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Havfarm 3: Governmentally driven innovations in Norwegian aquaculture

A challenge for the governing system?

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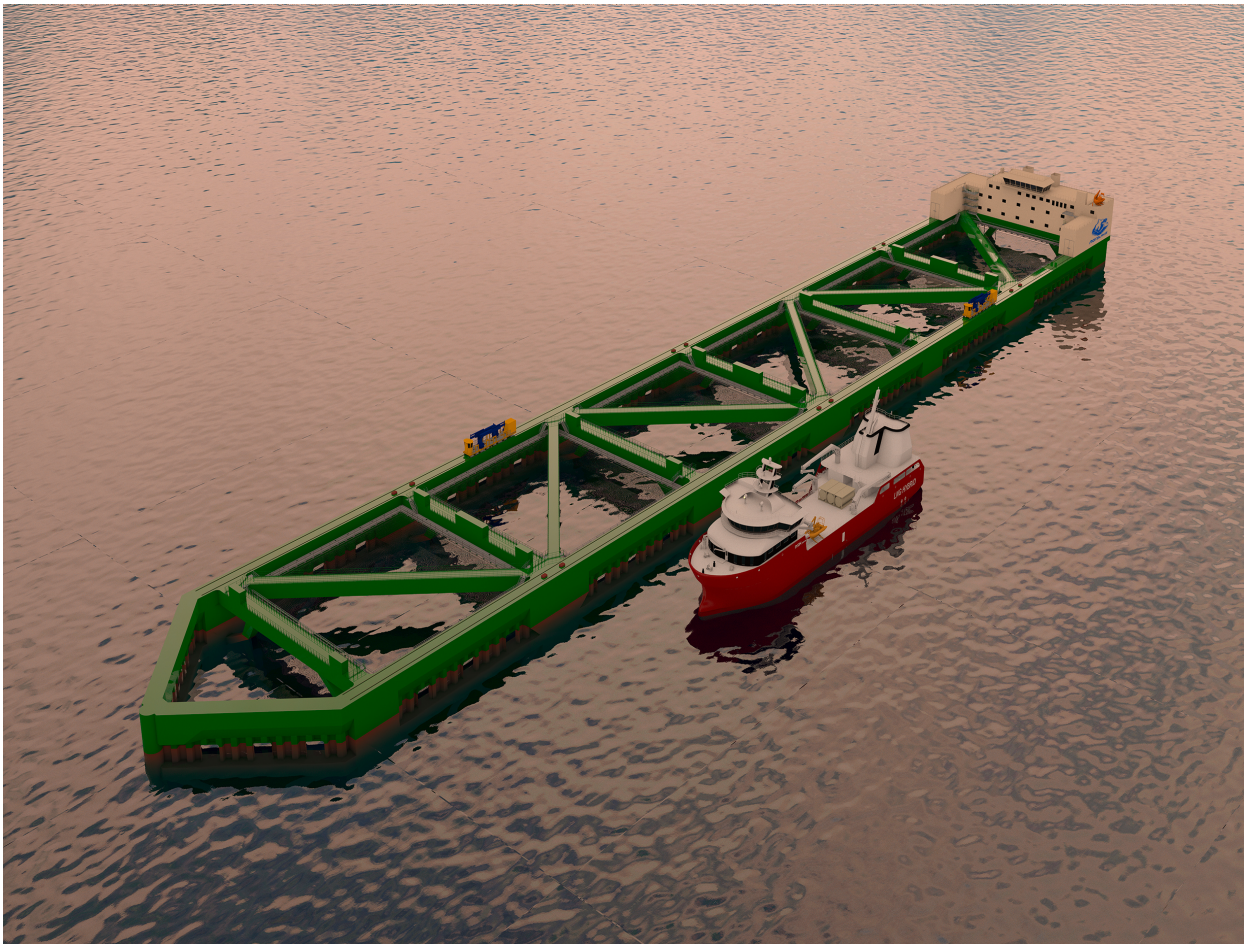

Illustration of Havfarm 1. Source: Nordlaks/NSK Ship Design

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Acknowledgement

With this master's thesis, I hereby conclude my time as a student at the Norwegian College of Fishery Science (NFH), the University of Tromsø – the Arctic University of Norway. It has been two challenging years, yet also interesting and knowledgeable.

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Abstract

The Norwegian aquaculture industry is today experiencing increasing demands of Atlantic salmon (*Salmo salar L.*) from global markets. However, past years has not seen the same rise in production as in value. In a time where several area and environmental-related challenges are hindering further growth of the Norwegian aquaculture industry, the development licenses have become the latest licensing regime established by the Norwegian government to stimulate technological innovations that shall contribute to solve these challenges. One development license concept is Havfarm 3, a mobile aquaculture installation owned by the group Nordlaks. However, it is yet to be materialized, as it is a technological innovation creating challenges for the governing system in terms how to regulate it. As a radical innovation it represents new technology never before explored in the aquaculture industry. Thus, the purpose of this thesis has been to explore some of the many questions that arise in the wake of such an innovation as Havfarm 3, in order to gain insight to what issues the concept is causing. Specifically, questions looked at was; what challenges it is thought to solve, what challenges it will encounter and what challenges it will create for the governing system. To answer these questions, I have interviewed Nordlaks and different representatives from the governing system and its agencies. A brief analysis of relevant documents has also been done. Data showed that Havfarm 3 will primarily contribute to solve the challenge of little available area, but chances are high it will also help better the situation regarding salmon lice, diseases and sedimentary pollution. Further, it was discovered that the challenges Havfarm 3 encounters, is greatly caused by itself creating challenges for the governing system. As a result, the governing system is experiencing regulatory uncertainty, largely due to the phenomenon termed the pacing problem – an innovation gap. Data showed it is also possible to believe that these challenges are enhanced as a result of a fragmented regulatory and organizational framework of the governing system.

Keywords: *public innovation, private innovation, technological innovation, the pacing problem, regulatory uncertainty, Norwegian aquaculture*

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Chapter 1: Introduction

1.1 The Aquaculture Industry of Norway

Norway, a country whose fish can be found in all corners of the world. Farmed salmon (*Salmo salar L.*) from Norway has gained popularity, both nationally and internationally, due to its high quality and excellent taste. It is a sought-after product – over 100 countries import the fish. In fact, it was Norwegian salmon that made Japanese sushi chefs reconsider salmon as a sushi ingredient. This was largely thanks to the efforts of a Norwegian delegation in 1985, and today, Norwegian salmon is considered the most important sushi ingredient (Norwegian Seafood Council, 2017). This story illustrates the success the Norwegian aquaculture industry has seen the last ten years. The industry is prosperous and profit margins are high, it is thought that 2019 will be the year where the value of exported seafood reaches the ‘’100 billion’’ NOK milestone. Last year, the value was 99 billion NOK and the salmon represented almost 70% of that value (Norwegian Seafood Council, 2019). Furthermore, the government has a goal of tripling the value within 2030 and quintupling it within 2050 (Olafsen et al., 2012). Norway has a desire of becoming the world’s greatest seafood nation (Meld. St. 22, 2012-2013) – a mission led by salmon, the *pink gold*.

Despite the recent success, the history of fish farming in Norway has not always been this cheerful. Since its beginning on the West coast in the early 1970s until today, the industry has seen both crises and struggling periods; falling price levels, overproduction, bankruptcies, price dumping accusations, disease outbreaks, etc. Nevertheless, the industry has exhibited resilience and the ability to tackle obstacles. A great portion of this fact can be attributed the industry’s will to always improve and develop. The industry has seen its fair share of technological innovations that have contributed to the rapid rise in value. For example, the transition from wet food to dry food (pellets), automation and efficiency improvements and use of vaccines leading to a drastic decrease in disease outbreaks.

However, since 2012 production levels have more or less stagnated despite the industry’s value increasing. The reason for this stagnation is due to the area- and environmental-related challenges facing the industry. This situation has harmed the industry’s ability to predict growth and gain access to growth, two factors that according to economic theory, needs to be in place to assure the greatest possible value creation (Meld. St. 16, 2014-2015). In an attempt at facilitating solutions, the government are distributing the so-called development licenses –

the government's latest licensing regime. To obtain these licenses, companies must develop significant technological innovations, albeit costly. The hope is then, that these innovations will solve the challenges facing the industry and at the same time contribute to an industrial technological renewal.

Challenges facing the industry

Even though the Norwegian aquaculture industry is booming and breaks records year after year, it faces many challenges. According to a risk assessment report from the Institute of Marine Research (IMR) (2018), the environmental challenges are related to; salmon lice, escapes, diseases and sediment pollution. In addition, there are issues concerning limited areas available for further growth (The Federation of Norwegian Industries, 2017). Thus, if Norway wants to reach its desire of becoming the world's greatest seafood nation, these challenges must be dealt with. The government has expressed that to solve these challenges, it is necessary with a knowledge-based and an environmentally sustainable policy framework (Meld. St. 22, 2012-2013). In other words, the industry must secure *sustainable development*, defined as *''development that meets the needs of the present without compromising the ability of future generations to meet their own needs.''* (Brundtland Commission, 1987).

1.2 Research questions

Solving the abovementioned challenges through allocating development licenses will hopefully lead to an industrial growth as well. This would be beneficial, as any form of capacity expansion will lead to increased value creation, increased employment and increased welfare (Meld. St. 16, 2014-2015). As this thesis will show, innovations as a result of the development licenses are slowly beginning to appear in Norwegian coastal waters. It focuses on "Havfarm 3", a concept by Nordlaks to become the world's first mobile aquaculture installation, and the potential governance-related challenges facing the governing system. Interestingly, it is a governmentally driven innovation that seems to be creating challenges for the governing system, as it enables the farming of salmon in a way previously unseen. Consequently, the current regulatory framework and governmental agencies seem to experience struggles in terms of how to regulate such an innovation. For this reason, this thesis aims to explore some of the many questions that arise in the wake of such innovations as Havfarm 3 represents. In particular, three questions have arisen for the purpose.

The research questions are as follows:

- *What challenges is it thought that Havfarm 3 will solve?*
- *What challenges will Havfarm 3 encounter?*
- *What challenges will Havfarm 3 create for the governing system?*

To answer these questions, I have interviewed five central stakeholders; Nordlaks, the Ministry of Trade, Industry and Fisheries (MTIF), the County Council of Nordland, the County Governor of Nordland and Hamarøy municipality, and analyzed their answers. A brief analysis of relevant documents has also been done. Moreover, it is clear that a satisfactory answer to either one of these questions requires an explanation for why the challenges arise and what they imply. Hopefully, this will develop a better understanding of the situation as a whole and contribute towards an understanding of how Nordlaks and the governmental stakeholders experience the situation.

1.3 Structure of the thesis

The next chapter provides a thorough introduction to the industry form its inception to the present day, and also future prospects. Chapter three gives a detailed explanation of the development licenses and the Havfarm 3 concept, including an overview of the currently approved steps. Chapter four presents the theoretical framework relevant to answer the research questions properly. Chapter five describes the methodical framework used collect and analyze the data as well as assessing its quality. Chapter six presents the main results whereas chapter seven discusses them within the theoretical framework developed in chapter two. Finally, chapter eight concludes this thesis with a summary of the main findings and some thoughts on what they imply for the future of the industry.

Chapter 2: Fish Farming in Norway – Past, Present and Future

2.1 From humble beginnings to promising industry

Even though there is evidence of simple fish farming in dams being performed in Norway as far back as in the age of the Vikings, the 1960s is considered to be the beginning of the aquaculture adventure (Klausen, 2016). In this decade, pioneers would try, but mostly fail, to farm rainbow trout in land-based dams based on Danish experiences (Møller & Hovland, 2014). Nevertheless, with the experience gained from experimenting with fish farming in that decade, the 1970s was when fish farming had its breakthrough in Norway. Now, farming was done on a larger scale and in more modern facilities. The Vik brothers discovered that salmon aquaculture in seawater yielded considerably better results than the farming of rainbow trout in freshwater dams. Moreover, the Hitra based Grøntvedt brothers further developed the technology by using net pens in the sea, and thus, this way became the dominant form of salmon aquaculture (Hersoug, Mikkelsen & Karlsen, 2019).

The 1970s

Before the 1970s, the fish farmers could only rely on themselves when it came to develop and expanding salmon fish farming in Norway. No support or guidance was provided by the public authorities. After much trying and failing in the 1960s it was made clear by the Norwegian Fish Farmers Association (NFFA) that the authorities should actively contribute to the development of this new and growing activity in order to establish it as a well-driven industry. Farmers wanted greater focus on research and allocation of resources that would allow to gain more knowledge (Kolle, 2014). After a proposal made by the Ministry of Fisheries and the Ministry of Agriculture in the autumn of 1971, these requests led to the appointment of the Lysø committee on the 25th of February 1972 by royal decree, making it the first public committee established to study what had to be in place in order to make fish farming a viable industry.

One of the more important contributions made by the Lysø committee came only a year after its establishment. The temporarily Concession Act from 23rd of March 1973 decided that farmers had to get a license in order to do fish farming. This act marked the beginning of a regulated industry made up by smaller, independent entities owned by the stakeholders themselves. This was a conscious decision by the authorities, as they did not want an industry where a few big companies with large facility areas and foreign capital shared the total

production. The committee was adamant about fish farming being a subject for district policy (Klausen, 2016). To restrict facility sizes, an upper volume limit was introduced with a maximum 8,000 m^3 per facility. This limit was reduced to 5000 m^3 in the period between 1975 and 1978 when further approval of applications was halted due to the fright of overproduction and decreasing market prices. At that time, the Directorate of Fisheries had 120 unprocessed applications representing a volume of 600,000 m^3 (Kolle, 2014).

The Lysø committee's final recommendation was given in April 1977. Their goal was clear; stimulating increased development of fish farming had to become a reality. Looking back at the committee's contributions, there is no doubt that the committee has been highly influential to the tremendous growth the Norwegian aquaculture industry has experienced recent decades. It laid the foundations for the politics and policies that would pursue the industry for a long time. Rarely, or never before, has a public committee had such a great authority and freedom to shape an industry (Klausen, 2016).

Initial structure of the industry

Two actors that deserve some attention for being instrumental in forming the industry are the Fish Farmers Sales Union (FFSU) and the previously mentioned NFFA. The NFFA was formed in 1970 with the purpose of gathering all fish farmers around the country. Their task was to do work regarding gathering and spreading information about fish farming. It was necessary for the fish farmers to have a common association that could act in their interests when discussing with the authorities (ibid). For example, the appointment of the Lysø commission by the authorities in 1972 can be credited to work done by the NFFA. The union also had to solve another important issue; namely, how the fish farmers were going to sell the increasing amount of farmed fish produced. This, in a way that satisfied all actors, in addition, turnover difficulties were becoming an increasing issue, thus, the idea of having a legally protected sales organization was suggested amongst the members. The establishment of such an organization did not happen without disagreements, as opinions were many both internally and externally. The actor covering sales for all wild caught fish (except salmon) from Nordmøre to the Russian border, the Norwegian Fishermen's Sales Organization, did not support the proposition of establishing a new sales organization. Questions were many regarding how such an organization should be established and who should have the responsibility (ibid).

On the 31st of March 1978, during NFFA's annual gathering in Trondheim, members agreed upon establishing the Fish Farmers Sales Organization (FFSU). By royal decree on the 28th of July 1978, ''Fiskeoppdretternes Salgslag A/L'' were given legally protected rights to take care of the first-hand turnover of farmed salmon, trout and char, in accordance with the Raw Fish Act (ibid). This was a model similar to the one the Norwegian fisheries industry was operating under; legally protected sales organizations along the coast of Norway in accordance with the Raw Fish Act. However, prior to this structuring of the farming industry, disagreements concerning which ministry should become the administrative organ and have responsibility of management were causing internal struggles. Some meant that the Ministry of Agriculture should have the responsibility, others meant that the Ministry of Fisheries would be a better governing body. It had to be one of the two mentioned, because it was a matter of cultivation of animals on the same level as domestic animals. A majority of the appointed Lysø commission meant that the Ministry of Fisheries should have the responsibility. However, the minority strongly disagreed (ibid). It all came down to whether the salmon should be described as a fish or a domesticated animal. After consideration, the committee decided to make the Ministry of Fisheries the governing body as they had the opinion of that being the most sensible solution. Thus, a sales organization was created with a similar framework as the one pertained to the fisheries industry. This contributed to defining farming as ''fisheries'' (ibid).

To sum up, the 1970s became the decade that shaped the industry. The NFFA was present from 1970 and launched important contributors such as the Lysø committee (1972-1977) and the FFSU (1978). The committee provided a legal framework for the industry through the temporary Concession Act (1973-1981), approved by the parliament, and the FFSU brought structure to the selling of farmed fish. Yet, it was still a small industry compared to its current size.

The 1980s

The permanent Fish Farming Act came in place in 1981, and, as recommended by the Lysø committee, the act emphasized on fish farming becoming an industry for the districts – decentralizing wealth and contribute to the creation of new work places in areas where job possibilities were low. In this decade, the directorate started assigning new food fish licenses again through so-called license rounds. Three ordinary license rounds were held in; 1981, 1983/84 and 1985/86. In the first round, the volume limit of each license was set to 3,000 m^3.

In the second the limit was 5,000 m^3 and in the third it was 8,000 m^3. In addition, an extraordinary round only for the northernmost counties Nord-Troms and Finnmark was held in 1989. This time, the limit was set to 12,000 m^3, a limit used until 2004 (Kolle, 2014; Klausen 2016; Hersoug, Mikkelsen & Karlsen, 2019). In total, 334 licenses were assigned. Prior to this decade, the southern part of Norway had the majority of fish farming facilities. That is why the authorities prioritized applications from Northern-Norway in the 1980s license rounds so that areas of poor work opportunities could turn the negative trend. This decision was criticized both by the southern fish farmers and the NFFA. They asked why areas with weak industries and low knowledge of fish farming should have priority over the stronger, more well-run farming communities in the south. During NFFA's annual meeting in 1986, the, then active, chairperson Anders Blom spoke about his concerns for how the authorities were handling the license policy. He meant that the authorities had ignored the warnings from the industry and allowed to great of an expansion of fish farming facilities, especially in the north, where the supply of smolt was not likely to meet the drastically increased food fish demands of the farmers. According to Blom, this was not a natural expansion and would hinder the industry from becoming viable (Kolle, 2014).

This drastic expansion of the industry can likely be explained by the change of government in 1981 when the Conservative Party (Høyre) gained power and Thor Listau became Minister of Fisheries. The party fronted a more liberal policy towards industry than the previous government and wanted to offer larger freedom of choice than what was available at the time. Hence, the new government decided to adopt a new Fish Farming Act in 1985, just four years after the permanent one came. The most important change in the new act was that applications for hatcheries licenses *had* to be accepted as long as they met the environmental and fish-health requirements. The result was a significant liberalization of the fish-farming industry. Even though this change reflected the political views fronted by the government, it was also a change made in order to turn around the trend regarding lack of smolt production in the industry at that time. Moreover, the new act increased possibilities for capitalization and industrialization through liberating minority interests. Thus, the relationship between majority owner and operational manager were no longer present, a relationship pursued in the 1981 act (Kolle, 2014).

The 1980s became the first major expansion phase in the aquaculture industry. More licenses, increased license volumes and an abundance of available smolt led to a dramatic growth in

production. This was especially the case towards the end of the decade – from 5,000 tons salmon in 1980 to 56,000 tons in 1987 and more than 169,000 tons in 1990. In other words, the production increased by 3280% in just 10 years. This can be seen as a side effect of the government's liberalization through the new 1985 Act. In 1989, prices dropped dramatically. This was not only due to production growth, but also a result of Norwegian capital, technology and knowledge contributing to creating competitors in foreign countries. Additionally, towards the end of the decade the industry experienced a severe disease outbreak leading to great losses for the farms. Issues related to the environment, diseases and disposal difficulties flourished, and the industry entered their first crisis where many actors disappeared due to bankruptcy. The fact that the FFSU had monopoly on first-hand sales also led to prices higher than what the market value would have been in a more liberal market. Upon exiting the 1980s, the industry was struggling with their reputation and environmentalists became increasingly skeptical towards aquaculture (Hovland, 2014; Klausen, 2016).

2.2 1990s: Salmon farming becomes large-scale industry

When the 1990s began, Norway was generally considered a ''super-power'' within aquaculture and the production of salmon gained attention abroad. Nevertheless, the issues of the late 1980s followed the industry into the new decade. Falling prices and enormous production growth caused serious difficulties related to excess of fish. As an attempt to turn the trend around, the sales organization, FFSU, finally decided that freezing a part of the production and, thereby, limit the supply could lead to higher prices. In short, the objective failed. The sales organization had trouble managing loans and stakeholders' loyalty towards the sales organization was greatly reduced. This, in turn, led to many producers selling fish on the black market. In the end, all these issues led to the bankruptcy and dissolvement of FFSU in late 1991. The same fate followed approximately 60% of the fish farmers, as many had high loans and little equity. As a result, the government decided to restructure the industry and liberalize ownership restrictions even further. The newly updated Fish Farming Act from 1991 made it possible to become majority owner in several companies and local ownership was no longer prioritized. In other words, licenses became freely transferable (Hovland, 2014; Klausen, 2016; Hersoug, Mikkelsen & Karlsen, 2019).

A huge part of the reason the sales organization, FFSU, went bankrupt can be attributed to the lack of political will to maintain it, even though they also suffered a heavy fiscal deficit.

Minister of Fisheries at the time, Oddrun Pettersen, did not hide her wishes of disbanding the organization and, as a result, the FFSU received little support from the authorities (Klausen, 2016). The government decided it better to negotiate with the banking sector, who took over the remaining reserve of frozen fish through establishing the company, ‘’Rød Fisk A/S’’. The company received a 400 million NOK interest-free loan from the government, which included a few conditions where repayment was necessary. The banks also decided to contribute 280 million NOK that would be shared amongst the fish farmers that still had assets with the FFSU (ibid).

