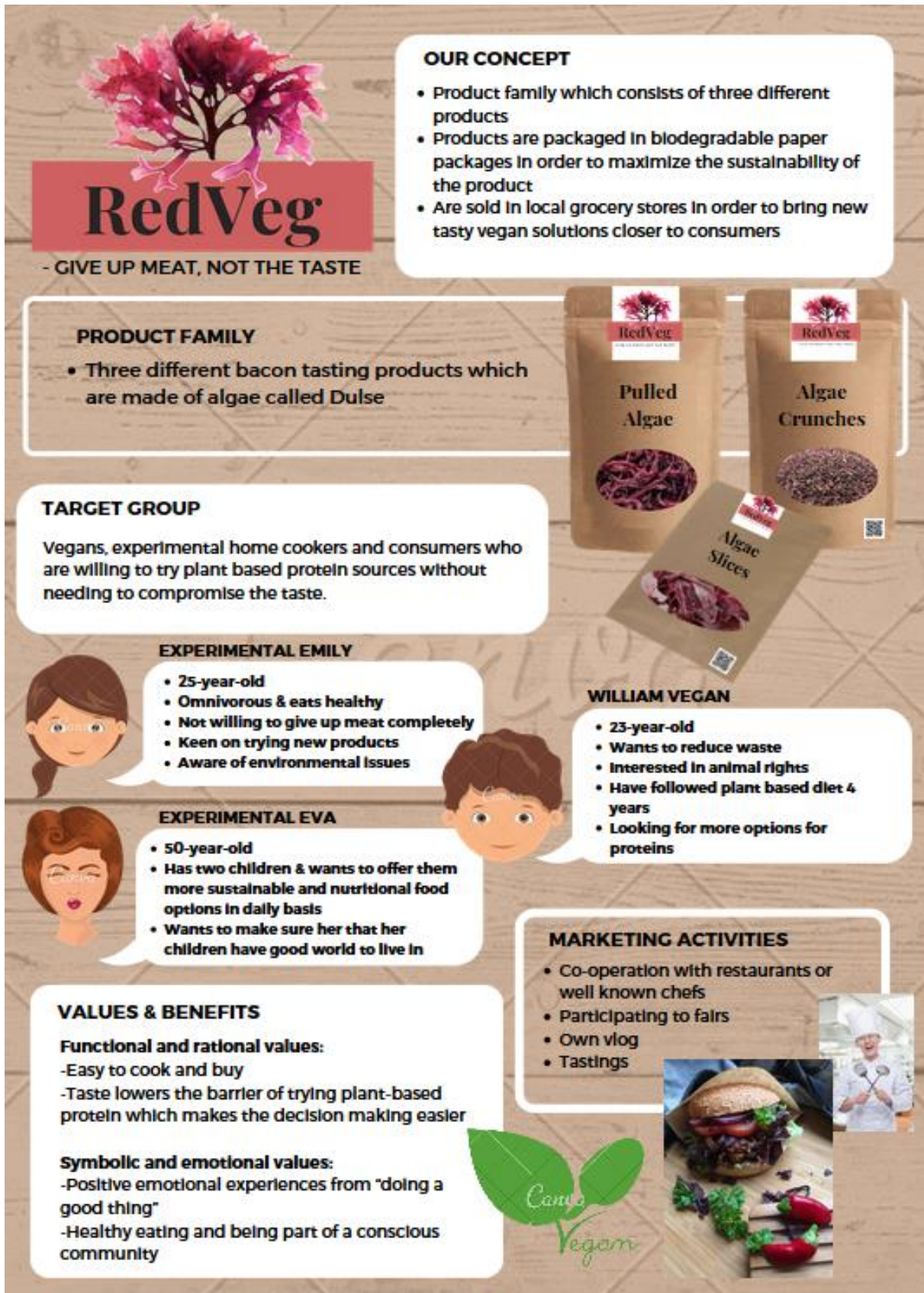
EUROPEAN PROJECT SEMESTER
NOVIA UNIVERSITY OF APPLIED SCIENCES
VAASA, FI

Website of C&S Algae: <https://wordpress.com/view/csalgae.wordpress.com>

Appendix 3 Circular model



Appendix 4 Concept posters



RedVeg
- GIVE UP MEAT, NOT THE TASTE

OUR CONCEPT

- Product family which consists of three different products
- Products are packaged in biodegradable paper packages in order to maximize the sustainability of the product
- Are sold in local grocery stores in order to bring new tasty vegan solutions closer to consumers

PRODUCT FAMILY

- Three different bacon tasting products which are made of algae called Dulse

TARGET GROUP

Vegans, experimental home cooks and consumers who are willing to try plant-based protein sources without needing to compromise the taste.

