Master's degree thesis

LOG950 Logistics

Growth in the aquacuture industry: Procurement as a mean to reach the goal of sustainability - with a focus on feed

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Preface

This master thesis is the end of our 5-year education at Molde University College, and the end of our 2-year *Master of Science in Logistics*. We have been working with this thesis from November 2021 until May 2022.

In this period of time, we have received help from our supervisors, whom we would like to issue a special thanks. Eivind Tveter and Øystein Klakegg have both in their own ways been of tremendous help in sharing their knowledge, answering our question, and giving us the feedback needed to get this thesis in the direction we wanted it to be.

We also want to thank to those who responded to our survey, even though we cannot identify them.

We want to thank our fellow students and friends who have been with us throughout the years here in Molde, as well as our families and each other who have supported us, and kept our spirits up.

Abstract

The Norwegian aquaculture industry is still growing and have done so since the 1970s. The implications of growth can be higher complexity, and within this term is also higher demand for the industry to comply with what they do. Sustainability is one of the things that are seen in high regard in society, and the aquaculture industry needs to comply with this to be able to sell their goods in the market. Procurement is a way of dealing with this, since a company can influence their suppliers in terms of clauses and initiatives. Feed have always been and are still a main input in the industry and the procurement of this is a good chance for the companies to reduce their negative impact. Thus, figuring out how the procurement functions work and finding out what they might be lacking to develop further is in place.

We sent out a survey to 59 companies in order to find things, with only 9 respondents we cannot generalize on an industrial level, but we can find indications. We asked them about their procurement function, how they rate the terms sustainability, environment and price when purchasing goods, and how they see themselves in terms of having power in negotiations.

We found indications of the industry leaning towards having centralized procurement functions, and that the aquaculture industry is the one which is more powerful in a negotiation setting. We also found that they all rate environment and sustainability higher than price. All-in-all we can say that the industry is ready for further growth, based our findings, and that the industry seems to be aware of the technological possibilities, even when some of the respondents did not seem like they would use the technology we asked about.

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1.0 Introduction

This chapter begins with our motivation, why we chose this topic, and a background of the industry we are writing about. We will present our research questions and problem statement; this will give insight into what we are looking for in our research and what we are trying to answer through this paper.

1.1 Background and Motivation

Backstory

Aquaculture is an old industry, with fish farming dating back around 4000 years to ancient China (Nash, 2011). Like other industries it has evolved and are today an important global industry. Fast forward a couple of thousand years from the ancient China and zoom in on Norway, the industry developed and got its breakthrough in the 1970s (NOU, 2019). It evolved from a side business to large worldwide companies, contributing to employment and livelihood in rural coastal areas. Despite having a base in rural areas, the industry has become a large part of the Norwegian economy by contributing to 10 000 jobs for employees, could also be measured through full-time equivalents (FTE) where the industry contributes to 42 340 FTEs directly and indirectly (Barentswatch, 2022b, DoF, 2021a). The industry also contributes to an income of 69 billion NOK in 2020 (DoF, 2021b). Norwegian aquaculture has surely developed from small actors to be a powerhouse industry of Norwegian exports in a rapid pace.

Motivation

This extraordinary adventure is something that can engage many, and it already has by searching on google scholar we can find that there are 3830 articles about Norwegian aquaculture with the keywords “norsk havbruk” (Norwegian aquaculture), and then we can add international studies as well which tallies 2 260 000 articles and books with the keyword “aquaculture”, the international studies have a much broader term and includes also inland, freshwater and other species than that used in Norwegian aquaculture. We are not very different, because we also wanted to take part of this adventure and see if there was something new that we did not know about the aquaculture industry that also could be interesting for others as well. This curiosity and interest in the industry made us investigate what have been written before to see if there were some gaps we could look into. One of

these gaps was the relationship between the aquaculture industry and their suppliers, more specifically the feed industry. From a search on Google scholar with the keywords "Norwegian aquaculture" and "Procurement", there were 114 results with these keywords, but these results where about other things than how the procurement function itself are working, but more of how the function can be used, like self-regulation (Osmundsen et al., 2021), circular economy (Ullern et al., 2021), and using public procurement to stimulate the market which aquaculture operates in (Mäkitie et al., 2020, Ullern et al., 2021). With this gap we started our journey which led to this thesis, and some interesting findings that we hope will other will find interesting enough to take further.

1.2 Problem Statement & Research Questions

In this chapter we state what we are trying to figure out through this paper, the overall problem we are working with is:

With a future built around sustainability, a focus on environment and procurement, how well are the aquaculture industry prepared for changes that comes with future growth?

We want a focus on sustainability, especially the environmental aspect of it. We also want to limit our research to the procurement of feed. This is because of there are many different types of procurement within the industry, but we want feed to be our main focus. To answer our problem statement, we formed five research questions that we think will help us do this. Some of the questions are designed to get an insight into how things work and how things are structured, and by this we hope to see if there are any connection between structure and behavior.

The first question we ask to underline the problem statement is:
How does the aquaculture industry structure their procurement function?
This will help us understand the strategy that the companies are using for their procurement functions. We also ask this question in hope to find if there are any connections to the use of technology in material management, which is a part of the procurement management.

The term power balance will be described later in the theoretical framework, but we will do a brief introduction to it her, so the term is introduced for the next question. Power

balance is how the actors in a negotiation, or a business setting, sees themselves and their counterpart´s standing, for instance if the buyer sees the seller as a more powerful actor, they are more likely to give in more for the seller´s demands. The second question is a deepening from the first one to look for relations:
How is the relationship between the procurement structure and the power balance in the industry?

With this question we can see if there are relationship between structure and power balance in negotiations. Power balance is in our eyes a vital part of procurement, because the power balance between customer and supplier can determine how a contract negotiation outcome look like, and who gets the better deal. A clause in a contract can for instance be transport of goods, to where, how, and how responsibility for the transport is divided. This can be either through INCOTERMS or self-regulation, where the two negotiating actors agrees on who will bear the cost, who will hire the transporter, who will take on the insurance, and more. Which actor who gets the better end of the stick in such negotiations can be influenced by the power balance. By having a research question about transport responsibility, we can get a picture of how the power balance really is influencing the conditions. Our starting hypothesis is that the responsibility of transport will be assigned to the part who is seen as the less powerful. Because of this we ask the third question:
How is responsibility for transport of procured goods divided?

Next question we would like to find an answer to is based on the industry. It is about seeing if there are anything that could be linked towards being an industry standard or if our findings are leaning towards being based on the individual company:
What trends can we find that is industry based, or are the occurrences based on the individual companies?
Answering this can be based on, for instance the answers from the three previous question, or other trends we find while conducting our research.

The last research question we want to find an answer to, is if the aquaculture industry is seeing the term sustainability as a term containing environment as an aspect or if they see environment and sustainability as the same. Which is why we want an answer to the following:

How does the aquaculture industry perceive the terms sustainability and environment, is environment an aspect of sustainability or are these two seen as synonyms?

1.3 Structure

This thesis is divided into seven main chapters, with respective sub-chapters. We started with an introduction to introduce our thesis and research question. This is followed by chapter 2, which presents our theoretical framework. Then we will present the aquaculture industry. After this we have a methodology chapter which presents our philosophical standing and the methods used to conduct our research. We will then present our findings, before discussing them in the next chapter in relations with the theoretical framework. Lastly, we will finish the study with our conclusion, as well as describe implications, limitations, and further research.

2.0 Theoretical Framework

The aquaculture industry is, as the rest of the business world, dependent on trade to be able to operate and prosper. Trading is done through the sales and procurement processes, and it is also in these two processes that there is a possibility to influence the actors with which you are trading. This can be done through clauses in the tender process and contract negotiations, be it delivery on a special day of the week, delivery by boat or truck, or more abstract clauses such as finding substitutes that can fill the role of parts or goods that could be deemed as inefficient, not sustainable, or simply too expensive. Inefficiencies are necessary to get rid of in a highly competitive market as aquaculture operates in, leading to the procurement process filling a role to help a company to make their inefficiencies more efficient. The procurement and sales processes can also fill a role of advertisement to their markets, for example today it is of importance to be seen as a “green” or “sustainable” company. Since the procurement process is a place where you as customer can influence the sellers who wants to deal with you, you can make clauses, and today news about such procurements and done deals travel fast because of the internet. Therefore, by having “green” clauses in a contract will make it look like your company look better in the eyes of the public. Which clauses a company can put in a contract and will get accepted in a negotiation will depend on the power balance between the companies in the negotiation, and the amount of trust the companies have and these are linked to relationship management.

In the following subchapters we will describe the procurement process, power balance in negotiations, sustainability and ERP and Technology with relevant literature found through our search, we will also provide definitions on the terms. These are theories that we have found relevant to our thesis, and that will help answer the research questions and problem statement.

2.1 Procurement

Procurement is brought up because its relevance to the triple bottom line, which is a part of the sustainability chapter (2.4), because of the potential for direct cost savings through procurement has influence on the economic aspect of sustainability. Through procurement demands, a company have the opportunity to talk to and influence suppliers.

2.1.1 Definition

The procurement process can be simply described as the way to get what you need, this is in general correct but should be rewritten to function better as a definition to this paper. First is the basis of that the process contains several activities, which would be a better way to put it than only with process. Next is that what you need could be many things and therefore should specify that it is either a good or a service. Lastly there should an element of what the need is for, if you are an end customer then the need is for you only, but in business-to-business markets you are usually not the end customer. Since this paper is based on an industry this should be reflected in the definition. This brings us to our definition of the procurement process:

The activities done in order to be able to satisfy an occurring need of a good or service to function and be able to produce goods or services for your own customers.

2.1.2 Kraljic Matrix – a tool for procurement

There has been performed research on the different processes in procurement and sale for a good amount of time. There is one theory which can be seen as fundamental, and thereby cannot be looked away from when talking about procurement, the Kraljic matrix (Kraljic, 1983), shown in Figure 1 below. This is a tool for purchasers which they can use in their strategic decision making for goods a company are purchasing. The strategic positioning of the goods and services you need to run a business, will help the purchasers identify how

they should proceed with the procurement of these necessities and how they should be treating the suppliers. This specific Kraljic matrix is modified by Mello et al. (2017) by including a sustainability aspect to the matrix, bringing in an aspect that have gained momentum through the recent years. Figure 1 could have been placed in the other subchapters as well, but we placed it here due to its origin.

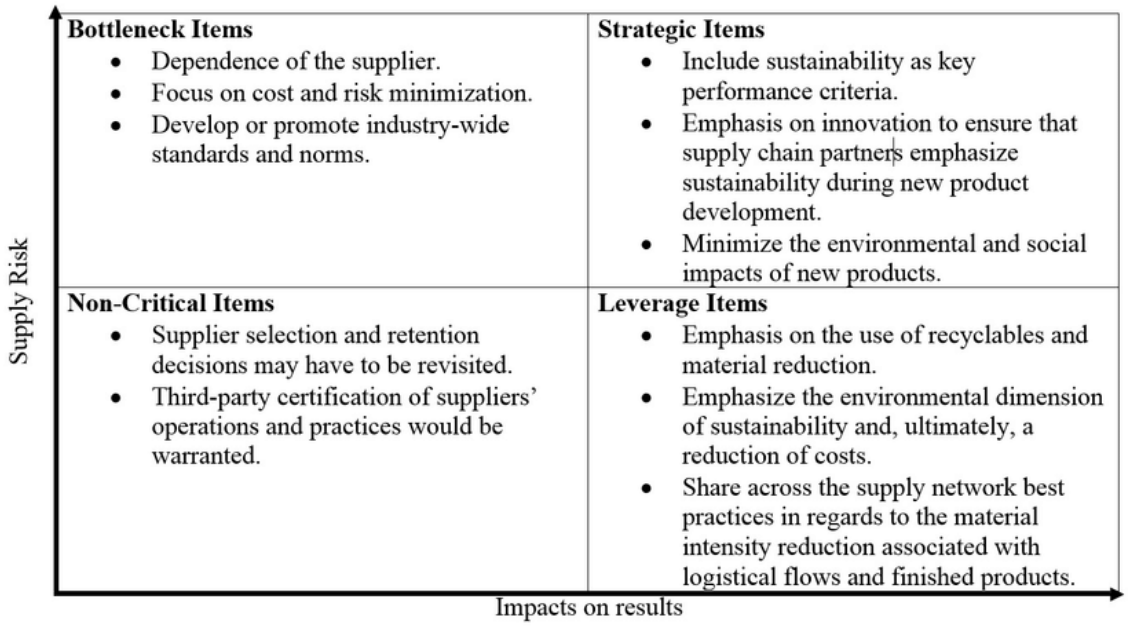

Figure 1: Matrix Including Sustainability in the Categories of the Kraljic Model (Mello et al., 2017)

As in the original Kraljic matrix there are two dimensions of classification, High and low supply risk, and high and low impact on result. By classify goods and services needed into these dimensions a purchaser can aim to choose a more suited procurement strategy to minimize supply risk and make the most out of their buying power (Padhi et al., 2012). A good that is placed in the non-critical quadrant is a good that are easy to get or standardized, an example could be office supplies such as pens, these kind of goods can be handled by standardized procedures and the suppliers does not need that much attention and the buyer can focus more on price (Wagner et al., 2013). Products placed in the leverage quadrant have a high impact on the result but a low supply risk, the suppliers of these products should be kept closer than the suppliers of non-critical products. If possible, help these suppliers to make them more efficient so their products might come to shift to a non-critical good instead, since these are substitutable and have more suppliers (Wagner et al., 2013). Bottleneck items are items that are not expensive but are difficult to obtain due to a monopolistic tendency. For the suppliers of these kind of goods, a good relationship with the suppliers is a good approach to secure your deliveries and limit the supply risk.

There could also be an advantage to have a long-standing agreement so both actors can feel somewhat safe (Wagner et al., 2013). The last category is strategic items, these are items that both have a high cost and have a high supply risk. The suppliers of these should be considered partners and should at least develop a relationship based on cooperation and trust, having cooperation in research and development, having regular meetings to see if there are some issues that can be solved together. These items are usually of such high importance that your business could stop functioning if you are not able to get the goods from the supplier (Wagner et al., 2013).

2.1.3 The procurement process activities

Procurement is a vital part of a business life in todays specialized business world. You need to get goods, parts, or ingredients so you can produce the products you are selling in the marketplace. Novack and Simco (1991) identified eleven activities in the procurement process that is done in order to fulfil the risen need. The first activity on their list is to identify the needs you have for a good or service, either of brand new or a recurring, when identified the process can proceed forward. The second activity they go through is defining the requirements. The ones who are in need of the good or service must also set the requirements for the service or goods so they can identify potential suppliers. Third is making the *decision of making or buying*. If the good can be easily obtained through the marketplace at a lower cost than making it inhouse the company should buy, unless they want to have full control over the entire production process. Fourth activity is which kind of purchase, whether it is a simple rebuy, modified rebuy, or a completely new buy. These types need different kinds of approaches later in the process. Activity number five is analysis of the market, which will help the purchasers to figure out how many potential suppliers there are, and what kind of power balance they can expect. Sixth activity is to identify all possible suppliers. The pool of possible suppliers should include both old and new suppliers and the suppliers should meet criteria set in advance by the procurement team so they know that the possible suppliers can be able to meet the needs they have identified earlier. The seventh activity builds on activity number two, here the procurement team needs to divide between demand and desire. Demand is what is actually needed in the good or service, while desire is what the user wants to have included. The desire is not a necessity and therefore can be crossed out if there are no suppliers that can meet it. Activity eight, after going through the first seven activities it is time to evaluate the

remaining supplier base. This base should now contain only suppliers who can meet the demand, and the goal of this evaluation to find those suppliers who can also meet with the desires mentioned in activity seven. This activity is often done through tender process or competitive bidding. The ninth activity they identified was to choose the desired supplier or suppliers, the choice also determines the relationship between the actors and the suppliers that was not chosen. The last two activities are delivery of goods or service which is initiated by the first delivery attempt by the supplier and evaluation of the supplier, this in order to control the suppliers in the form of their ability to meet the criteria set in the contract.