Accusations of price dumping and subsidies were still suspicions the industry had to deal with and in 1991 the US introduced a customs penalty on fresh Norwegian salmon so high that the export level fell immediately. Soon afterwards, the EU (primarily Ireland and Scotland) threatened to implement a similar penalty and a long-lasting process against Norwegian salmon farmers began. Finally, the government had to sign the EU salmon agreement in 1997, which limited growth in export quotas (maximum 10% per annum) and increased the export fee to promote salmon on the European market. This is understandable, considering the EU was the most important export market responsible for two-thirds of total exports. At the same time, the Norwegian government introduced other restrictions in the form of a feed-quota regime coupled with strict density regulations (maximum 25 kg fish per m^3 farmed volume in aquaculture facilities). This regime would last until the end of 2004 (Klausen, 2016; Hersoug, Mikkelsen & Karlsen, 2019).

The pressure opposed by the EU created a situation where the aquaculture industry in Norway had to re-regulate its steady liberalization. This process started in the 1980s and increased in scale over time. After the last license round in 1985/86, there were no ordinary rounds until 2002 (the round in 1989 was extraordinary and applied only to Northern-Norway). As ownership structure demands was still kept quite liberal, this led to a scenario where the existing farms underwent a massive reorganization through consolidation. By 2002, the 10 largest companies controlled 40% of the total production (Hersoug, Mikkelsen & Karlsen, 2019). This stood in stark contrast to intentions laid forward in the Concession Act of 1973. The conservative government that gained power in 2001 had thoughts about repealing the license regime, but realized it was too late. The system had become too thoroughly implemented to discard it, and the banks found the licenses themselves being the most valuable collateral (ibid). The Ministry of Fisheries was already under enough pressure due to

the EU situation and keeping the license regime would at least contribute to maintain some control over the aquaculture industry (Hersoug, 2014b, Chapter 8).

For the Norwegian aquaculture industry, foreign pressure through accusations and customs penalties, disagreements related to disease outbreaks, overproduction, bankruptcies and different views on how the industry should be shaped, became the factors synonymous with the period between 1990-2002. However, amidst this rocky period, the industry grew tremendously and entered its industrial phase.

2.3 2000s: The stock market and a multi-billion dollar generating industry

By 2002, the industry had grown to a large-scale size where even the production volume of the smallest companies was on an industrial scale. The idea was to make salmon into a product consumed by the masses – ‘’the chicken of the sea’’ (Hersoug, 2014, Chapter 8). This growth can be hugely credited to the massive increase in productivity and efficiency that took place during that period. From 1992-2002 the total production of salmon increased from 147,800 tons to 546,000 tons. Keep in mind, in the same period, no new licenses were distributed, and the maximum volume limit was not increased. Additionally, the number of tons produced per employee increased by a staggering 330% – from 79.5 tons per employee in 1992 to 342.4 tons in 2002. In the same period, cost of production per kilo fish decreased from 36 NOK to 17 NOK. Distribution became safer, technology became more advanced and a high rate of innovation pushed the industry forward (ibid).

After a licensing hiatus due to the events of the 1990s, the authorities were again ready to allocate new rounds and further expand the industry, with the first round of the century being held in 2002. Unluckily, this turned out to be amidst a second major economic crisis (2001-2003) in the aquaculture industry - the most serious one since the bankruptcies following the breakdown of the sales union in 1991 (Hersoug, Mikkelsen & Karlsen, 2019). Similar to the first crisis, production had grown at a faster rate than what the market could handle. Thus, prices dropped. Not even the EU salmon agreement signed in 1997 had managed to stall the production growth. This was unfortunate for farmers as many of them completed quick and expensive acquisitions with the expectation of salmon prices being stable. Equity was priced by the banks and feed companies, which for a period converted debt to share capital, and thus, remained as owners of several companies (Hersoug, 2014c, Chapter 9). Large companies (Marine Harvest, Cermaq and Lerøy) decided to be listed on the Norwegian stock exchange

and share prices skyrocketed. As a result, gaining access to the market became increasingly harder over time as existing companies grew larger through acquisitions of smaller companies struggling with the low salmon prices. It did not help that the industry was heavily regulated, with the later addition of a maximum allowed biomass (MAB). Moreover, the industry would experience problems related to diseases, salmon lice and escapees. Even though they were problems of sustainability they did not prevent the industry from growing at a great rate (ibid).

Market access – The EU and USA

By mid-2003, the EU had ended the 1997 agreement with Norway and once more the Norwegian market could export fish to the European market on the conditions prescribed by the World Trade Organization (WTO). Prices dropped to an all-time low of 2.2 EUR per kilo fish, but from here on out it could only go one way – upwards (Hersoug, 2014c, Chapter 9). Nevertheless, it did not take long before Scottish farms again decided to rattle the cage. Complaints from Scotland led to the EU reinstating restrictive measures again in 2005, this time in the form of minimum price and import quotas. The Norwegian government decided to take the case to court through WTO with the support of the Norwegian Seafood Federation (then known as Fiskeri- og Havbruksnæringens Landsforening). A final verdict did not arrive before 2012, but the long-lasting process proved worthy in the end. The Norwegian aquaculture industry's claims were upheld in court, and EU's measures were deemed invalid. The verdict came only a month after the export penalties the US had established in 1992 also were deemed invalid. By the end of 2012, Norway was finally free to export fish to these important markets (ibid).

Licensing rounds from 2002 to 2009

As mentioned above, the first licensing round after the hiatus was held in 2002. The government decided to allocate 40 new licenses where 24 of these would be designated for the three northernmost counties (Nordland, Troms and Finnmark) for reasons of purely raising state revenue. Price per license was 5 million NOK or 4 million NOK if the company was located in North of Troms or in Finnmark. Coastal municipalities with a potential for aquaculture was especially prioritized. A clause stating that relocation of these farms would not be allowed in the first 10 years was added to hinder conglomeration in certain regions. However, this clause became partly undermined by the introduction of a new administrative regulation in 2005 that made it possible to relocate farms from one municipality to another as

long as the location would still be within the administrative region of the same Directorate of Fisheries as the initial location (Hersoug, Mikkelsen & Karlsen, 2019).

The 2003 round was mobilized in order to get the industry going again after the second major economic crisis. Fifty licenses were allocated, in addition to 10 licenses not sold in the 2002 round. Prices were the same as last round. However, requirements were a bit more specific this time as the authorities wanted to be sure that the new licenses would yield success and provide a sustainable development for the industry. Sales of the licenses was not allowed the first 10 years. It was still important for the government that salmon farming could serve as an important industry for remote, rural areas. However, the idea of ''one man, one farm'' belonged to the past – the conglomeration process was inevitable. In accepting this, the new goal reduced to having a ''diversified industry'' consisting of small, medium and large companies (ibid).

In 2006, an extraordinary auction round was held for Finnmark because of the 10 licenses still not sold in the previous rounds even though the county received special treatment in the form of lower license prices and higher MAB. Performing aquaculture in Finnmark seemed to be very difficult and, therefore, the only requirement for this round was that the companies were financially solid. Reallocation was not allowed until after 10 years for this round as well (ibid).

The 2009 round allocated in total 65 licenses in order to further secure a competitive Norwegian aquaculture industry. Due to a disease outbreak, the pancreas disease (PD) was flourishing and doing its damage on farms along the West Coast in this period. This led to the inclusion of a new criterion for farmers in that area; when they applied for a license, they should be able to reduce the disease problems (ibid). In 2009, it was calculated that the industry lost a total export value of 4.7 billion NOK due to diseases and wastage (Hersoug, 2014b, Chapter 9). Geographical considerations in this round was based on figuring out where it would be impossible to introduce more aquaculture activities, while securing economic sustainability was still the principal objective. Prices increased to 8 million NOK per license, while for applicants from Finnmark the price dropped to 3 million NOK per license (Hersoug, Mikkelsen & Karlsen, 2019).

The 2013 round – green and super-green licenses

In the years after the 2009 round, the Ministry of Fisheries and Coastal Affairs received sharp criticism from the National Audit Office (Riksrevisjonen 2012) regarding the management of the aquaculture industry. It was discovered that allocation requirements turned out to be more indicative than mandatory, and the authorities provided no follow-up inspections on the purchasers of the licenses. Additionally, the ever-increasing sea lice problem had not received attention necessary to be properly dealt with. Monitoring and control lacked. Thus, the planned expansion of 5% MAB was cancelled. Moreover, it was proved in 2013 that 25% of the licenses from the 2009 round, where smaller companies were prioritized, had ended up at bigger companies through sales. This discovery caused public outcry and the allocation system was being questioned (Hersoug, Mikkelsen & Karlsen, 2019).

The solution to these concerns became the introduction of so-called *green licenses*. In the first round, environmental and fish-health related concerns were emphasized (except for the 2009 round including the PD concern and five ecological licenses). The green licenses would allow farmers to expand production if they developed and adopted new solutions that could reduce the problems of sea lice and escapes. This sparked the introduction of various louse-defeating techniques, ranging from skirts outside the net pens to the use of lasers shooting the sea lice. The selection of who should get green licenses was done by a special committee, consisting of a lawyer and professionals, and not by the Directorate of Fisheries (ibid).

The structure of the round was relatively complicated and consisted of three different groups of licenses (A, B and C) totaling at 45 licenses. Group A consisted of 20 licenses distributed equally to Troms and Finnmark; the fee was 10 million NOK, sea lice limit was set to 0.25 per fish and existing licenses had to be transformed to green licenses as well. Group B auctioned 15 licenses available for all farmers and the sea lice limit and transformation requirement were similar to Group A. An interesting notion regarding the auctions held in group B was that it uncovered the real value of licenses as offers were being accepted in the range between 55-66 million NOK. Lastly, group C contained what has been termed the *super-green licenses* due to their extremely low sea lice limit of 0.1 per fish. Price per license was 10 million NOK and there was no requirement of transforming existing licenses. These strict requirements were positively received by both the industry as well as environmentalists. However, it was later reported that farmers were struggling with keeping up with the strict sea lice restrictions, but so far none has been sanctioned upon breaching the limit. Additionally,

one of the most important side effects of this round was that the authorities were bound up by an enormous amount of paper work both before deciding allocation and after deciding it, when complaints and cases ended up in court. The round was held in 2013, but it did not realistically end before 2016, when the last case was settled (ibid). ‘’Never again!’’ was the wording from leading politicians (Hersoug, Mikkelsen & Karlsen, 2019, p. 158). The words were aimed at the green license round as in how it required too much resources and time, while also being very politically discretionary in deciding the allocation of licenses. However, it did happen again. This time under a completely new scheme named the *development licenses*.

2.4 Mid 2010s: Emphasis on objectivity, but still also discretion

The 2015 round – development licenses

In 2015, the government was ready for yet a new licensing round through the introduction of the so-called ‘’development licenses’’. This was a temporary regime lasting until November 2017 and in order to receive such licenses, farming companies had to meet the set requirements for this round, which was different from previous rounds. This time, the focus was on developing new technologies to resolve the environmental and area-related challenges of the Norwegian aquaculture industry (Hersoug, Mikkelsen & Karlsen, 2019). The licenses themselves are without fees, thus free, in a sense. However, developing and realizing the approved ideas will be immensely costly for the companies, likely hundreds of millions of NOK per investment. Ultimately, this creates a risk of huge investment losses if the finalized concepts do not turn out to work as intended. More about this licensing round will be explained in the next chapter.

Land-based aquaculture installations

A different technological concept that has been popularly discussed lately is the establishment of land-based aquaculture installations. This form of aquaculture is not common in Norway due to many uncertainties regarding fish welfare and safety, area usage (demands great space), and that production costs are still higher than the traditional production form utilizing sea net-pens (Fløysand & Jakobsen, 2017). It is however a concept with great potential as land-based installations will remove the issues related to sea lice, environmental impact and escapes. The debate between going for technological innovations in the sea or land-based installations is at the moment a hot topic in Norway. Recently, the municipality of Tromsø

proposed that only land-based or closed facilities would be allowed to be established in the area, causing public outcry among existing farmers, as it will imply a large increase in costs for farmers (ILaks, 2018). Environmentalists and traditional fishers on the other hand, were greatly satisfied with the suggestion. Nonetheless, it is too early to choose a path between sea or land. At present we know that land-based installations require more innovation in order to compete with the economic efficiency of traditional installations at sea.

The traffic light system – objective and non-discretionary

In 2017, the government implemented a new production management regime named the ‘’traffic light system’’. Different to the development licenses, this is a permanent regime established to act as the government’s main policy instrument to control growth in the production output of the industry. The system has emerged as a consequence of lack of political will for further capacity increases in the aquaculture industry unless environmental considerations are to a greater extent emphasized (Rødt trafikklys, 2019). It is based on 13 production zones where future growth is determined by the color of the traffic lights in a given production zone. Green indicates expansion, yellow indicates stagnation and red indicates reduction. Which color the different zones are assigned, comes down to the environmental situation, measured by the number of salmon lice and assessments of lice-induced mortality for wild fish stocks. Per now, the salmon lice indicator is the sole indicator for the environmental situation, a situation assessed by an appointed scientific committee (Hersoug, Mikkelsen & Karlsen, 2019).

The idea of this new regime is to give the industry better predictability; the industry will now know the criteria for obtaining growth, how often growth will be assessed and what happens when the environmental effect is acceptable, moderate or unacceptable (Meld. St. 16, 2014-2015). Thus, farmers will not in advance be aware of when and where production can or must be adjusted, and it is their collective responsibility to make sure expansion will be possible. The difference between this regime and the previous license allocation rounds is that political discretion is no longer possible – no more ‘’beauty contests’’ (Hersoug, Mikkelsen & Karlsen 2019, p. 160).

2.5 Current status and future forecasts

Since 1980, the Norwegian salmon industry has seen a growth in production from 4,000 tons to roughly 1.2 million tons in 2017 (Statistisk Sentrabyrå, 2019). However, this amount has

been fairly stable since 2012 due to little increase in capacity as the industry still has their environmental and fish health issues to deal with (IMR, 2018). Despite little increase in production, in 2018, the industry exported 1.1 million tons of salmon to a first-hand value of 67.8 billion NOK. The latter of which, being a record (Norwegian Seafood Council, 2019). Figure 3.1 displays the increase in value even though production has nearly stalled.

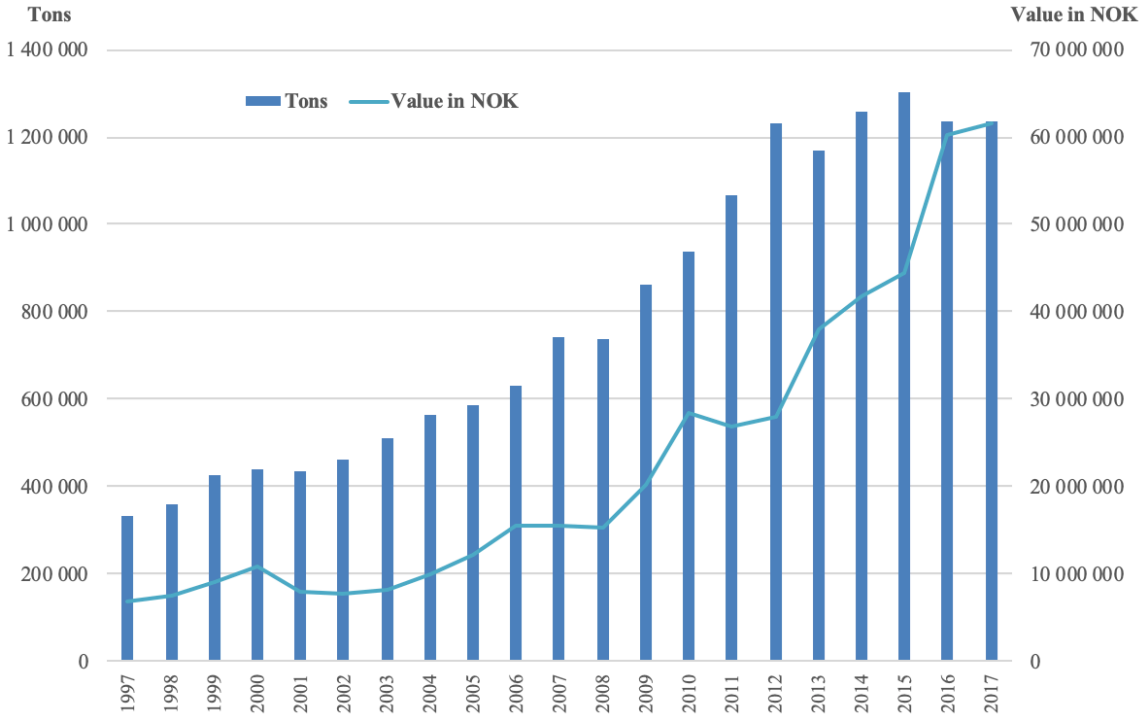

Figure 3.1: *Amount sold and first-hand value of salmon throughout the years. Source: SSB (2019)*

The biggest export markets are the EU, the US and Japan (ibid). Previously, Russia and China were also great markets, but due to restricted market access as a result of political disagreements, that is no longer the case. This is woeful, as prior to 2012, Russia was Norway's second largest export market and the share of Norwegian salmon in the Chinese market was 92% in 2010. However, in 2013, this market share had dropped to 29 %. For an industry that is entirely dependent on exports, being exposed to economic and political volatile conditions is not preferable (Hersoug, 2014c, Chapter 9).

Despite market restrictions, the industry is still prosperous. Salmon aquaculture in Norway produces up to 37 million meals daily, or 25,700 meals per minute (Norwegian Seafood Council, 2019). Additionally, the largest companies no longer only have facilities in Norway,

but also in other countries across the world such as Chile and Canada. No wonder the industry is referred to as ‘’Norway’s answer to IKEA’’ (Klausen, 2016).

The Norwegian aquaculture industry has become an industry of great importance for Norway, still with a great potential to grow even further, but first the industry will have to find a solution to the a numerous of issues. As pointed out by IMR (2018) and the Federation of Norwegian Industries (2017), the main challenges hindering sustainable development and further expansion are; salmon lice (impact on wild salmon), escape incidents (impact on wild salmon), sediment pollution, diseases and limited available area for aquaculture.

Even though the country has a far-stretched coastal line and an economic zone amassing 800,000 km^2, there is still a challenge of little available areas for aquaculture. This, as not all areas are equally valuable, the aquaculture industry is continuously on the outlook for so-called *superlocalities* (traditional aquaculture localities), which are usually locations in the fjords. Superlocalities are areas with sufficient depth, sound water exchange and adequate sheltering from harsh weather conditions (wind/waves). In addition, there is a need of access to solid infrastructure for the production on land. There is not an abundance of such localities, and aquaculture is not the only activity utilizing the areas along the coast. Other activities claiming the right to use, is everything from recreational, tourism, fishers, to ships traffic and oil and gas. Not to forget environmentally protected areas. Further, locating the localities to densely, will increase the likelihood of diseases spreading. Roughly calculated, the aquaculture industry seizes an area totaling 420 km^2, equaling 0.5% of the area within the baseline[1] (Hersoug, 2014a, Chapter 12)

Apart from the challenges above, maybe the most difficult hinder is to convince the public and the politicians that the industry can be driven sustainably. Dealing with these concerns will make it possible to triple the value and production by 2030, and quintuple it by 2050, as are the goals set by the government. However, if these goals are to be realized, there must be improvements to the current political, market and environmental related limitations (Klausen, 2016). Nonetheless, the future has a bright outlook.

[1] Definition: ‘’Except where otherwise provided in this Convention, the normal baseline for measuring the breadth of the territorial sea is the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State’’ (UN General Assembly, 1982, Article 5).

Chapter 3: The development licenses and current status of the industry

3.1 The purpose behind the development licenses

As mentioned in the previous chapter, the government launched a new temporary licensing regime termed the *development licenses* in 2015. The purpose behind establishing these licenses is to stimulate increased sustainability, sought-after renewal and innovation, and an increase in total value creation in the industry. More specific, the idea is that the development licenses will facilitate a technological ''face-lift'' in the industry by only allocating licenses to projects that develop new technological solutions (The Ministry of Trade Industry and Fisheries, 2016). Subsequently, the hope is that the emerging technologies can contribute to solve one or more of the environmental and area-related challenges constricting growth of the Norwegian aquaculture industry (Hersoug, Mikkelsen & Karlsen, 2019)

The regime is limited to focus on technological product innovations only, i.e. equipment or installations. Hence, projects involving, e.g. the development of new operational processes, vaccines or feeds are not considered. In the document titled *''Guidelines for processing applications regarding development licenses''* (2016), it is stated that projects applying for the licenses has to represent *significant innovations* and *significant investments*. By significant, the government mean new and costly innovations with a certain risk of failure. However, what the authorities will in fact consider significant is entirely their decision to make. Thus, the selection is discretionary.

The licenses are allocated free of charge for up to 15 years, as the government saw the need for incentives in order to get companies to be risk-tolerant. In addition, if the project is carried out in accordance with the set goals, the licenses can, after a given time, be converted into commercial licenses for a fixed fee of 10 million NOK (The Ministry of Trade Industry and Fisheries, 2015). This fee is miniscule, when considering the fact that a commercial license have a value thought to be around 120,000 NOK/ton (Misund, 2017). Therefore, in that sense, the licenses can be viewed as subsidies. The MAB per license is 780 tons, thus, the potential monetary benefits of acquiring development licenses are enormous.

By creating the development licenses regime, the government went back on their words regarding never arranging such rounds again, as mentioned in the previous chapter. Again, the government decided on the use of an instrument allowing the use of discretionary allocation

of licenses. Unsurprisingly, the round has brought on a workload too extensive to be finished within a reasonable time after the expiration of the regime, which ended formally November 2017, as many complaints from the applicants are still being processed. Thus, again large strains have been put on the authorities (Hersoug, Mikkelsen & Karlsen, 2019).