EXPERIMENTAL EMILY

- 25-year-old
- Omnivorous & eats healthy
- Not willing to give up meat completely
- Keen on trying new products
- Aware of environmental issues

EXPERIMENTAL EVA

- 50-year-old
- Has two children & wants to offer them more sustainable and nutritional food options in daily basis
- Wants to make sure her that her children have good world to live in

WILLIAM VEGAN

- 23-year-old
- Wants to reduce waste
- Interested in animal rights
- Have followed plant-based diet 4 years
- Looking for more options for proteins

VALUES & BENEFITS

Functional and rational values:

- Easy to cook and buy
- Taste lowers the barrier of trying plant-based protein which makes the decision making easier

Symbolic and emotional values:

- Positive emotional experiences from "doing a good thing"
- Healthy eating and being part of a conscious community

MARKETING ACTIVITIES

- Co-operation with restaurants or well-known chefs
- Participating in fairs
- Own vlog
- Tastings

Products shown: Pulled Algae, Algae Crunches, Algae Slices

Images: A chef, a burger, and a plate of food.

Logo: Cause Vegan

Website: <https://redvegfoods.wordpress.com/>

Healthical

Feel Free – Eat Clean

For clean eating early adapters

"Healthical offers an opportunity for its users to take part in preventing the climate change and simultaneously to take a better care of their health by enjoying protein products made of natural ingredients."



@Healthical



Coming soon



Healthical18@gmail.com



Algae protein shot

Fresh pressed apple juice 57,5 %, spirulina 12,5 %, lime 24 %, ginger 6 %



Crunchy algae granola

Gluten free oats (60 %), red algae (5 %), sunflower seeds (6 %), flax seeds (6 %), almonds (5 %), cashew nuts (4 %), pecans (4 %), dried blueberries (3 %), dried raspberries (3 %), coconut oil, salt, cinnamon

CUSTOMER GROUPS

GREENISH, AGE: 20-34

- Sustainable lifestyle, cares about nature, social, is vegetarian/veganises a lot of plant products in daily life

SPORTIACS, AGE: 18-40

- Does a lot of sports or any kind does not just include the "fitness" people and has a healthy lifestyle, wants to eat healthy and keep him/herself nourished during everyday activities

GOLDIES, AGE: 40

- They have concern about the status of planet and environmental and want to be part of the change, they have been jump to new experiments (foods, supplements, medicines), they want to take care of their self as the old days and have high values towards climate change



CONCEPT AND BRANDING

- Protein supplements are popular trend at the moment
- Ocean Powder offers an easy way to get extra protein to consumers' diet in a sustainable way
- Ocean Powder is 100 % vegan protein, and at the moment there are only few vegan protein supplement on the market
- In addition protein is a good option to non-vegan consumers because it includes lots of vitamins, omega 3 and antioxidants
- Protein supplements market worth is expected to grow \$2.6 billion by 2025
- Plant-based products are expected to display fastest growth



OCEAN
Powder

VEGAN PROTEIN SUPPLEMENT WITH ALGAE

- Vegan protein supplement with health benefits of algae
- High in algae (ulva 20%) mixed with soy protein (80%)
- Has every aminoacids that consumer needs
- Good source of minerals like iron, magnesium, iodine, potassium, selenium, vitamin B12 and beta-carotene
- Can be used on daily basis for example in smoothies, 1勺 or as it is blended with water
- Powder does not include any added flavours, mild taste
- Is packed in a recycled paper bag
- Net weight: 500g/18oz
- Serving size: 0.5 - 1 dl per day

POSITIONING AND COMMUNICATION

- The product is positioned as a high-end product, it is little more expensive and has better quality than its competitors
- It is also positioned as sustainable, organic and environmental product
- It stands out from its competition with the health benefits that algae provides
- Visual packaging includes info about the health benefits and vegan mark
- Bringing awareness about algae products and the health benefits nutritional therapists
- Marketing channels: Blogs, cooperation, expos, magazines, Instagram



Seaweed snacks
from
Scandinavia!