All of these activities are also under the influence of environment. Environment in this case are described as one or more factors that influences the process which the participants have non or little control over (Novack and Simco, 1991). An example of this is governmental influence through regulations, supplier loyalty and market influence. An example of market influence could be that customers wants traceable and sustainable products which sets more criteria´s to the provider of the products and their suppliers.

2.1.4 Centralized and Decentralized organization

Centralization and decentralization are organizational tools that companies use to structure their departments, such as the procurement department or sales department. A centralized procurement department will do purchases on behalf of the company, while a decentralized department will have single agents doing purchases for their branch. There are arguments both for and against both types of structures. The main argument for a centralized structure is the lack of coordination one might find in a decentralized structure, while the arguments for decentralization is theory that decentralization enhances the government's to local situations (Arcuri and Dari-Mattiacci, 2010). Arcuri and Dari-Mattiacci (2010) research shows that the with centralization is favorable in both accurate decisions making and has less risk, as long as the expertise is good enough. With poor expertise, the decentralization had less risk, whilst the centralization was still more accurate.

McCabe (1987, cited by Glock and Hochrein, 2011) found an empirical support for a relationship between purchase complexity and the structure of the procurement department, and that "an increasing degree of complexity leads to a higher degree of

centralization". This can be an effort to ensure long-term availability of resources, increase specialties and management when making purchasing decisions (Glock and Hochrein, 2011).

2.1.5 Make or buy decision making

The make or buy decision making was originally a question asked by Ronald Coase in 1937 and further looked at through the transaction-cost economics developed by Oliver Williamson (Tadelis, 2002). The make or buy decision have been according to Welch and Nayak (1992) been focused on cost, more specifically the cost of labor, even though the cost of procurement alone atone for about 53 % of the total cost and labor only about 10 %. With these numbers, they state that the attention to make or buy decisions cannot be overstated, with short term profit in mind lots of long-term risk by outsourcing was neglected. For instance, that the low-cost suppliers could become competitors after learning about the critical skills necessary to make the complete product, making only cost based make or buy decision dangerous (Welch and Nayak, 1992).

Welch and Nayak (1992) also found that since specialized suppliers deliver their product to more than one customer, their production levels will be higher in total than if a company were to produce for themselves. This indicates that the supplier has a cost advantage because of economies of scale and/or advantage from learning-by-doing, which is bigger than the individual company. This could explain why there is extra cost occurring to the firms that takes the "make" decision and makes others think about why is there any firm that wants to produce inhouse at all. This coincides with Welch and Nayak (1992) who states that when the technological advantage is low there could be an incentive to buy, and therefore when the technological advantage is high, or a high value-adding activity, it could indicate that a company should make the part themselves in order to protect their product from being copied by a supplier. Welch and Nayak (1992) concludes that companies should look past the cost savings when making this decision and look at the total scenery to not only gain in short term.

2.2 Enterprise Resource Planning and Technology

In order to have full control over the resources in a company, with their size and complexity as a variable, it is no longer possible to keep track solely based on manual

paperwork. One way to handle the higher complexity is by implementing an enterprise resource planning (ERP) system, which could be thought of as one of the most efficient ways of being able to secure traceability, which is important for a company to have better control over their resources (Rizzi and Zamboni, 1999). By having an ERP system, a company´s opportunities for other technologic advances increases greatly. The reason behind this is the sheer amount of information that will be handled more efficient and faster can travel between creators and users (Siew Kien et al., 2002). The information is in real time and ERP systems have an adaptability for also register information on its own by the use of sensors. For instance, with automated storage, the ERP system can register when the container or silo are reaching a given minimum level, and alert purchasers that it is time to order and stock up following economic order quantity (EOQ) strategy, this can be done through "internet of things" and sensors (Mahmud, 2017).

An ERP system and its applications, with its ability to function across several company business functions without the need of manual interference, reduces waste of time, bureaucracy and the chance of occurrences of errors, because of automated updating (Wortmann, 1998). The mentioned "internet of things" (through the technology of wireless communication), EOQ and sensors that reads the level of inventory are all part of material management, and this management task is considered to be a part of procurement management (Mahmud, 2017). Since the feed are a fresh good (SkrettingAS, 2012) it is also perishable, and Rizzi and Zamboni (1999) have identified three main issues regarding storage of perishable goods. The first is high traceability levels have to be reached to efficiently deal with perishable goods, the second is optimization of warehouse fill rates, and the third is reduction of order lead times. Because of perishability there is a necessity for the storing to not be too massive, lead time must be short and fill rates need to be of a higher frequency than if the feed was not perishable. With the sensor technology and ERP systems that are available, the traceability and efficiency can be raised, and a company in the aquaculture industry can free capacity of the breeders. This allows them to be able to focus more on the fish handling and less on administrative tasks such as storage and purchasing, because the system will take the task and do it for them.

2.3 Negotiation power

When purchasing products or services the parties involved goes through negotiations, and Henry Kissinger (1969, cited in Alfredson and Cungu, 2008) defined negotiation as "a

process of combining conflicting positions into a common position, under a decision rule of unanimity". While Fisher (1983) define negotiations as all communications between two or more parties in the purpose to influence the other parties' decision. Fisher's definition of negotiation is broader, and in our research, we find this one to be the most fitting. Kissinger's definition is aimed at conflicting nations, while Fisher's is considering all communications aimed to persuade a counterpart. Fisher further explains that negotiating power is the ability to affect someone else's opinion in your own favor, and that the power is dependent of other's perception of your strength, not your actual power. Whenever a company is entering a new negotiation, there is always a power balance. There can be a symmetric balance where the parties are equal, or there might be an asymmetrical balance where one party is more powerful than the other(s).

2.3.1 Symmetric Power

In a symmetric power balance, the parties are as powerful as each other, so how can this balance be affected? The answer to this is who. Negotiations are led by people and a skilled negotiator can have a large impact on the negotiation. According to Fisher (1983) there are 6 factors that are helpful to be perceived as more powerful negotiator: skill and knowledge, a good relationship, a good alternative to negotiating, an elegant solution, legitimacy, and commitment. These factors together can be learned and are therefore a powerful tool. If a master of these techniques negotiates with someone that are not that great of a negotiator, they will establish a power over their counterpart. This is because they on paper are equal, but the negotiators involved are not, and because of this a symmetric power balance can turn asymmetric.

2.3.2 Asymmetric Power

An asymmetric power dynamic can be the consequences of different factors, most notable are size, expertise, and dependence. These factors can create a dynamic which gives one party a larger portion of the benefits because it is more powerful. When the power balance is asymmetrical the more powerful end up getting a larger part of the benefits more often than not, which is a frustrating for the lesser party (Maglaras et al., 2015).

Something that also can affect the power dynamic in negotiations are technology. Newly technological advances can affect shift the power from a position of weakness to a position of strength, or vice versa. Making innovative strides can make a powerful supplier even

more sought after, or a smaller supplier can suddenly become a powerhouse (Porter, 1985). This means that if a supplier suddenly develops a new product that are, for example, better for the environment than all other products in their category they suddenly have more power in their negotiation because of this desired trait. This can make the buyer dependent on the new technology. This can create a situation where the buyer needs the unique product to fulfill their customer's needs, and at this point the supplier have a more powerful position within the negotiation. This new technology can also require expertise that no other company can provide, for instance due to service or maintenance, then the buyer of this product needs the expertise of the seller or service provider.

As mentioned, size is a prominent factor, larger companies have a larger purchasing power, and this can become apparent in the negotiations. Because of the importance of steady sales, a larger buyer who can accommodate this desire will have a greater power dealing with a smaller supplier. The smaller supplier wants the stability in sales the buyer can provide and is therefore more accommodating, which can lead to a snowballing effect where the smaller supplier eventually offers a too large portion.

2.4 Sustainability

We will now describe the term sustainability, and our definition will come at the end of the sub-chapter. The reason behind we bring up sustainability in the theoretical framework is that it is a big part of our thesis, and it will be put on as point-of-view into what we are doing for the rest of the paper. For instance, when asking about procurement in the industry we also include the sustainability point-of-view as possible answers in the survey we sent out during our research.

Sustainability is a reasonable new term with many definitions depending on its context. To be sustainable are in general seen as being able to make a profit, with little or no impact on the community and environment. The first mentioning of the term sustainability is officially from the Brundtland report anno 1987, based on this report the United Nations sustainability goals also was developed from this report. With growing interest in sustainability through the years the focus on sustainability in aquaculture also raised within people, discoveries of problems such as escaping fish that mixes into the wild fish tribes, discharge of waste, both excess feed and fish excrements (Ramírez-Godínez et al., 2013), and the usage of fish oil and meal (Martins et al., 2010). The growth of the industry and its

importance to feed a globally growing population can be seen from the incline from the almost 50 % of the global food consumption in 2012 and the predicted 63 % by 2030 (Mitra, 2021). Of the total seafood supply salmon and salmonoids stands for roughly 5 %, but with an expected rise in demand this will with high probability also rise due to the low risk and high industrialization (MOWI, 2021). A higher output raises risk for the prementioned concerns of escapees and waste, and there is a need to increase the input, fish feed, to be able to keep up with the growth in output, stated in other words that the ones who invest to increase output also increase the output risk (Tveteros, 1999). Further on we will look at the three columns of sustainability individually, profits, environment, and community, and describe each of them with regards to our topic and its relevance to it. We are going to talk about the various aspects of sustainability, which we have taken from Figure 2.

Figure 2 Three spheres of sustainability (Żak, 2015)

2.4.1 Economic dimension

The economic dimension of sustainability includes as shown in Figure 2 profit, research and development, cost savings and economic growth. These points emphasize that a company should be operating in a viable market and that their product also must be viable.

The research and development point is experienced to have a high influence on cost, especially for small and innovative firms (Hall, 2002), but the cost of research and development can lead to knowledge that only exist inside the company which could in turn be more valuable than the cost itself, and it could lead to innovative products which can be sent to the market.

Economic growth should be a goal for companies all around, but economic growth could be mistaken for a growth in profits. Economic growth are according to Ahlstrom (2010) due to innovation and growing companies, which hires more people and thereby raising the living quality of the people in society. In Ahlstrom's words profits are not the same as economic growth, but a part of it, because if a company does not have profit they are not able to invest in further growth and thereby not being able to contribute to economic growth.

Profit is one of the easiest way to put how well a company is doing, bigger profit usually means better company in economic terms, a good way to make profits higher is to manage cost savings. Well managed procurement can be one of the ways to properly manage cost since procurement alone is worth about 53 % of total cost (Welch and Nayak, 1992), so businesses can have good benefits of managing itself properly.

2.4.2 **Environmental dimension**

The environmental dimension takes on the natural aspect of sustainability, which means the resources a company takes from nature and the company´s influence on nature as pollution, waste, noise, and such. In the context of this paper, we will look at the resources that are relevant to it, this will most likely exclude some subjects that in general should be included. First, we have the natural resources being used by the aquaculture industry, we have categorized the feed in this because of its use of marine ingredients such as fish meal and fish oils. To be able to claim that you are sustainable in this matter you have to be sure that you do not exploit the resources you need to produce feed too much, but this constraint is being strained more as the population grows. The population growth and thereby growing demand for fish challenges (Thilsted et al., 2016, Mitra, 2021) the already strained fisheries also the continuous tightening of sustainable constraints of fishing (Mitra, 2021) due to United Nations Sustainable Development Goals and local

governments will to live up to these. This in essence means that with growing demand for fish and feed, the feed producers must find alternative ways of getting the same or better result as the feed today since they cannot extract more natural marine ingredients. Mitra (2021) brings up several ways that they are now researching as possibilities to replace or complement the fish meal and fish oil in feed of today in an attempt to enlighten what is being done to conquer the sustainability challenge. Examples of this are plant based alternate feed, which is solely based on plant organisms like algae from the sea and soy or rice from land. Land-based animal byproduct is an alternate that relies on animal fats that are a byproduct of slaughter of for instance pigs and poultry. There are more examples that Mitra (2021) brings up, but the last one that we would bring up is Biofloc meal, which is a natural product made by bacteria dried and grounded, and with a high content of proteins and lipids can become a full substitute of fish meal. If this succeeds, the substitution of fish meal and fish oil from the feed, the industry will become more sustainable in terms of the already strained fisheries also the continuous tightening of sustainable constraints of fishing (Mitra, 2021). If this succeeds, the substitution of fish meal and fish oil from the feed, the industry will become more sustainable in terms of overfishing and not be dependent on from fisheries. Proof of this already being handled in terms of research and actual usage could we find graphically, Figure 3, in the "Salmon farming industry handbook" from MOWI (2021), which shows that globally in 1990, there were only vegetable oils represented, while in 2020 vegetable oils and meal stood for 70 % of the feed content.

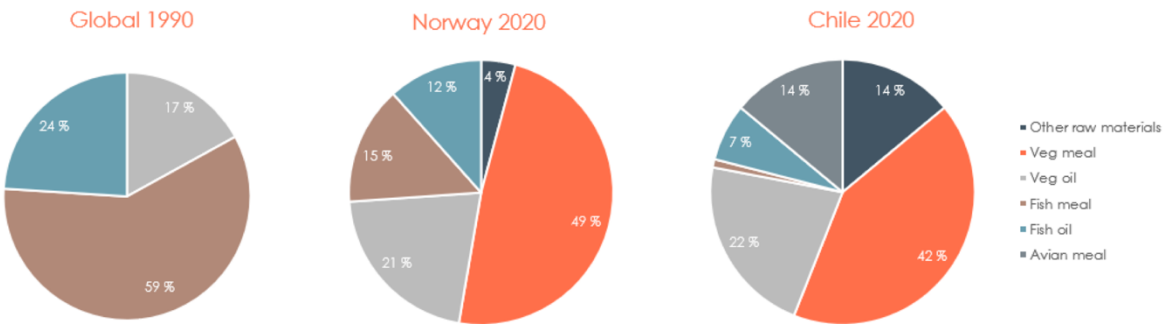

Figure 3 Salmon feed ingredients (MOWI, 2021)

In environmental management, there is the aspect having control over what a company is releasing out to the environment and that there should be a strong commitment from the top management to compliance with environmental legislatives and:

recognition that the corporate responsibility for the environment can affect short-term as well as long-term profits; and the realization of the fact that costs for environmental responsibility can be minimized and even some profits can be made. (Gupta, 1995)

Considering our paper we have included the problem of escaping fish, with the words from Gupta (1995) above we can say that managing this problem correctly, trying to improve the situation and the cost of environmental responsibility will go down and profits will go up. The escaping fish is also an environmental problem that the Norwegian government is fully aware of, where data is gathered from both Directorate of Environment and Directorate of Fishing. This is a problem the government and the industry are handling together. We can see from Figure 5 that there have since 2005 been incidents of escaping every year (Dark blue line), and that earlier a bigger part of the incidents totally in the aquaculture industry was because of escaping incidents. In 2020 the number of escapes was less than half of total incidents, and that through the year escaping have been stable with the exception of a high peak in 2009 and a low peak in 2012. Even when the number of escaping incidents are being stable, the number of escaping fish have been decreasing (shown in Figure 4) (Barentswatch, 2022a). Escaping fish is considered a big threat to the natural wild fish (Forseth et al., 2017) because the farmed fish does not have the same immune defense as a wild fish and the genes are specially breaded to grow big and be eaten, and not the extreme conditions of going from ocean and into fresh water and back out.

