

USMAN ZAHID BAJWA (9150) & EIRIK TAPIO (9043)
SUPERVISOR: RAGNAR TVETERÅS

Sustainability in the Norwegian aquaculture industry: The green financing, accreditation and certification conundrum

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Abstract

This thesis explores the conundrum of green financing, accreditation, and certification in the context of sustainability in the Norwegian aquaculture industry. As the demand for sustainable practices in aquaculture continues to grow, the industry faces the challenge of reconciling financial considerations with environmental objectives. The study highlights sustainability and how it encompasses various dimensions, including environmental, financial and productive considerations, as it has become a key focus in the global discourse on responsible resource management. It then examines the role of green financing instruments, such as green bonds, in promoting sustainable initiatives and attracting capital for environmentally friendly projects. It also delves into the complexities arising from the presence of multiple accreditation and certification schemes, which create ambiguity and hinder comparability of environmental performance. To give this scenario an on-going context, this paper compares leading Norwegian aquacultural companies; SalMar, Mowi & Grieg Seafood, in terms of their role and involvement in achieving sustainable practices as well as securing capital from green-financing. The research highlights the need for harmonization and standardization efforts to ensure transparency, credibility, and accountability. Moreover, the thesis underscores the importance of collaboration between industry stakeholders, regulators, and NGOs to address the challenges and advance sustainable practices. Through a comprehensive analysis of the green financing, accreditation, and certification landscape, this study provides valuable insights and recommendations for achieving sustainability in the Norwegian aquaculture industry. By considering the complexities and embracing a multi-faceted approach, the industry can navigate the conundrum and make significant progress towards a more sustainable future.

Preface

This thesis explores the conundrum of green financing, accreditation, and certification in the Norwegian aquaculture industry. It is the culmination of our passion for sustainability and our desire to contribute to responsible aquaculture practices.

We are grateful to our thesis supervisor: Ragnar Tveterås for his guidance and support throughout this research journey. I also extend my appreciation to the University of Stavanger for giving us the opportunity to write this thesis.

This thesis builds upon the work of previous researchers and aims to contribute to the existing knowledge on sustainability in aquaculture. By addressing the complexities of green financing, accreditation, and certification, we hope to inspire positive change in the industry.

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Introduction

The Norwegian aquaculture industry has experienced remarkable growth over the past few decades, establishing itself as a significant contributor to the country's economy and global seafood market. However, this growth has also raised concerns regarding its environmental impact and long-term sustainability. As the industry strives to address these challenges, a conundrum arises in navigating the complex interplay between green financing, accreditation, and certification mechanisms.

This thesis aims to explore the conundrum surrounding the green financing, accreditation, and certification practices in the Norwegian aquaculture industry while shedding light upon issues and on-going practices with sustainability within the aquaculture industry. By examining the interplay between the mechanisms, the thesis seeks to explicate on the opportunities, barriers, and potential synergies that exist in promoting sustainability. Through an in-depth analysis of the current landscape, including relevant policies, industry practices, and stakeholder perspectives, this research aims to provide valuable insights for decision-makers, industry leaders, and other stakeholders involved in shaping the future of Norwegian aquaculture.

The concept of sustainability encompasses various dimensions, including ecological, economic, and social considerations (Glavič & Lukman, 2007), and it has become a key focus in the global discourse on responsible resource management. In the context of aquaculture, sustainable practices aim to minimize environmental degradation, ensure the responsible use of resources, and promote social well-being within and beyond local communities (Ajmal et al., 2018). Achieving sustainability requires a multifaceted approach, which often involves adopting innovative technologies, implementing robust management strategies, and establishing effective regulatory frameworks.

One critical aspect of promoting sustainability in the Norwegian aquaculture industry is financing. Green financing, characterized by investment in environmentally friendly projects, has gained significant attention in recent years as a means to drive positive change. By directing capital towards sustainable aquaculture initiatives, green financing can encourage the industry's transition towards more environmentally responsible practices. However, the implementation of green financing mechanisms in the aquaculture sector is not without its challenges. Determining the

eligibility criteria, identifying suitable investment opportunities, and ensuring transparency and accountability are all complex tasks that need to be addressed to leverage the full potential of green financing.