Team Chipstastic
Rosa-Lia Ekroos, Sofia Dahlbacka, Johanna
Vesala, Nicolas Wuolle & Zowie Segers

PA: Minna-Maarit Jaskari

THE CONCEPT IN A NUTSHELL

Healthy snacking
Healthy rye and oat based algae snacks
for consumers to enjoy. High nutritional
value and pure products.

Delicious taste
Strong flavors from Nordic nature: rye,
oat and seaweed. A few different
flavors for different consumer groups.

A green and sustainable choice

TRENDS

1. Health-boom
2. Sustainability
3. Foodie-trend and a new growing interest in exotic or out-of-the-ordinary flavors, tastes and ingredients.

A healthy and conscious
alternative for everyday
life and snacking!

ALGAE USED IN THE PRODUCTS

KARWEED

- Known as Arctic Kombu, gives great taste dried or fresh.
- Harvested in the Northern Atlantic, in the clear waters of the west coast of Norway.
- Contains Vitamins A, C, D, E, and all the B Vitamins including B12, plus 60 trace minerals like calcium and magnesium.

- This glossy leathery brown kelp anchors itself to rocks and is shaped like the palm of a hand with irregular finger-like
- This fascinating seaweed is one of the oldest plants on earth. It doesn't produce roots or flowers and absorbs its nourishment solely from the sea, making it a treasure trove of natural beneficial ingredients.

MATCHA
The natural
source of the
chips' green
color.

CUSTOMER GROUPS

Quinn The Quality-aware

- Likes products with high quality
- Appreciates healthy options
- Seeks to pay a higher price for quality
- Tries to find options that add to mental and physical well-being
- Taste matters
- Fitness and sport are close to heart
- The full production process matters a lot (carbon footprint)

Sam The Snack Lover

- Daily user of snack products
- Loves salty snacks and chips
- Doesn't pay attention so
- Prefer quick and easy solutions
- Are open to alternative options but not ready to abandon these products
- Like to have healthy products if they taste good
- Consumption is regular, even daily

Vera The Vegetarian

- Follows a strict diet
- Doesn't eat products containing meat / milk / eggs for healthy and plant-based products
- Looks for new options for the poor offering
- Allergies and food restrictions (gluten-free)

Ella The Experimental

- Curious and open-minded person who likes to try new things
- Follows food trends
- Makes impulse decisions and likes to try out new products
- Uses a bit more money for products because isn't so price aware
- Product needs to have great taste to buy again

THE PRODUCTS

The ultimate wasabi snack

For the adventurous and curious snacker trying to save the planet one crunchy bite at a time.



For oat lovers everywhere

For the mellow snack loving health nut, who appreciates quality and sustainability.

Good snack, good company

To be enjoyed in good company. Perhaps with a nice filling and a glass of wine.



Appendix 5 Agenda

Agenda Meeting Transalgae meeting (week 2)			
Date: 19-4-18 Time: 12:30 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller (secretary) 2. Corinne van den Brink 3. Max Mallant 4. Zowie Segers (chairman)	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 sec	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks has to be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group has to clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 sec	chairman
8. closing	Closing the meeting	5 sec	chairman

2. last week: the work that we wanted to do was defining the mission, vision and objectives. However, we had to less information about our scope and what the definition of our project was.

3. time follow up: last week most time spend on reading about Transalgae



4. work to be done for coming week: WBS, project chart, contract, SWOT analyse

5. issues about the project:

- Contacting marketing students to define the mission
- What is the scope of the project? Focus on which part of the Transalgae method?
- Waste water interesting for the circular economy? Can we use that part in our project or is our focus somewhere else?
- Can we provide the marketing students with suggestions about a revenue model (selling service instead of the product)?
- Focus on anaerobe digestate or cultivation

Agenda Meeting Transalgae meeting (week 4)			
Date: 26-09-18 Time: 12:30 Location: Technobothnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller (secretary) 2. Corinne van den Brink 3. Max Mallant 4. Zowie Segers (chairman)	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 sec	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants



7. next meeting	Planning the next meeting	30 sec	chairman
8. closing	Closing the meeting	5 sec	chairman

2. last week: last week everybody worked on their tasks of the execution and control phase. The triple p model and SWOT analysis are finished. The tasks that are now in progress contain: creating a roadmap, defining and visualizing the chemical part of Transalgae, defining the main influence factors for algae cultivation and creating a future possibilities model.