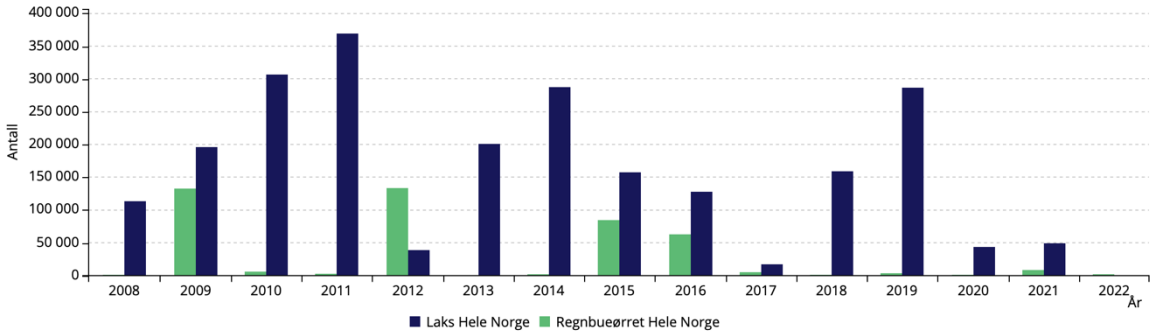

Figure 4 Escaping salmon and trout 2008 to 2022 (DoF, 2021, cited in Barentswatch, 2022a)

Figure 5 Number of reported escaping incidents in Norway 2005-2021 (DoF, 2022)

Next topic point taken from Figure 2 is Pollution prevention, this has connections to environment management. Pollution prevention is a more practical aspect than the other point mentioned since here it is about preventing it. One of the main concerns for Norwegian fish farmers to have in mind is the excess feed and excrements that drop to the seabed and drift away with the currents and affects the ecosystem in the surrounding area. They are not dangerous themselves since they are organic but because of the volume they may alternate their surrounding ecosystem (Karlsson-Drangsholt et al., 2017). Research on how to prevent it, with technology and facilities, is not something that we will go deeper into, but it is worth mentioning that it is a field of research because of the awareness of this problem, and because it is a part of sustainability.

2.4.3 Social dimension

The social dimension of sustainability is maybe the aspect that is more visible to people in the communities around a company than for instance the pollution the companies do. The social dimension is in place to make sure that companies do not forget that there are people around them that are involved either as employees or stakeholders in the community. People´s standard of living is one aspect of the social dimension, giving people a place to work and earn money will increase their wealth and thereby how they are able to live. Dillard et al. (2008) also mentions standard of living, but not in the exact words, they say that employees should have terms and conditions in their work agreement so they can feel

secure about their job, that they will get paid and that they will have opportunities to develop and learn in their jobs. Further, Dillard et al. (2008) states that suppliers in terms of supply chain impact should have fair terms and pay for the products they are delivering, this is to ensure that you destroy a company by pushing them too far. The next point they mention is communities, that the companies should be aware of the net negative effects of the people living in the area around the company have from them and the socioeconomic effects that moving out of a location has for the community (Dillard et al., 2008). In our case of the aquaculture industry this last point is more reversed. Muir et al. (1999) found in their research about Scottish aquaculture industry "salmon farming has positive effects such as population retention, employment and income generation in remote areas". This could also relate to Norway since aquaculture companies settles down in rural coastal areas breathing new life into these small communities. There is also another way for the industry or the companies within the industry to contribute to the community and the social aspect. By paying taxes to the local and national authorities they contribute to the welfare of society, and they could enter as sponsors for local and/or regional sports teams and cultural events and groups such as bands, theatrical groups or galleries.

2.4.4 Definition

Sustainability is a broad term and arguably the most cited definition is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" from the Brundtland report (Vos, 2007). The UN have based their 17 sustainability goals on this definition and this makes the goals a kind of specification of the original definition. Vos (2007) states that they find that most of the definitions of sustainability to share common core elements, like how they look at environmental problems in relation to the other two aspects of sustainability social and economic aspects.

Since this thesis is about aquaculture, our definition of sustainability should have life in the sea at its core, or in other words the UN sustainability goal 14 "life below water" as a core element. A first draft could be:

capture of habitants of the sea that meets the need of today, without jeopardizing the need of tomorrow

This draft captures the elements of sustainability goal 14 and the original Brundtland report definition and suits the part of how the feed industry influences the aquaculture industry but is too vague to be the final draft. Sustainability is a three way relationship between environmental, social and economic pillars, but as in forgetting one of three important ingredients in your dinner, sustainability have in the same sense become more environmentally focused and organizations tends to "forget" the social and economic aspects of sustainability (Meehan and Bryde, 2011) this inclines us to be sure to incorporate these aspects as well, so the further development and second and final draft could be:

Exploit resources of the sea for profits, while protecting them for later generations and protect the community with green solutions.

This can be read both from the feed and aquaculture perspective, both are using the sea to make a profit, both have to look for solutions that will ensure that they do not over exploit the resources they are harvesting, and at the same time they have to be sure that their decisions are for the good of the communities around them and globally with having the environment in mind with innovative thinking for problems that are there now and will come later.

3.0 The Aquaculture Industry

As we mentioned in our introduction, the aquaculture industry is an old industry in continuous growth. The continuous growth of the aquaculture industry is good for society in the creation of jobs, contribution to GDP, and as an industry it has the potential to become the biggest Norwegian export. As of today, Norway's biggest export is oil and gas (OEC, 2021), this is a nonrenewable resource which means that at some point the extraction of oil will have to stop. Oil and gas are also recourses that have a large environmental impact, and with several of the UN Sustainable Development Goals impacting this sector the extraction of oil and gas will have to be reduced, and eventually discontinued. With the exception of oil and gas, the biggest export from Norway is non-fillet fresh fish (OEC, 2021), and this is where we see the potential of it being Norway's biggest export one day.

This growth brings positives, but we can also consider some challenges that it brings forward as well. The operations within the aquaculture industry will require more resources. Some of these resources are spatial, where can new fish farms be installed, how much fish can they contain, and how many is needed to meet the demand. Another resource that can bring challenges, and is of focus in our research, is feed. We see this as a challenge since growth in volume of fish requires growth in volume of feed, and with the higher demand of feed and the increased focus on sustainability the creation process will be affected.

3.1 Economic Development

There is still growth within the industry, even during the Covid-19 pandemic Norwegian fish exports have been increasing steadily (Nilsen, 2021). The growth is even more visible looking over a larger time period, in the last decade there were a rise from 1,02 million tons sold for 30,6 billion NOK in 2010 to 1,49 million tons of fish sold for 69 billion NOK in 2020 with the amount value and weight of fish sold shown in
Table 1 (DoF, 2021b). This is a 125 % rise in value, and a rise of 46% in tonnage. This table also shows the changes in price per kilo with a decade low in 2012 where it dipped down to 22,8 NOK per kilo and a high in 2018 with a kilo price that was 50,1 NOK, which is over twice the price in 2012.

Table 1: Amount of fish sold from 2010 to 2020 (DoF, 2021b) modified

Year	Weight (tons)	Value (1000 NOK)	NOK/KG
2010	1 017 809	30 615 383	30,1
2011	1 141 976	28 926 524	25,3
2012	1 319 128	30 028 230	22,8
2013	1 245 502	40 466 564	32,5
2014	1 330 481	44 319 743	33,3
2015	1 378 066	46 834 775	34,0
2016	1 323 944	64 014 221	48,4
2017	1 306 035	64 959 724	49,7
2018	1 353 220	67 805 657	50,1
2019	1 450 761	71 706 223	49,4
2020	1 488 005	68 710 881	46,2

To get a more visual picture of the changes within the industry's economical side we have created Figure 6. Where we see the weight corresponding to y-axis on the left-hand side, with the weight of slaughtered fish in rounded tons, and the value of the amount in

thousand NOK on the y-axis on the right-hand side. We can see that the weighted amount has gradually increased throughout the decade, with a few periods of decreasing amounts. In the meantime, we can see that the value of the amount has increased in a more aggressive tempo. We only see two periods where the value has decreased, from 2010 to 2011 and 2019 to 2020. There is an increase in the weighted amount in both periods, but as we can see in Table 1 these periods have a decreasing price per kilogram. There are two rather large jumps in value, the first from 2012 to 2013 and the second one from 2015 to 2016.

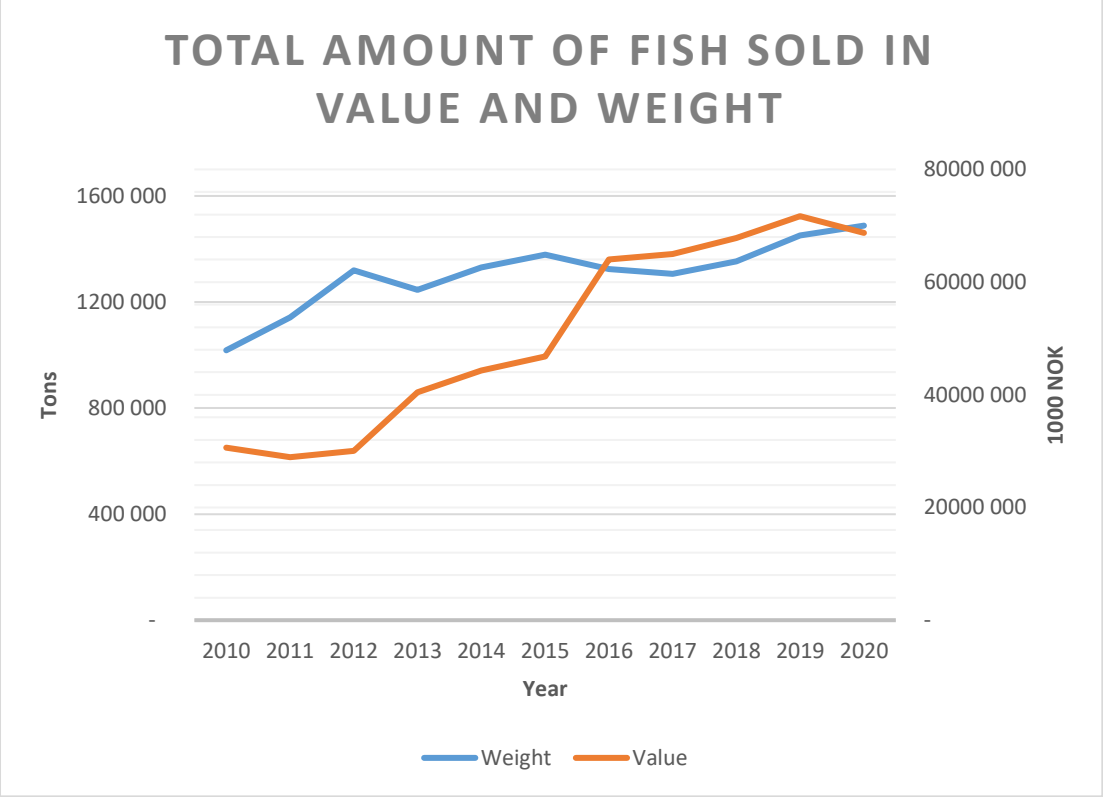

Figure 6: Total amount of fish sold yearly from 2010 to 2020 (DoF, 2021b)

3.1.1 Market shares

The market has, like the industry, evolved in a high tempo. Within the aquaculture companies needs permits to breed fish. In Figure 7 the portion of production permit per company, in the end of 2005, is shown. Here we can see that the 10 biggest companies within the sector contribute to 40 % of the production permits. While, in Figure 8, we can see the same statistic in the end of 2017, where the 10 biggest companies contribute to 68 % of the permit shares. This shows us that the biggest companies are expanding their market share, and the companies below the top 10 is decreased massively in the 12-year-period between when these statistics where gathered.

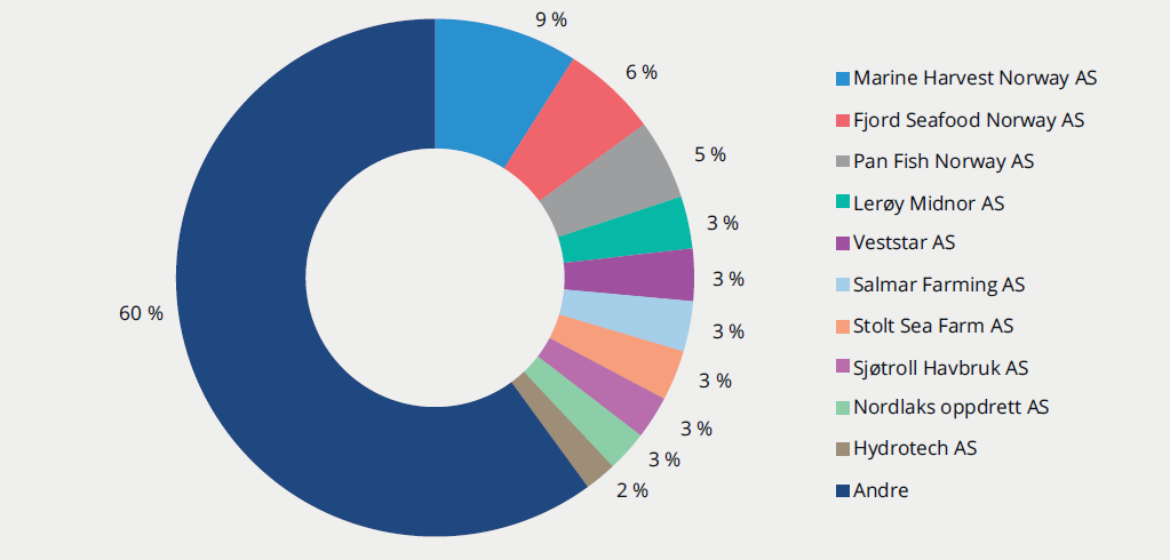

Figure 7: Norway's biggest aquaculture companies, share of production permits 31.12.2005 (NOU, 2019)

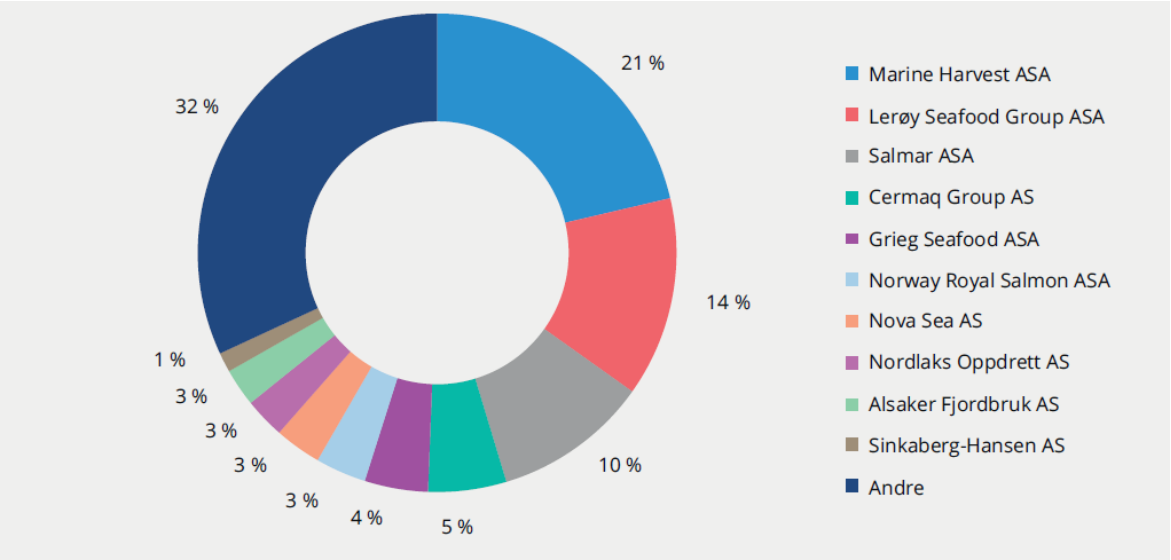

Figure 8: Norway's biggest aquaculture companies, share of production permits 31.12.2017 (NOU, 2019)

3.2 Procurement of Feed

A challenge we have identified as a consequence of the growth in the industry is the further need for feed, especially when we can see how the amounts of fish are increasing. We have focused on feed as the good that is being purchased, and the placement of feed in the Kraljic matrix would be close to strategic items. This is because that it is perishable, there are few vendors, it is important for the companies to have it, so much that it could almost be said that they are dependent on the vendors. The reason why we do not put it all the way up in the top right corner, meaning maximum supply risk and impact on cost, is

because of the volumes that the vendors are able to produce, and that there is research going on that tries to find a way of substituting the scarce marine ingredients and replace them with more sustainable sources which can be used to up the production more. This means that the supply risk is not as great as maximum but not good enough to get out of the high category. According to Knapp et al. (2007) feed are the biggest component of the production cost, and do therefore have an high impact on the results in. We can tell that if the fish does not get food the companies will not be able to sell their product, so it really have, in a direct way, great influence on the results. Which is why we want to hold the high category on impact on result for feed, leading us to that feed belongs along the border between leverage item and strategic item.