In addition to financing, accreditation and certification play a pivotal role in enhancing the sustainability of the aquaculture industry (Ponte, 2012). Accreditation programs and certification schemes serve as valuable tools for verifying and recognizing environmentally and socially responsible aquaculture practices. They provide consumers with assurance about the products' quality and origin while incentivizing producers to comply with stringent sustainability standards. However, the proliferation of different accreditation and certification schemes can create confusion and fragmentation, making it difficult for industry stakeholders to navigate and select the most appropriate mechanisms. Balancing the need for standardization and harmonization while accommodating the unique characteristics of the Norwegian aquaculture industry presents a significant challenge.

In order to better understand the ecosystem of the aquaculture industry, this thesis has been divided into two primary parts. The first part caters to the “**Sustainability**” aspect within the aquaculture industry, by identifying important challenges faced in order to consider practices as sustainable practices within the industry. The second part provides insight and focuses upon “**Green Financing**”, its certification and accreditation, with a link towards sustainability to gain insight on whether or not green financing caters to issues related with sustainability within the aquaculture industry in Norway.

Sustainability as a major factor of influence in aquaculture

Like any form of agriculture, aquaculture has environmental impacts as well as financial implications that can threaten the long-term sustainability of the industry. Environmental sustainability gets threatened due to intensive farming practices, such as high-density stocking, use of antibiotics, and the release of waste into the surrounding environment, which lead to pollution, habitat destruction, and the spread of disease. Financial sustainability on the other hand is essential for continuing profits and production practices whereby lack of secured financing as well as reduced profitability can lead towards wastage of investment and resources, resulting in an even greater environmental impact. Moreover, productive sustainability in itself plays a major role

within the industry as it directly relates to finding a balance between environmental impact & social responsibility while ensuring maximum production and efficiency in production.

As per Tacon et al., (2009), ensuring the environmental, financial & productive sustainability of aquaculture farming is therefore crucial for the long-term viability of the industry and for protecting the health and well-being of the ecosystems in which it operates. Sustainable aquaculture farming aims to balance the needs of economic viability with environmental and social responsibility by using practices that minimize the industry's environmental impact, promote biodiversity, and support the health and welfare of fish and other aquatic organisms.

The demand for seafood is increasing rapidly due to the growth of the global population and changes in dietary habits. As a result, aquaculture has become an essential source of fish for consumption purposes. However, unsustainable practices such as overfishing, the use of harmful chemicals and antibiotics, and poor waste management can have a negative impact on the environment and the long-term viability of the industry (Asche, 2008). By promoting sustainability in aquaculture, we can ensure that we meet the growing demand for seafood in a way that does not harm the environment or compromise the industry's ability to provide fish for future generations.

Moreover, the health of our oceans and aquatic ecosystems is critical to the health of the planet. Aquaculture, like any form of food production, has the potential to impact the environment, and unsustainable practices can lead to pollution, habitat destruction, and the loss of biodiversity. By adopting sustainable practices in aquaculture, we can minimize these negative impacts and ensure that our oceans and aquatic ecosystems remain healthy.

Furthermore, sustainability is becoming increasingly important to consumers. Many people are concerned about the environmental impact of the food they eat and are looking for more sustainable options (Yi, 2019). By prioritizing sustainability in aquaculture, producers can meet the growing demand for sustainable seafood and differentiate themselves in the marketplace. As such, sustainability is important in the aquaculture industry to meet the growing demand for seafood in a way that does not harm the environment or compromise the industry's ability to provide fish for future generations, to protect the health of our oceans and aquatic ecosystems, and to meet the growing demand for sustainable seafood from consumers.

Environmental, financial & productive sustainability

Environmental Sustainability

Currently, food scarcity is increasing as a result of overpopulation in the entire world. Due to this phenomenon, there is a higher demand for food, satisfaction of which is directly proportional to the growth of the aquaculture industry globally. This demand has been increasing for numerous decades now, with an expectancy to grow even further in the near future (Cressey, D. 2009). Due to this growth, and aquaculture food being associated with healthier diets, the stringency in terms of policies has emerged to keep aquaculture farming a healthy phenomenon not only in terms of produce but in terms of its sustainability over the years as well (Subasinghe et al., 2009).