3. time follow up: last week most time spend on the execution and control phase tasks. Including the SWOT and the sustainability model of triple p.

4. work to be done for coming week: creating a future possibility model, creating a roadmap for the algae project, defining the main influence factors for algae cultivation and defining and visualizing the chemical background of algae cultivation.

5. issues about the project:

- We thought about creating 2 separate missions, one for the midterm report and one for the final report. The mission for the final report contains a measurable factor to optimize the algae cultivation. The delivery of the midterm report can be used as input for the final report, where we use the information to brainstorm about a suitable optimisation or problem-solving idea.

Agenda Meeting Transalgae meeting (week 5)			
Date: 04-10-18 Time: 12:30 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller (secretary) 2. Corinne van den Brink 3. Max Mallant 4. Zowie Segers (chairman)	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman

3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks has to be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group has to clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 sec	chairman

2. last week: last week we finished the future possibilities model, the roadmap, the visualization of the chemical part and the influence factors.

3. time follow up: last week most time spend on the execution and control phase tasks. Mostly creating useful models that are understandable for every stakeholder.

4. work to be done for coming week: starting with the format of the midterm report and the midterm presentation. Creating a revenue model, and a chemical background model. Thinking about the new mission for the final report.

5. issues about the project:

- Any thoughts about adding value for the Transalgae product for creating the new mission
- Check if the deliverables so far are good

Any suggestions about how to go further after the midterm report

Agenda Meeting Transalgae meeting (week 6)	
Date: 09-10-18 Time: 14:00 Location: Technobotnia	participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller (secretary) 2. Corinne van den Brink

		3. Max Mallant 4. Zowie Segers (chairman)	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman

2. last week: last week we worked on the midterm report. We are almost finished with that part but still must put in some chapters. Also, we launched the website, created the logo and the business card.

3. time follow up: last week most time spend on finalizing the midterm report

4. work to be done for coming week: creating the PowerPoint for the midterm report.

5. issues about the project:

- None so far



Agenda Meeting Transalgae meeting (week 8)			
Date: 18-10-18 Time: 11:30 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller (secretary) 2. Corinne van den Brink 3. Max Mallant 4. Zowie Segers (chairman)	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman



8. closing	Closing the meeting	5 secs	chairman
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2. last week: last week we worked on fine tuning the report and discussing the content of the PowerPoint.

3. time follow up: last week most time spend on finalizing the midterm report

4. work to be done for coming week: Finishing the report and the presentation

5. issues about the project:

- Feedback about the presentation and what it should contain?
- Can you give some more information about the workshop?

Agenda Meeting Transalgae meeting (week 9)			
Date: 01-11-18 Time: 10:00 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants

6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman

2. last week: last week we started the collaboration with the marketing students of Vaasa university. Within this first workshop we received information and the goal of the project. After the workshop we have still lots of questions about what is expected from the EPS project group.

3. time follow up: last week we worked on receiving the right information about macro algae food. We also created the presentation and are now focussing on a new mission/vision.

4. work to be done for coming week: Defining our tasks and our added value for the upcoming project weeks. We need to form new objectives in order to realise our new mission.

5. issues about the project:

- Can you give some more information about the deliverables?
- What is a suitable new mission/vision concept? (in what way do we have to think?)

Our final role in the marketing role and the EPS project.

Agenda Meeting Transalgae meeting (week 10)			
Date: 07-11-18 Time: 10:00 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants

4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman

2. last week: last week we defined some new missions and we searched for new ways to create objectives.

3. time follow up: last week we worked on the new mission and vision. We developed multiple ideas and know we have to focus on a certain part. We would like to receive some feedback on this subject.

4. work to be done for coming week: Defining our mission and vision in new objectives and start making a new schedule with deadlines. Start focusing on the end report and consulting the marketing students.

5. issues about the project:

- Creating new objectives to realise a new report
- A new schedule must be created
- Combination between the mission and the food principle

Agenda Meeting Transalgae meeting (week 11)	
Date: 15-11-18 Time: 10:00 Location: Technobotnia	participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman)

		4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman

2. last week: last week we defined and created the new objectives. We also created a form for the final report and in the current phase everyone can work on his-her part of the research.