Table 3.1: *Approved applications allocated licenses per 30.04.19. Source: Adapted from the Directorate of Fisheries (2019)*

#	Applicant	Approval Date	Limitation	Concepts
1	Ocean Farming AS (SalMar)	26.02.2016	8 licenses (6240 tons)	"Havmerd" based on offshore technology
2	Nordlaks Oppdrett AS	07.09.2017	21 licenses (16380 tons)	"Havfarm" for sea-based aquaculture
3	MNH Produksjon AS	28.04.2017	4 licenses (3120 tons)	"Aquatraz" Semi-closed pen
4	AkvaDesign AS	05.06.2018	2 licenses (1560 tons)	Closed pen technology
5	Marine Harvest Norway AS	01.03.2018	6 licenses (3120 tons)	"Egget" Closed pen technology
6	Atlantis Subsea Farming AS	22.02.2018	1 license (780 tons)	Lowerable aquaculture installations
7	NRS ASA / Aker ASA	09.03.2018	8 licenses (5990 tons)	«Arctic Offshore Farming» -Half lowerable offshore aquaculture installation in steel
8	Hydra Salmon Company AS	06.04.2018	4 licenses (3120 tons)	Aquaculture in closed production containments
9	Mariculture AS	22.02.2019	8 licenses (6240 tons)	"Smart Fishfarm" - Wholesome solution for open ocean
10	Cermaq Norway AS	01.03.2019	4 licenses (3120 tons)	‘’iFarm’’ - Technology for individual based aquaculture of fish
11	Mowi Norway AS	05.04.2019	4 licenses (1100 tons)	‘’Marine Donut’’ Solid, closed units

3.2 Status of the applications

As of May 2019, all 104 applications have been processed – 1,5 years after the deadline. However, as mentioned there are still unresolved complaints that need to be dealt with (fisk.no, 2019). So far, 11 projects are allocated in total 68 licenses, representing 50,770 tons in biomass. In addition, eight projects are considered within the set criteria, but are yet to receive licenses due to ongoing clarifications, and lastly, 85 applications have been declined. Reasons for why companies have their applications declined is normally due to the projects not fulfilling the requirements regarding significant innovation and investment, or that they are too similar to projects already approved. In that sense, the ‘’first come, first served’’

principle is largely applicable to the description of this licensing regime. Lawyer Halfdan Mellbye has written an article where he criticizes the allocation of the development licenses. In the article he writes that almost only the largest companies with large, expensive and groundbreaking technology advancements have had licenses allocated. This, while smaller companies with good ideas not demanding an equally massive investment has had their applications rejected, too often based on thin reasoning (Mellbye, 2018).

3.3 The licensing system

Aquaculture in Norway is a license-based industry, where the number of licenses for salmon, trout and rainbow trout are limited, i.e. aquaculture licenses are only given when the government decides so. It is a complex system involving many of the governing agencies, but it provides the authorities with control over which companies are farming salmon, to what extent and on what terms. Especially in terms of environmental governance, such a licensing system is important, as the risk of overuse and destruction of natural resources are great. However, it is often desirable that natural resources are exploited and utilized for value creation, the licenses are then a regulatory mechanism that gives the authorities the opportunity to balance the intersecting societal considerations in a sensible manner (Rødt trafikklys, 2019).

The MTIF has the main and general responsibility for the aquaculture industry and decides, according to §4 in the Aquaculture Act (2005), how many licenses are to be distributed and what the criteria are. Although it is not explicitly stated in the wording of the Aquaculture Act, the aquaculture licenses do, in practice, consist of two different licenses, granted in two stages (‘’two-step system'’). Thus, to simplify the explanation, I will make use of the distinction made by Mellbye (2018), whom uses the terms *farming license* and *locality license*.

To be allowed to farm salmon, both a documentation of permission (farming license) and locality clarification (locality license) is needed. First, a company applies for a farming license, and if allocated, the company will now have the right to farm a specified MAB per license, but not the right to operate. Farming licenses are distributed by the Directorate of Fisheries and appeals are handled by either the directorate or the MTIF. After acquiring a farming license, the company must then apply for a locality license, in order to get a geographical given location to farm the fish. Locality licenses are distributed by the County

Council of the relevant County. Many governmental agencies are involved in the process of allocating locality licenses, and the County Council acts as the coordinating authority (Figure 3.1). The County Council forwards the application to the relevant municipality, which has to inform the public and gives their recommendation on the application with regards to municipal plans and interests. The County Council also makes sure the application is sent to governmental sectorial agencies, these being primarily; the County Governor, the Norwegian Coastal Administration, the Norwegian Food Safety Authority and the Directorate of Fisheries (Hersoug, 2014a, Chapter 12).

The County Governor of the relevant county assesses the case according to the Pollution Act and gives their recommendation about environmental conservation, fishing and outdoor activities. The Norwegian Coastal Administration handles the case in accordance with the Harbor Act, while the Norwegian Food Safety Authority assesses the application in accordance with the Food Act (and the Animal Welfare Act). Lastly, the relevant regional office of the Directorate of Fisheries makes a statement about fisheries interests, including indigenous interests. Ultimately, the County Council gathers all statements, processes the case and makes the final decision in accordance with the Aquaculture Act. Similar to the farming licenses, it is the Directorate of Fisheries that deals with appeals (ibid).

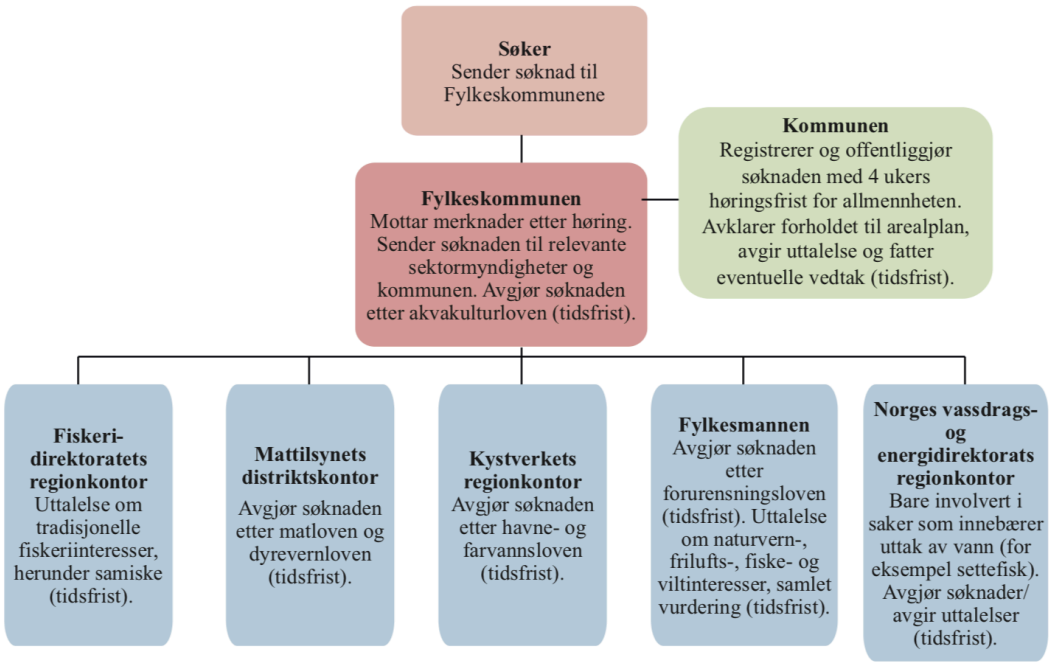

***Figure 3.1**: Application process for an aquaculture license (locality license). Source: Meld. St. 16 (2014-2015)*

3.4 Nordlaks Oppdrett AS: The Havfarm Project

The Havfarm project consists of two different concepts; one stationary concept and one mobile concept. The concepts are titled Havfarm 1 and 3. With the Havfarms, Nordlaks intend to move the final and most intensive part of the salmon's growth stage out of the fjords and further away from other aquaculture installations than what is considered normal today. The Havfarms are to be placed in areas that cannot be utilized to farm fish with today's available technology. These are sea areas that are more exposed to complex conditions regarding wind, currents, waves and great depths. The allocated localities will provide excellent environmental, fish welfare and production conditions (Nordlaks, 2019). This is Nordlaks' explanation of the project:

> *The Havfarm project is a part of Nordlaks' solution to provide a sustainable development of the aquaculture industry. Today, sea area is a significant limitation for further development of the industry and gaining access to new areas is a necessity if the industry is to develop in a direction considering fish welfare and environmental concerns as well. That is why we are building the Havfarms. (Nordlaks, 2019)*

Per now, only Havfarm 1 is under construction and according to the plan, it should be ready in 2020 (TekFisk, 2018). Havfarm 3, on the other hand, is still in the process of acquiring a location. This thesis will show why that is so. Thus, construction has not begun, nevertheless, Nordlaks says the plan is to have the installation ready by 2022 (ILaks, 2019). As a result of this, there only exists illustrations of how Havfarm 1 will look like (Figure 3.2) as the design of Havfarm 3 is yet to be finalized. However, in a video released by Nordlaks it is possible to see that Havfarm 3 will likely be similar to the design of Havfarm 1.[2] The design of the concepts resembles that of a ship, with an outer steel frame stretching 385 meters and a wheelhouse at the back. Its width will be 59,5 meters and depth 37,75 meters, and as seen in the picture below, the installation will make use of an open net-pen technology (Nordlaks, 2019).

[2] Video presenting the different concepts, available from Nordlaks' website per 03.05.19 (Nordlaks, 2019)

While Havfarm 1 is a stationary concept, Havfarm 3 is different as it is a dynamical concept, i.e. it will have the possibility move and relocate. On their website, Nordlaks write that Havfarm 3 will not have a permanent anchoring solution (different to Havfarm 1) but will base its dynamical location on propulsion machineries. This to be able to stay stationary without anchoring, while also be able to move. A different, more simple anchoring solution is planned to implement in order to relieve the propulsion machineries and to reduce fuel consumption when the installation is going to be located at the same locality over time. Thus, Havfarm 3 will be able to move between areas depending on time of the year, weather and wind conditions or interests from other users (Nordlaks, 2019)

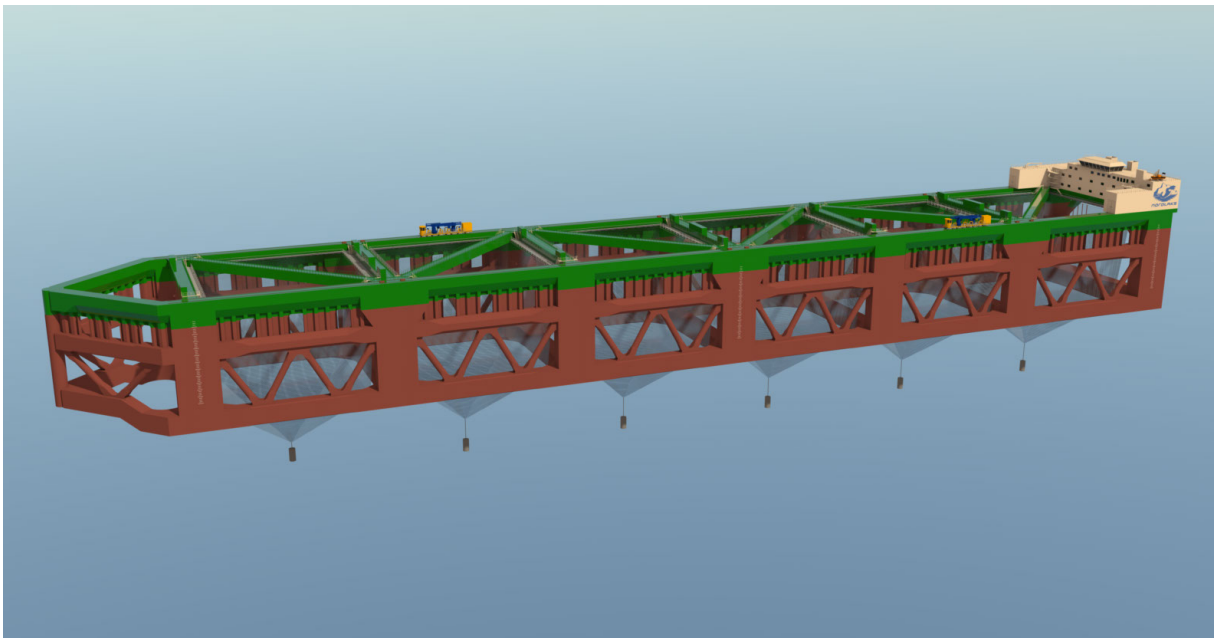

Figure 3.2: *Illustration of Havfarm 1. Reasonable to think Havfarm 3 will be similar. Source: Nordlaks/NSK Ship Design*

Nordlaks were among the first to be allocated development licenses. Initially, they applied for a MAB of 30 000 tons, this corresponded 39 development licenses (780 tons per license) for three concepts; Havfarm 1, 2 and 3 (The Directorate of Fisheries, 2016b). However, at first, only 10 licenses were given to Nordlaks for constructing Havfarm 1. The Directorate of Fisheries saw it sufficient with 10 licenses to carry out a testing of the concept at a commercial scale (The Directorate of Fisheries, 2016a). Additionally, the reason for allocating licenses to only one Havfarm had to do with the fact that, at that stage, there was no documentation providing a thorough description of the differences between the concepts, according to the directorate. Thus, the directorate could not deliver a factual opinion on

whether all of the three concepts fulfilled the requirement regarding significant innovation (The Directorate of Fisheries, 2016b).

With this decision, Nordlaks made use of their right to make an appeal. The appeal was handled by the MTIF. After providing additional information about the Havfarm project, the ministry decided to assign not ten, but 13 licenses to Havfarm 1, due to the consideration of the need to mitigate risks (The Ministry of Trade Industry and Fisheries, 2017). Furthermore, the ministry did also overrule the directorate's decision regarding Havfarm 3. This, as they had the opinion of a mobile installation being able to solve the area-related challenge to an even greater extent than Havfarm 1. Thus, the ministry assigned eight licenses to the Havfarm 3 concept, explaining that eight licenses should be enough to conduct a testing at commercial scale. Havfarm 2, also a variant representing mobile aquaculture, was not given any licenses as the ministry saw it too similar to Havfarm 3 and the one with least potential between the two concepts. In the end, Nordlaks ended up with 21 development licenses. This final answer was given in the autumn of 2017 (ibid).

Chapter 4: Theoretical Framework

4.1 Conceptual clarification

This chapter will be used to clarify various central concepts and theories according to the goal of this thesis; to study technological advancements and innovations in the Norwegian salmon farming industry (here: a mobile aquaculture installation) and see how innovation can create challenges related to the governing system and regulatory bodies of Norwegian aquaculture. That is, challenges that raises a need for the governing system to adapt its regulatory approach to the aquaculture innovations. A mobile aquaculture installation differs from traditional net-pen farming, as mobile installations has the ability to relocate if internal or external conditions/situations would deem it necessary. Relocation could happen due to e.g. rough weather conditions, fisheries activities or wild fish spawning.

It will be important to explore what innovation implies in both the private (here: business) and the public (here: government) sector. Yet also, the driving forces behind the development of Havfarm 3, how it will operate within the municipality's management responsibility, and how the governing system respond to such an innovation. Regarding literature on innovation in the two aforementioned sectors, it is interesting to see that a literature research shows that it seems as most published literature on the relationship between innovations in the two sectors, is about how governing systems affect innovations through acting as enabler or barrier innovation, and not the other way around. Less seems to be written about how private innovations challenges existing governing systems and forces them to be innovative as well. In other words, the main aspect of this chapter is to cover how innovation challenges the existing governing regime on all levels; local, regional or national.

4.2 Schumpeter's entrepreneur

The late renowned Austrian economist, Joseph A. Schumpeter, introduced the theories on innovation and entrepreneurship in his book *''The Theory of Economic Development''* (1934). Even though he was not the first to describe innovation or the first to try and understand it and its processes, his name is still one of the most central ones when discussing the subject of innovation. In his book, he presents innovation as a social phenomenon and explains that innovation does not necessarily involve doing something in a completely different manner than before. According to Schumpeter, existing knowledge and resources combined in new ways can lead to innovation. A view that still is very relevant today. He viewed entrepreneurs

as highly central driving forces in the economy, pointing out that it is the entrepreneurs that creates innovation and doing so through new combinations of knowledge and resources (Njøs & Sjøtun, 2016). This way of thinking was different to the classical economical equilibrium theories, where the economical agent, *Homo Oeconomicus*, was perceived as a strict rational and calculating being. Instead, Schumpeter had the opinion of entrepreneurs being a *Homo Ludens*; a playful human being with great sense for creativity, curiousness, openness and improvisation, and with an *inner drive* (Enoksen, 2018; Haukanes, 2016). In this sense, Schumpeter was particularly obsessed of the individual being the innovator.

Schumpeter separates between five different types of innovation; new products, new production methods, new suppliers, entrance in a new market and new ways of organizing an industry (Njøs & Sjøtun, 2016). While the abovementioned types are still relevant interpretations, how we interpret the concept of innovation has evolved since the time of Schumpeter. Criticism has been directed towards the fact that the excellence of an entrepreneur is not enough if one is to fully understand innovation processes and the establishment of new products or other innovations. There are several other factors that needs to be taken into account. For example, Steve Jobs (Apple), Steve Wozniak (Apple) and Bill Gates (Microsoft) are all great entrepreneurs that has contributed to elevating the computer science envelope, but they were not alone and not the only driving force. It is therefore more natural to view innovations as a result of the effort from several persons and incidents (Enoksen, 2018).

This shift in focus, from Schumpeter's individualistic actor, to collaboration and interaction between different actors and the knowledge sharing of these actors, is thus, something the innovation literature is increasingly emphasizing. Now, it is more of a system-oriented approach, a methodology being termed *innovation systems*. This is an approach that emphasizes collaboration across different actors. The idea is that planning and facilitating interaction will increase innovation activity in both the private and public sector. The Norwegian policy instruments is molded after this approach (Njøs & Sjøtun, 2016). The NCE Seafood Innovation Cluster is an example of said approach. NCE is short for Norwegian Centers of Expertise.

4.3 Definition of innovation and different types of innovation

There are a series of different understandings and interpretations of the concept of innovation. The problem with any discussion on innovation seems to be that the word "innovation" is used in many different ways. Interpretations differs especially when it comes to define the different types of innovation, where it often seems to be difficult to establish clear-cut differentiations between the several types. As a result, it is possible to get the impression of definitions overlapping each other.

A quick literature search will show that there is an abundance of published literature on innovation, where especially the definitions regarding the different classifications seem to differ at times, one can easily be confused by the many inconsistencies in interpretations of the different types of innovation. Additionally, most of the literature on innovation is about the private sector, little work has been done to cover the public sector (Jaskyte, 2011). As this thesis is about innovation in both the private and public sectors, it will be important to establish definitions that covers both areas. Thus, the definitions provided in this chapter are the ones that I find suits the discussed topic best. In general, however, an innovation can be defined as follows:

> *An **innovation** is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (OECD/Eurostat, 2018, p. 60)*

The above general definition of innovation is from the newest edition (2018) of OECDs ''Oslo Manual'' (Guidelines for Collecting, Reporting, and Using Data on Innovation). In the definition, the term 'unit' refers to the innovative organization, which can be a business, government, municipality, etc. Thus, making it a definition that suits across any sector, whether it be the private, public or non-profit sector (Arundel, Bloch, & Ferguson, 2019; OECD/Eurostat, 2018). Since its first edition in 1992, the manual has been a widely used tool among researchers and practitioners in order to get a clear vision of what innovation is and the different types defined (Arundel, Bloch & Ferguson, 2019).

Innovation in the private sector

The current Oslo Manual definition comprises two types of innovation; *product innovations* and *business process innovations*. Previous definition consisted of four types of innovation (product, process, organizational and marketing) and it is this classification that many journal articles and other papers has utilized (OECD/Eurostat, 2018; Geldes, Felzensztein & Palacios-Fenech, 2017; Schmidt & Rammer, 2007). However, studies have shown that many researchers and practitioners found the previous definition complex, leading to a revision of the definitions (OECD/Eurostat, 2018). The current definition is:

> *A **product innovation** is a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market. (OECD/Eurostat, 2018, p. 70)*

> *A **business process innovation** is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use in the firm. (OECD/Eurostat, 2018, p. 72)*

As this classification is still a broad one, leaving it open for interpretations, the Oslo Manual has included several sub-categories for both of the types of innovation in the business/private sector. This, to better clarify what the definitions cover. Accordingly, a product innovation is either a good or a service innovation (or a combination thereof). While business process innovations got six different functional sub-categories to better describe the different kinds of process innovations. Such an innovation can be described with use of just one sub-category or a combination of several (OECD/Eurostat, 2018). These sub-categories are displayed in Table 4.1.