While the policies have flourished to ensure sustainability, aquaculture farming has had an impact over the environment in terms of climate change and eutrophication. A part of climate change can be attributed towards the increased energy requirements for industries like aquaculture, for instance, to maintain favorable conditions for aquaculture farming (Galappaththi et al., 2020). Moreover, the feed used for farming is an additional liability upon environmental impacts, keeping in mind energy requirements in order to process the feed to be usable for farming purposes (Tacon & Forster, 2003). Furthermore, eutrophication, a process in which water is enriched with nutrients which leads to the production of algae and macrophytes, ultimately resulting in low oxygen levels and deterioration of water quality (Gowen, 1994) is a common phenomenon in man-made fish farms due to the need of producing more supply of fish for consumption and retail purposes.

In order to measure the environmental impact that an aquaculture farm has, Life Cycle Assessment (LCA) is an ISO – standardized methodology which is widely used to quantify a large number of environmental impacts from aquacultural systems (Bohnes & Laurent, 2019). This assessment method can be utilized in all stages of the product lifecycle, which in this report applies to aquaculture farming. LCA can also be used to compare the environmental impacts of different stages of the aquaculture farming life cycle from raw material extraction to production, feed and delivery. Furthermore, LCA has been utilized for assessing various aquacultural technologies such as ponds, polyculture and recirculating aquaculture systems (RAS) (Henriksson et al., 2012).

However, environmental sustainability alone is not sufficient to ensure that the on-going demand is met, simply due to the fact that until a business is profitable and financially sustainable, investors would not be willing to invest.

Financial Sustainability

Aquaculture farming, like any other practice, requires a sustainable source of finances in order to optimize in terms of generating profits to remain viable in the long run. The key factors to be considered when looking at a long-term financially sustainable project within the aquaculture farming industry relate to feed costs, disease management, water quality, capital investment, market demand, regulatory environment and energy costs (Ruby, 2008).

Feed Costs

Aquaculture farms rely on feed to provide the nutrients necessary for the growth and development of fish. However, the cost of feed can be a significant expense for farmers, particularly if the feed is of high quality or if the price of key ingredients such as fishmeal or soybean meal increases. The cost of feed can have economic implications for the farm, as it can impact profitability and the ability to remain competitive in the market. Additionally, if feed costs are high, it may be tempting for farmers to cut corners by using cheaper or lower quality feed, which can negatively impact the health and welfare of the fish.

Feed costs can also have environmental implications, as the production of fish feed requires the use of natural resources and can result in the release of greenhouse gas emissions and other pollutants (Rola & Hasan, 2007). Additionally, the overuse of fishmeal and fish oil in aquaculture feed can contribute to overfishing and other environmental issues (Perez, 2003). To address the issue of feed costs in aquaculture farming, farmers can implement a range of sustainable practices. For example, they can reduce the amount of fishmeal and fish oil in feed by using alternative protein sources such as plant-based proteins, algae, or insects. They can also implement feeding strategies that optimize the use of feed and reduce waste, such as feeding fish multiple times a day in smaller quantities.

Sustainable feed practices not only help to reduce the cost of feed, but they also have environmental benefits such as reducing the reliance on fishmeal and fish oil, which can help to preserve marine ecosystems (Perez, 2003). Additionally, they can help to improve the health and

welfare of the fish, which can improve overall farm productivity and profitability. As a result, feed costs are a significant sustainability factor in aquaculture farming, and farmers must implement sustainable feed practices to ensure the economic and environmental sustainability of their operations.

Disease Outbreaks

Disease outbreaks are a significant sustainability factor in aquaculture farming, as they can have negative impacts on the health and welfare of the fish, the environment, and the economic viability of the farm. Aquaculture farms can be vulnerable to disease outbreaks due to the high stocking densities of fish in a confined space, which can create ideal conditions for the spread of disease. The introduction of new fish into the farm can also increase the risk of disease outbreaks, as the new fish may carry diseases that can infect the existing population.

Disease outbreaks can have a significant impact on the health and welfare of the fish, leading to increased mortality rates and reduced growth rates. This can have economic implications for the farm, as it can lead to reduced yields and lower profitability. In some cases, disease outbreaks can also have environmental impacts, such as the release of pathogens into the surrounding ecosystem. To address the risk of disease outbreaks, aquaculture farmers must implement effective disease management strategies. This can include regular monitoring and testing of fish populations to identify potential health issues, the use of vaccines and antibiotics to prevent and treat diseases, and the implementation of biosecurity measures to prevent the introduction of new diseases into the farm.

Sustainable disease management practices can also help to reduce the impact of disease outbreaks on the environment. For example, the use of probiotics and other natural treatments can help to reduce the need for antibiotics, which can have negative environmental impacts when they are released into the surrounding ecosystem.