3. time follow up: last week we worked on the new mission and vision. We developed the new objectives that we are convinced are suitable and eventually realise in a good report.

4. work to be done for coming week: Consulting the master marketing students and start working on the objectives.

5. issues about the project:



Is it possible to extract proteins from seaweeds because red seaweeds have a lot of proteins but they also contain vitamin K and some other elements that can raise your blood pressure and make it blood thin? (extract vitamins because we want to make protein powder)

Agenda Meeting Transalgae meeting (week 12)			
Date: 23-11-18 Time: 10:00 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spent on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman

2. last week: last week everyone started working on their part/objective. We keep working together with the marketing students, but we don't know for sure what's needed to be the end result. (we might deliver them additional information)

3. time follow up: Talking about our current deliverables.



4. work to be done for coming week: Consulting the master marketing students and finishing our objectives when possible.

5. issues about the project:

In the Eps timetable we must make a poster/do a poster presentation?

What are our end deliverables with the marketing students where we need to participate?

Agenda Meeting Transalgae meeting (week 13)			
Date: 29-11-18 Time: 10:00 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman



2. last week: last week everyone worked on their part/objective. We keep working together with the marketing students. Adrian and Corinne combined their chapters to create a better bridge in information.

3. time follow up: Talking about our current deliverables.

4. work to be done for coming week: Almost the end of the project. Focussing on the report and the presentation. We would like to finish it before the Lapland journey.

5. issues about the project:

Now we don't have any issues. We know what is expected from us. (only the report structure)

Agenda Meeting Transalgae meeting (week 14)			
Date: 05-12-18 Time: 10:00 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 secs	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks must be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group must clarify	15 min	All participants
6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 secs	chairman
8. closing	Closing the meeting	5 secs	chairman



2. last week: last week everyone has delivered their objectives and we are ready to hand in the concept version to Roger. We are looking forward for the feedback and we think we did a good job. We can also show you the concept version of the video we created.

3. time follow up:

- Talking about the concept report
- Talking about the video
- Talking about the presentation

4. work to be done for coming week: Preparing for the presentation and finishing the report and video.

5. Issues about the project:

What do we need to reflect?

Agenda Meeting transalgae meeting (week 15)			
Date: 12-12-18 Time: 14:30 Location: Technobotnia		participants: Andreas Willfors (Tutor) TA: 1. Adrian Schneller 2. Corinne van den Brink (Secretary) 3. Max Mallant (Chairman) 4. Zowie Segers	
Agenda item	goal	Time	Responsibility
1. Opening	Welcoming	10 sec	chairman
2. last week	Everything decided last week has been done?	2 min	chairman
3. time follow up	Hours spend on tasks	10 min	All participants
4. work to be done for the coming week	Which tasks has to be done for the upcoming week?	15 min	All participants
5. issues about the project	Questions the project group has to clarify	15 min	All participants

6. other issues	Issues that participants initiated in the meeting?	5-10 min	All participants
7. next meeting	Planning the next meeting	30 sec	chairman
8. closing	Closing the meeting	5 sec	chairman

2. last week: We almost finished all the project parts. We are happy with the comments on the concept version of the report. (as group we only had one discussion about delivering the concept version to Roger last week)

3. time follow up:

- Talking about the final report
- Talking about the presentation (showing the video after the presentation/Marketing students input/feedback)

4. work to be done for coming week: Preparing for the presentation and finishing the report. We would like to talk about a good order of the presentation. (Project management parts and the midterm presentation)

5. Issues about the project: Currently there are no issue's.



Appendix 6 minutes of meetings

Minutes	
Project: C&S Algae	
Date: Fri 07.09.2018	Meeting number: 01
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: Determining project roles Chairman: Zowie Secretary: Adrian	-
Topic 2: Organizational issues - trips during semester and working time spent on the project - weekly workload - previous work done on the project by other teams and students of university of Vaasa (literature, thesises) - work together with the students of university of Vaasa working on business models about algae	- read provided literature - contact them to get information about their work
Challenges: Define mission and vision statement for the project, define goals/objectives, WBS	