Table 4.1: *Functional categories for identifying the type of business process innovations. Source: Adapted from OECD/Eurostat (2018)*

	Short term	Details and sub-categories
1.	Production of goods and services	Activities that transform inputs into goods or services, including engineering and related technical testing, analysis and certification activities to support production.
2.	Distribution and logistics	This function includes: (a) transportation and service delivery, (b) warehousing and (c) order processing.
3.	Marketing and sales	This function includes: (a) marketing methods including advertising (product promotion and placement, packaging of products), direct marketing (telemarketing), exhibitions and fairs, market research and other activities to develop new markets, (b) pricing strategies and methods and (c) sales and after-sales activities, including help desks other customer support and customer relationship activities.
4.	Information and communication systems	The maintenance and provision of information and communication systems, including: (a) hardware and software, (b) data processing and database, (c) maintenance and repair and (d) web-hosting and other computer-related information activities. These functions can be provided in a separate division or in divisions responsible for other functions.
5.	Administration and management	This function includes: (a) strategic and general business management (cross-functional decision-making), including organizing work responsibilities, (b) corporate governance (legal, planning and public relations), (c) accounting, bookkeeping, auditing, payments and other financial or insurance activities, (d) human resources management (training and education, staff recruitment, workplace organization, provision of temporary personnel, payroll management, health and medical support), (e) procurement and (f) managing external relationships with suppliers, alliances, etc.
6.	Product and business process development	Activities to scope, identify, develop, or adapt products or a firm's business processes. This function can be undertaken in a systematic fashion or on an ad hoc basis and be conducted within the firm or obtained from external sources. Responsibility for these activities can lie within a separate division or in divisions responsible for other functions, e.g. production of goods or services

Considering Havfarm 3 and other approved development projects[3], I find it relevant to mention that they can be classified as what literature terms *technological innovations*. The definition of technological innovations is to some extent self-explicatory, it simply refers to innovations resulting in new or improved technology. However, generally, these are product and process innovations (Haukanes, 2016; Geldes, Felzensztein, & Palacios-Fenech, 2017). In terms of Havfarm 3, it would be reasonable to think that the concept is, first and foremost, a technological product innovation, as it represents a solution that will help Nordlaks and the industry make a leap forward in terms of the technology used to farm fish. Havfarm 3

[3] By writing this, I am referring to the development-licensing round, and the projects and concepts that have been approved by the Directorate of Fisheries.

represents technology that will improve the ability of tackling the challenges faced by the industry. This coincides with the criteria for being eligible to receive development licenses. Which are, among others, that the innovation contributes to a technological ‘’face-lift’’ and represents a solution to the area or environmental-related challenges (The Ministry of Trade Industry and Fisheries, 2015). In other words, the concept represents a new and improved product primarily.

Havfarm 3 does also represent a process innovation. This, as the installation is primarily thought to be used for fish above 1-1.5 kg. Thus, leading to a change in the company's production strategy as Nordlaks will alter from a two-step production process, to a three-step alternative[4]. It might not be much of an innovation to go from two-steps to three-steps in itself, but the implications and potential improvements of such a change makes it an innovation. Looking at table 4.1, I would argue that Havfarm 3 is also a process innovation in the way that it is thought to improve the activities that transforms inputs into goods (category 1), and how it is thought to improve activities that adapts a firm’s business processes (category 6). Ultimately, this particular development project entails both types of innovation; product and process.

Innovation in the public sector

While the idea and notion of innovation is wide, the term is often applied in a much narrower sense in which it is understood as a practice primarily taking place in the private sector. In other words, there is a hidden assumption in the conceptual apparatus that the innovation process takes place outside the public sphere (Njøs & Sjøtun, 2016). However, that is not the actual case. Lately, one has begun to talk about innovation in the public sector also. Innovation in the public sector differs from innovation in the private sector in some ways. The more common difference lies in the fact that there is a higher risk related to innovations in the private sector compared to the public sector. For example, investments in research and innovation in the private sector usually comes with a varying degree of monetary risk for the companies. While in the public sector, this risk is nullified, as innovation projects are mainly financed by municipal or state budgets, i.e. public funds. Thus, the driving forces behind

[4] A two-step production process implies farming the fish in two different stages; first stage is at the hatchery, while second stage is in the traditional net-pens. Altering to a three-step alternative implies adding a final stage, that being the Havfarm. With this alternative, the fish is initially brought up at the hatchery until post-smolt (200-500 g). Then it is transferred to the open net-pens and then transferred a final time to the Havfarm at a weight of around 1-1.5kgs (Nordlaks, 2018; Informant, Nordlaks).

public investments are often different to the business logic applied in the private sphere (Njøs & Sjøtun, 2016).

What is also evident is that public innovation serves two purposes. This matter is discussed by Rønning and Teigen in their book titled *''An innovative governance?''* (2007). They split the two purposes into two main themes: *innovation in the public sector* and *the public sector as an innovation promoter*. Innovation in the public sector is about the sector's responsibility to always seek new and improved solutions that will enhance welfare and governability. While the public sector as an innovation promoter, is about the sector's responsibility to make sure that private stakeholders has frameworks and incentives that makes it possible to innovate and develop. Taxation, regulations, laws and subsidies are all examples of this. In the context of Norwegian policies, the incentives created with regards to electrical cars is also an example of the public sector as an innovation promoter. Compared to the private sector, the success criteria for the public sector is bigger than itself and must serve the society in a way that promotes development for everyone, which is why the public sector has this responsibility. These two central themes make up, what Rønning and Teigen (2007), term *innovative governance*. In this thesis, these central themes help interpret the results retrieved.

Rønning and Teigen (2007) split innovation in the public sector into three main categories; (1) *production* of goods and services, (2) the *organization* of the sector and (3) *politics* as a tool for governance. For this thesis, the all categories will be relevant. The public sector is a large producer of goods and services, examples are oil, electrical power, dental health and infrastructure. Such goods and services contribute largely to social welfare and it is important that these matters are managed properly by the public authorities. The organization of the sector is also an important subject when discussing innovative governance. How the sector is organized into different ministries, directorates and other sectorial bodies, contributes a lot to how the sector is able to govern and innovate. Lastly, political decisions and policies controls what is allowed and how. It is the political apparatus that must implement policies on behalf of the government (Rønning & Teigen, 2007). This can be interpreted as governance innovations, something that Bekkers, Tummers, Stuijfzand and Voorberg (2013) defines as the development of new forms and processes of governance in order to address specific societal problems.

The public sector as an innovation promoter, is also divided into the three categories; production, organization and politics. Rønning and Teigen (2007) explains the first category is about the production of goods and services that promotes innovation in the private sector. For example, efficiency and productivity is promoted through providing a well-built infrastructure. Furthermore, it is important that the organization of the public sector is organized in a way that promotes innovation, as the easier it is for the private sector to innovate, the easier it is to maximize value creation. Here, a way of organizing that emphasizes cooperation between the governmental bodies, is crucial. Solås et al. (2015) argues that the fragmented governing system of Norwegian aquaculture is organized in a way that makes it difficult develop further. Lastly, the political category is about the role the governing system has in the democracy. Incentives characterizes this political function and is important for the sector's ability to promote innovation in the private sector. Through incentives, the government is able to indirectly promote a certain development in the private sector. Taxation policies, various forms for subsidies and the development licenses are all examples of the public sector being a promoter of innovations. In exchange of ''freely'' obtaining development licenses, companies has to innovate and develop solutions that leads the industry towards the sought-after environmental sustainable direction.

4.4 Incremental and radical innovation

Innovation can also be divided into the following binary classification; incremental and radical innovations. The difference is related to how extensive the innovation is, compared to current product, process, regime, system, etc. (Haukanes, 2016; Holte, Sønvisen & Holmen, 2016). Incremental innovation happens step-by-step in a more or less continuous process, where further development of current innovations is minor. Most often, incremental innovations takes place in products or processes that were introduced as a radical innovation (ibid). In the context of the Norwegian aquaculture industry, innovation of an incremental character are normally minor improvements of technology used for automation and efficiency improvements. Holte, Sønvisen and Holmen (2016) further mentions that incremental innovations often happens due to the efforts of the participants of the industry, while radical innovations usually are a result of comprehensive R&D efforts and basic research. In a section above, it was discussed that Havfarm 3 represents a process innovation as well as a product innovation. In terms of the process innovation that Havfarm 3 represents (enabling the use of a new production process), I would argue that this innovation is of incremental character, as changes are minor.

Radical innovation is the introduction of a completely new product or process, where development leads towards a brand-new direction, never before explored – a so-called ‘’game changer’’. Upon market introduction, such innovations will have great effect and alter, or replace, current innovation. Examples of this are Airbnb and Uber, two innovations that radically altered the then current market composition, when introduced. Radical innovations have great influence power (economically, marked and process) in the industries that will be affected by the innovation (Haukanes, 2016). The Norwegian aquaculture industry has seen radical innovations occurring related to research on breeding, diseases and vaccines. For example, the shift from curative to preventive disease treatment, i.e. vaccines injected into the fish before release into the sea pens, have reduced disease issues significantly and have also resulted in a drastic decline in the antibiotics usage (Asche, Guttormsen, & Tveterås, 1999). The transition from wet feed to dry feed (pellets) can also be considered a radical innovation.

The technological product innovation that Havfarm 3 represents can be considered an innovation of radical character in terms of it representing a solution that makes it possible to relocate in order to always maintain optimal farming conditions. However, it is still a fish farming installation making use of similar open-net pen technology applied by traditional installations. Thus, Havfarm 3 is an example showing that distinguishing incremental from radical might not always be so simple.

4.5 The Pacing Problem

This thesis is looking at the relationship between a private sector innovation and the governing system surrounding it. In literature, the outcome of this relationship is often termed the *pacing problem,* which can be defined as the growing gap between emerging technology and the law (Eggers & Turley, 2018; Marchant, Allenby, & Herkert 2011; Moses, 2011). Nowadays, the accelerating pace of technology is in stark contrast to the not so rapid pace that legal frameworks evolve. Society relies on legal frameworks to regulate and manage emerging technologies in order to maintain a balance. The traditional tools of legislation and judicial review are seemingly not able to keep up with emerging technologies (Marchant, Allenby & Herkert, 2011). The consequences of this growing gap between pace of technology and regulation are related to the increasingly outdated and ineffective legal structures, institutions and processes that regulates emerging technologies. Unfortunately, instead of having a dynamic outlook on society and technology, many legal frameworks are based on a more static point-of-view and on technologies of the past. Additionally, the legislative process

is notoriously slow, with governments only having the capaity to adress a small part of the total amount of potential issues that exists (Eggers & Turley, 2018; Marchant, Allenby & Herkert, 2011). To possibly solve these issues, Marchant, Allenby & Herkert (2011) suggest a way to reduce this gap could be through improving the capacity of current legal regimes to adapt to rapidly evolving technologies, even if this would imply abandoing traditional forms of legal regulation and adapt into broader forms of governance. A quote by Benjamin Cardozo from 1960 (in Marchant, Allenby & Herkert, 2011, p. 20), states the following; *''with new conditions there must be new rules''*.

While the review of Marchant, Alleby and Herkert (2011) regarding the pacing problem might be a bit harsh and gloomy, their suggestions on how to solve the problem serves great purpose. Osmundsen, Almklov and Tveterås (2017) write in their article about the regulatory issues related the Norwegian aquaculuture industry, that there is a need for an approach to governance that is flexible and adaptive. Not an approach that emphasizes stability and control if the governing system is to keep up with such a non-linear, volatile and ever innovating the industry is. By non-linear and volatile, the article means that aquaculture and biological features makes it an industry where knowledge is never complete, thus creating regulatory uncertainty, and that there will always be real or perceived environmental externalities related to the production of farmed fish. Additionaly, the article argues that the fact that the current governing system is quite fragmented seems to be a factor contributing to the regulatory uncertainty, as there is an abundance of governmental agencies involved in decision-making process. Accordingly, it becomes evident in Osmundsen, Almklov and Tveterås (2017), that also the Norwegian aquaculture industry is subject to an innovation gap between the private and the public sector. Osmundsen, Almklov and Tveterås (2017) explain it as a ''wicked problem'', i.e. an unsolvebable problem. Saying that, although much can be improved in terms of structure, the uncertainty and complexities will persist, therefore they must be managed in some way.

4.6 Why does innovations arise?

As a conclusion to this chapter, I thought it reasonable to reflect around why innovations happen and what motivations causes the promotion of innovation and technological developments.

Every day, new ideas are formed while others are scraped; the technological development is a process happening continuously in today's society and contributes to discover new markets or more cost-efficient solutions. In the private sector, there will always be a need to develop in order to not lag behind competitors. Not progressing, increases the likelihood of reduced competitiveness, loss of market share or increased expenditures. This competition fueled race is beneficial to society, as this constant innovation expands the knowledge available (Haukanes, 2016). A result of increased knowledge might be tightened regulations and stricter conditions for the market actors. In terms of the aquaculture industry, and it being an industry that interacts more with their surroundings than other industries, such scenarios have occurred. Often when governing systems learn more about the external impacts of aquaculture, a response has been to tighten regulation in order to mitigate those issues, which is positive, environmentally wise. However, if the regulations are too heavy, the industry's development will stagnate. Thus, governments must find the perfect balance of regulatory intervention (Osmundsen, Almklov and Tveterås, 2017). For the indsutry, an answer to this challenge is to keep innovating and provide new or improved solutions. Summarizing, for businesses, innovations arise due to the discovering of new markets, more efficient and cost saving production methods, new products and the need of being able to face challenges (Trott, 2012).

In recent years, the Norwegian aquaculture industry has had an increased focus towards issues related to the environment and sustainability. The industry is experiencing reputation issues due to these environmental challenges. The main challenges are related to the salmon lice, but there are also questions regarding the negative environmental impacts from excessive feeding, excrements and escapes, which in turn affects the wild salmon stocks. It is for this reason that the government established the development licenses, so that the industry could meet the need for developing new and environmentally friendly innovations, so-called *eco-innovations*[5] as termed by Fussler and James (in Azevedo et al., 2014, p. 4). The idea is that Havfarm 3 will represent such an innovation, it does however remain to be seen if it actually is an eco-innovation, as it is still not sure how the installation will impact the environment. This uncertainty is likely why the governing system finds it difficult to decide exactly how to regulate the installation, again acting as a reminder that innovation in the private sector can often lead to a necessity of innovation in the public sector.

[5] Eco-innovations are defined as: ''*New products and processes which provide customer and business value but significantly decrease environmental impacts.''*.

Chapter 5: Methodical Framework

When writing a master's thesis, it is expected to give a thorough description of exactly what was done to answer the research questions. Thus, having a good research method and design is essential for constructing a well-written thesis. This way will best enlighten the research questions and make it possible to acquire new knowledge (Everett & Furseth, 2012). Briefly explained, the difference between method and design is that the research method is the scientific method chosen to answer the research questions, while the research design is the buildup and structure of the project. A project has only one design, but there can be several methods included in the design of it (Haukanes, 2016).

This thesis has a research design consisting of three main components; the theory, primary data and secondary data. The *theory* is based on peer-reviewed scientific literature on central terms such as innovation, technological innovation and governmental innovation, in addition to literature discussing the relationship between innovation in the private sector and the governing system. *Primary data* is un-processed material that is closest to the discussed matter with regards to time. It is information that you yourself have collected through conducting, e.g. interviews, field observations, public documents or letters. *Secondary data* is defined as data or information collected by others or from primary data for other purposes, yet it can still be data relevant to your research. This can be e.g. newspapers or textbooks (Haukanes, 2016; Everett & Furseth, 2012).

Traditionally, the collection of data happens through use of either quantitative or qualitative methods. *Quantitative methods* revolve around collecting data that can be measured in numbers and quantities. Here, exactness is a central term as the collected material is often represented through use of tables, graphical figures or other statistical portrayals (Befring, 2015). *Qualitative methods*, being the opposite, are more about the actual content and meaning of the collected data. Here, people's experiences and views are the important factor. Collecting such data is normally done through conducting interviews, observations or doing a document analysis.

The research questions of this thesis are about exploring challenges Havfarm 3 is thought to solve and various challenges it is going to encounter - or create for the governing system. Thus, it will be reasonable to have a *qualitative* approach to this study, a study that will be

built up similar to case, analyzing in-depth variables of a unit. Here, the discussion will focus on one thing; different challenges. However, reflections on what causes them and what the challenges might imply for the future will also be made. Points made will be based upon personal reflections from the interviewed stakeholders and supportive material collected from document analysis. Hopefully, it will be possible to gain knowledge of the stakeholders' perceptions and attitudes regarding the Havfarm 3 concept, which can be difficult to quantify. The idea behind the qualitative approach is to acquire a detailed insight and description of what the realization of Havfarm 3 might imply, while at the same time develop a better overall understanding. Therefore, it will be advantageous to adapt the research process to the results gained along the way.

5.1 Qualitative methods

If the goal is to gain a deeper understanding of phenomena, it would be wise to use qualitative methods. This, as the goal is to look at the logic behind actions to explain the *how*'s or *why's* of situations (Johannessen, Kristoffersen & Tufte, 2010). Followingly, to get a further better understanding of these matters explored, it is common to make use of interviews, observations or document analysis to collect material (Gripsrud, Olsson, & Silkoset, 2004). With regards to the research questions of this thesis, it will be most appropriate to interview a few, selected stakeholders, while also doing a document analysis.

Interview

A qualitative interview is characterized by lose conversation, where an interview guide highlights the various issues at hand. This is an opposition to quantitative methods, which usually makes use of questionnaires (Kunnskapssenteret, 2017). The advantage with a qualitative interview is that the informants are free to answer in the way they prefer. At the same time, in this way the process will be more time consuming. That is why this interview method bases itself upon a smaller selection of stakeholders, as it is the content that is the important factor here, not the quantity. However, a consequence is that the material obtained cannot be generalized in the same way as material gathered from quantitative methods (Klausen, 2016). Nevertheless, by carefully selecting informants, category-representative results are achieved, where the selected stakeholders are representative in relation to the category expected to enlighten. In this context, the specific informants chosen will also not be random, but carefully thought out.

Document analysis

In the context of this thesis, the term ‘’document’’ will here apply to all written sources that can be relevant in order to highlight the research questions. This involves public documents such as white papers, reports, news articles, scientific journals and other relevant articles found on the internet. The sources can be divided into three categories; primary, secondary and tertiary sources. Two of them are mentioned above. *Tertiary data* builds upon primary and secondary data, sources interpreted by others, such as lexicons, databases and bibliographies (Johannessen, 2013).

Today, there are numerous of ways to gather information regarding a subject, but not all sources can be regarded as credible. Therefore, an important thing to remember when making use of written material in research projects, is to be critical about the sources used. An author will always have a personal intention with the material being published and it is the author itself that sets the standard for which kind of discourse they want to be part of (Ulleberg, 2007). When gathering information, there are four criteria that are especially important to consider when assessing documents; *authenticity* (whether the document is what it seems to be or is forged), *credibility* (whether we can trust what the source tells), *representativeness* (whether the document is satisfactory for what we want to investigate or if the information is a result of randomness in the selected informants). The last criterion is *interpretation*; whether we comprehend the document well enough, as the author might try to affect the reader in some way (Storsul, 2005).

As a researcher, it is important to be critical of the information that is going to be used, especially when collecting information from the internet. Well-known media as e.g. Fiskeribladet and iLaks.no appear to be reliable, in the sense that they are serious actors describing current research findings or opinions as they appear, but also such sources will be influenced by the author. Here, the researcher has to have an open mind and understand that not necessarily all facts are *true* facts (Klausen, 2016). Public primary sources such as white papers are usually given extra credibility compared to e.g. a news article. However, do not forget that also the white paper is written in an ongoing discourse. The content of a public document represents the views of the ministry or directorate in question, where the critical objections are few. Nonetheless, it will be accurate to assume that public documents and textbooks and various forms of public statistics will have a high level of credibility and validity (Johannessen, 2013).

5.2 Selection process

When using qualitative methods, the informants selected must be chosen from a perspective of what you want to gain a better understanding of, and which attributes you know the relevant persons possess. Hellevik (1980) terms these two approaches *probability selection* and *non-probability selection* (discretionary selection). A discretionary selection can be wise to have in order to guarantee a varied selection, if such is necessary. At the same time, it is important to keep in mind that this type of selection can be biased instead of representative. Nonetheless, a biased selection is positive if you are looking to confirm various hypotheses. However, a discretionary selection can also be negatively skewed if it is desirable to test the hypothesis ‘’under the most adverse conditions’’ (Hellevik, 1980, p. 83).

In this thesis, the selection was based on a non-probability selection, as this is the more ideal approach to highlight the research questions at hand. Nordlaks was the first and most obvious stakeholder to select, as the thesis is a case study of their innovation. Secondly, to gain perspective over others who would be most relevant for the thesis, two main groups were established; (1) governmental agencies and (2) organizations associated in the industry. Within these groups, stakeholders where then determined based on their level of involvement with regards to Havfarm 3 getting development licenses and their importance with regards to the governance of Havfarm 3.

With this in mind, the selected stakeholders became: Three informants from the MTIF, one informant from the County Council of Nordland, one informant from the County Governor of Nordland and one informant from Hamarøy municipality. Contact were made with the Norwegian Food Safety Authority (group 1) and Steigen/Hamarøy Fishermen’s Association (group 2) as well, but due to no response and limited available time I ended up excluding them from the selection. As Steigen/Hamarøy Fishermen’s Association were the only informant I saw relevant from group 2, the final selection ended up consisting of governmental agencies (group 1) and Nordlaks. Initially, contact was made with the Directorate of Fisheries as well. However, they decided not to be available for interview and recommended to contact the MTIF instead. Personal interviews were made with all stakeholders in Bodø and Hamarøy, except from the informants from the MTIF and the County Governor of Nordland, whom I interviewed by phone. This, as those interviews were decided after returning from the trip. I travelled to Bodø by plane and drove to Hamarøy from Bodø.

The reason for selecting multiple stakeholders from the governing system, was to be able to gather as much information and as many perspectives as possible from various parts of the system. The final selection ended up including representatives from all levels of the governing system; national, regional and local, and in that regard, it was a satisfactory result. Having representatives from all levels, while also having an informant from Nordlaks, provides a varied selection, which is favorable. This, as discretionary selections often have a tendency to deviate ''from the universe'', as Hellevik (1980) points out. All selected governmental stakeholders have, either directly or indirectly, been a part of the process of allocating farming licenses to Havfarm 3 and is a part of deciding the locality of Havfarm 3. Everyone was contacted through email and responded fairly quickly. When conducting the interviews, the informants were given a brief introduction to the thesis and the research questions, while also being informed about the structure of the interview and what would happen with the collected material gathered during the interview. Everything has been done in accordance with the guidelines of the Norwegian Centre for Research Data (NSD).