Overall, disease outbreaks are a significant sustainability factor in aquaculture farming that must be carefully managed to ensure the health and welfare of the fish, the environment, and the economic viability of the farm. By implementing effective disease management strategies and using sustainable practices, aquaculture farmers can help to minimize the impact of disease

outbreaks on their operations and improve the overall sustainability of their farms (Asche et al., 2009).

Water Quality

In aquaculture farming, water quality is affected by a variety of factors, including temperature, dissolved oxygen levels, pH, salinity, and nutrient levels. Changes in any of these factors can have negative impacts on the health and growth of the fish and can lead to disease outbreaks and increased mortality. Poor water quality can also have environmental impacts, such as the eutrophication of water bodies, which can lead to harmful algal blooms and oxygen depletion in the water (Zhang, et al., 2011). Additionally, poor water quality can lead to the accumulation of nutrients and organic matter in sediments, which can have long-term impacts on the health of the ecosystem.

To address these issues, aquaculture farmers must carefully monitor water quality and take steps to maintain optimal conditions for the fish and the environment. This can include the use of water treatment systems, such as biofilters and mechanical filters, to remove waste and excess nutrients from the water. The use of sustainable management practices can also help to maintain water quality in aquaculture farming. For example, the use of integrated multi-trophic aquaculture (IMTA) systems, which combine the cultivation of multiple species to create a more sustainable and diverse ecosystem, can help to reduce the impact of aquaculture farming on the environment while also improving water quality (Pantjara et al., 2015). Overall, water quality is a critical sustainability factor in aquaculture farming that must be carefully managed to ensure the health and welfare of the fish, the environment, and the economic viability of the farm. By implementing sustainable management practices and using appropriate water treatment systems, aquaculture farmers can help to maintain optimal water quality and improve the sustainability of their operations.

Capital investment

Capital investments can include the purchase of equipment, land, and other infrastructure necessary for aquaculture farming. Investments in sustainable aquaculture practices can improve the long-term viability of aquaculture farming by reducing environmental impacts, improving

yields, and enhancing the quality of the product. However, these investments can also require significant upfront costs that may be difficult for small-scale farmers to bear.

To address this issue, governments and other organizations have implemented various programs to support capital investments in sustainable aquaculture farming. For example, some governments offer subsidies or grants to farmers for the purchase of energy-efficient equipment, the implementation of sustainable management practices, or the adoption of certification programs such as the Aquaculture Stewardship Council (ASC) or the Global Aquaculture Alliance (GAA). Private investors and financial institutions have also begun to show interest in sustainable aquaculture projects. Green bonds, which are debt securities that finance environmentally sustainable projects, have been used to finance sustainable aquaculture projects. These bonds can provide long-term funding for aquaculture projects while promoting sustainable practices. In addition, there is a growing interest in aquaculture investment funds that allow investors to invest in sustainable aquaculture projects. These funds can provide a way for investors to support sustainable aquaculture while also generating a return on investment.

Overall, capital investment is an important sustainability factor in aquaculture farming because it can determine the level of resources available for investment in sustainable practices and technologies (Valenti et al., 2011). By supporting sustainable aquaculture investments, governments, private investors, and financial institutions can help to improve the long-term viability of aquaculture farming while reducing its environmental impact.

Market Demand

As consumers become more aware of the environmental and social impacts of the food they eat, there has been a growing demand for seafood produced in an environmentally and socially responsible manner. This demand for sustainable seafood has put pressure on aquaculture farmers to adopt more sustainable practices, such as reducing their use of antibiotics, limiting pollution, and promoting biodiversity. Aquaculture farms that can demonstrate their commitment to sustainability through certification schemes, such as the Aquaculture Stewardship Council (ASC) or GlobalGAP, are more likely to attract environmentally conscious consumers and secure market access for their products. At the same time, the demand for sustainable seafood is also creating new business opportunities for aquaculture farmers (Natale et al., 2013). As the market for sustainable seafood grows, farmers who can produce high-quality, sustainably farmed fish are

likely to benefit from increased demand and higher prices. In addition to consumer demand, there is also growing interest in sustainable seafood among retailers, restaurants, and other businesses that purchase and sell seafood products. These businesses are increasingly seeking out sustainable seafood suppliers and are willing to pay a premium for products that meet their sustainability criteria. As a result, farmers who adopt sustainable practices are more likely to have access to a wider range of markets and customers, which can help to ensure the long-term viability of their businesses.