Minutes	
Project: C&S Algae	
Date: Thu 13.09.2018	Meeting number: 02
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: Review of last week Feedback to mission/vision/objectives	Hand in statements to Andreas
Topic 2: time follow up formula	-
Topic 3: Scope of project, what has to be done, the project is still vague formulated Focus on biogas part of algae project → study/focus biogas Learn basics about cultivation Also consider food aspect (food of future) → workshops Aspect service instead of product Circular economy → wastewater aspect	Defining scope of project on ourselves → if necessary lecture by Andreas about the topic
Topic 4: next meeting on Thu 20.09.2018 12:30	-
Challenges: clarify algae process and go into detail	



Minutes	
Project: C&S Algae	
Date: Thu 20.09.2018	Meeting number: 03
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: showing WBS, maybe changing during project	
Topic 2: PPP model Planet part: which technique is already used? --> difference between micro- and macro-algae, open pond vs bioreactor, which use afterwards Sedimentation and centrifugation (energy demanding) most commonly used Flocculation (complicated, cost intensive and added chemicals)	
Topic 3: more focus on solving problems Biogas and animal feed (example) Where is the water coming from	
Topic 4: contact marketing students and professor, not yet managed to meet	
Topic 5: monthly review of yourself and the other team members	
Topic 6: next meeting Thu 27.09.18 at 12:30	



Challenges: -	
Minutes	
Project: C&S Algae	
Date: Thu 27.09.2018	Meeting number: 04
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: review of last week • Triple P model, finished • SWOT analysis, finished • Road map, in progress • Defining and visualizing the chemical process, in progress	
Topic 2: creating 2 separate missions Measurable factor for final presentation to give more value to the project	
Topic 3: monthly self and peer assessment	Fill in before next meeting
Topic 4: no reply to Andreas from the marketing students yet	
Topic 5: next meeting Thu 4 Oct 12.30	
Challenges: -	



Minutes	
Project: C&S Algae	
Date: Thu 04.10.2018	Meeting number: 05
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: review of work done during last week - simplified circular economy - chemical flow model - future possibilities model - SWOT analysis and confrontation matrix - influence factors model also general use of them for everybody not only marketing students	
Topic 2: self and peer evaluation	
Topic 3: planned for next week - homepage, logo, business card - midterm report and presentation	



Topic 4: reply from lecturer of university of Vaasa, course not yet started role as technical experts is requested → costs, feasibilities, production system, available products guidance for decisions product to (nordic) market (example Norway)	Research on macroalgae cultivation for food production + waste products of algae → solutions
Topic 5: next meeting Tue 09 Oct 14.30	
Challenges:	

Minutes	
Project: C&S Algae	
Date: Tue 09.10.2018	Meeting number: 06
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: review of - homepage/logo/business card	Change name of project → change on homepage, report, business card
Topic 2: time management more content to use the time? → clothing of macroalgae (?)	Research on food made of algae and maybe clothing
Topic 3:	next meeting Thu 18 Oct 11.30
Challenges:	



Minutes	
Project: Transalgae	
Date: Thu 18.10.2018	Meeting number: 07
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: feedback on report	take corrective action on mistakes (spelling and grammar) → spelling check from Word in latest added parts! Algae → algae “controlled eutrophication” page 33 references in bibliography “Supervisor” etc. for Andreas change “EU funding” → misunderstanding → “different financiers” “TransAlgae principle”: more about “algae cultivation” → check report for consistency! “shelf life”: meaning not clear brief explanation for triple P “appendix” instead of “enclosure” → more precise
Topic 2: algae workshop starting on Thursday 25th Oct	Gather information on “Ulva Lactuca” (Sea lettuce)



Topic 3: presentation: focusing more on process, things found out, changes, how to continue	
Topic 4: next meeting on Wed 24 Oct 10.00	
Challenges:	

Minutes	
Project: C&S Algae	
Date: Wed 24.10.2018	Meeting number: 08
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Adrian Schneller	
	Upcoming tasks:
Topic 1: Election of new chairman and secretary New chairman: Max New secretary: Corinne	
Topic 2: Discussion about midterm presentation → Biodiversity in business model (circular economy) -Check time for final presentation -Files from C&S Algae Dropbox in EPS Dropbox or -invite Roger to C&S Algae Dropbox -Possible change of objectives after first workshop	-Change address of homepage -Further research on macroalgae (food → “waste” from food production, biofuel) → relevant information and sites Clarify meaning of logo
Topic 3: next meeting Thu 1 Nov 10.00	