5.3 Data collection

Semi-structured interview and interview guide

The type of interview method applied for this thesis was semi-structured in-depth interviews, a well-known method within qualitative approaches, applied to be able to delve into a phenomenon. With this type of method, it is wise to familiarize yourself with the topic to be enlightened, while also being aware of what kind of information it is desired to retrieve. Follow-up questions are an essential part of the process of acquiring new insights (Gripsrud et al., 2004).

An interview guide was made in advance, where the Nordlaks informant was the only one to request it being sent prior to the interview (Appendix I, II, III, IIII) taking place. The guide was adapted to each of the stakeholders, meaning that e.g. the MTIF guide (national level) was slightly different to the one of Hamarøy municipality (local level) and Nordlaks. Nonetheless, the guides where all greatly alike. Having an interview guide is clever in order to achieve a positive interaction with the informant during the interview, as it helps in keeping a fruitful conversation and to have discussion subjects prepared (Brinkmann & Tanggaard, 2012). These subjects and questions can vary each interview, as some might be less prioritized due to how the conversation develops. Some questions might even also be added

during the interview. The order of which my questions and prioritizations were initially set up did vary to some degree from interview to interview, all dependent on how the conversation developed along the way. After my trip to Bodø, I made some adjustments to the interview guide to make it more precise for the final two interviews I did by phone.

None of the interviews were recorded, instead notes were taken by hand during the interviews. This was something I experienced being stressful at times as it could be difficult to notice everything that was said while at the same time writing notes. The interviews started with casual conversations in order to kind of ease in to the important parts and have a relaxed environment. Having the interview guide helped greatly not to lose track of the important matters and to have a productive progression. However, informants were also given freedom in the sense that they were free to focus their answers on what they considered important parts of the subjects discussed. Naturally, some informants preferred to give long, broad answers, while others answered more precisely. Summarizing, doing the interviews were a pleasant experience as the informants were welcoming and gave excellent answers. I have the impression that the informants shared the same experience, where some of them expressed it in words.

Analysis of data

In order to gain best possible overview over gathered interview material, the notes taken during the interviews were quickly written in the form of a summarizing report after the interviews. This, as the likelihood of getting the best possible interpretation of information is highest straight after the conversation. Aase and Fossåskaret (2007) describe this as the phase when the interpreted reality will be translated to the ‘’formal language’’ of science. As a researcher, it is here important to be reflective, which means the necessity to recognize one's own point of view in the situation. Everyone has different backgrounds and perceptions that will influence the interpretation of what the informants tell. Here, everything from age and experience to professional background can have an influence on interpretations.

Several theories exist on how to analyze interview material in the most efficient way. Jacobsen (2005) emphasizes the categorization of the content in order to map out similarities and differences from each informant, doing so within each of the categories. The analysis of this thesis can be said to be loosely similar to this approach, but it was more of an intuitive decision than it was conscious. When reading through the summarizing reports I would note

the relevant categories (e.g. different types of challenges) next to the paragraph addressing it, in the designated color. I labelled each of the three research questions in their own colors. This made it easy to track back and find information I needed.

The interviews have been an important part of the thesis, providing material that especially came in handy when writing the discussion, as I gained new thoughts and perspectives. As they were held in Norwegian, it is me that have translated all material to English, including the direct citations presented in the thesis. The citations were approved by the informants on beforehand. Titles of various documents that were in Norwegian have also been translated to English by me.

Conducting the document analysis

The primary method applied to gather material was through doing the interviews. However, when I saw it fitting/necessary, I would look for material that could support or at least broaden the perspective of some of the answers given. Thus, the document analysis done for this thesis has not been a comprehensive one. For the governing system, an innovation like Havfarm 3 has raised many questions in terms of how the installation should be regulated, as there per now exists no regulatory framework for mobile aquaculture installations. Hence, information from governmental documents addressing these issues has been used in this thesis. It is important to examine the linguistic meaning behind the information gathered, both in terms of content and form in order to find the message in texts analyzed (Klausen, 2016).

A governmental document relevant to this thesis is the inter-ministerial report ‘’Aquaculture at Sea’’ from 2018. It addresses various issues the industry has to deal with in order to expand, among these issues are also the ones related to mobile aquaculture. A document like this can be considered both a relevant and credible primary source. In order to shed light on the problem of, e.g. salmon lice and escapes, published research reports will be most relevant, but also secondary sources from scientific journals that refer to these. If possible, it would here be sensible to check if the information is correct before choosing to use the source for its own use.

Development of the research questions

Since the start of this process of writing a master’s thesis until the end, the chosen research questions have to some extent altered. In the beginning, the approach was more deductive,

and I was focusing on which laws and regulations specifically that would encounter challenges in terms of the innovation Havfarm 3 represents. However, my approach changed during the process of constructing the interview guides and reading the ‘’Aquaculture at Sea’’. I chose to go for a more of an inductive approach, i.e. asking openly about what challenges Havfarm 3 might encounter or create. At the same time, some interview questions were still of a more specific character in order to not be too broad in the approach. This, by e.g. asking specifically how it is thought to solve the locality-related issue, as this is a highly central matter regarding the Havfarm 3 concept. Thus, I went for a more open approach in terms of the research questions and let the informants decide what would be my focus points in the discussion.

5.4 Quality of the data: Validity and reliability

How the material gathered is used is an important part of the study's reliability. The credibility of qualitative research methods has long been questioned. However, several researchers have come up with their own descriptions to prove its credibility (Shenton, 2004). The concepts of validity and reliability have traditionally been used in quantitative studies but are also now used to describe qualitative relationships Therefore, in qualitative studies, validity can also be called credibility/transferability and reliability can be called dependability/confirmability (ibid).

Validity

Validity says something about how well the gathered material covers the research questions to be enlightened. A necessity for gaining credibility is according to Shenton (2004) to have findings that correspond with reality. During a qualitative interview, the researcher needs to be aware of how the informant interprets the questions, while at the same time not force a desired perspective but instead let the informant contribute with their own opinions and views. A way to reassure yourself that what you have collected is credible is to, e.g. reconfirm the material by sending a summarizing report to the interviewee. The same principles apply to document analysis, it is necessary to be critical of your sources. Here, findings can for example be tested against other research, theories or by having a discussion with experts of the given subject. A different part of qualitative studies that can prove critical, is that the researcher’s views can affect the interpretation of the material, something that in turn will affect the final result (Shenton, 2004). The validity of this thesis should be well taken care of in the perspective of how the interviews were conducted, as summarizing reports were sent

out and their contents confirmed. A lot of time has also been spent reading and assessing the used documents.

Reliability

Discussing the reliability and dependability of a study means to assess its level of accurateness in terms of the collected material. A way of displaying this accurateness is by having a methodical framework chapter, such a chapter enables the reader to learn about the processes and experiences of writing this thesis, from beginning to conclusion. In qualitative studies, the interviews are normally less structured compared to quantitative studies, and different people will have different ways to interpret data due to views and age. Thus, for the reliability to be high, the approaches and decisions made should be explained as well as possible. The reliability of this study can be considered good, as the approaches made have been well-explained in this chapter. In addition, as material gathered from interviews have been reconfirmed through summarizing reports, the material should appear equally accurate as the reality.

External validity

External validity is about the transferability of the results, if they can be applied to a wider population. In terms of a qualitative study, since the findings are specific to a small selection of individuals, it is difficult to demonstrate that the findings and conclusions are applicable to other situations and populations. However, although each study may be unique, they represent also an example within a broader group. As a result, the prospect of transferability should not be immediately disregarded (ibid). The idea of this thesis is not to generalize the findings made, the purpose is not to transfer the phenomenon of Havfarm 3 and mobile aquaculture in general to other sectors. Although the results are difficult to generalize, they still represent valuable, specific examples that can be interesting for some.

To conclude this chapter, I found it reasonable to reiterate some thoughts from Hersoug (2005) to describe this thesis; this is my version and my choice of facts, with my perspective on things – thus, the thesis will have a unique conclusion. As a researcher, I have tried to look at the phenomenon that is Havfarm 3 from the perspective of an ‘’outsider’’. However, after two years as a student at the Norwegian College of Fisheries, my views and perspectives might of course be affected, in addition to my role as a ‘’neutral scientist’’.

Chapter 6: Results

This chapter will be divided in four sections; one section introducing the different stakeholders, and three sections divided amongst each of the different research questions; (1) which problems shall Havfarm 3 solve; (2) what challenges will it encounter; (3) what challenges will it create for the governing system. I will try to answer these research questions through use of material gathered from documents and interviews with different stakeholders. As mentioned, stakeholders interviewed are: the MTIF, the County Council of Nordland, the County Governor of Nordland and Hamarøy municipality, in addition to Nordlaks.

6.1 Stakeholders

Nordlaks

As mentioned, Nordlaks is the group behind Havfarm 3. It is a family owned aquaculture group consisting of several companies covering the entire production chain. The founder Inge Berg established Nordlaks in 1989 in Stokmarknes, and today the group has around 420 employees with activities spanning across 12 municipalities in the counties of Nordland and Troms in Northern-Norway.

The Ministry of Trade, Industry and Fisheries

The MTIF is the superior authority in the governing system of Norwegian aquaculture. Their responsibility is to provide the legal framework for the aquaculture industry, and responsible for the Aquaculture Act and the subsequent regulations. Formally, it is the ministry that decides the sectoral authorities suitable to regulate the aquaculture industry, unless something else is declared in the law. It was the MTIF that allocated the 21 development licenses to Nordlaks for their concepts; Havfarm 1 and 3.

The County Council of Nordland

In Norway, political governance is represented on three levels; Government (national), County Councils (regional) and Municipalities (local). The County Council is the people's elected council on a regional level, with primary tasks related to; transport, cultural activities, environment, dental health, public health, roads and high schools (Nordland County Council, 2019). The County Council of Nordland has jurisdiction over the county that includes the municipality where Nordlaks wishes to locate Havfarm 3. As mentioned, the County Council

is the coordinating authority when processing locality license applications for salmon farming.

The County Governor of Nordland

While the County Council is elected by the people, the County Governor is the government's representative on a regional level. Their task is to carry out objectives and goals set by the government and parliament. In the governing system of Norwegian aquaculture, the County Governor has two roles. One role is as a consultative body concerning the Planning and Building Act. Here, the County Governor has to make sure that national and regional interests and values are preserved when plans are developed. These could be interests related to ecosystem conservation, recreational activities and fishing activities. The other role is as a pollution authority with regards to the Aquaculture Act. When the County Council are allocating locality licenses, the County Governor has to give permission according to the Pollution Act in terms of emissions, but also conditions concerning wild salmon stocks are assessed.[7]

Hamarøy municipality

Hamarøy municipality is the proprietor of the sea area where Nordlaks wishes to locate Havfarm 3 (Figure 6.1). In the governing system of Norwegian aquaculture, the role of the municipalities is to take a position on what activities to allow where within their management area. According to the Planning and Building Act (2008), the municipalities have to plan their areas through use of a municipal master plan. The municipal management area stretches out to the baseline of the territorial sea plus one nautical mile.

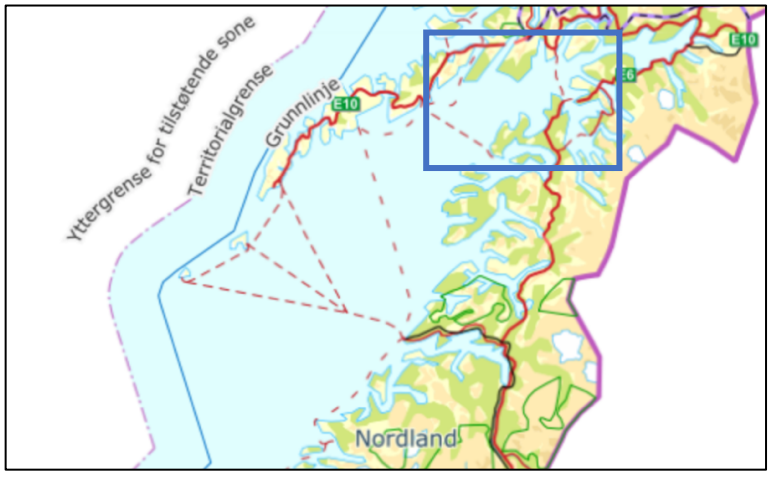

Figure 6.1: *Highlighted blue box is the sea area outside Hamarøy, in Northern-Norway. Source: Kartverket (2019)*

[7] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19

6.2 What challenges is it thought that Havfarm 3 will to solve?

Havfarm 3 was first of all made possible by the development licenses, which created incentives for developing large, technological innovations. Innovations that hopefully will help to push the industry further forward in a sustainable direction. The informant explained as follows:

> *We then thought this could be an opportunity to develop a mobile aquaculture installation. The advantage with such an installation is that it makes it possible to exploit new sea areas that previously have been unavailable due to great depths and rough weather conditions. Additionally, a mobile aquaculture installation will have the ability to adapt and coordinate according to other activities that uses the same areas, activities such as fishing and recreation.*[9]

In other words, Havfarm 3 could contribute with solving the challenge regarding area and available space. Available space for new aquaculture installations in the fjords has been a challenge for some time now and represents one of the main challenges the industry is dealing with. The informant from Nordlaks further added that through exploiting new areas, Nordlaks and the industry in general will be able to grow without developing a dense concentration of installations in areas where they traditionally have been located. Separating fish through time and space will act as preventive measure against disease outbreaks, salmon lice and negative impacts on the ecosystem. All, being concerns that the industry is having challenges with now.

To separate fish through time is to fallow, this is something Nordlaks wants to do more frequently. It is a procedure that will be possible with the Havfarm 3, combined with the company's new production strategy (Figure 6.2). Fallowing is used as a preventive measure to improve fish health and fish welfare. This strategy involves the smolt being in the sea for a shorter period of time, and the hope is that this will give the salmon lice less time to flourish before harvesting. Nordlaks is going to produce large smolt[10] (200-500 g) at the hatchery, which then will be put out in traditional net pens. When a weight around 1-1,5 kg is reached, the fish is then transferred a final time with well boats to the Havfarm. The fish will be in the Havfarm until a weight of 5 kg plus, is reached. In total, from hatching to packing should not

[9] Informant, Nordlaks. Interview in Bodø: 13.03.19
[10] Normal size of smolts transferred from the hatchery is 60-150 g (The Directorate of Fisheries, 2018)

take longer than 26 months. With such a strategy, the traditional net pens can be fallowed more frequent compared to today's standard, which involves having the fish from 18-22 months in the sea. This, meaning the net-pens are not fallowed that often. The idea behind this is to have lice free fish when it is transported to the Havfarm. Consequently, the plan is to avoid lice treatments at the Havfarm. This will minimize the use of medical drugs, and in turn, hinder impacts on the wild fish stocks. However, if there are lice on fish after being in the net pens, it will still be possible to conduct primarily non-medicine treatments while on board the well boats. The informant did not elaborate on which kind of treatments[11]

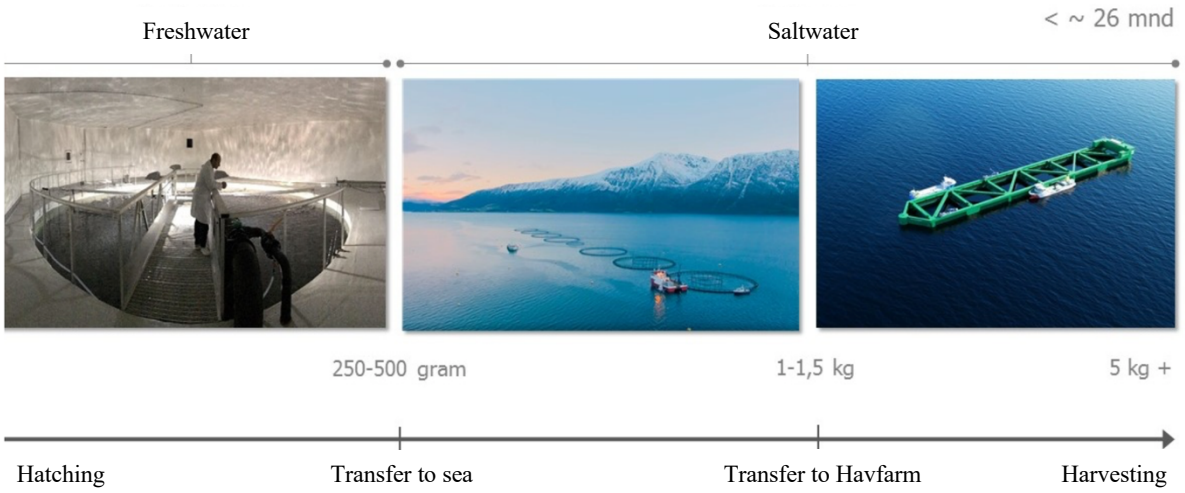

***Figure 6.2**: Graphical description of Nordlaks' new production strategy. Source: Adapted from Nordlaks (2019)*

The informant from Hamarøy municipality is also fond of the concept Havfarm 3 represents, and mentions the new production strategy the informant from Nordlaks talked about:

> *It is important not to neglect today's challenges the industry is facing. Havfarm 3 will make it possible to protect the environment and the ecosystems through utilizing new sea areas for aquaculture. This, combined with Nordlaks' new production strategy will most likely also contribute to improve today's challenges regarding the salmon lice.*[12]

[11] Informant, Nordlaks. Interview in Bodø: 13.03.19
[12] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19

Many of the other stakeholders I interviewed similarly agreed with regards to Havfarm 3 and the challenges facing the industry (Informants, MTIF; Informant, County Council; Informant, Nordlaks); that its purpose is to solve the challenge related to limited areas available for further growth. As the informants from the MTIF explained, this is the primary reason for why the concept was considered innovative and new, and hence, approved by the MTIF. The informant from the County Council explained that Havfarm 3 represents a solution to the densification of aquaculture installations:

> *It will be less location dependent and have the ability to reach previously unreachable areas. These are positive features. Additionally, there is a hope, and a belief, that through spreading the distances between aquaculture installations, the situation regarding salmon lice and diseases will improve.*[13]

The informant from Nordlaks also addressed the claims about salmon aquaculture causing severe damage to the fjord ecosystems where farming installations are located, especially to the seabed straight beneath and around the net pens. Agreeing that aquaculture does indeed leave an environmental footprint, but not to the extreme extent some are claiming. Saying that many create an impression of an industry that leaves irreversible damages on the environment, a claim that many in the industry does not support. The truth is possibly somewhere in between, and adds:

> *For example, regarding the challenge of available space; I agree that further development of the industry based on today's traditional technology will sooner or later lead to the industry reaching the tolerance limit of the ecosystems in the fjords and the limit regarding bio security. Thus, it is imperative that further development of the aquaculture industry in Norway is based upon us managing to provide new technology that makes it possible to move forward not at the cost of the environment.*[14]

Nordlaks' contribution to these challenges is thus the Havfarm project, consisting of the two concepts; Havfarm 1 and Havfarm 3. As the informant from Nordlaks says, in open waters the

[13] Informant, County Council of Nordland. Interview in Bodø: 15.03.19
[14] Informant, Nordlaks. Interview in Bodø: 13.03.19

total load will be less due to depth, topography and strong currents. A mobile aquaculture installation will also make it possible to optimize production conditions at all times.[15]

The informant from the County Governor also touches upon the subject regarding environmental pollution, adding that the installation will most likely not impact the environment as sediments and sludge from the net pens will be scattered in such a large area where currents are strong: ‘’Vestfjorden is open sea, so pollution wise it will most likely be fine’’.[16]

The informant from the County Governor finds the concept of Havfarm 3 exciting but is to some extent a bit more reserved in the way of answering, compared to other stakeholders. Adding that it is still uncertain how such a large production of fish at sea will affect the ecosystem: ‘’What will Havfarm 3 imply for wild fish in the area? Concluding that type of impact is not easy to do at this stage’’.[17] Regarding other challenges the industry is facing, the informant from the County Governor said that it is a bit difficult to tell exactly how well Havfarm 3 will contribute to solve those challenges. Saying that we have to wait until the planned impact assessment is completed. The informant believes that salmon lice and escaped farmed fish are classical issues that will follow Havfarm 3 regardless of how it will end up looking like

I asked the informant from Nordlaks how and if Havfarm 3 will solve the issue with farmed fish escaping from net pens. The informant replied that escapes is not the main reason as to why the concept was developed but says that safety obviously will be top priority when developing Havfarm 3. Adding that the construction will withstand any relevant weather condition within the area of the chosen locality. For example, the company’s own demands regarding risks related to casualty at sea are similar to the standards of an oil platform with personnel. The informant then goes on explaining that escapes in the industry is related to operational failures, e.g. de-licing, supply of fish or changing of nets:

> *In the Havfarm, a reduction of such operations will be facilitated for. Regarding more common operations, it will no longer be a need for using service vessels,*

[15] Informant, Nordlaks. Interview in Bodø: 13.03.19
[16] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19
[17] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19

the need for handling the fish will be reduced. Nets will be more robust and last longer than the traditional net pens, they will also not be copper impregnated.[18]

To summarize, as the informant says: ''Nordlaks is working in different ways to solve the challenges facing the Norwegian aquaculture industry today''.[19]

I also asked the informants from the MTIF about their thoughts on what Havfarm 3 will be capable to do with regards to other challenges than the area-related challenge. The informants from the MTIF agrees to some extent that Havfarm 3 might contribute to solving other industry related challenges but restates that Havfarm 3 first and foremost represents a solution to the challenge related to limited areas available for aquaculture. Adding that the challenges related with lice, diseases, escapes and other environmental impacts are less prioritized, with regards to this concept. The following quote displays their thoughts on how Havfarm 3 might contribute to solving other challenges as well:

However, if you locate the installation in an area where there are no lice and it is an area far from other farming installations, then naturally one would think that issues related with the lice will be minimized. Oppositely, placing the installation in an area close to other farming installations could prove to be quite challenging with regards to lice, since the number of salmon individuals will be so great.[20]