This increased demand of feed and raised questions of how the feed producers will be able to keep up with the growth and where will they get the resources, they need to produce the feed needed to meet the demand. An ingredient that has been present in the feed since the beginning is biomaterials, such as fish and fish-oils. These resources were more important in the earlier days of feed production, when in 1990 the feed contained 90% marine ingredients (Ytrestøyl et al., 2015), while in 2016 only 25% were of marine ingredients (Aas et al., 2019). Even though the portion of marine ingredients has gone down the demand for the ingredient have gone up because of higher production, which in turn still put lot of pressure on the natural resources that are already being pushed hard. As a response to this, more sustainable substitutes are being researched as mentioned in chapter 2.4 under the “environmental dimension”, like the Biofloc, using byproducts from animals and fully plant-based products.

There could be some resistance against going over to alternate ingredients by the fish farmers since they already know that the feed they use now works well, and they do not really know if the substitute will work just as good or better than the present product, since naturally salmon feeds on pelagic food sources and by replacing the marine ingredients with vegetable-based sources could be seen as tampering with nature. This can be called fear of the unknown, and since their job is to farm fish into healthy grown-up fishes that can be sold on the market, they would rather keep doing what they are doing because it is working.

Since the raising of fish is an important job, the right goods are needed as well, therefore, must fish health and quality be considered important factors for the processes described in chapter 2.1 Procurement. Since health and quality are being set as criteria by the customer of feed, the feed industry has to at least meet the standard. Because of this they need to try to innovate their product for the better, to be able to change the customer's desire. One issue that has occurred due to innovation of the feed and more usage of vegetable ingredients are the decline in Omega-3 acids. The reason behind this is that the vegetable ingredients does not give the salmon the same nutrients as marine ingredients, such as amino acids and fatty acids, which is a part of the Atlantic salmon´s nutrient requirements (MOWI, 2021). As mentioned in chapter 2.1 a customer´s desire is negotiable, so if the feed industry can provide proof of a substitute giving at least the same result, or preferably better, than the normal feed they can direct the customers desire towards a more sustainable solution. This also works the other way around. A customer that desires an innovative product that possibly gives better results, are more sustainable, and best-case scenario cheaper than the original, can influence the supplier to try figuring something new.

An issue around feed procurement can also be seen from another perspective, material management. Fish feed, like most other types of feed and food, are fresh goods which in other terms means that feed are perishable (SkrettingAS, 2012). This means that the industry cannot order in overly extensive quanta, because the feed will become unusable over time. With the correct procurement strategy and help from technology this could be solved. As we mention in chapter 2.2 Enterprise Resource Planning and technology, there are ways of solving this by exploiting sensors. These measures and keeps track of the amount of feed in storage, wirelessly communicate the data to the ERP system, internet of things, that are according to Mahmud (2017) to "connecting the unconnected and sensing and sensemaking", and ERP applications, that will receive and sort the information that are gathered by the other points we have mentioned.

3.3 Sustainability Within Aquaculture

Aquaculture in its basic idea can be seen as a sustainable industry, since the fish is produced in natural environment and are not in itself bad for the surrounding. There are however some drawbacks that emerges when looking below the surface, for instance the

excess feed and excrements from the fish, which in itself are natural organic materials and not bad for the surroundings, but in the amounts created over time it influences the environment and habitat of the wildlife living under and around the locations (Karlsson-Drangsholt et al., 2017). In terms of greenhouse gases, the industry is pretty clean especially compared to land animal production who they are emitting 14 million tons CO2 less than (MOWI, 2021). They might have a diesel generator if they are not connected to the electric grid by cable, and it is their vessels that might run on diesel. So, regarding the environmental dimension of sustainability the problem that might be the biggest issues is escaping of fish and Gyrodactylus Salaris (Salmon Lice), which has been described in chapter 2.4. The escaping of fish might have a bigger impact on the wildlife than the previous mentioned excess feed and excrement. This is because the escaped fish can mix in with wild fish and begin mating with them in the rivers and with the genes that the farmed fish haves, they are not suited for a life in the wild, and with genes that might make the wild salmon more susceptible for illness and lice, they are a big concern.

Muir et al. (1999) found some positive and negative impacts from the Scottish aquaculture, when they did a study on its impact regarding sustainability, their findings can also relate to the Norwegian aquaculture since they are similar in the sense that both are mostly sea based with cages that are not fully closed. It is an article which is pretty old, but the aquaculture industry is still contributing in the same way today.

	Economic aspects	**Social aspects**	**Environmental aspects**
Positive	– Jobs, national tax revenues, social security benefits – Marketable products and good market signals	Maintenance of the viability of a local community and of its services	Negligible, alhough reduced pressure on wild stocks may be claimed
Negative	– Conflict with other economic activities (tourism)	– Loss of amenity – Conflict between locals and incomers	Pollution, nutrient enrichment, visual intrusion, disease and genetic impacts on wild fish stock, lack of strong policy framework

Figure 9 Economic, social and environmental signals of the Scottish salmon industry (Muir et al., 1999)

The next aspect of sustainability we want to describe is the social aspect, as shown in Figure 9. The main positive in this aspect is that the industry is maintaining small local communities, since the industry mainly settles down in rural coastal areas. At the same time, it can lead to conflict, especially if the company brings in only “outsiders”, because this can become a cultural crash between the locals and incomers. Since the social aspect of sustainability is not our focus point, we will not go much further into it than this, but the

positives of bringing work to rural places are thought of highly, since it can bring back life to a place that struggles with people moving away.

Last aspect of sustainability is the economic aspect, in at least two ways it overlaps with the social, because Muir et al. (1999) have classified jobs, national tax revenues and social security benefits in the economic aspect, but we would have classified it in the social aspect since it is that these are a negative impact on the company in economic terms, while they are positive impact for society and the social aspect. Being an intrusive sight in the landscape and this conflicting with for instance tourism, but we ourselves have seen is that this intrusiveness is somewhat included in the pros and cons in the process of getting a concession for a location. We can name a local example at the Atlantic Road, were the tourists stops to look around. There is not a single location, but as soon as you cross the last bridge towards Molde there is one, which tells us that the governing body have taken tourism into account. With the economic prospects being good for the aquaculture, economic growth is also a good possibility. Ahlstrom (2010) states that economic growth is made by companies growing and innovations. Growing companies often is a source for new available jobs, which then makes it possible for new people to get into the work market, this could again make it so the community around the aquaculture company gets more inhabitants, which gives more income from taxes, and thereby better welfare offerings. As mentioned in chapter 2.4 profits in itself is, therefore, not economic growth, but a mean to get economic growth, because a company can use their profits too further invest in research and development, or development of higher production rate which in turn makes them able to produce more. With higher production there might come more profit, which in turn again can be reinvested to further growth, this is a continuous loop that can ensure growth in the long run.

4.0 Methodology

Research methodology is a systematic way to solve a research problem. Here we look at the different steps that are often used by researchers, along with the logic and method behind them (Kothari, 2004). In Figure 10 we see the Research Onion by Saunders et al. (2015). This shows us the different steps, or “layers”, which we use to carry out our research. This is the overall layout of our methodology chapter, starting from the outer layer and working inwards.

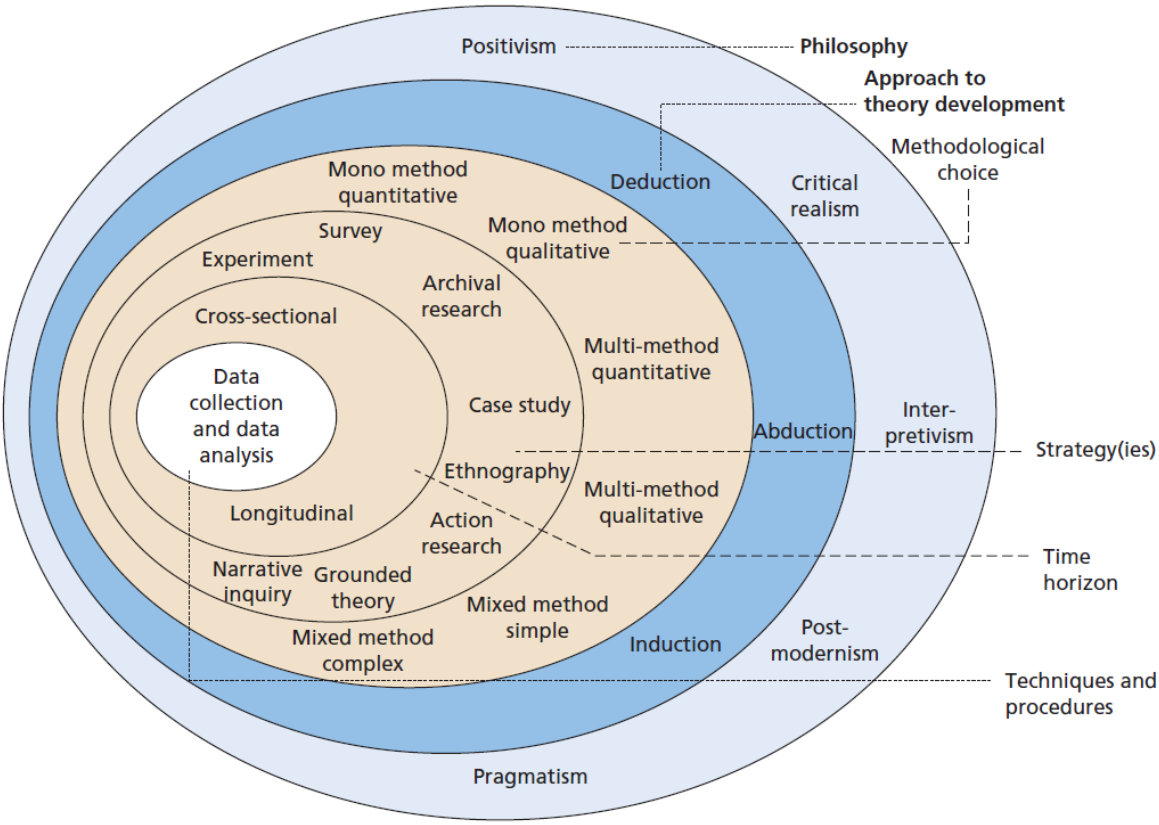

Figure 10: The research onion (Saunders et al., 2015)

4.1 Research Philosophy

Research philosophy is the first step in the research design process. Here we find philosophical assumptions and beliefs about the development of knowledge. When doing research, the aim is to develop new knowledge, no matter how large or small the research situation is. When conducting research, there will automatically be made assumptions (Saunders et al., 2015). Philosophical assumptions repeats themselves in literature, where we see Bryman and Bell (2011) Saunders et al. (2015), and Creswell (2007) mentioning ontological and epistemological. According to Wahyuni (2012) these two are considered as the *"main philosophical dimensions to distinguish already existing research paradigms."*

Ontology looks at the nature of reality to see if social entities, like participants in a study, can be considered as objective or subjective (Creswell, 2007, Bryman and Bell, 2011). When further classify these different positions as objectivism and subjectivism. In objectivism the social entities are considered like physical entities, and the social actors'

experience dose not impact the social world (Saunders et al., 2015). This means that the experiences of the participant do not change the reality and therefor the reality will be fixed. In subjectivism on the other hand claims that the social reality is made from the perception and consequent actions of social actors (Saunders et al., 2015). In the case of subjectivism, the reality will be different between the participants since they perceive everything differently.

Epistemology is interested in what is expectable knowledge within a discipline, or at least what should be. A central issue within epistemology is if the social world can, or should, be studied with the same principles, processes, and character as the natural sciences (Bryman and Bell, 2011). Positivism is a position as a natural scientist working with an observable social reality. A researcher with a positivism position often uses existing theory to develop hypotheses to be tested to further development of theory, while remaining neutral to prevent affecting the findings. Another popular philosophical position is critical realism. This is often recognizable with the researcher believing that we only see a small part of the bigger picture, which we rather should be looking at. The philosophy focuses on explaining what is seen, in the observable events and underlying structure.

When considering our philosophical standing in our research, we are using ontological objectivism, as well as epistemological positivism. The reason objectivism within otology is that we consider the industry as fixed and that the actors within it is not influenced by their own experiences. This means that we consider the respondents within the aquaculture industry to have removed personal experiences and answer our questions as objective as possible. The reason for having an epistemology positivism is that we observe the aquaculture industry and want to use existing knowledge to further science in the field. We also focus of a smaller part of the industry, the procurement of feed, which guides us away from realism.