Regulatory Environment

The European Union has established a range of policies and regulations that aim to promote sustainable aquaculture practices and protect the health of aquatic environments.

One of the key regulatory instruments in this area is the EU Common Fisheries Policy, which aims to ensure that fishing and aquaculture activities are managed in a sustainable and responsible manner. The policy includes measures to protect fish stocks, promote sustainable fishing practices, and support the development of sustainable aquaculture (Read & Fernandes, 2003).

Another important regulatory framework is the EU Aquaculture Regulation, which sets out common rules and standards for the authorization and operation of aquaculture facilities across the EU. The regulation includes provisions to promote the sustainable development of the aquaculture sector, such as requirements for environmental impact assessments and rules on the use of antibiotics and other veterinary medicines.

In addition to these overarching policies and regulations, there are also a number of specific initiatives aimed at promoting sustainable aquaculture practices in Europe. For example, the Aquaculture Stewardship Council (ASC) is a certification scheme that sets standards for sustainable aquaculture practices and provides certification for farms that meet these standards. The ASC is supported by several European retailers and businesses, which helps to drive demand for sustainably farmed seafood and incentivize farmers to adopt sustainable practices.

As a result, the regulatory environment in Europe plays an important role in promoting sustainable aquaculture practices and protecting the health of aquatic environments (Bauer et al., 2020). By establishing common rules and standards for the industry, and by promoting initiatives such as the

ASC certification scheme, regulators are helping to ensure that aquaculture can continue to provide a sustainable source of seafood for Europe's consumers.

Energy Costs

Aquaculture farming requires energy for a variety of activities, including pumping and filtering water, maintaining temperature and lighting, and transporting and processing fish.

The use of energy in aquaculture farming can have both direct and indirect environmental impacts. Direct impacts can include the emissions of greenhouse gases from energy generation, such as carbon dioxide and methane. Indirect impacts can include the production of other pollutants associated with energy generation, such as nitrogen oxides and particulate matter. To address these issues, there is a growing interest in the use of renewable energy sources in aquaculture farming. Renewable energy sources, such as solar, wind, and hydroelectric power, can help to reduce greenhouse gas emissions and other pollutants associated with energy generation (Troell et al., 2004).

In addition to environmental benefits, the use of renewable energy can also help to reduce energy costs for aquaculture farmers. Renewable energy sources can often be more cost-effective than traditional fossil fuels over the long term, as they require less maintenance and have lower operating costs. Furthermore, the use of energy-efficient technologies can also help to reduce energy costs and improve the sustainability of aquaculture farming (Folke & Kautsky, 1992). For example, the use of energy-efficient pumps and filters can reduce the amount of energy required to circulate water in fish tanks, while LED lighting can provide the same amount of light as traditional lighting while using less energy. Overall, the energy costs of aquaculture farming are an important sustainability factor that should be considered in the development of sustainable aquaculture practices. By using renewable energy sources and energy-efficient technologies, farmers can help to reduce their environmental impact and improve their economic viability over the long term.

Productive Sustainability

Productive sustainability in aquaculture refers to the practice of maximizing productivity and efficiency while minimizing environmental impacts and maintaining social responsibility. It

involves finding a balance between economic growth and social well-being within the aquaculture industry.

In the context of aquaculture, productive sustainability focuses on optimizing production systems to achieve higher yields without compromising the long-term health of aquatic ecosystems or compromising the welfare of workers and local communities. It encompasses various aspects, including responsible resource management, efficient feed and nutrient utilization, disease prevention and control, waste management, and minimizing the use of chemicals and antibiotics (Adewumi, 2015).

To achieve productive sustainability, aquaculture operations often adopt innovative technologies and management practices. For example, the use of advanced monitoring systems, such as sensors and real-time data analysis, can help optimize feeding regimes, water quality management, and energy usage (Vince & Haward, 2017). Recirculating aquaculture systems (RAS) are another example of a technology that promotes productive sustainability by reducing water usage, minimizing environmental impacts, and enabling better control over the production environment (Badiola et al., 2012). Figure 1 below displays how an RAS system works.