6.3 What challenges will Havfarm 3 encounter?

When I asked the informant from Nordlaks about the status of the project, it became clear that the process of obtaining a locality for Havfarm 3 has taken a long time. The informant explains that the locality process was initiated already back in autumn 2017, but at the time of doing the interview, little progress had been made. First, the plan was to apply for a dispensation from the municipal master plan, a plan approved by both the municipal executive board and municipal council: *''*They expressed that such a solution was in accordance with the planning strategies for the Salten region, 2017-2027*''*.[21] However, as the informant

[18] Informant, Nordlaks. Interview in Bodø: 13.03.19
[19] Informant, Nordlaks. Interview in Bodø: 13.03.19
[20] Informants, the MTIF. Interviewed in Tromsø by phone: 01.04.19
[21] Informant, Nordlaks. Interview in Bodø: 13.03.19

explains further, the local fishers and the Steigen/Hamarøy Fishermen's Association were not fond of this proposal – questioning how such a dispensation would work in practice, demanding an impact assessment. Other concerns, related to the fact that it was a large area in question, and not the best conditions for local cooperation and involvement, led to the decision of not developing a dispensation from the plan, but an area zoning plan instead. The decision was made by Nordlaks autumn 2018 during a meeting with governing stakeholders, consultant Akvaplan NIVA and the Fishermen's Association. The advice of developing a zoning plan instead of a dispensation came from the County Governor of Nordland.[22]

The informant from Nordlaks explained that they followed the decision up by having dialogues with both the County Council and the County Governor of Nordland to get a good understanding of processes and expectations. However, it turned out that such dialogues can prove difficult, as the governing system cannot pre-process cases. Thus, locality wise, they are waiting for the Committee for Planning Matters to deliver their recommendation regarding the area-zoning plan, to the Municipal Council. Getting a go ahead from the municipality implies that Nordlaks can develop the plan and proceed with applying for a locality in accordance with the Aquaculture Act. However, as the informant tells:

> *As of now, planned startup is uncertain. Basically, you could make a zoning plan for the entire sea area belonging to Hamarøy, but this is not something we wish or need. That would entail a process which probably would take years for Hamarøy to complete, and that is something we cannot wait for.*[23]

The explanation above portrays what has turned out to become a slow process in terms of getting a location. It has also proven a challenge for the engineers designing the Havfarm 3, as the informant from Nordlaks explains that in order to obtain all necessary information about how the installation must be designed, dimensioned, etc., they need to know where the exact location will be. This, because the installation has to be fitted to the conditions of the area it will operate within. According to case files from meetings in the municipality, the size of the proposed area is 75 km^2 (Plan- og ressursutvalg, 2019). This slow process seems like the

[22] Informant, Nordlaks. Interview in Bodø: 13.03.19
[23] Informant, Nordlaks. Interview in Bodø: 13.03.19

result of a regulatory framework that is not adjusted to cover mobile aquaculture installations, as the informant from Nordlaks tells:

> *The process has not been particularly efficient in terms of having the zoning plan work initiated. A mobile aquaculture installation would probably demand an adjusted framework that will properly regulate operations and locality questions related to mobile aquaculture. This type of framework was not ready when we received the development licenses, resulting in a situation where many questions has to be clarified between the companies and the governing system along the process development.*[24]

The informant from Hamarøy municipality agreed with the fact that the process regarding allocating a locality for Havfarm 3, has been a bit slow. Reconfirming that the slow process has posed a challenge for Nordlaks and Havfarm 3. The meeting of the Committee for Planning Matters had not been able to reach a conclusion on whether a recommendation with regards to the startup process of the zoning plan should be given or not. The informant explains that the reason for this decision was based on uncertainty in the committee:

> *The case will thus be forwarded to the municipal executive board. This is maybe not a decision that is favored by Nordlaks, I have an impression that they wished the process went a bit quicker. However, this is a decision that must not be stressed, it is important to get this done in the best possible way and that takes time*.[25]

The informant adds that a possible contributing factor to why the process has been a bit slow, is the fact that the municipality is in the midst of merging with a different municipality. That process is both time and resource demanding; hence, the municipality not having a new municipal master plan ready. According to the informant, making a decision with regards to Nordlaks' case could have been easier if the new municipal master plan had been adopted beforehand.

[24] Informant, Nordlaks. Interview in Bodø: 13.03.19
[25] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19

The informants from the MTIF also adds to this matter, explaining that an immediate challenge for Havfarm 3 is clarifying the locality question; how to define the location it will operate within. Adding that since it is a mobile installation, the current way of allocating a locality to a specific, limited and fixed geographical area is not a model that will fit the way Havfarm 3 is thought to operate: *''*This is a challenge we need to solve before Havfarm 3 is ready to operate*''*.[26]

From this reply, it is possible to draw a connection between challenges Havfarm 3 will meet and create. That is, the challenge it meets concerning a slow localization process, is a result of a challenge it creates for the governing system – that the governing system does not yet know how they should define the locality, thus, it will take time to figure out the best alternative. The innovations is challenging the governance system.

The County Council informant had less to say with regards to possible challenges for Havfarm 3, but mentions how the installation and the technology innovation it represents will contribute to increase competition from foreign stakeholders in the future. Explaining further that Nordlaks with Havfarm 3 and the industry in general is in a way creating its own competition: *''*A challenge is that the more one develops, the more one opens up for competition. It will be important for Norway to keep our competitive advantages related to competency and knowledge*''*.[27] However, the informant adds that development is normal and positive, even though increased competition is a natural consequence of it.

The informant from the County Governor raised yet another challenge Havfarm 3 might meet. This being challenges related to possible conflicts that can arise if Havfarm 3 becomes reality. Asking questions about how it will adapt to other interests in the same area, if it will be able to move quickly enough and if Nordlaks will always be willing to move the installation to accommodate for other activities:

> *These are interesting questions that possibly can create local conflicts. There are many considerations. Decisions regarding such an installation will always*

[26] Informants, the MTIF. Interviewed by phone from Tromsø: 01.04.19
[27] Informant, County Council of Nordland. Interview in Bodø: 15.03.19

impose conflicts. It is important to have a look at these conflicts and discuss if they are worth the wealth created through money and jobs.[28]

The informant from Hamarøy municipality did also talk about the importance of considering other activities and interests that make use of the same area that Nordlaks wishes to allocate Havfarm 3 in: *''*The same sea area where Havfarm 3 is planned to be situated in is also utilized by activities such as fishing, recreation and tourism*''*.[29] Regardless, the informant believes it is fully possible to have the same type of activities, to the same extent as now, even though Havfarm 3 would be present. The informant adds that even though fishery activities are present in the area, they are not significant. There are few registered catches. Moreover, to those who has the opinion of Havfarm 3 damaging Hamarøy's attractiveness for tourism, the informant tells:

Why cannot the Havfarm be an attraction in itself? It is fully possible. The installation will be big and unique; a sight that might be interesting itself. Furthermore, ship-like constructions are a familiar sight to the sea area outside Hamarøy – where ship traffic has been going on for a long time.[30]

Lastly, the informant from Nordlaks mentioned a different matter that I interpreted as a possible challenge not only for Havfarm 3, but also for the entire industry. That is the concern related to the fragmented regulatory framework and governing system the Norwegian aquaculture industry is subject to. The informant explains that the fragmented framework might represent a part of the reason as to why there is this regulatory uncertainty that particularly Nordlaks is experiencing the consequences of now, with Havfarm 3. Comparing this with the oil industry in Norway, the informant says:

The oil industry has always had a broad political coherence regarding how the industry should be regulated. This has led to a situation where the companies have predictability and the possibility to plan long-term in order to maximize wealth creation. The oil industry has also always had a complete regulatory

[28] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19
[29] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19
[30] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19

framework that is little fragmented, while the situation is opposite for the aquaculture industry, which have a more fragmented framework.[31]

The informant says that it is important to add that the authorities were obviously quite aware of the value of the oil, something that probably explains why they were so amenable towards supporting the oil industry. The informant further tells that the situation has been different for the aquaculture industry, as it really has only been the last ten years that the industry has shown its potential for becoming a significant wealth creator for both the communities along the coast and the nation as a whole. Compared with the oil industry, it has also been more uncertainties associated with aquaculture; e.g. uncertainties related to the consequences of biological production.

I found the comments from the Nordlaks informant regarding a fragmented framework quite interesting, thus, I wanted to question the MTIF informants on their thoughts about how the governing system is structured. This is what they replied:

When conducting aquaculture related activities in the sea, one operates in areas where different considerations must be done, and these considerations are regulated by different laws and regulations. In this manner one could say that the aquaculture industry has to deal with several authorities, but that structure is also a consequence of what kind of activities that are conducted. No matter how you twist and turn it, there will always be a lot of considerations to think about.[32]

The MTIF informants go on further explaining that how the governing system is structured, is also a question of organizational structure, i.e. how one wishes to organize the aquaculture industry. They mentioned two ways to approach this question. One way is a thematic approach, for example, that the pollution-oriented authorities specializes in pollution and the Food Safety Authority specializes in, in this case, fish health and fish welfare. The alternative approach would be to have a system based on different industrial authorities. This approach might suit one industry, but maybe not every industry, as with such an approach one loses the

[31] Informant, Nordlaks. Interview in Bodø: 13.03.19
[32] Informants, the MTIF. Interviewed by phone from Tromsø: 01.04.19

perspective that many authorities have today. That e.g. one authority deals with pollution-related questions for many industries. The informants say:

> *It is simply a question of organizational structuring – which approach one chooses to take. An interesting question indeed, a subject one can say a lot about and it is not given that one approach is better than the other approach.*[33]

Conclusively, the informants from the MTIF add that it is important and reasonable to have good coordination between authorities and that case proceedings are managed as smoothly and efficiently as possible. Here, the informants admit that the governing system of Norwegian aquaculture could still improve. This, despite the fact that the system is organized as a ‘’one-stop-shop’’, where the process regarding allocating a location is significantly simpler than in many other countries.

6.4 What challenges will Havfarm 3 create for the governing system?

The informant from Nordlaks understood that the solution the Havfarms represent will most likely create challenges for the governing system, as both Havfarm 1 and 3, and other similar innovations, are completely new to the aquaculture industry. The informant follows up by saying that, this implies a lot of uncertainty related to how today’s regulatory framework should be applied, as it is a framework that has a design based on familiar technology, i.e. traditional farming installations:

> *That is probably why there are few clarifications attached to how the framework should be applied or understood together with initiating such development projects. As a result, this could lead to a need for getting dispensations for certain measures, since the existing regulatory framework is not adapted…We in Nordlaks hope that there is capacity and a will within the governing system to handle these challenges*.[34]

Even though Havfarm 3, as a result of the development licenses, is creating challenges for the governing system, the informant from Nordlaks still thinks positively of the licensing round

[33] Informants, the MTIF. Interviewed by phone from Tromsø: 01.04.19
[34] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19

and the situation they are in now. Explaining that it might be a good thing that someone leads ahead, tries out different operating models and challenges the regulatory framework along the way:

> *The development licenses and our project are maybe an example showing that innovation also within the governing system, is pushed forward by the companies themselves. This, instead of the governing system having a fixed or predetermined framework setting the perimeters for how and where the companies can innovate*.[35]

However, the informant adds that in this way there could also be a risk that the framework becomes indistinct and little consistent over time.

The informants from the ministry did, as the informant from Nordlaks, touch upon the subject of the relationship between innovations in the industry and the governing system of the industry. Explaining that they consider it a healthy situation that innovations in the industry are challenging the governing system, thus, causing the regulations to adapt and update. Furthermore, they add that periods of intense technology developments might prove a challenge for the governing system with relation to its capability to keep up. Therefore, as they explain, it is important that the governing system adds an extra effort towards following developments and having a good dialogue with stakeholders from the industry and those who develop technology. In this way, the governing system might be able to foresee what kind of challenges they might face in the future. As they mention, the ‘’Aquaculture at Sea’’ report (Norwegian Government, 2018) is a result of trying to be at the forefront of development.

The relationship between innovations in the industry and the governing system is further explained like this:

> *There will always be a certain gap between those who are at the forefront of innovation and what is established in the legislation, as it is not us that are innovators and technology developers. Alternatively, the other way around could be that the governing system is tightly connected to technology advancements*

[35] Informant, Hamarøy municipality. Interview in Hamarøy: 14.03.19

through trying to predict the many directions an industry can develop itself in. In this way, we might be able to be ahead of technology developments. The problem is that this structure could possibly imply spending a lot of time and resources on developing a regulatory system for innovations that are never realized. Something that would be a waste of resources for the society. Therefore, we think it is only healthy that the governing system is being pushed by the technological innovations.[36]

The informants from the ministry did not provide a clear-cut answer regarding exactly what challenges Havfarm 3 creates for the governing system. Explaining that there are many questions and issues raised by such an innovation that Havfarm 3 represents. That is the reason for why they have, in collaboration with other ministries, put together the report ''Aquaculture at Sea'' (2018). The report tries to tackle the various challenges that arise due to the new technological innovations that are slowly beginning to appear, as a result of the development license round.

The informants from the ministry did however emphasize one matter from the report; how to define a locality for a mobile aquaculture installation. The informants told the report offers three suggestions acting as solutions to this challenge. Whereby the solution they emphasize as maybe the most appropriate one, is the suggestion that involves having two localities where the installation can operate within. When it is allowed to move is then decided in an approved operating plan that must also contain sailing routes.

The ''Aquaculture at Sea'' (2018) report describes the three proposed solutions. First, it suggests that the mobile installation will receive one area specific locality where it stays anchored, and then it is allowed to sail from that location to either the hatchery or the packing station with an approved operating plan including sailing routes (Appendix Va). Second, , the one the informants from the ministry highlighted,, which is similar to the first solution, but the mobile installation will have two locations to legally operate within, and fish will be both brought and collected with well boats. The mobile installation will have the possibility to move to the other location if e.g. weather conditions become too rough. The localities can be viewed as one summer and one winter locality. When stationed in either of the localities the

[36] Informants, the MTIF. Interviewed by phone from Tromsø: 01.04.19

mobile installation must be anchored and have an approved operating plan with sailing routes, similar to the first suggestion (Appendix Vb). Third, is different from the first two, where the mobile installation is constantly moving with use of its own propulsion machinery throughout the whole production period. The mobile installation has a permit, but no locality. All production happens within the limits of the approved operation plan included with allowed sailing areas. Here, fish is transferred with use of well boats (Appendix Vc).

When mentioning sailing routes, I am here referring to what the report explains. Mobile aquaculture installations that sails around with, or without fish, as a part of the regular operations, will need to have sailing routes (corridors) to move between locations. These will be areas where the installation cannot be anchored or fixedly positioned in a different way. Thus, it is thought that mobile aquaculture installations will need to have a combination of localities and sailing routes.

I asked the Nordlaks informant about their thoughts on how the installation would operate within the given area and how it would move around. To this, the informant answered that the plan is to have several permitted areas for anchoring (Havfarm 3 will have its own anchor, not fixed anchor points) where the production would take place. This, including a ‘’safety zone’’ where the installation can be situated if weather conditions in other areas would be above the set limits. The informant adds that the fish will be in the pens as normal during relocation, but there will be no feeding, and it will be important to monitor the fish in relation to exterior conditions (weather, currents, etc.).

Furthermore, the informant from Nordlaks explained that the installation will not be in constant movement, like the third solution from the report (Appendix 1c). This, regardless if allowed several permitted areas for production, where they move between predetermined corridors or if they end up with a certain area, where they can roam freely around. Adding that the idea is to occupy as little space as possible, so that other activities can still take place in the adjacent areas.

The informant I spoke with at the County Governor told me that since Havfarm 3 is an innovation representing something completely new, being an installation very different from traditional ones. Thus, it will be a lot of uncertainties related to how it is going to be managed and regulated. Adding that many of these uncertainties relate to area planning and the

Aquaculture Act. The informant further tells that the County Governor has the opinion of Havfarm 3 being aquaculture within a limited area. Saying that it has to be regarded as use of area similar to other traditional localities and not just a ship with fish moving around. The informant explains that there is ,however, a difference between this type of locality related to Havfarm 3 and traditional localities:

> *The difference is that with Havfarm 3 we are talking about a very large area. Therefore, it must be regulated together with other activities and use purposes. Essentially, this will be a multiple use area, but should include regulations that separate the activities from each other. One regulation could be about the Havfarm's placement during the different parts of the year, taking into consideration other activities. In this way, Havfarm 3 will not disturb other activities. These kinds of regulations could contribute to minimize negative consequences.*[37]

However, later on in the interview the informant revisits this issue, further explaining:

> *It will still be difficult to clarify these issues related to area planning. In one way we are not talking about a locality here, but a ship with fish that moves around. On the other hand, we could say that it definitely is an aquaculture locality, just that it is an unusually large locality where the entire locality is not used at all times for aquaculture activities – different from traditional localities. The challenge here is to clarify how we should define the installation and the locality.*[38]

Regarding the decision of choosing a zoning plan instead of applying for a dispensation from the municipal master plan, the informant tells that this decision from Nordlaks came after a recommendation from the County Governor. The informant explains that a zoning plan is more beneficial as it is a more wholesome process that involves all stakeholders. A dispensation is more limited in this regard.

[37] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19
[38] Informant, County Governor of Nordland. Interviewed by phone from Tromsø: 26.03.19

The informant from the County Council had a different angle to this research question, answering that the challenges created by Havfarm 3 are challenges related with facilitation and side effects of introducing such an installation. The informant explains that an enormous facilitation is necessary, both regionally and locally, in order to be able to handle the increase in mass production of salmon. Logistics wise, a packing station and other facilities has to be expanded or built in order to facilitate the huge amounts of salmon that will come from Havfarm 3, and these will be costly investments. Due to Havfarm 1, the informant explains that Hadsel municipality has applied for an investment of 30 million NOK in total from the County Council, in addition to raising a loan from Nordlaks. This, in order to be able to expand the current quayside to a size that will be able to handle the production from Havfarm 1. The informant continued:

> *They will also have to improve the infrastructure around the area, build new reception facilities. A pallet factory is also being built. In other words, there is a large logistics process ongoing and everything has to be ready by 2022, when the first harvesting is planned to take place.*[39]

The answer given by the informant shows that Havfarm 3 will likely have implications for logistics as well. One of the consequences of Havfarm 3 will probably be an increase in heavy transportation, as there will be a need for more semi-trailers to transport the increased amount of fish. The informant hopes for stricter demands paving the way for a more environmentally sustainable development of the industry, saying that one way of minimizing this particular issue could be to use trains as a means of transportation of fish on a greater scale than today.

The importance of proper infrastructure is also stressed in the ‘’Aquaculture at Sea’’ report (2018). Likewise, the report explains that marine aquaculture projects (e.g. Havfarm 3) will likely lead to an increase in production volumes and total transportation load. Thus, a well-developed infrastructure must be in place for the aquaculture industry to operate as efficient and environmentally friendly as possible. According to the report, the Norwegian government has initiated and prioritized the work of improving transportation links across the Barents region. This is a joint project together with Norway’s land-neighboring countries. Nordland County has conducted a so-called freight flow analysis (godsstrømanalyse) showing that the

[39] Informant, County Council of Nordland. Interview in Bodø: 15.03.19

seafood industry accounts for almost 20% of the heavy transportation in the county. Thus, the report stresses the importance of also emphasizing efficient and environmentally friendly transportation methods. This could be through improving the possibilities for transportation via trains, planes or ships, and in this manner, replace some of the heavy transportation.

The informant from the County Council concludes by answering that management wise, the challenges caused by Havfarm 3 will be related to an increase in case proceedings and new management related issues. Consequently, the County Council might have to adapt, to a certain extent, how they approach tasks and issues related to the aquaculture industry.

Chapter 7: Discussion

The empirical findings presented in the previous chapter have given insight to what industry related challenges Havfarm 3 is thought to solve, and what challenges the interviewed stakeholders think Havfarm 3 will encounter and create. Now, the remaining part will be to have a look at the research questions in a larger perspective. It will be important to reflect thoroughly around all three research questions and establish a connection between the empirical findings and the theoretical framework presented in chapter four. This, to gain a better understanding of the subject from different viewpoints.

7.1 What challenges is it thought that Havfarm 3 will solve?

In the theoretical framework, it is explained that one of the reasons as to why innovations arise, is to be able to deal with challenges (Trott, 2012). Essentially, this is what Havfarm 3 is a result of. The empirical data shows that Havfarm 3 will, first and foremost, contribute with solving the challenge of limited available area for aquaculture. Additionally, there are also reasons to believe Havfarm 3 will contribute with solving the environmental-related challenges as well. The likelihood of it being a solution to the challenges related to pollution from the net-pens, is highest, but it is also likely that it can deal with the challenges related to salmon lice and diseases. However, to become certain in terms of what it can do for the environmental-related challenges, a risk assessment has to be done.

Innovations are, according to Schumpeter's innovation theory and the Oslo Manual, new combinations of resources and knowledge that results in something significantly different from what exists today. These new combinations can be new or improved products or processes, e.g. new green technologies (Geldes, Felzensztein & Palacios-Fenech, 2017). Further, innovations can represent incremental changes or radical changes (Holte, Sønvisen & Holm, 2016). Relating this theory to Havfarm 3, it is clear that the installation represents a technological product innovation of a radical character, primarily. In addition, if it contributes to the greening of the industry, it can be viewed as an eco-innovation as well, as defined in the theory (Azevedo et al., 2014). Moreover, it is a radical innovation, because of the technology it represents, and the implications it is causing for the governing system, making it approach the regulation of aquaculture in a different way. In the theoretical framework, I explained that Havfarm 3 stands as an example of it being hard to distinguish between incremental and

radical innovations. However, at the end of this section I will explain why I, after analyzing the material, define it as radical innovation.