4.2 Research Approach

A research approach has been defined as the path conscious scientific reasoning (Peirce, 1931 cited in Spens and Kovács, 2006). There are three different research approaches: deductive, inductive, and abductive. The research process of each approach is shown in Figure 11. When the deductive approach is used, it starts by creating a strong foundation of theory. This is used to create hypotheses or propositions that can be tested with empirical

data. A contrast of the deductive approach is the inductive approach. The inductive process' first step is to look at empirical data or observations, for then to later look at the theoretical foundation. The goal of this approach is to develop theory, not test it. The third and final approach, abductive, uses both empirical data and theory in the initial foundation, while going back and forth to propose new theories. These theories come in the form of hypotheses and propositions that can then be tested empirically. (Spens and Kovács, 2006)

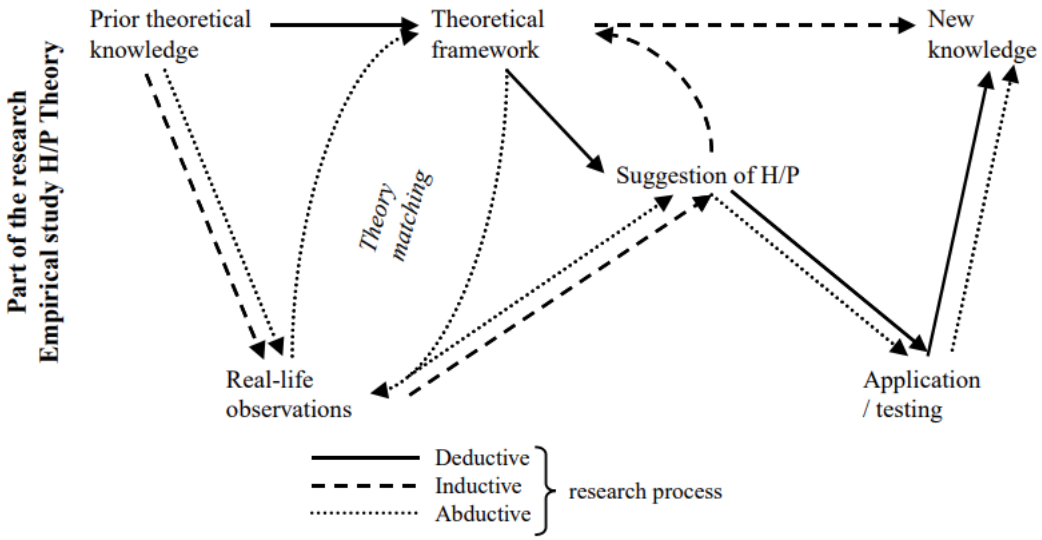

Figure 11: The three different research approaches (Spens and Kovács, 2006)

We are using an inductive approach to answer our research questions. The reason for using this approach is that we use real-life observations gathered from the aquaculture industry and then looking at the existing knowledge within the industry. The aim is to create a theory of how well-prepared the aquaculture industry is to handle growth while still being focused on sustainability.

4.3 Research Method Choice

There are three main categories in research method: quantitative, qualitative, and mixed method. The easiest way to distinguish between quantitative and qualitative research is to consider quantitative as research using numerical data, while qualitative research uses non-numerical data like words, images, and videos. Still, there are often some aspects of quantitative research in a study which is mainly considered qualitative, and vice versa. Because of this the research choice can be looked at continuum between quantitative and qualitative methods, and therefor often end up being a mixed method. (Saunders et al., 2015)

The methods stated above alle have subcategories to further detail the choice of research method. The qualitative and quantitative methods are both divided into mono method and multi-method. Where the difference is if the research contains one or several methods to conduct the research. Mixed method is classified as either simple or complex. Where the simple method separates the quantitative and qualitative methods, while the complex methods uses them in sequences where one method is used first and then influences the second. (Saunders et al., 2015)

To answer our research question, we have decided to use a mono-quantitative method. This because we want a larger pool of information about the aquaculture industry compared to what we would get from a qualitative method. We can with this take aim to cover the industry to answer our research question rather than a select few businesses.

4.4 Research Design

Research design is a general plan of what to do to answer the research question (Saunders et al., 2015) and according to Kothari (2004) "*Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money*." He further goes on to compare it to a blueprint when constructing a house, prepared by an architect. This blueprint is needed to construct the house in the best possible way without unnecessary loss in resources. Just like the blueprint of the house, research design is an important part of building a strong foundation for the further research to stand on. This does not mean that it is a logistical plan for the study, as stated by Yin (2011), but rather a logical one. This logical plan, like a blueprint, dose not say when each thing is done but rather what to do.

The research design should have a purpose. This purpose is often explanatory, descriptive, exploratory, evaluative, or in some cases a combination of these. An explanatory study looks at a situation and try to explain the relationship between variables. Descriptive studies are used to obtain an accurate profile of events, persons, or situations. Exploratory studies are used to discover what is happening and gain insights through open questions. An evaluative study is used to evaluate how well something works. This can for instance be strategy, process or program. (Saunders et al., 2015). Since we want to understand the

aquaculture industry as a whole, the descriptive design will be the best suited for our study. It will give us a profile we want to answer our research question.

4.5 Research Strategy

The research strategy is the methodological link between the research philosophy and the choice method to collect data. This is an action plan to reach the research goal. There are several different research strategies, which are often seen as quantitative, qualitative, or mixed methods (Saunders et al., 2015).

To answer our research question, we have opted to use the questionnaire strategy, a quantitative method. When using questionnaires, we can gather data from a larger number of participants then we would with using interviews. Questionnaires are also quicker which leaves an opportunity to get answers from those who do not have time for interviews (Bryman and Bell, 2011). This allows us to see the aquaculture industry as a whole, rather than getting information from a select few which might give the complete industry the wrong image. The difference in size and market influence might obscure the reality for some, and this is something we want to avoid.

There are some downsides to using questionnaires. One of these is that we cannot dig deeper and ask follow-up questions to get a better understanding of the respondent's thoughts. The questions asked must also be understandable and relatable so that the respondent does not get confused and are not able to answer the questionnaire (Bryman and Bell, 2011). These downsides are important to remember when creating the questions for the questionnaire. If the questions are hard to understand the questionnaire is redundant since the answers collected will be misleading, and if the respondent cannot understand them, they are more likely to quit the questionnaire.

The respondents are answering the survey to help in the research process and are not getting anything in return. There is then room to question their motivation. A motivational theory for them to complete the survey is the warm glow effect. An economic theory developed by Andreoni (1989) where people are motivated to contribute because they might receive acclaim or status, or a warm glow feeling of doing their part. This might make them give answers they believe is correct, because this makes them believe they have done their part. Another motivation can be self-interest, in the way that all the

respondents are part of a business within the aquaculture industry and can therefore be serving the industry and embellish the answers they give. While we have tried to eliminate this as well as possible by making the questionnaire anonymous, the respondents might still be self-serving, or they might have a more glorified perception of how their company conducts their business.

4.6 Time Horizon

There are two time horizons to take into a count when researching, cross-sectional and longitudinal. Saunders et al. (2015) compared them with a snapshot and a diary. Where the snapshot is a cross-sectional time horizon, while the diary is longitudinal. A cross-sectional time horizon refers to research of a phenomenon at a specific time, or a snapshot. Meanwhile the longitudinal time horizon stretches over a longer period of time, which allows research to account for changes and developments, like a diary. In our case we will be researching in a cross-sectional time horizon.

4.7 Data Collection

Data collection or information gathering is the base of research, and according to Befring and Timmons (2004) a base of valid and reliable data is the lifeline of empirical research. There are two main categories of data that gets collected, primary and secondary data. Primary data consists of data collected firsthand, usually in the form of observations, interviews, or surveys. Secondary data is data collected form pre-existing sources (Befring and Timmons, 2004).

We have decided to use questionnaire as our primary data source. We collect secondary data through a literature review as well as statistics published by credible sources, such as the Directorate of Fisheries and Statistics Norway (SSB), the national statistical institute of Norway.

4.7.1 Survey

When using questionnaires there are a few things that is important to have in mind throughout the process of creation and distribution.

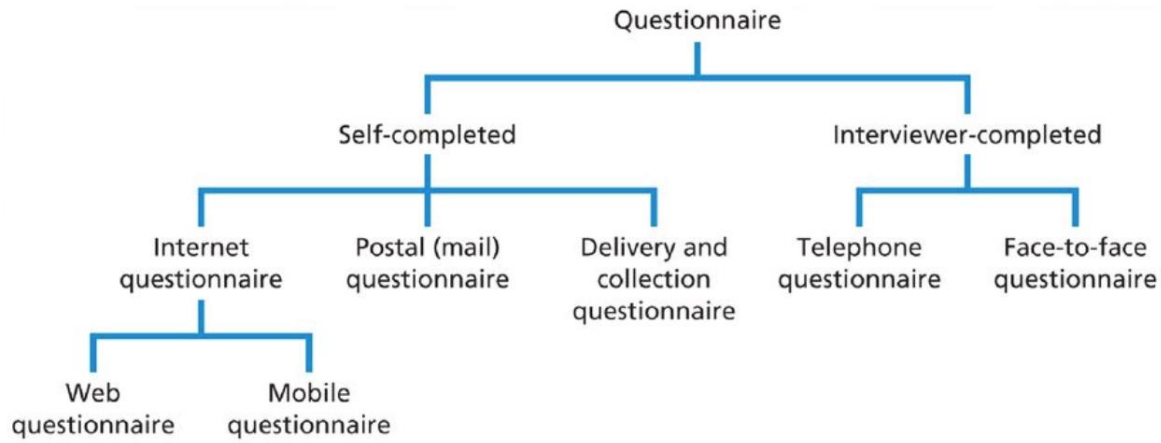

Figure 12: Types of questionnaires (Saunders et al., 2015)

The first thing to consider is which type of questionnaires we wanted to use. Interviewer-completed or self-completed questionnaires are the main category options, shown in Figure 12 with additional sub-categories, that could be used to gather the information we wanted (Saunders et al., 2015). We opted to use a self-administered questionnaire. Which is also referred to as surveys, which we will use henceforth. The reason we wanted to use surveys instead of the other questionnaire methods is that they are more time-consuming for us to administer. The use of surveys will also give the participant more time to understand the questions and give a considered answer that really reflect what we are asking. We wanted to use web-based survey and distribute this by e-mail to the different participants. Our reasoning behind this is that it gives us great confidence in who is answering the questionnaires, it is both available on PC and mobile phone, and we can record how long completion time is for all respondents.

Secondly, we needed to know who we wanted to ask. As mentioned in the introduction, the aquaculture industry is large in size. Since we are looking at fish farmers and the feed they are using, we found it natural to ask the procurement departments from different companies. For instance, the things these departments view as important when purchasing fish feed will reflect that what is important for the company in general.

As we stated in the Research Strategy chapter, we wanted as many respondents as possible to answer our survey. The survey needed to be large enough so that we would get enough information from each respondent, but not so big that it would occupy to much of the respondent's time and deter them from answering. We decided to use Nettskjema, an

online survey platform created by the University of Oslo. This is a platform which is visually clear to the respondent, as well as easy to export data from after the allotted time frame was done.

We decided to ask questions about how the company structured their procurement department, self-production, importance of different elements, and negotiations. We sent the survey to 59 different companies on 11th of January 2022, using a templet email, and receiving 9 answers. This a response rate of about 15 % and are by some regarded as unacceptable. According to Mangione (1995, cited by Bryman and Bell, 2011) anything less than 50 % response rate is unacceptable and up to 60 % response rate is barely acceptable. This is not necessarily always the case as stated by Bryman and Bell (2011) who says a key point when experiencing low response rates is to recognize and acknowledge this implication, as we do here. The response rate for this research is low and cannot be considered as a representation for the industry as a whole, and while this is the case it can still give us tendencies within the aquaculture industry.

4.7.2 Literature Review

When conducting academic research, it is important to have a good foundation. In academia one of the building blocks of this foundation is prior research conducted by oneself or others. The reason for this is that we always want to be in the forefront of the large wave of research that is being performed all over the world (Snyder, 2019). Throughout the years we have seen a boom in the amount of research published. The ability to get information through the help of the internet have made it easier than ever to acquire information. This have enabled science to make great strides. Because of this it is no easy task to always be in the forefront of science, and to help us we need to do a literature review.

When using literature review, there are three main methods to consider. These are systematic review, semi-systematic review, and integrative review. A systematic review is often used in medical science since it has the ability to produce findings in a systematic, transparent, and reproducible way. This method is often used in combination with statistical analysis to include results from the studies used (Snyder, 2019). The semi-systematic method is often used where a topic has been studied by different researchers

and further been conceptualized in different ways (Wong et al., 2013). Because of this it can be harder to do a systematic review and the semi-systematic method is often applied. Lastly the integrative review, which is also known as a critical review, has rather different objective. It looks to evaluate and criticize the current theoretical framework, to then enable the development of new perspectives (Snyder, 2019).

No matter which method for the literature review that is chosen, there is four general phases that needs to be followed when conducting the review. The first phase is designing the review, the second is conducting the review, third is the analysis, and the fourth and final phase is structuring and writing the review (Snyder, 2019).

We have chosen a semi-systematic review; this is based upon that we are not out for criticizing the existing material to develop a new perspective. Reason behind this is the literature we are using are found from different fields, making our web of theories wide-spread and not narrow enough for it to be a systematic review.

4.8 Analysis

The data collected in our research is quantitative, and when analyzing this we first have to know which type of data we have collected. We use the model from Saunders et al. (2007) shown in Figure 13 together with our survey in Appendix 1 to define the data. Since question 8.1 and 8.2 does not gather a data variable they will not be considered here. For the first question in the figure, we have a need to divide our questions. Question 2 can be measured numerically and is therefore quantifiable data, while the rest of the questions cannot be measured numerically and is therefore categorical data. Continuing with question 2, the values between two data values can be calculated and it is therefore ratio data. Since it can also take any value within a range it is continuous

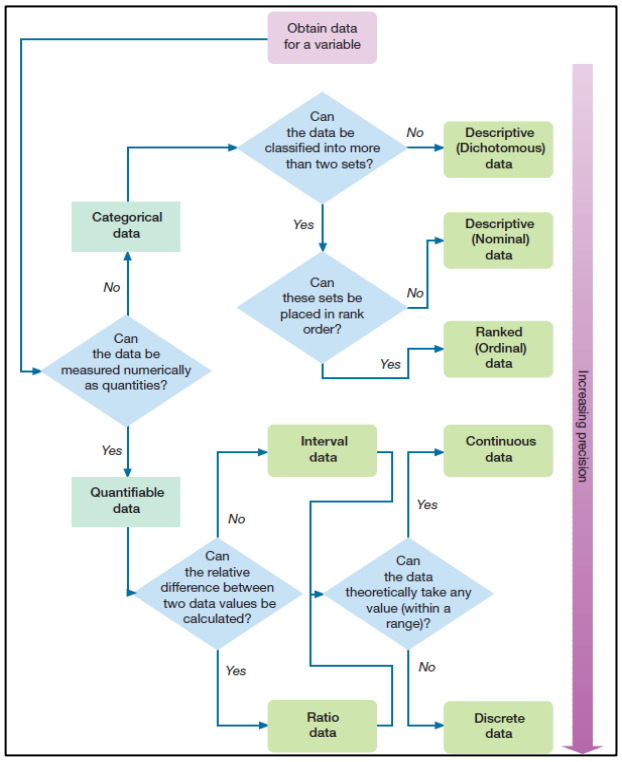

Figure 13: Defining the data type (Saunders et al., 2007)

data. All other questions, except question 8, can be classified into more than two sets. Question 1, 3, 3.1, 5, 6, and 7 cannot be ranked and are therefore descriptive data. Question 4 and 5.1 can be ranked and are therefore classified as ranked data.

Data coding is usually very important when dealing with quantitative data, and according to Saunders et al. (2015) the development of coding scheme should be done when we have collected between 50 and 100 data cases. This is where our sample size is lacking. We only have 9 respondents which means that any respondent will impact the result of any statistical output in a high degree. This will hinder us in producing effective mean, median, and mode values which are representative for the industry. The number of respondents can still give us tendencies within the industry and are therefore helpful to answer our research questions.