Minutes	
Project: C&S Algae	
Date: Thu 01/11/2018	Meeting number: 08
Participants: Andreas Willfors, Zowie Segers, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Corinne van den Brink	
Opening 10:02	Upcoming tasks:
Topic 1: Deliverables	-Depending on what the marketing students have to do. -Look back on what has been said at the beginning of the project. -For example: roadmaps, concepts. -How do we proceed? -Summarize/describe the products from the workshops. -What the product means for the region.
Topic 2: New mission vision ideas	-Circular economy. -Use marketing story in our report. -What information adds value? -Put all ideas together.
Topic 3: Our role in the marketing project	-Provide information and knowledge without defining the project.
Topic 4: Next meeting	Wed 7/11 at 10h
Challenges: creating a new mission and vision	
Closing: 10:38	



Minutes	
Project: C&S Algae	
Date: Thu 07/11/2018	Meeting number: 10
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Adrian Schneller	
Minute taker: Corinne van den Brink	
Notification: Zowie Segers is absent	
Opening 10:05	Upcoming tasks:
Topic 1: Mission and Vision	-Vision: change focused on algae based food to → where algae is used as food and fuel. -Mission: Combining micro- and macro algae cultivation within a circular economy - chapter ideas for final report looks good
Topic 2: Circular economy	-Not municipal wastewater for macro algae cultivation. - Clean water from micro cultivation flows back to offshore cultivation → sea/ocean - Using biofuel as energy for heating cultivating processes
Topic 3: Focus of the project	- Macro algae as food as support of the concepts and why do we do this (chapter) -why and how, combine circular economy of micro and macro algae
Topic 4: Next meeting	Thu 15/11 at 10:00h
Challenges: creating a new mission and vision	
Closing: 10:43	



Minutes	
Project: C&S Algae	
Date: Thu 15/11/2018	Meeting number: 11
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Adrian Schneller, Zowie Segers	
Minute taker: Corinne van den Brink	
Opening 10:07	Upcoming tasks:
Topic 1: Transalgae workshop and C&S algae	- Focus is now more on the project with the marketing students so the schedule should help to do our work for our own project
Topic 2: Extract proteins from seaweed	- It is not possible to extract all of the proteins in seaweed - There are several ways to extract proteins. - It is possible to extract only proteins - Universiteit Wageningen is a good source
Topic 4: Next meeting	Fri 23/11 at 10:00h
Challenges:	
Closing: 10.35h	

Minutes	
Project: C&S Algae	
Date: Fri 23/11/2018	Meeting number: 12
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Zowie Segers	



Notification: Adrian Schneller is absent	
Minute taker: Corinne van den Brink	
Opening 11:18	Upcoming tasks:
Topic 1: EPS Schedule and transalgae workshops	- We will do a poster presentation with the marketing students - We will not attend another seminar - Keep participating and supporting the marketing students - Our final presentation and report are the important parts for EPS, but the transalgae workshops remains important and is part of our project
Topic 2: Contents for report	-Appendix: sort of reflections of differences in marketing groups -Look into previous reports
Topic 3: Next meeting	Thu 29/11 at 10:00
Challenges: finalizing the report, keep supporting marketing students, fill in WBS dictionary	
Closing: 11:57	
Minutes	
Project: C&S Algae	
Date: Thu 29/11/2018	Meeting number: 13
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Zowie Segers	
Notification: Adrian Schneller is absent	
Minute taker: Corinne van den Brink	



Opening: 10:09	Upcoming tasks:
Topic 1: Ending of the project	- We like to finish the project on the 5 th of December because of the Lapland trip
Topic 2: Logbook	-Keep up with the logbook, so Roger and Andreas can see the time we've spent on the project. We can put it in the dropbox or send it to Andreas by email
Topic 3: Trans Algae project	-Mina-Maritt is happy with the work we've done within the project groups :D
Topic 4: Final report	-We'll have to figure out the structure and of the report and see what we put in the enclosures or in the report
Topic 5: Next meeting	Wed 5/12 at 10:00
Challenges: Finishing the project on time	
Closing: 10:36	

Minutes	
Project: C&S Algae	
Date: Thu 29/11/2018	Meeting number: 14
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Zowie Segers, Adrian Schneller	
Notification: Adrian is absent	
Minute taker: Corinne van den Brink	
Opening: 10:11	Upcoming tasks:



Topic 1: Conclusion/ recommendation	- Conclusion needs good attention, should not be underestimated. We should all have input in that.
Topic 2: Time schedule	-The graphs for cost management are good, we should decide if we want a graph for each member or leave it like it is. -zoom in a bit more in the bar chart graph so the differences don't look that big
Topic 3: Video	-music in the video might be copyright - blurr some parts in the video → privacy rights and stuff
Topic 4: Reflection	-write the report for Camilla - fill in the monthly review about eachother - final evaluation, dividing points → don't have to do that yet. If we don't get further information about it we have to make something ourselves and hand that in.
Topic 5: final meeting	Wed 12 dec at 14.30h
Challenges: finish the last things in the report and hand it in, Final delivery dat of final report: wed 12 dec	
Closing: 10:45	

Minutes	
Project: C&S Algae	
Date: Wed 12/12/2018	Meeting number: 15
Participants: Andreas Willfors, Max Mallant, Corinne van den Brink, Zowie Segers, Adrian Schneller	

Minute taker: Corinne van den Brink	
Opening: 13:03	Upcoming tasks:
Topic 1: Final report	Good feedback to work with.
Topic 2: End results and working with marketing students	Well presented, good improvements. Not really professional view during shark tank but more consumer/marketing point of view. Teacher is happy with the outcome and our contribution.
Topic 3: Presentation	Reflection about working together with marketing students in the report or appendices. telling during the presentation about it is part of the discussion Do not repeat the mid-term report, more of a summery/refresh a bit. Bring it all together since the final presentation is about all the information. Aim for 30 min, 10 min questioning. Speak in equal terms. Put the posters in the appendices Doesn't have to be a normal PowerPoint
Topic 4: Movie	The music in our movie is allowed no copyright Probably shown after presentation but does not have to be part of the presentation.
Challenges: Finishing final report and movie. Make the presentation	
Closing: 13:40	



Appendix 7 reflection collaboration Vaasa University

Reflection Max:

During the second half of the semester I had the pleasure to work with 4 master marketing students of Vaasa University. During this collaboration we have developed multiple marketing concepts and presented them during a shark tank presentation. Personally, I have put a lot of time and effort in the workshops and the project with these Finnish students. In my opinion I have taken care of a big part of their project. I have received a lot of experience during this collaboration. Afterwards I noticed that my project group was difficult and not individualistic compared to the others. Almost every time one team member and I gave all the input and the others were quiet. In a brand development project this is difficult to work with and that is why I changed my supporting role into a leading role. After all I am pleased with the outcome and I am happy with this experience.

Reflection Adrian:

After the midterm presentation we also worked with marketing students from the University of Vaasa in their marketing course. It was about developing a marketing concept for algae-based food. Struggling with the task in the beginning, it became clearer after a while and we could go on.

The work with the team was very productive and we learnt much from each other. The work load was also equally distributed among the team members and everybody could introduce their ideas. In the end I stepped back a bit as the Finnish students received a grade for the course and not us.

Reflection Corinne

Personally I really enjoyed working together with the marketing students. I've never done anything with marketing before, so this was totally new to me. I feel like I learned a lot about how branding/marketing works. The marketing students were also very interested in my study, it was really nice that we got to share our knowledge. The communication in our group went really well, nobody was afraid to tell about their concerns, opinions and ideas for our concept. Obviously there was Finnish communication but mostly to translate explanations, since that is mostly better to understand in your own language. Often times we felt quite



confused about our concept and didn't know how to move forward. The group meetings besides the workshops really helped to clarify our uncertainties. Besides the intensity and work load of this course, there was plenty of room to joke around. I think we were all equally involved in the project, we might not have had the best concept, but I think we made a really good team.

Reflection Zowie

The collaboration with the marketing students at the University of Vaasa was a good learning school for me, especially the different way they worked on a project. Pushed to get out of your comfort zone by working within a multidisciplinary project group gave me new insights. Pitching the concept brands was a nice element to improve my presentation skills. For me the subject of our project is something that we will be using in the future when it comes to circular economy thinking and execution of the circular economy principle at companies. Some things that could have been better was the communication during the project within our project group. Misunderstanding can occur more often when working with different nationalities. However the workshops with Peter Menger gave me some information about how to handle these situations in a different and more efficient way.