With the materialization of Havfarm 3 in the sea area outside Hamarøy, new areas become available for aquaculture activities. This is important, as there are not many of the so-called superlocalities available today. However, it is also possible to imagine that the installation will not help solve the area-related challenge. As the informant from the County Governor pointed out, uncertainty prevails in terms of how Havfarm 3 will affect, e.g. wild fish in the area. If it turns out that the negative effect on wildlife outweighs the positive side of enabling the use of new areas, then a possible outcome could be that Havfarm 3 will not be allowed to be situated in the sea area outside Hamarøy. Thus, the result will be that Havfarm 3 does not contribute to solving the area-related challenges.

Fløysand and Jakobsen (2017) write, that the advantage of locating an installation in open sea areas, is that the water is continuously replaced, which is not possible at inshore locations. Thus, open sea will likely contribute to a sufficient spatial distribution of sediments and other particles from the net-pens even though it is still uncertain. Furthermore, there are also reasons to believe that Havfarm 3 will contribute with solving the challenges related to salmon lice and diseases, as separating fish in time and space should act as a preventive measure against the lice and infections. Again, the article from Fløysand and Jakobsen (2017) provide substance to that claim, writing that a localization of fish farms far enough apart, can drastically improve fish health and welfare, as interaction between farms and any danger of infection are minimized. Additionally, the article states that it will likely also reduce the salmon lice issue, as the lice does not prosper in open sea due to lower temperatures. Nevertheless, it is important to remember that Havfarm 3 will make use of open net-pens, i.e. the same type of technology used by traditional net-pens. Thus, the environment will still be prone to negative externalities from the installation, either way.

There exists little empirical evidence suggesting what the outcome of Havfarm 3 might imply for the environment, thus, not providing guidance in decreasing the uncertain outcome. In Norway, the only comparable installation that is actually realized, is the Ocean Farm 1[44]. As it became operational only recently (in 2018), it is too early to know the possible environmental

[44] SalMar's marine aquaculture installation, which according to the company is the first offshore fish farm in the world (SalMar, 2019)

implications due to its presence in the area. In China, a copy of Ocean Farm 1 has been constructed, but that installation is also very new (SalmonBusiness, 2018). Hence, there will be uncertainty related to environmental impacts of the Havfarm 3, also after its realization, if that becomes the case. It is important to be realistic about the situation; the environmental challenges will likely never disappear, but hopefully the industry will find technology, e.g. Havfarm 3, that minimize their impacts to an insignificant level.

In all fairness, I do not believe it is likely that Havfarm 3 is not materialized. Firstly, as an offshore fish farm (Ocean Farm 1) has already been materialized, thus, precedence has been created. Secondly, politically it represents a solution that is favored by the current liberal and ''industry-friendly'' government. It is also preferred by all of the public authority informants interviewed. There are some critical voices, but as the informant from the County Council of Nordland explained, there is no substance in the criticism.

Ultimately, there seem to be no solid argumentations stating why Havfarm 3 should not be realized. Realizing the Havfarm 3 concept will result in the sought-after increase in production levels and consequently, an increase in value as well. Additionally, the huge greening potential innovations such as Havfarm 3 has in terms of solving the environmental-related challenges, make them very attractive for both industry and governing system (Fløysand & Jakobsen, 2017). Thus, in this sense, it will become difficult to not materialize Havfarm 3, even though there is a risk of it not ending up successful. As the informant from Nordlaks said regarding the testing of new technology: ''Unfortunately, this is the meticulous and painstaking crawl towards the future that the industry must undergo and which we must have acceptance to undergo''.[45]

Fortunately, the knowledge gained from these processes will be shared, and in the end, the industry will hopefully be left with solutions that will contribute to solve the challenges prohibiting further growth. Conclusively, Nordlaks and Havfarm 3 will likely be allowed to operate in the sea area outside Hamarøy, thus, solving the area-related challenge and likely contribute to improve the environmental situation of the industry.

[45] Informant, Nordlaks. Interview in Bodø: 13.03.19

The reason for why I considered Havfarm 3 incremental, was because it will make use of similar open net-pen technology as traditional fish farms. Thus, in that sense not contributing to a technology renewal. However, visually, Havfarm 3 looks like a radical innovation straight away, as the structure and design resemble nothing like a traditional fish farm. Additionally, it has the ability to move, thus, opening up possibilities never before available to aquaculture. Further, as Fløysand and Jakobsen (2017) put it, installations like Havfarm 3 implies a high technology disruptiveness, a high greening potential and a strong industrial renewal. All, factors that describe a radical innovation. Like written in the theoretical framework, a radical innovation is the introduction of something where development leads towards a brand-new direction, never before explored (Haukanes, 2016). The article also explains, that marine operating installations will require radical adjustments in the regulatory framework, allowing for aquaculture in exposed open-ocean environments. Next section of this chapter will clarify why radical adjustments are needed.

7.2 What challenges will Havfarm 3 encounter and which will it create?

After interpreting the results, I have come to the conclusion that the second and the third research questions are greatly interrelated, in the way that the challenges Havfarm 3 encounters, is greatly caused by itself creating challenges for the governing system. Thus, for the next part of this discussion, I will reflect upon the two research questions together.

The main challenges Havfarm 3 encounters are related to slow and lengthy case processes, stalling the progression towards materialization. Interestingly, this is happening as a result of Havfarm 3 also creating challenges; specifically, the challenge of regulatory uncertainty. This relationship creates what the theoretical framework refers to as the pacing problem, or the innovation gap. Further, there are also reasons to believe that these challenges are enhanced as a result of a regulatory and organizational framework of the governing system that is perceived as fragmented. Challenges related to local conflicts and infrastructure, are also identified, while a problem not only Havfarm 3 will encounter, but the industry as a whole, is the challenge of increased competition in the future.

The pacing problem: The issue at the root of it all

As mentioned in the theoretical framework, the pacing problem is what many researchers refer to as the gap caused by the private sector innovating at a rate higher than what the public sector is able keep up with, in terms of policy making (Eggers & Turley, 2018; Marchant,

Allenby & Herkert, 2011; Moses, 2011). When looking at the identified challenges in a broader perspective, it becomes clear that the main challenges Havfarm 3 is encountering and creating, are primarily due to this existence of an innovation gap. This is essentially what it all boils down to.

How is Havfarm 3 contributing to the pacing problem? The installation is a result of a technological product innovation by the private sector, made possible by the public sector's innovation-liberal policy instrument – the development licenses. With the development licenses, the governing system facilitated for large technological innovations, and in that way, fulfilling its task as a promoter of innovation, as mentioned in the theoretical framework (Rønning & Teigen, 2007). However, what is now also evident, is that the governing system's decision to promote large innovations in the private sector, has led to a need of fulfilling its other task; innovation in the public sector (ibid). This, to be able to keep up with the pace at which the aquaculture industry is innovating. Thus, as a result, Havfarm 3 is contributing to the pacing problem because it is at the forefront of innovation, while the governing system is not – it is lagging behind. Hence, the pacing problem arises.

Now, closing the gap is unlikely. The approaches demanded for that to happen will cause situations not optimal for both the sectors; public and private. One approach is to have a governance form where the governing system, to a great extent, restricts the allowed radicality of innovations. However, this approach would imply regulations acting as barriers for innovation, Holte, Sønvisen and Holmen (2016) explain that in this way, the industry might miss out on opportunities and technologies that could increase efficiency in production, or even cheapen production. Such a scenario occurred in the US and Ireland, where heavy regulations caused production to stagnate at small volumes (Osmundsen, Almklov & Tveterås, 2017). Hence, value creation is not maximized. A different approach is, as mentioned by the informants from the MTIF, where the governing system is highly pro-active and prepares several regulatory frameworks for possible future innovations. Yet, either this is favorable, as such an approach would imply an immense allocation of time and resources to develop regulatory frameworks for innovations that might never exist. Consequently, the pacing problem will likely always persist, thus also, uncertainties and complexities as explained in the theory.

What is the correct approach in order to at least minimize the pacing problem between Havfarm 3 and the governing system? The theoretical framework mentions the need for an adaptive and flexible approach in the governing system of Norwegian aquaculture, not a one emphasizing stability and control (Osmundsen, Almklov & Tveterås, 2017). Further, Marchant, Allenby and Herkert (2011) explain this as improving the capacity of the current governing systems, even if it would imply abandoning traditional forms of governance. In the Deloitte report by Eggers and Turley (2018), five principles for regulating emerging technologies are discussed, where the focus is on adopting models that are agile, iterative and collaborative in order to face the challenges created by new technological innovations, while at the same time still be able to promote innovations. Here, it is possible to draw a direct connection to what the theoretical framework refers to as the public sector's need to promote innovation, but also make sure the sector itself is innovative (Rønning & Teigen, 2007).

Looking forward, the pacing problem will not become any less of a problem in the future. This, as technology advancements will never stop. It has been estimated that it has been created more scientific knowledge the past four decades than what was created in the previous 5,000 years (Marchant, Allenby & Herkert, 2011). As technologies make new products, governing systems might not be able to keep up due to lack of knowledge and capacity. Thus, the laws that are already in existence, may not be sufficient in order for the regulatory regime to operate as effectively as it has done the past (Moses, 2011). Similar to Havfarm 3, other projects as a result the development licenses are likely also creating regulatory issues for the governing system. Thus, it is clear that this governmentally driven wave of innovation that the aquaculture industry is experiencing now, is likey largely demanding for the governing system, in terms of both resources and time spent coping with the challenges. As a result, the accumulation of all these projects and subsequent challenges might contribute to widen the innovation gap, as Eggers and Turley (2017) predict. If not, the innovations at least solidify it, making sure that the pacing problem will always be present. If the development projects turn out to cause too much trouble for the governing system, a scenario could be that the government will restrict innovations to a greater extent in the future. However, that remains to be seen. In terms of Havfarm 3, the bare minimum the governing system can do to deal with the pacing problem and the regulatory uncertainty that follows, is to at least have good communication and collaboration with Nordlaks. In general, the governing system should put extra efforts towards following developments in the aquaculture industry, so that sound productivity is ensured.

Coping with regulatory uncertainty

As seen, the governing system is perceiving uncertainties related to the regulation and governance of Havfarm 3. In the theoretical framework, it is emphasized that in general, this knowledge shortage will always persist due to the volatile and non-linear biological features of the industry (Osmundsen, Almklov & Tveterås, 2017). Clarke and Stewart explain in the book *''The Managing Care Reader''* (2003), that when dealing with a policy problem without an obvious or established (or even common-sense) solution, i.e. a problem that is creating regulatory uncertainty, it is important to think holistically. That implies embracing new ways of thinking and working, work across organizational/sectorial boundaries and involve the public. To a certain extent, the MTIF and other ministries has worked in such a manner, through putting together the prior mentioned inter-ministry report ''Aquaculture at Sea'' (2018). As mentioned, it is here, that the governing system comes with suggestions on how to tackle the various challenges, including the urgent issue of defining a locality for mobile aquaculture installations. As explained in the results chapter, three solutions are suggested in this report (Appendix V).

When comparing, it seems as the second solution (two locations) is the one most similar to the idea Nordlaks got of a locality for Havfarm 3. The difference is that Nordlaks wishes more than two locations to increase flexibility in terms of adapting to weather conditions and other activities in the same area. As seen previously, Nordlaks would also like a location that can act as a ''safety zone''. I interpret this safety zone as a location that is shielded and closer to land than the other locations. Initially, Nordlaks' suggestion seems fair and sober; it tries to facilitate Havfarm 3 for every possible situation. However, there is a paradox involved in the idea of a safety zone, an idea that contradicts the purpose for why the Havfarm 3 concept was approved by the MTIF; to operate in areas previously unavailable to fish farming activities. As mentioned, the safety zone location sounds similar to what a traditional aquaculture locality is. Thus, if Havfarm 3 is stationed in such a location it does not really provide any help in dealing with the area-related challenge the industry is facing. If Havfarm 3 is in need of a safety zone, a question surfacing then, is whether Havfarm 3 will actually be able to withstand any kind of rough conditions in the area it is thought to operate in? And also, if it has several other localities initially (not considering a safety zone), should not that provide sufficient security? Nonetheless, the need of having a solution for a worst-case scenario is understandable, as security for both employees and the biology must be of highest considerations.

Out of the three solutions suggested by the report and the solution Nordlaks wants, the third solution in the report (constant movement), is the least likely and least realistic one out of them all. Current locality regime for aquaculture areas, based on the Plan and Building Act (2008), enables the adoption of plans that provide areas for aquaculture exclusively, or through multipurpose areas where aquaculture is included. As soon as an aquaculture installation has received a locality according to this regime, the locality is exclusively fixed to that given geographical area. In other words, a mobile aquaculture installation being in constant movement would be a fundamental disruption of this regime. Due to this fact, the more suitable solution is to determine two (or more) localities where Havfarm 3 can be anchored and where it must follow specific sailing routes when moving between localities.

Even though Nordlaks expressed their plan is to have several localities and not have Havfarm 3 constantly moving, it is possible to believe they might have wanted a more flexible system. However, such a system, which would be closer or similar to the report's third suggestion, would probably take years before it could be developed and implemented. The reason is that a system based on constant movement would have required an immense coordination between Nordlaks and every other stakeholder operating in the same area (fishing, recreational, tourism, etc.). Such a coordination would be very demanding, both in terms of resources and time available. As written in the theoretical framework, legislation processes are notoriously slow (Marchant, Allenby and Herkert, 2011). With this in mind, and the fact that Havfarm 3 is planned to be ready for implementation in 2022, establishing and implementing such a regime as described above, would likely not be possible before 2022. The governing system has already got to work swiftly enough, in order to solve the many challenges that arises.

A fragmented framework, a contributing factor?

It is apparent that the inevitable pacing problem is the core issue to the relationship between Havfarm 3 and the governing system, where the installation encounters challenges due to the ones it causes. However, could there be any other factors contributing to this innovation gap and regulatory uncertainty? Tracking back, I wrote that the fragmented framework might be a factor that enhances these challenges the governing system has to deal with, thus also slowing down Nordlaks' case progression. Both the informants from Nordlaks and the MTIF talked about the structure of the current framework, where the informant from Nordlaks believed it might be a part of the problem, while the informants from the MTIF said the answer is not clear-cut, it depends. In the theoretical framework, it is written that the fragmentation of the

governing system does indeed contribute to a regulatory uncertainty (Osmundsen, Almklov & Tveterås, 2017). Solås et al. (2015) explain in their report about the regulatory framework of the aquaculture industry, that the current framework is greatly complex; there is for a fact 344 paragraphs relevant for the industry and that are being controlled by different agencies. It has been a problem that uncertain knowledge has led to different conclusions about suitable policies and regulations among different stakeholders, and across time. For example, regulations implemented to control disease, parasites and escapes are abundant in the regulatory framework of the industry. New and increasingly detailed policies attempt to mitigate these issues but rather contribute to a regulatory framework that is complex and fragmented. An intricate web of regulations and policies between an abundance of governmental agencies and levels of jurisdiction are a result of this (Osmundsen, Almklov & Tveterås, 2017).

In the theoretical framework, Rønning and Teigen (2007) explain that a sound and effective organization of the public sector is important due to two factors; how accessible innovation becomes for the private sector and the public sector's ability to govern and be innovative itself. There is no doubt that the governing system of Norwegian aquaculture are doing well in terms of politically being a promoter of innovation, while also fronting a policy that makes innovation possible. However, to deal the challenges that has arisen from having innovation-friendly policies, it is likely to believe that a less fragmented and byzantine framework would have minimized the pacing problem in general, and thus, the consequent challenges as a result of the gap. As Marchant, Allenby & Herkert (2011) points out, technology advancements are only becoming more complex, as more stakeholders become involved in the regulatory process. This, further slows down the potential for rapid regulatory action.

Local conflicts

Apart from the challenges related to slow and lengthy processes, another challenge highlighted as a one Nordlaks and Havfarm 3 will encounter, is the challenge of local conflicts. As seen, the informant from the County Governor of Nordland raised interesting questions on how Havfarm 3 will adapt to other interests in the same area. It is definitely possible that local conflicts (tourism, recreational, fisheries, etc.) can arise if the Havfarm 3 concept is materialized, as large implementations such as Havfarm 3 are often followed by local tensions and conflicts. Little is written about negative consequences of innovation (Sveiby, Gripenberg & Segercrantz, 2009), but Rogers (1995) writes that most innovations

cause both desirable and undesirable consequences. An example of this is where air-cooling technology in larger cities ended up raising the temperature of the city streets (Niilola, 2017). Thus, there are definitely reasons to believe that Havfarm 3 will raise conflicts. It is an example of an innovation created to solve at least one challenge but might end up raising others. Consequently, it will be important to consider the possible conflicts and discuss whether they are worth the values Havfarm 3 creates, in financial as well as employment terms. Keep in mind that distinguishing what are considered significant conflicts will vary among the different stakeholders involved.

Infrastructure

It seems like there will also be challenges related to infrastructure due to Havfarm 3, as highlighted by the informant from the County Council and the aforementioned report ''Aquaculture at Sea''. Both sources point toward the importance of having a well-developed infrastructure that provides a platform for the industry to be as efficient and environmentally friendly as possible and develop further. In the theoretical framework, it is stated that it is important that the public sector provide a well-built infrastructure that promotes productivity and efficiency in the private sector. This relates to the governing system's two main roles, as mentioned several times (Rønning & Teigen, 2007). In terms of economic benefits, it seems there is not much to gain, as Holtz-Eakin & Schwartz (1995) explain in their article, that similar to other research, they found little support in the claims of a dramatic productivity boost from improved infrastructure. Thus, the challenge of infrastructure seems to be a challenge that is more urgent in terms of the possible environmental benefits, than the economic ones.

Increased competition in the future

The challenges related to increased competition from foreign stakeholders were also emphasized during interviews. This might not be a significant challenge at the time being but is highly likely to become a one in the future. Havfarm 3 and other development projects will without a doubt contribute to provide the global market with technologies that make it possible for other countries (than Norway) to carry out salmon farming on a similar industrial scale. In that sense, Norway is itself contributing to minimize its comparative advantage, i.e. the many deep fjords providing excellent conditions for farming salmon. Fløysand and Jakobsen (2017) explain that especially land-based farming installations, will lead to the loss of comparative advantage, a scenario also applicable to the case of marine aquaculture

installations as well. For example, as mentioned China has already seized the possibility to take advantage of the technology Norwegian aquaculture has developed, as a Chinese company has copied the Ocean Farm 1 project of SalMar and developed their own version (SalmonBusiness, 2018). Agreeing with what the informant from the County Council said, development and advancements of an industry is both normal and positive, but it will be important for Norway to at least keep the comparative advantages related to competency and knowledge.

Chapter 8: Conclusion

In a time where several area and environmental-related challenges are hindering further growth of the Norwegian aquaculture industry, the development licenses have become the latest licensing regime established by the Norwegian government to stimulate technological innovations that shall contribute to solve these challenges. One development license project is Havfarm 3, a mobile aquaculture installation owned by the group Nordlaks. However, it is yet to be materialized, as it is a technological innovation creating challenges for the governing system in terms how to regulate it. As a radical innovation it represents new technology never before explored in the aquaculture industry. Thus, the purpose of this thesis has been to explore some of the many questions that arise in the wake of such an innovation as Havfarm 3.

The challenges Havfarm 3 shall solve

Havfarm 3 represents a solution that primarily will contribute to solve the challenge regarding limited areas available for aquaculture and further aquaculture growth. The intention is to locate Havfarm 3 in open sea areas, farther out from the fjords, where fish farming installations traditionally have been located. Its propulsion machinery makes it mobile and thus possible to operate in areas of great depths and strong currents. However, as the discussion shows, Havfarm 3 is also likely to contribute to solve some of the environmental-related challenges as well; particularly, sedimentary pollution, salmon lice and diseases. These challenges are likely reduced for Havfarm 3, as water is continuously replaced in open sea area, securing sufficient spatial distribution of sediments. Havfarm 3 will also operate far away from other aquaculture installations, minimizing interaction; hence, this should drastically improve fish health and welfare. It is also a fact that salmon lice do not prosper in open sea due to lower temperatures.

The challenges Havfarm 3 may encounter and create

The challenges Havfarm 3 may encounter, are greatly interrelated with the challenges it creates for the governing system. Thus, the governing system is experiencing regulatory uncertainty, as Havfarm 3 represents a new technology. As a result, Havfarm 3 is encountering challenges of slow and lengthy case processes, which stall the progression towards materialization. These processes take time because of difficulties in how to define a

locality for a mobile aquaculture installation. Consequently, the current regulatory framework is not adapted to regulate an innovation like Havfarm 3.

When looking at the identified challenges in a broader perspective, it shows that the main challenges Havfarm 3 is encountering and creating are primarily due to the pacing problem. This is essentially the root of the challenges. The pacing problem arises as a result of the public sector not being able to keep up with the rate at which the private sector is innovating. Of which Havfarm 3 is an example. The slow progression is because of the lack of knowledge in terms of how to regulate the installation. Thus, an innovation gap arises.
This thesis also reveals that it is highly likely that the governing system's fragmented regulatory and organizational framework is enhancing the uncertainty it is experiencing with Havfarm 3. Previous research has also found that the framework of today's governing system is highly complex and intricate, a situation that indeed is contributing to regulatory uncertainty (Osmundsen, Almklov & Tveterås, 2017; Solås et al., 2017). The organization of the governing system and its approach to governance must be designed to emphasize collaboration and adaptability, in addition to building regulatory competence. In this way, the pacing problem will become less of an issue and reduce regulatory uncertainty.

Further, the thesis identifies that Havfarm 3 might encounter challenges related to local conflicts as it shall be located in an area utilized by other activities as well (tourism, recreational, fisheries, etc.). Moreover, the governing system must improve the infrastructure to facilitate for the increased production of Havfarm 3. Lastly, there is also a possibility of increased competition from foreign actors, as technological innovations in Norway are adopted. In this way, technological innovations are contributing to minimizing the comparative advantage of Norway's aquaculture industry.