To explore and present the data collected from the survey the use of Tukey's (1977, cited in Saunders et al., 2015) Exploratory Data Analysis will fit our data well since it uses graphs to explain it. The Exploratory Data analysis offers flexibility to the analysis where we can get findings that do not only focuses on our research questions, but also other relationships in the data (Saunders et al., 2015).

5.0 Findings

In this chapter we will show and analyze our findings from our survey. As noted in the methodology chapter, we only got answers form 9 respondents which will affect the result, especially when considering the percentile distribution of answers. Here will one answer affect the results by 11,1 %. The survey sent out to companies in the aquaculture industry is displayed in Appendix 1.

5.1 Answer Statistics

We will go through the answers for each question without looking for any relations in the surveys from the respondents. We want to do this to get a spread of answers from the industry and see if there are any industry standards that comes to light, or if there are something the companies within the industry does very differently from each other.

5.1.1 Procurement Departments

Firstly, participants were asked if their company's procurement process was centralized or decentralized, with the responses shown in Figure 14. We were interested in knowing their structure for procurement since this can have an effect on other aspects of the procurement process like negotiation power, self-production, and procurement flexibility. Here, 67 % of the respondents worked in companies which use a centralized procurement department, while only 11 % work in a company which uses decentralized procurements of fish feed. We can see that there are a larger portion using a centralized procurement structure. This shows us that the larger part of the respondents chooses a larger procurement department before a more flexible one.

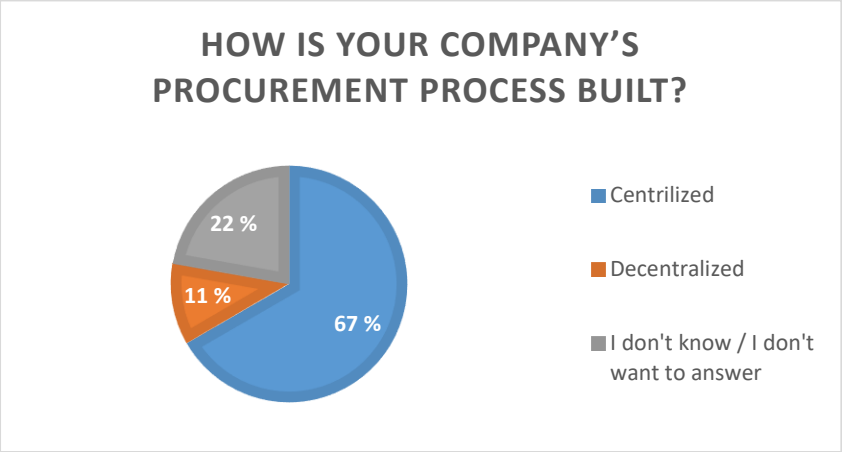

Figure 14: Procurement structure

5.1.2 Self-produced Feed

We want to see how many produces, and how large portion of the feed used is self-produced. This is important for us since it might affect procurement, in that if there are a lot of self-production their purchasing power is lessened. The amount of self-produced fish feed by each company is shown in Figure 15. There were only one of the respondents that produced any fish feed themselves. They produced about 70 % of their fish feed. This a large portion of the total feed, but there are still 30 % of the used feed that are bought from suppliers. This is interesting since we can see that there is a possibility to use self-production but there is only one respondent that has chosen to do it. There can be more companies that self-produce and this does not shine through in these findings since there are so few respondents. We can also see that the company that produces some of their feed does not produce 100 % of the feed they use. This can be a safety measure to ensure that they do not have any leftover feed, or it can make them more flexible in the use of it.

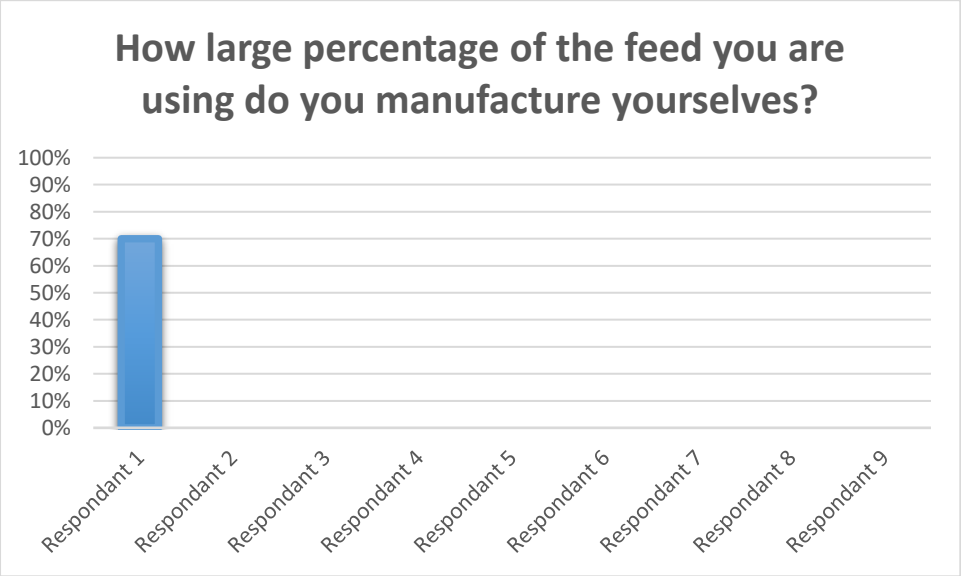

Figure 15: Portion of self-produced fish feed

5.1.3 Electronic Ordering Systems

With the evolution of technology, it is important to see how well this is implemented in the aquaculture industry, more specifically how well they implement automated ordering systems. This is because technology have shown to have great impact on industrial evolution, and it is important to be a part of this evolution because it can offer advantages, both economical and managerial, through efficiency. Figure 16 shows the portion of the companies use automated ordering systems, as well as how they use them. 56 % of the companies do not use automated ordering systems at all, 22 % use them for all orders, and 11 % only uses them for repeat orders. Automatic ordering has the ability to free up time for the employees ordering feed, and this time can be used in another way which can be more cost-efficient. However, since feed is a perishable good it might be an extra layer of control to not use automated ordering systems. Businesses will than look at cost-efficiency versus control. This is an interpretation from our side, and not something that is clear from the findings.

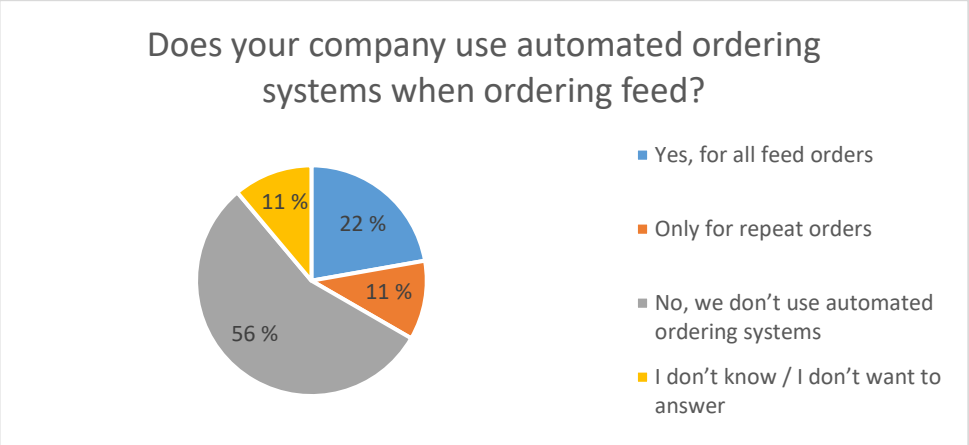

Figure 16: Use of automated ordering systems

We asked the respondents who answered "No, we don't use automated ordering systems" if this was something their business wishes implement. As seen in Figure 17, four of the five whom answered no say that their company will not implement automated ordering systems. While only one of the respondents see this as a possibility, but there are no plans for this at the moment. This can support our assumption that the companies that do not choose to use an automated ordering system see this as a lack of control, since they do not see this implementation happening at all. This can also be why one company see this implantation as possible in the future, when there is an evolution in the technology, and at the same time does not have any plans to implement it yet.

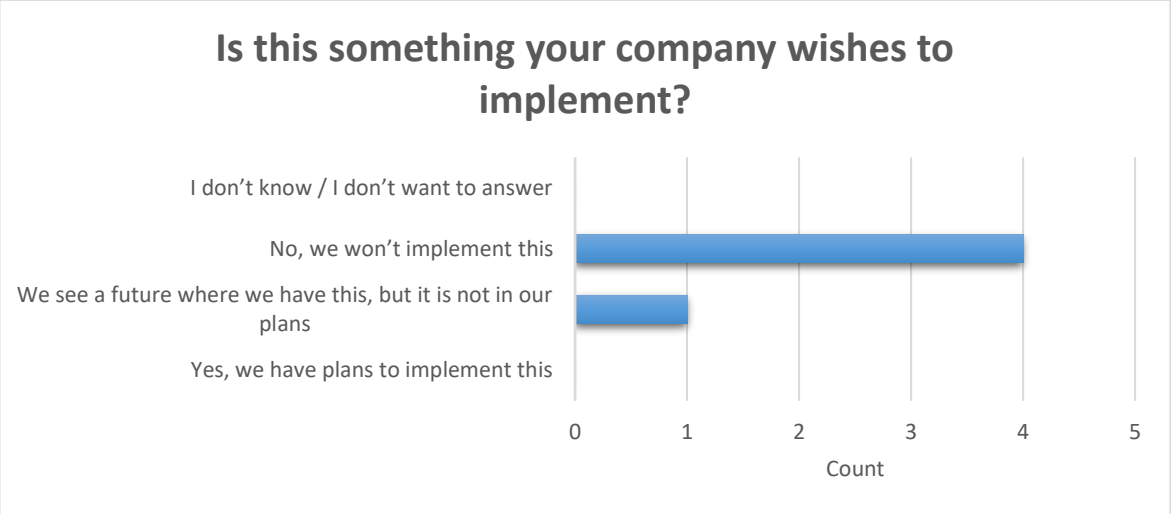

Figure 17: Implementation of automated ordering systems

5.1.4 Importance of Factors

The participants were asked how important different factors were for their company in the purchase of feed. The factors in question were price, environment, and sustainability. We chose these factors because they highlight what we think is important for businesses

procuring products in 2022, generally speaking, and we want to see how these translates into the aquaculture industry. Price have always been important for procurement, but with United Nations' Sustainability Goals we want to see if this have impacted what is most important in procurement. The level of importance ranged from not important to essential. The answers in Table 2 shows that all the factors are either important or essential, with the importance being the popular vote for all the categories. We do not find this very surprising, considering all the attention sustainability have, and especially the environmental aspect of it. Price is still considered as the most important with 4 votes on essential while the other two factors have 3 essential votes. We believe there is an evolvement of importance since there are more votes that price is important instead of essential in the price-factor. We interpret this to mean that a larger part of the companies, price might not be the deciding factor.

Table 2: Importance of factors when purchasing feed

	Not important	Kind of important	Important	Essential
Price	0	0	5	4
Environment	0	0	6	3
Sustainability	0	0	6	3

5.1.5 Sub-supplier Research

Companies often investigate their suppliers, especially to see if they fit in under different criteria, for instance their environmental impact. However, the companies were asked if they investigated different sub-suppliers. We asked specifically for sub-suppliers because we believe this is an area where there is larger variation in the answers we will receive, and this might be an indication of how serious the companies are about the factors regarding sustainability and environment. Form Figure 18 we can see that **Feil! Ugyldig selvreferanse for bokmerke.**55 % of the respondent said that they do some form of investigation, where 33 % of the respondents investigated sub-suppliers before a purchase and 22 % investigated sub-suppliers but only a few times. While the remaining 44 % answered that they did not investigate any of their sub-suppliers.

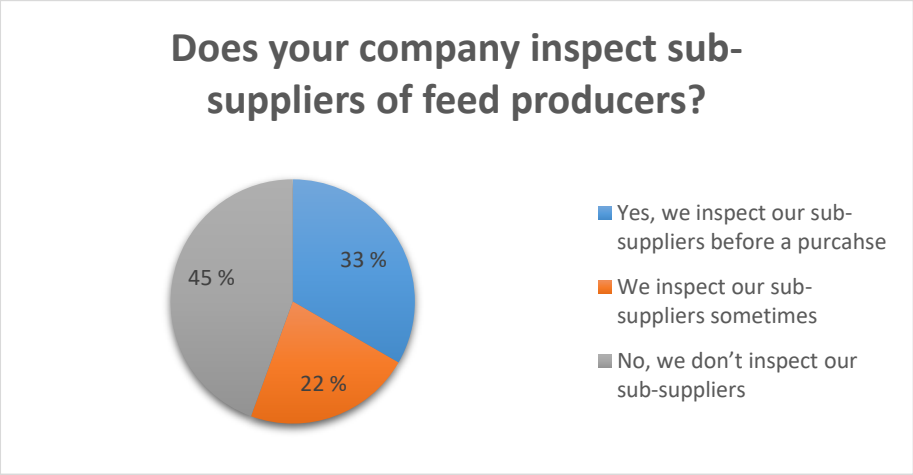

Figure 18: Inspection of sub-suppliers

The respondents who answered that they investigated their sub-suppliers, were then asked how important their sub-suppliers' economy, environmental impact, and sustainability was. Table 3 shows that one company did not find the economy of their sub-suppliers important. This might be because their suppliers use a lot of sub-suppliers and the economic situation of one of them do not have a large impact on the supplier, nor them. Three found economy to be important, and one found it to be essential. This on the other hand can be because these companies regard a good economic situation as stability, and they want more stability through the supply chain. There was an equal split in importance of both environment and sustainability, where two found it important and three found it essential. We can see that there are more votes for essential then important for these factors, and we can assume these to be the main reasons why companies are investigating their sub-suppliers, since they themselves can be reflected by their sustainable and environmental decisions.

Table 3: Importance of factors when investigating sub-suppliers

	Not important	Kind of important	Important	Essential
Economy	1	0	3	1
Environment	0	0	2	3
Sustainability	0	0	2	3

5.1.6 Power Balance

We wanted to know if any of the respondents felt like they had an upper hand in negotiations with feed producers. This was because this can impact deals, services, and there might show how structure and importance of sustainability, environment and price have an impact on negotiations. In negotiations there were four out of the nine respondents who answered that their company had the upper hand when entering negotiations about

feed. There were also four people disagreeing with this, with an equal split of two stating the supplier had the upper hand and two answering that it was fairly balanced, as shown in Figure 19. This can be interpreted as that the feed producers, in most cases, finds themselves at a disadvantage and that they in most cases need to give in or compromise with the companies in the aquaculture industry.

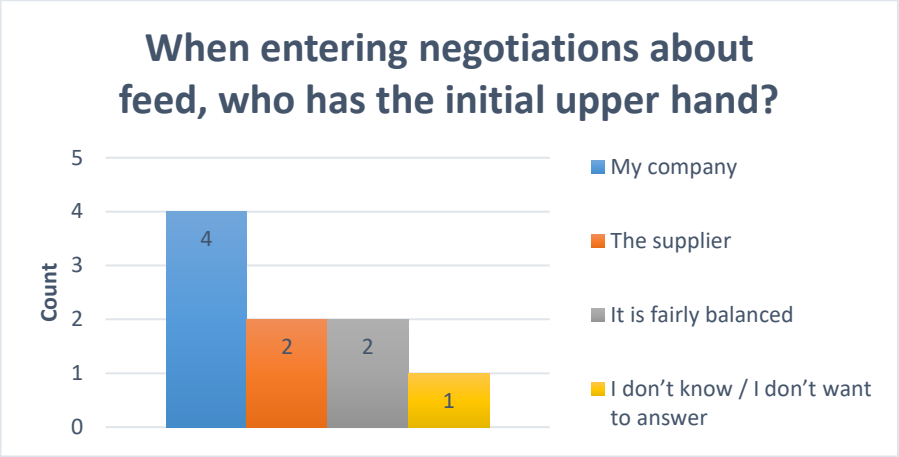

Figure 19: Upper hand when entering negotiations

5.1.7 Transportation Responsibility

The responsibility of transport can be interpreted differently. This can be seen as a smaller service, or at least a service that is easier to give in. Because of this we want to see who is responsible for the transportation of feed, and if it might have something to do with the power balance or if there are any other trends within the industry. The respondents were all in agreement on who took the transportation responsibility in when purchasing feed, as shown in Figure 20, where all nine participants answered that it was the sender who was responsible for the transportation of feed. This means that it does not come as a result of the power balance since some participants said they were at a disadvantage and still the supplier is responsible for the transport. The responsibility of transport seems to be an industry standard because since 100 % of the respondents gave the same answer.

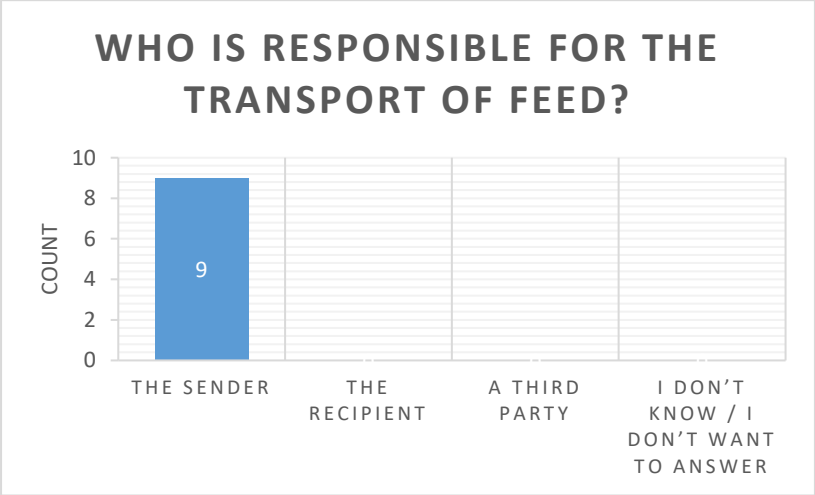

Figure 20: Transport responsibility

5.2 Respondents' Answers

The answers themselves can show us trends in the industry. While this is sought-after, there can still be relations in the answers given by each individual participant. Because of this we want to see if we can get more from the answers by putting them in context with each other.

Respondent 1

Respondent 1 answered that they used a centralized procurement department. This was also the only company where they had any form of self-produced feed, with about 70 % self-production. The company did use automated systems, but only on repeating orders. Respondent 1 found price important, environment essential, and sustainability essential. They also investigated their sub-suppliers, where they found their economy important, environment essential, and sustainability essential. Respondent 1 had the upper hand when entering negotiations, and they had their suppliers be responsible for the transport.

The respondent's company have a centralized procurement department. This can help give more influence in negotiations, as we see that they have the initial upper hand when entering negotiations. Environment and sustainability were essential for the company, and we see this is the with their investigation of sub-suppliers as well. Automated repeat orders save the company the time of reordering, which further gives economic advantages. Both environmental, sustainable, and economical factors can be the reason the company chooses to self-produce a portion of the feed, but this is speculation from our side.

Respondent 2

Respondent 2 also answered that their company used a centralized procurement department. Their company did not have an automated ordering system, and this was not something they wished to implement. Respondent 2's company found price, environment, and sustainability important. They did not investigate their sub-suppliers. They also had the upper hand when entering negotiations.

Respondent 2 and respondent 1 uses a centralized procurement department, and both have the initial upper hand in negotiations. While they found price, environment, and sustainability important, they do not use automated ordering systems, nor do they investigate sub-suppliers.

Respondent 3

Respondent 3 answered that they use a centralized procurement. They did not use an automated and had no wish to implementing it. They found price, environment, and sustainability equally important when purchasing fish feed. They did not investigate their sub-suppliers. Respondent 3 found negotiations to be fairly balanced.

Respondent 3 and respondent 2 are fairly synchronized in the answers they give, for all except the power dynamic when entering negotiations. Here we also see the first respondent to not find themselves having the upper hand when entering negotiations.

Respondent 4

The company of respondent 4 have a centralized procurement department. They do not use automated ordering systems, nor do they wish to implement them. Respondent 4 stated that while environment and sustainability were important, price was essential in their purchase of feed. The company do not investigate sub-suppliers, and they have the upper hand when entering negotiations.

Respondent 4's company, like respondent 1 and 2, have a centralized procurement department and maintain the upper hand in negotiations. This is especially important since price is essential for the company. While price is essential, they do not use any automated ordering systems.

Respondent 5

Respondent 5 did not know or did not want to answer if they used a centralized or decentralized procurement department. They do not use automated ordering systems and they do not intend to implement them. Price, environment, and sustainability where all ranked as important for their company. While the company do not always investigate their sub-suppliers, they do it sometimes. Under this investigation they find economy, environment, and sustainability important. The respondent did not know or did not want to answer if they had the upper hand in negotiations.

Respondent 5 stated that their company do not always check their sub-suppliers, but when they do there are consistency in the importance of the factors that were important when they purchase feed and what they find important in their investigations.

Respondent 6

Respondent 6 did not know or did not want to answer if they have a centralized or decentralized procurement department. The company uses automated ordering systems with all their orders. Price is essential for respondent 6, while environment and sustainability is important. They do not investigate their sub-suppliers. Respondent 6 states that their suppliers have the upper hand in negotiations.

While the other respondents have stated that they have the upper hand or that it is fairly equal, respondent 6 states that their supplier have the upper hand. This might be a standout occurrence, but it opens for a possibility that the power dynamic is based on each company, not the industry.

Respondent 7

Respondent 7 answered that they use a centralized procurement department. The respondent did not know or did not want to answer if they used automated ordering systems. When ordering feed, price was essential, and environment and sustainability were ranked as important. They did investigate their sub-suppliers sometimes. When doing this the sub-suppliers' economy was not important, while environment and sustainability was important. In negotiations respondent 7's company had the upper hand.

Respondent 7 is the fourth respondent to have a centralized procurement department and also have an upper hand when entering negotiations. In the cases where the company investigates sub-suppliers, they do not find their economy important, while environment and sustainability are important. This can be because the economy of a sub-supplier does not impact the company in any noticeable way.

Respondent 8

Respondent 8's company uses a decentralized procurement structure. They do not use any automated ordering systems. They can implement this, but they do not have any plans to do so. The company finds environment and sustainability essential when purchasing food, while price is important. They investigate their sub-suppliers before an eventual purchase. In the investigation they find the economy of the sub-supplier important, and environment and sustainability essential. Respondent 8 states that the supplier have the upper hand when entering negotiations.

In respondent 8's case where they have a decentralized structure, they find that the suppliers have an upper hand in negotiations. This can be because of the structure, or it can have something to do with the fact that they find price important while environment and sustainability essential. If there is a supplier that are better in these two areas their competitors, they automatically have an edge. The structuring can also be a reason for why they do not have any automated ordering systems, even after they finds this optional.

Respondent 9

The company of respondent 9 uses a centralized procurement structure. They use automated ordering systems with all purchases. They find all price, environment, and sustainability to be essential in the purchase of feed. They do investigate sub-suppliers before an eventual purchase, where they find economy, environment, and sustainability to be essential. They also have a fairly balanced power dynamic in negotiations.

We see that the importance of all factors asked about is ranked as essential. When entering negotiations where everything is equally important it can be hard to breakthrough with every request. This might be a reason why they have a balanced power dynamic while other respondents with similar structure find themselves in a better position in negotiations. The company can seem very self-aware in that they are focusing on the same

things when they are purchasing as well as when they are investigating. They also use technology and a structure which are able to help in these areas as well.

5.3 Relations Within the Industry

5.3.1 Centralization vs Decentralization

A thing that seemed to be recurring in the answers the respondents gave was that the companies which used a centralized procurement structure seemed to have a better power dynamic in negotiations. In Figure 21 we can see how the combination between how the procurement department is structured and who have the upper hand in negotiations. This model does not show respondents who answered "I don't know/I don't want to answer" to any of the questions, this is why there are a total of seven respondents in the model. We can see that there are four respondents that have a centralized structure and find themselves having the upper hand. None of the companies with centralized procurement have a disadvantage when they are negotiating, but two of them finds the power balance to be fairly balanced. There are only one company that had a decentralized procurement structure and they found that the suppliers often have the upper hand in negotiations.

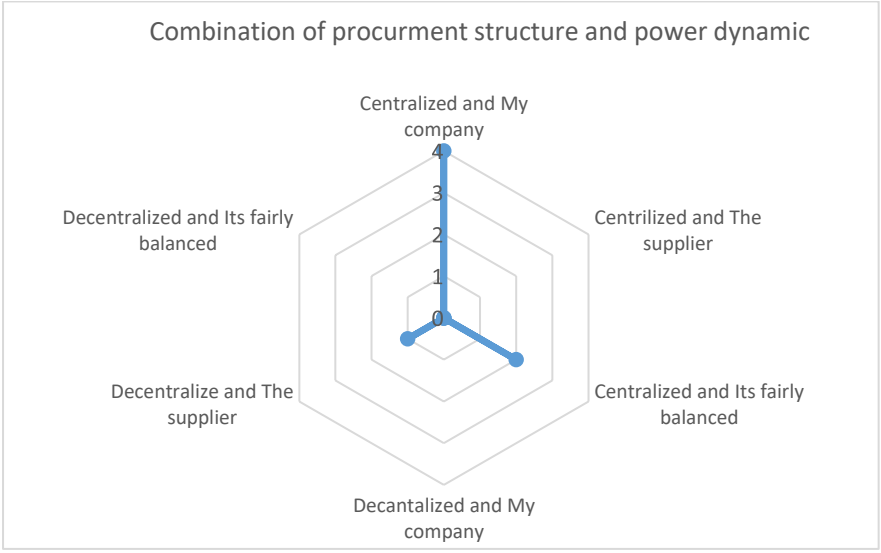

Figure 21: Combination of structure and power dynamic

Since it is always favorable to have an edge when negotiations we can classify the power dynamic as "good" when the respondent have the upper hand, "natural" when its fairly balanced, and "bad" when the supplier have the upper hand, seen from the respondents in the aquaculture. The companies which have a centralized structure will find that they are in a good position four out of six times when entering negotiations, and never in a bad

position. At the same time the company using a decentralized structure will have bad position in a negotiation. From what we have found here it seems like there are a relationship between the structure and the power balance. With the greater bargaining power being at the companies using the centralized structure for purchase of feed. There might be other factors playing a role in this, and because of the low number of respondents we cannot say anything by certainty. This still make it seem like the power balance of the supplier and the buyer is more company based than industry based.

5.3.2 Environment and Sustainability

A matrix of how the respondents answered question 4, where they were asked importance of different factors, is shown in Figure 22. The matrix does not show "not important" and "kind of important" since none of the respondent answered this for these questions. We can see that the importance of environment and sustainability is identical in the answers for the respondents. Respondents 1, 8, and 9 found both sustainability and environment to be essential, while respondents 2, 3, 4, 5, 6, and 7 found them to be important.

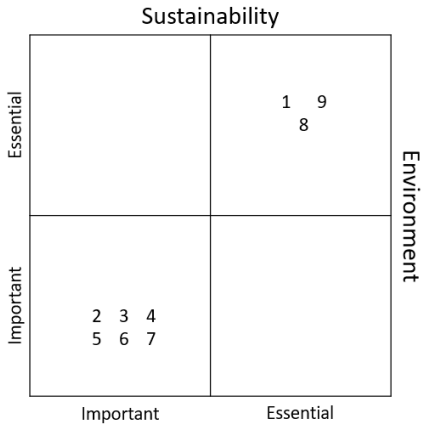

Figure 22: Matrix showing importance of the respondents

Sustainability and environment are ranked by all as the two highest alternatives. When something is essential and often important as well, measures is usually taken to ensure that certain requirements are met. In this case we asked if the companies investigated their sub-suppliers as one of these measures. In Figure 23 we have shown how the respondents who answered that they investigated sub-suppliers, either sometimes or before a purchase, have ranked the importance of sustainability and environment and put this into our matrix. Respondent 5 and 7, and 1, 8, and 9 have put the same importance for the investigation as they did when asked how important each factor was for their company. The matrix shows that the two companies that found both sustainability and environment important only investigated their sub-suppliers sometimes, while the three whom found it essential

investigated before a purchase. We can consider the level of investigation to match the importance of the factors for these 5 companies. However, since this analysis is only based on five respondents' answers this has a very high uncertainty, and it might just be a coincidence. We can still see the relation between the level of importance and the level of investigation, but we cannot get a reliable result with the number of observations.

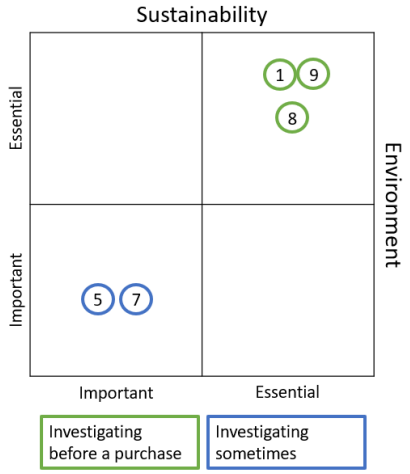

Figure 23: Matrix of important factors when investigating, and the level of investigation of sub-suppliers

For the remaining respondents who did not investigate their sub-suppliers might not have the resources to investigate, or they might not find the factors as important as they state. However, this is speculation from our side since we do not have any more information.

6.0 Discussion

In this chapter we will use our findings and discuss the meaning of these in conjunction with each other. We have structured this chapter in a such way that the topics of the research questions are also the headlines of the parts, in other words each individual part is in one way also a discussion of the answers to the research questions.

How is environment and sustainability perceived by the industry?

It has become common knowledge that sustainability, and especially the environmental aspect of this, have become an important topic in the years since the term was defined by the Brundtland-comity on behalf of the United Nations in 1987 published the report "Our common future". In the survey we sent out to the industry we asked them to rate how they perceived the importance of sustainability and environment in two separate questions, this was with the intention to see if there was any difference in the answers, because if there were it could be a sign of misunderstanding the term sustainability. "Environment" are a

part of sustainability (Figure 2 (Żak, 2015)), but it could seem like the business world are forgetting that sustainability is a concept with three pillars and not only one of them, not that they are wrong in prioritizing one aspect rather than biting over all the aspects at once. When asked the nine respondents all answered that both environment and sustainability is either important or essential, with three answering essential and six answering important. Since they all are within the same categories and replies with the same rate at both environment and sustainability, it could indicate that the industry thinks of these as the same thing. They have in that case proven Meehan and Bryde (2011) when they stated that sustainability have in the same sense become more environmentally focused and organizations tends to "forget", or rather deprioritize, the social and economic aspects of sustainability.