Although this thesis is limited, as it focuses on Havfarm 3, it has hopefully contributed with valuable insights. However, research providing an even broader perspective is needed. This includes other innovative projects that are a result of the development-licensing round, as those projects will raise different uncertainties and challenge the governing systems in different ways. Because of the governance challenges and the pacing problem, perhaps innovations in the industry must be more restricted in the future or perhaps the governing systems learn how to adapt to it. A fitting phrase to describe this thesis is; uncertainty. However, at least one thing is certain, there will always be room for improvement.

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Appendix I

Intervjuguide: Nordlaks

Introduksjon: Dette intervjuet omhandler 'Havfarm 2' og hva slags utfordringer en slik innovasjon skaper for dagens forvaltningssystem.
Problemstilling: Hvilke forvaltningsmessige utfordringer innenfor kommunens ansvarsområde oppstår av en slik løsning som Havfarm 2 representerer? Dette med tanke på areal, lokalitet, drift, miljø og fiskevelferd.
Anonymitet: Navnet til intervjuobjektet vil ikke bli brukt i oppgaven, men heller referert til som 'en representant fra X'
Datainnhenting: Båndopptaker vil ikke bli brukt, intervjueren vil kun skrive notater.
Tid: +/- 30-40 min

Kategorier	Intervjuspørsmål
Om deg Generelt	• Løs samtale, hvordan havnet du i Nordlaks • Tanker om fremtidig vekst i næringen/i Nordlaks

Her ønsker jeg å finne ut hva statusen for Havfarm 2 er per dags dato	• Hvor står saken per dags dato?
	  • Hvordan kom dere frem til at å etablere en reguleringsplan for havområdet til Havfarm 2 er det beste alternativet?
	  • Hvorfor landet dere på valget av å etablere en reguleringsplan? I stedet for å søke om dispensasjon på området, for eksempel
	  • Hvordan ser reguleringsplanen ut?
	  • Hvor ønsker dere at området for Havarm 3 skal ligge?
	  • Hvor stort er dette ønskede området?
	  • Når satser dere på å få sendt inn søknad om lokalisering?
	• Har dere fått et forhåndstilsagn fra fiskeridirektoratet?
	  • I så fall, hvilke føringer legger den?
	• Når er det tiltenkt at anlegget skal stå klart til bruk?

Her ønsker jeg å finne ut hvorfor Nordlaks landet på en slik løsning anlegget representerer	• Hvorfor Havfarm 2?
	• Hvordan mener dere Havfarm 2 vil bidra med tanke på dagens utfordringer næringen opplever? Hvorfor er Havfarm 2 en bedre løsning enn tradisjonelle merder?
	  • På hvilken måte bidrar Havfarm 2 til å løse lakselusproblematikken?
	  • På hvilken måte bidrar Havfarm 2 til å minske risikoen ved utslipp fra oppdrettsanlegg?
	  • På hvilken måte bidrar Havfarm 2 til å minske sannsynligheten for rømming?
	  • Det er kjent at flytting av levende fisk er en stor risikofaktor for spredning av sykdommer. På hvilken måte bidrar Havfarm 2 til å minske sannsynligheten for sykdomsutbrudd?
	  • For mobile anlegg kan det være mer krevende å forutse smitte på villfisk. Hvordan skal dere unngå å påvirke

	villfiskstammer om de oppholder seg i områder nært Havfarm 2? • På hvilken måte mener dere det ikke vil oppstå konflikter med andre aktiviteter i samme området hvor Havfarm 2 skal ferdes?

Her ønsker jeg å finne ut hvordan det er tiltenkt at Havfarm 2 skal driftes	• Vil anlegget kunne samle opp slam og andre rester fra notene? Hvis ja, på hvilken måte?
	• Vil anlegget fortsatt kunne være i normal driftstilstand når det er i bevegelse?
	• Vil det være mulig å heve anlegget når vær eller andre forhold gjør det aktuelt? Hvis ja, vil dette på noen måte påvirke fiskevelferden?
	• Er det tiltenkt at anlegget skal være i kontinuerlig bevegelse eller kun flyttes på mellom faste lokaliteter etter interne/ytre behov/forhold? Eller ønsker dere en annen løsning?
	• I henhold til rapporten ‘’Havbruk til Havs’’, når det gjelder hvordan anlegget skal flyttes på, ønskes det en løsning gjennom lokalitetsklarering og/eller en driftsplangodkjenning av seilingsruter? Hva anser dere som beste alternativ og hvorfor?
	• Det er lovfestet at fiskeriaktiviteter og generell ferdsel må forholde seg en viss avstand unna oppdrettsanlegg. Havfarm 2 skal gå for egen maskin og være 300-400m langt, dermed kreves en god frist med tanke på kursendring. Ser dere da noen utfordringer for hvordan lovregelen er utformet i dag? Eller er den tilstrekkelig?
	• Er dere enige med rapporten på det punktet hvor den mener at mobile anlegg burde klassifiseres som skip og derfor bli underlagt reguleringer som omfavner skipsfart?
	  • Dette vil i så fall kreve et mannskap, hvordan ser dere for dere at besetningen på anlegget ser ut?
	• Ettersom anlegget skal drives for egen motor, hvilken fremdriftsløsning er det tiltenkt for Havfarm 2?
	  • En løsning mer miljøvennlig enn vanlig bensin/diesel?
	• Andre forvaltningsmessige utfordringer et slikt anlegg kan gi?

Sluttkommentarer	• Rundt hvilken vekt settes smolten ut i merdene i den nye tredelte produksjonsstrategien? • Andre kommentarer?

Appendix II

Intervjuguide: Departement

Introduksjon: Dette intervjuet omhandler 'Havfarm 2' og hva slags utfordringer en slik innovasjon skaper for dagens forvaltningssystem.
Problemstilling: Hvilke forvaltningsmessige utfordringer innenfor kommunens ansvarsområde oppstår av en slik innovasjon som Havfarm 2 representerer? Dette med tanke på areal, lokalitet, drift, miljø og fiskevelferd.
Anonymitet: Navnet til intervjuobjektet vil ikke bli brukt i oppgaven, men heller referert til som 'en representant fra X'
Datainnhenting: Båndopptaker vil ikke bli brukt, intervjueren vil kun skrive notater.
Tid: +/- 30-40 min

Kategorier	**Intervjuspørsmål**
Om deg Generelt	• Løs samtale • Tanker om fremtidig vekst i næringen • Hva er deres rolle i forvaltningssystemet av havbruk i Norge?

Her ønsker jeg å finne ut hvorfor Fiskeridirektoratet landet på å godkjenne en slik løsning anlegget representerer	• Hva slags synspunkter har dere på Havfarm 2?
	• Hvilke problemer/utfordringer som næringen har, kan HF2 løse?
	  • Areal? Produksjon?
	  • Minske sannsynligheten for rømming?
	  • Minske risikoen ved utslipp fra oppdrettsanlegg?
	  • Løse lakselusproblematikken?
	  • Det er kjent at flytting av levende fisk er en stor risikofaktor for spredning av sykdommer. På hvilken måte bidrar Havfarm 2 til å **minske** sannsynligheten for **sykdomsutbrudd**?
	  • For mobile anlegg kan det være mer krevende å forutse smitte på villfisk. På hvilken måte representerer Havfarm 2 en løsning som unngår dette problemet?

Her ønsker jeg å finne ut hvordan Fiskeridirektoratet mener at Havfarm 2 skal driftes	• Ser dere for dere at anlegget skal være i kontinuerlig bevegelse eller kunne flyttes på mellom faste lokaliteter dersom interne/ytre forhold/behov krever så? Eller ønsker dere en annen løsning? • I henhold til rapporten ''Havbruk til Havs'', når det gjelder hvordan anlegget skal flyttes på, ønskes det en løsning gjennom lokalitetsklarering og/eller en driftsplangodkjenning av seilingsruter? Hva anser dere som beste alternativ og hvorfor? • Utviklingstillatelsene vektla bl.a. løsninger som kunne løse miljøutfordringene. Havfarm 2 skal driftes for egen maskin. Hvilke tanker har dere rundt hvis Havfarm 2 skal driftes på fossilt brensel? Vil det da på en måte være et 'steg tilbake' med

	tanke på å løse miljøutfordringene? Burde de benytte seg av andre løsninger?

Her ønsker jeg å finne ut om hva Fiskeridirektoratet mener om at en innovasjon som Havfarm 2 fører til at dagens forvaltningssystem blir utfordret	• Hvilke utfordringer vil HF 2 møte på?
	
	• Hvilke utfordringer oppstår for forvaltninga ved introduksjonen av denne innovasjonen HF 2 representerer?
	  • Hvilke utfordringer oppstår når regelverket ikke er tilpasset slik type teknologi HF 2 representerer?
	  • Hvordan responderer forvaltningen?
	
	• Hvilke synspunkter har dere på at det i dette tilfellet er innovasjonen (Havfarm 2) som skaper utfordringer for dagens forvaltningssystem? Og ikke forvaltningen som former innovasjonen. Positivt? Utfordringer?
	
	• Hvilke synspunkter har dere rundt den foreslåtte ideen om å utarbeide en reguleringsplan for sjøområdet? Som nå virker å bli løsningen med tanke på areal og lokalitet
	  • På hvilken måte er det bedre med en reguleringsplan i stedet for å søke om dispensasjon for bruk av området som per nå ikke er regulert for akvakultur?
	
	• Hvordan opplever dere samordningen mellom forvaltninga og næringen?
	
	• Om §18 om fiske og ferdselsforbud i akvakulturdriftsforskriften: Havfarm 2 skal gå for egen maskin og være 300-400m langt, dermed kreves en god frist med tanke på kursendring. Ser dere da noen utfordringer for hvordan lovregelen er utformet i dag? Eller er den tilstrekkelig?
	
	• Samtidig, båter på over 21m kan ikke ferdes i det tiltenkte området til Havfarm 2. Hvilke synspunkter har dere på at det nå kanskje skal driftes et 300-400m langt ‘’skip’’ i dette området? Også sett sammen med at det kanskje må en endring til i §18 nevnt ovenfor som øker avstand krevd.
	
	• Hvilke andre forvaltningsmessige problemer kan et slikt anlegg gi?

Sluttkommentarer	• Andre kommentarer?

Appendix III

Intervjuguide: Kommunen/Fylkeskommunen

Introduksjon: Dette intervjuet omhandler 'Havfarm 2' og hva slags utfordringer en slik innovasjon skaper for dagens forvaltningssystem.
Problemstilling: Hvilke forvaltningsmessige utfordringer innenfor kommunens ansvarsområde oppstår av en slik løsning som Havfarm 2 representerer? Dette med tanke på areal, lokalitet, drift, miljø og fiskevelferd.
Anonymitet: Navnet til intervjuobjektet vil ikke bli brukt i oppgaven, men heller referert til som 'en representant fra X'
Datainnhenting: Båndopptaker vil ikke bli brukt, intervjueren vil kun skrive notater.
Tid: +/- 30-40 min

Kategorier	**Intervjuspørsmål**
Om deg Generelt	• Løs samtale • Tanker om fremtidig vekst i næringen
Her ønsker jeg å klargjøre synspunktene de har rundt Havfarm 3	• Hva slags tanker har dere rundt Havfarm 3: Positive? Problemer? • Hva vil Havfarm 3 kunne bidra med til for kommunen/fylkeskommunen? • Hva mener lokalbefolkningen om muligheten av at et slikt anlegg skal driftes her i området? Har dere innsikt i dette? • Hva mener de lokale fiskerne om muligheten av at et slikt anlegg skal driftes her i området?

Her ønsker jeg å finne ut hva statusen for Havfarm 3 er per dags dato	• Hvor står saken per dags dato?
	  • Støtter dere forslaget om en reguleringsplan for hele området?
	  • Hvordan vil denne i så fall se ut?
	  • Hvorfor er det ikke bedre med å få til en dispensasjon for området i stedet for reguleringsplan?
	  • Hva forventer dere å evt. få igjen for å stille et så stort havområde til disposisjon?
	• Er det startet med noe form for forarbeid på området? (Konsekvensutredning)

Her ønsker jeg å finne ut hvordan Havfarm 3 passer inn i fylkets regionsplan/kommunens arealplan	• På hvilken måte er/er ikke Havfarm 3 forenelig med hvordan dere ønsker å forvalte vannområdene tilhørende dere? • Er det noen områder Havfarm 3 ikke kan operere i grunnet andre formål/bruk av området? • Vil Havfarm 3 kunne føre til problemer for andre bruksaktiviteter i nærområdene?
Sluttkommentarer	• Andre kommentarer?

Appendix IIII

Intervjuguide: Fylkesmannen

Introduksjon: Dette intervjuet omhandler 'Havfarm 2' og hva slags utfordringer en slik innovasjon skaper for dagens forvaltningssystem.
Problemstilling: Hvilke forvaltningsmessige utfordringer innenfor kommunens ansvarsområde oppstår av en slik innovasjon som Havfarm 2 representerer? Dette med tanke på areal, lokalitet, drift, miljø og fiskevelferd.
Anonymitet: Navnet til intervjuobjektet vil ikke bli brukt i oppgaven, men heller referert til som 'en informant fra X'
Datainnhenting: Båndopptaker vil ikke bli brukt, intervjueren vil kun skrive notater.
Tid: +/- 30-40 min

Kategorier	**Intervjuspørsmål**
Om deg Generelt	• Løs samtale • Hva er deres rolle når det gjelder havbruk? • Hva er deres synspunkter om Havfarm 3?
Her ønsker jeg å finne ut hva de mener Havfarm 3 burde utrette	• Med tanke på forurensning, naturvern og andre interesser, hva slags synspunkter har dere på Havfarm 3? • Hvilke problemer er det Havfarm 3 skal løse? Hva bidrar den med? Areal, lus, sykdom, miljøpåvirkning, rømming, produksjon
Her ønsker jeg å forhøre meg om utfordringer Havfarm 3 vil møte	• Hvilke utfordringer/problemer vil Havfarm 3 møte?

Her ønsker jeg å finne ut hvordan de mener Havfarm 3 utfordrer forvaltningen	• Hvilke utfordringer oppstår for forvaltninga ved introduksjonen av denne innovasjonen Havfarm 3 representerer?
	  • Hvilke utfordringer oppstår når regelverket ikke er tilpasset slik type teknologi Havfarm 3 representerer?
	  • Hvordan responderer forvaltningen?
	
	• Hvilke synspunkter har dere på at det i dette tilfellet er innovasjonen (Havfarm 3) som skaper utfordringer for dagens forvaltningssystem? Og ikke forvaltningen som former innovasjonen. Positivt? Utfordringer?
	
	• Hvordan opplever dere samordningen mellom forvaltninga og næringen?
	
	• Hvilke andre forvaltningsmessige problemer kan et slikt anlegg gi?

Sluttkommentarer	• Hva er bakgrunnen for anbefalingen av områderegulering? • Andre kommentarer?

Appendix V

Va)

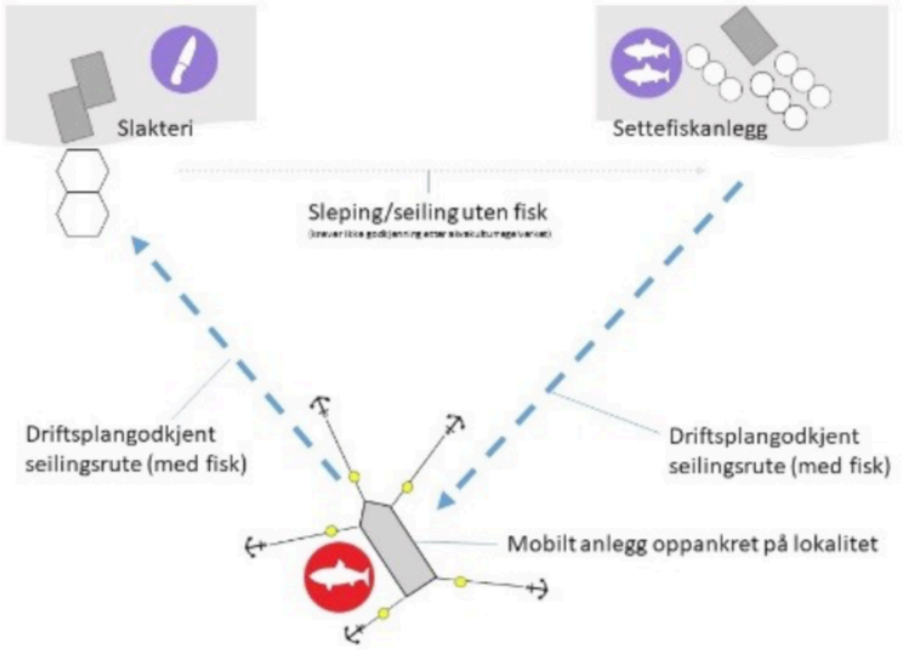

Figure 1: A mobile aquaculture installation with one locality. Source: the ''Aquaculture at Sea'' report.

Vb)

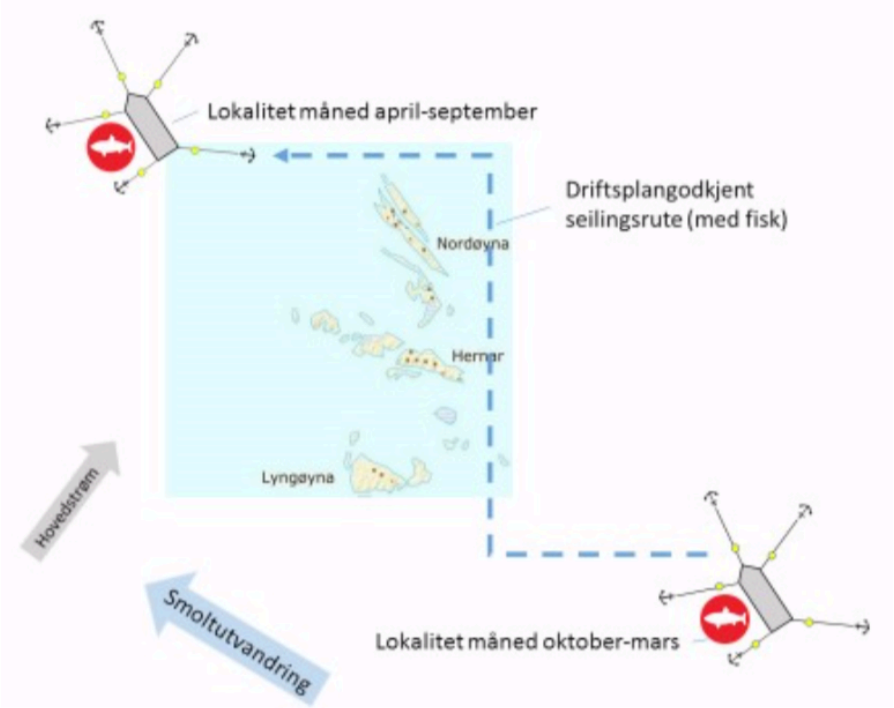

Figure 2: A mobile aquaculture installation with two localities. Source: the ''Aquaculture at Sea'' report.

Vc)

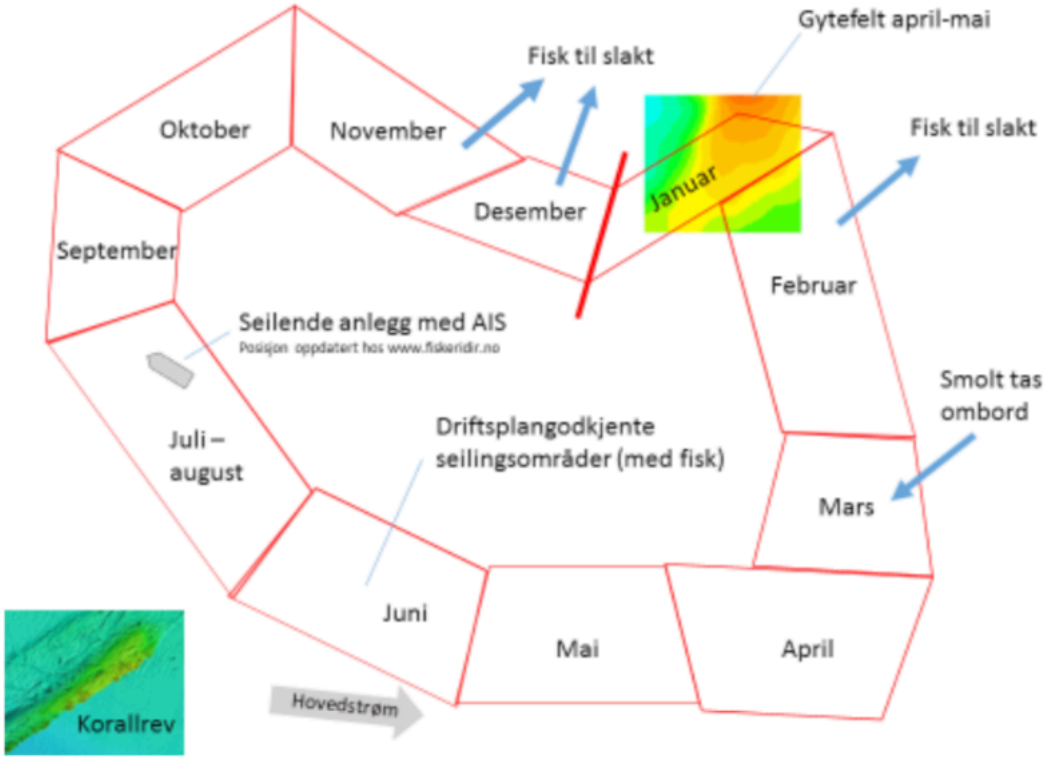

Figure 3: The mobile aquaculture installation constantly in movement throughout the whole production period. Source: the ‘’Aquaculture at Sea’’ report