Procurement structure in the aquaculture industry and utilization of technology

The structure of a company´s functions are of importance since it say something of how the company strategies to cope with the daily tasks they must complete, structuring the procurement function is within this statement. There are three ways of organizing your procurement function; centralized model, decentralized model, and the hybrid model. Since these are theoretical models which is probably not very common in the workplace, we asked through our survey about only two of these. Also, having in the back of our mind that they would have to answer in such a way that they would take the one closest to the real thing. We asked them how their procurement process is built, if it was centralized, decentralized or that they did not know or did not want to answer. The answers we got was that that 67 % of the respondents have a centralized structure, 11 % have a decentralized structure and 22 % did not know or did not want to answer. Even though we did not have more than 9 respondents this could indicate a trend of the aquaculture industry are building their procurement as a centralized function. Having a centralized procurement function has its benefits, for instance high utilization of standardization in the procurement process which leads to high efficiency and other benefits are for instance the possible savings from doing bigger purchases, or in other words benefit from economies of scale. Decentralized procurement on the other hand should also benefit the aquaculture industry, because then the people on site can order more freely and can have more of a saying in the volume of the orders, which is good since feed is a perishable good, and thus benefit from economies of scope. The decentralized structure also benefits from lower risk because there are the people on site knowing what they need. On the other hand, with a centralized structure

they will have more risk of information since somethings can be misinterpreted or misunderstood. Both economy of scale and economy of scope are two outer edges theories of procurement and not one correct way of doing business. Most likely does none of the participants have a clear economy of scale or scope point of view and are somewhere in between. An example can be respondent number 5, who answered that they did not know or did not want to answer which, and we speculate that this can mean that they have a hybrid structure and since they could not place it.

Being that there is an indication of a trend in having centralized procurement, we also wanted to see if there could be other relations within our topic and questions. Since, we asked in our survey "Does your company use automated ordering systems when ordering feed?", to this we got 22 % that said yes to having automated systems, while 56 % said that they do not use automatic ordering, while 11 % used it for only repeating orders and 11 % did not know or did not want to answer. When also bringing in the answers from the previous question and the respondent summaries in chapter 5, we can say that there are no trend or relation at all behind having centralized procurement structure and having automated or not automated ordering systems. We can say that we are somewhat surprised that there is not a trend of being fully automated and centralized. This is because we have these great technologies today, where a company can through the internet of things, ERP systems and sensors have full control over stock and for when they need to order more by looking at a computer. The ERP systems are not only used for the ordering of feed, but they are also used to update the types of feed used. Feed differs in size and content pendent on where the fish is in its lifecycle. While the systems can be used in different ways, we can understand that they do not want to rely on automatic systems because feed is perishable and therefore will need more attention than, for instance, the limestone which is also a product that is often bought in bulk but do not perish. With technology the purchasers can get notified automatically when the levels are running down to a set level. They can then run the order process without needing people on site to keep an eye on the stock and tell the purchasers when they are running low. By automating and using an EOQ method they can lower the risk of stockout, make it more predictable for the supplier, and thus helping the supplier to be able to plan further ahead of time, which mean there can be less risk during the lead time.

When doing procurement, you want to know your supplier as much as you can. This can reduce the risk of them not being able to deliver their product for any reason. With the recent decades having a focus on sustainability, and maybe more so environment, this has become one of the elements of the background check of the suppliers and sub-suppliers. Since investigating the potential suppliers are usual too do, we only asked in the survey about inspection of sub-suppliers, and according to the survey a larger part of the respondents say they inspect the sub-suppliers with 55 % in some form, and 45 % say they do not do it before a purchase, the degree of investigation varies. When they do investigate, they answered we found that within economy there was one respondent that found this point not important, while the three found it important and one essential. This tells us that not all companies have the same criteria for investigating the sub-suppliers, and maybe that they do not find the economic status of the sub-supplier to be their business. While there actually was a difference in the economic aspect, the answers about environment and sustainability again have very similar answers. There were two who answered that environment vas important, the same with sustainability, and there were three who answered that these two points were essential. We cannot draw up a trend with only five answers, but they give an indication that if a company is looking into their sub-supplier's environment and sustainability can be important factors.

The relationship between procurement structure and power balance

As we found in chapter 5.3.1 where we looked at centralization and decentralization and compared them to the negotiating power balance, were we found a connection between the procurement structures and who had the upper hand in negotiations. In the results we found in that analysis it was pretty clear that there was a connection between the two. This however might not be the case, one of the reasons for this is that the number of answers is low, and we can therefore not make a generalization in the industry. The structure might be an important factor, but as we mentioned in chapter **Feil! Fant ikke referansekilden.** there are different power balances, and they are there for different reasons.

We found in Figure 19 that four out of the nine respondents found their own company as having the upper hand, which is a portion of 44 %, while 22 % said that it is fairly balanced, and 22 % said it was the supplier. This large variation in answers can be an indication that we might have an industry which operate in a primarily symmetrical power balance. The shift in power can be because of the negotiators, as we mentioned in our

literature review where the negotiators have the ability to affect a symmetric power balance and make it asymmetric. However, as we can see there were two respondents choosing the "the supplier" option and two choosing the "it is fairly balanced" option. This might be because of a technological development that they cannot find at other suppliers and are therefore feeling like they have a disadvantage or that it is balanced when the industry standard actually is favorable towards the buyer.

It cannot be avoided that there is a link in our findings between the power balance and the procurement structure. We did not have a single respondent that answered that they were at a disadvantage that used a centralized procurement structure. This can be because of the size of demand a centralized structure provide. This size allows for larger orders which is ideal for the feed producers. The feed are fresh goods, and it is therefore a necessity for the production to be as close to the demand as possible, to not waste any resources. It will therefore be a favorable for the suppliers to actually meet more of the buyers demands when they use a centralized structure, since this after all is a structure that have a more accurate demand and is more concurrent in orders.

As we saw from the market shares in chapter 3.1.1 the biggest companies have been growing. This might also be a reason for how we see the power balance leaning more towards the aquaculture companies and not the feed suppliers. They are getting bigger and because of this they can be considered more powerful. It might also be that the bigger companies choose a centralized structure before a decentralized since their market share is larger, which allows them to exploit economy of scale and are able to use resources to get expertise needed to get the lower risk and accuracy Arcuri and Dari-Mattiacci (2010) refers to.

Responsibility of transport

Transport of goods is deemed as a derived demand in transport geography theory (Rodrigue, 2006), this is not something we can argue against, getting goods you have bought or sold from point A to point B is vital, and it is no different in the aquaculture industry. When a company have signed a contract with a supplier it will contain instructions on where and how the goods is going to be delivered, with aquaculture in mind, specifically Norwegian aquaculture, most locations are on the fjords and some might not be able to receive trucks, so they are dependent on ships to deliver the goods. For the

environmental aspect this a good thing since ships is seen as the more friendly regarding emissions, and they can carry more volume than a truck so they can visit more customers than a truck is able to. When deciding who is responsible for the transport we could look towards INCOTERMS and literature behind these, but it seems that these are not that relevant, because 9 out of 9 respondents answered that it was the supplier who was responsible for the transport. With this many answering the same it could seem like transport have become an extra service offered by the supplier instead of a negotiated clause in the contract and is now an industry standard instead of a privilege. Bringing in the question of who the companies felt had the power in the negotiation, it shows that the one responsible for the transport, no matter who they believed got power in their favor, was the supplier. When having this much coinciding answers, it is building more foundation towards transport being considered an extra service, and not the negotiable clause we thought it might be when we wrote the question.

Industry standards?

In this chapter we have discussed several different aspects of the industry. We wanted to see if there were any of the aspects that were industry based or if individual actors are solely responsible for the actions taken. As far as the survey tells us directly, the responsibility of transportation is industry based where the suppliers are responsible for transportation. We discussed if it might be a part of an extra service, but since it seems to be something that is consistent for all respondents, we can see this as an industry standard practice.

Sustainability and environment have been a vocal point throughout our research, wondering how important these aspects are as well as trying to see how businesses oversees them. All companies stated that environment and sustainability were either important or essential when asked in the survey. The survey also showed that a couple of the businesses did not investigate their sub-contractors all. This might be resource dependent, but we find it strange that a factor that is at least important do not warrant an action to confirm the promises made by their suppliers about the environmental impact of their feed production and the base resources used. Environment and sustainability are two focuses in society in general, and because of what we see as a lacking action in the pursuit of sustainability and minimizing environmental impact we do not see that the industry

standard for this is any higher than the focus in society in general. However, we do not see that the industry standard is any lower either.

In the case of the buy versus make decision, we found one out of the nine companies had a portion of self-production. This company produced 70 % of their feed, while purchasing the remaining 30 %. With the findings we have collected we can say that there are more likely an industry standard for the purchasing feed, with the addition of one that deviates. This is because of that there is a make-buy-split. This can be a result of a transition period where the company goes from strictly purchasing to producing their own feed, or that they have opted for a mixed model. Nevertheless, the industry standard can be seen as using the procurement function of the company to purchase their feed.

7.0 Conclusions

Here we will answer the research questions and the problem statement, write about the managerial implications, limitations to the study and suggestions to further research.

7.1 Research summary

RQ1: How does the aquaculture industry structure their procurement function?
Within the aquaculture industry we can see a tendency in the use of centralization when it comes to the structure of the procurement department. There are some uses of decentralization but based on our finding they are fewer.

RQ2: How is the relationship between the procurement structure and the power balance in the industry?
We found that there is a clear relation between the procurement structure and the power balance within the industry. The companies using the centralized procurement structure always finds themselves in a balanced or favorable position of power. While this can be a result of few answers, we cannot disregard this relationship.

RQ3: How is responsibility for transport of procured goods divided?
We found that the transportation of feed is handled by the sender, and they are responsible. This is concurrent throughout the industry.

RQ4: What trends can we find that is industry based, or are the occurrences based on the individual companies?

We can conclude that the responsibility of transport is purely industry based. In the aquaculture industry the supplier of feed is responsible for the transportation of it. We have found that the industry standard of acquiring is procurement, even with the one respondent that deviated from the rest. This respondent still purchases feed, just not 100 % of it.

RQ5: How does the aquaculture industry perceive the terms sustainability and environment, is environment an aspect of sustainability or are these two seen as synonyms?

We found that the industry rated environment as important or essential. Based on this we want to say that the environment is held in high regards within the industry, on the same lines as the rest of society today. Regarding sustainability, we found that the industry rated sustainability as important or essential. This is consequent in both our findings and literature with regards to the three pillars: economic, social, and environment.
Since they rate both equally this gave us an indication towards those two terms being seen as the same thing.

With a future built around sustainability, with a focus on environmental impact and procurement, how well are the aquaculture industry prepared for changes that comes with future growth?

We can say that the industry as a whole is ready for the future growth, how each individual company is prepared we cannot say. The industry is aware of sustainability and its importance for the future and are trying to comply with regulations and expectations that the communities around them have. They also have strong procurement functions that are focused on the sustainability factors.

7.2 Managerial implications

Throughout this research period we met some implications along the way. Firstly, we created two surveys, one for the aquaculture industry which we have used in this thesis, and a second survey to get the perspective of the feed producers. This survey only got one response and was therefore excluded from this research. A second implication was that we initially wanted to use a mixed method with both survey and interviews. As shown in

Appendix 1 question 8, the respondents were asked if they could participate in an interview. All respondents answered no on this question.

7.3 Limitations of the study

First limitation we would like to mention is that we have only used Norwegian companies for our survey. The Norwegian aquaculture industry and, and especially, the feed industry does not have large pool of possible participants. We sent out the survey to fifty-nine companies but only got nine responses, which is not enough to generalize, but could be enough to see indications. Since this is a single method strategy, with the survey strategy, we do not have in dept answers. This limits the foundation of our findings. There might also be bias, where companies knowing they are in a good position, for example in sustainability, choose to answer while companies which find themselves in a worse position does not want to contribute.

7.4 Suggestions for further research

Our research is not big enough to capture all the aspects we initially wanted to look at, so we want to suggest some topics that could investigated later based on what we have found. First, we want to suggest further research into the technology that are being used, both in material management and procurement. The ERP systems and stock monitoring are parts of these topics that could be interesting to see something about why is not more used than today. The next topic is related to sustainability, and this is if the industry perceives sustainability as two separate subjects or if they actually see environment as a part of sustainability. The reason behind this is to see if Meehan and Bryde (2011) is correct about businesses in this industry also forgets that there are two more aspects of sustainability aside from the environment aspect. The next topic is related to sustainability, and this is if the industry perceives sustainability as two separate subjects or if they actually see environment as a part of sustainability. The reason behind this is to see if Meehan and Bryde (2011) is correct about businesses in this industry also forgets that there are two more aspects of sustainability aside from the environment aspect.

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Appendixes

Appendix 1: Survey

Question 1:

How is your company's procurement process built? *

- ○ Centralized
- ○ Decentralized
- ○ I don't know / I don't want to answer

Question 2:

How large percentage of the feed you are using do you manufacture yourselves?

0 10 20 30 40 50 60 70 80 90 100

Value

Question 3:

Does your company use automated ordering systems when ordering feed? *

- ○ Yes, for all feed orders
- ○ Only for repeat orders
- ○ No, we don't use automated ordering systems
- ○ I don't know / I don't want to answer

Question 3.1:

Is this something your company wishes to implement? *

This element is only shown when the option "No, we don't use automated ordering systems" is selected in the question "Does your company use automated ordering systems when ordering feed?"

- ○ Yes, we have plans to implement this
- ○ We see a future where we have this, but it is not in our plans
- ○ No, we won't implement this
- ○ I don't know / I don't want to answer

Question 4:

How important are the following for your company?

	Not important	Kind of important	Important	Essential	I don't know / I don't want to answer
Price *	○	○	○	○	○
Environment *	○	○	○	○	○
Sustainability *	○	○	○	○	○

Question 5:

Does your company inspect sub-suppliers of feed producers? *

- ○ Yes, we always inspect our sub-suppliers
- ○ We inspect our sub-suppliers sometimes
- ○ No, we don't inspect our sub-suppliers
- ○ I don't know / I don't want to answer

Question 5.1:

This element is only shown when the option "We inspect our sub-suppliers sometimes" or "Yes, we always inspect our sub-suppliers" is selected in the question "Does your company inspect sub-suppliers of feed producers?"

When inspecting your sub-supplier, how important is the following for you?

	Not important	Kind of important	Important	Essential	I don't know / I don't want to answer
Economi *	○	○	○	○	○
Environmental impact *	○	○	○	○	○
Sustainability *	○	○	○	○	○

Question 6:

When entering negotiations about feed, who has the initial upper hand? *

- ○ My company
- ○ The supplier
- ○ It is fairly balanced
- ○ I don't know / I don't want to answer

Question 7:

Who is responsible for the transport of feed? *

- ○ The sender
- ○ The recipient
- ○ A third party
- ○ I don't know / I don't want to answer

Question 8:

Do you want to contribute further with an interview? *

- ○ Yes
- ○ No

Question 8.1:

Your name (first name and surname)? *

This element is only shown when the option "Yes" is selected in the question "Do you want to contribute further with an interview?"

Question 8.2:

What is your e-mail address? *

This element is only shown when the option "Yes" is selected in the question "Do you want to contribute further with an interview?"