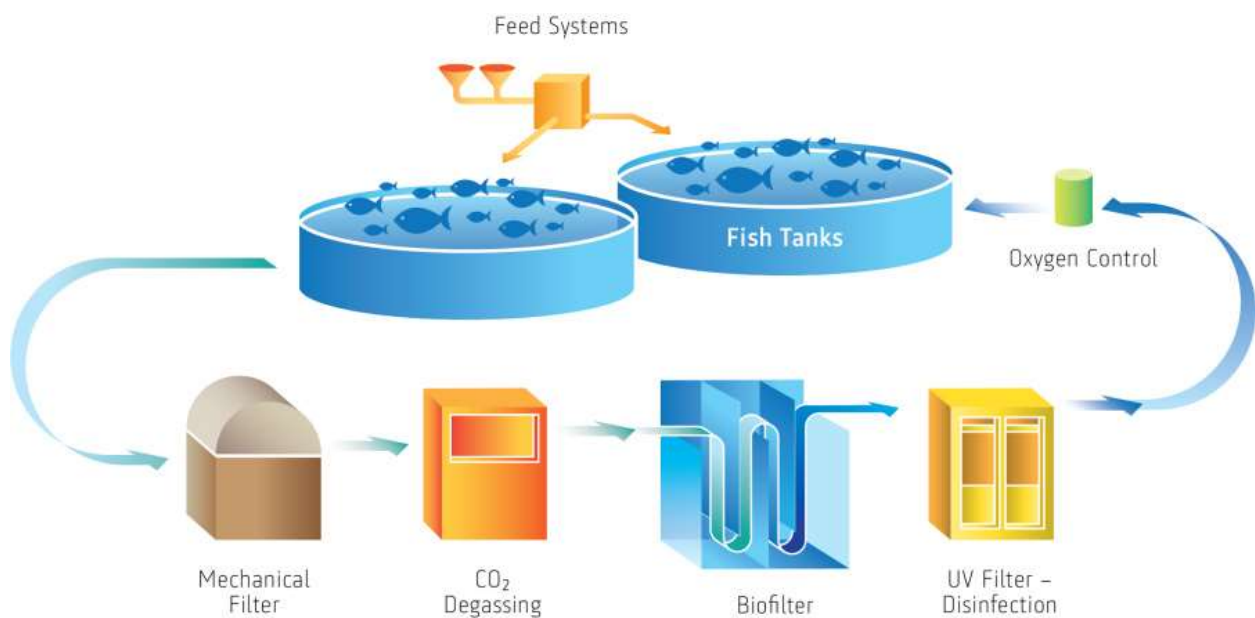


Figure 1: National Institute of Water and Atmospheric Research (2020), *Recirculating Aquaculture Systems (RAS)*, <https://niwa.co.nz/file/47107>

The concept of productive sustainability recognizes the interconnectedness of ecological, economic, and social factors and emphasizes the need for holistic and integrated approaches. By striving for productive sustainability, aquaculture aims to meet the growing demand for seafood while minimizing its environmental footprint, conserving resources, and supporting the well-being of communities involved in the industry.

As it may seem obvious, a lot of aspects in terms of environmental, financial and productive sustainability tend to overlap with each other, simply because a single aspect can have an impact upon other forms of sustainability as well. Adewumi (2015), Vince & Haward (2017) and Goddek et al., (2015) are of the opinion that the most common factors when considering environmental, financial and productive sustainability relate to water quality, disease control, feed type & aquaculture waste within the aquaculture industry. As such, to determine whether or not an aquaculture farm or practice is sustainable, the accreditation upon green financing is expected to cater to or resolve the common yet necessary factors mentioned above, in order to ensure that the aquaculture farming can be recognized as “green”.

In order to get an overview of current industry practices, we take a look at sustainability practices of some of the prominent aquacultural corporations in Norway, that is, SalMar, Mowi & Grieg Seafood.

Sustainability within Corporations: Practices of SalMar, Mowi & Grieg Seafood

While talks about sustainability in most cases might look like “desirable” but not “achievable” within certain industries, in the case of aquaculture industry in Norway, we see leading corporations adapt towards the progression for sustainability and adopt practices which are determined as “green/sustainable”. SalMar, Mowi, and Grieg Seafood are prominent companies in the aquaculture industry within Norway, and as such they adhere to the changes within the demand structure of the industry, whereby the trend is moving towards sustainability within aquaculture in terms of environment as well as finances. As a result, these corporations have also implemented several sustainability practices in their farming operations. Sustainable feed sourcing, environmental monitoring and management, disease prevention and control, genetic improvement programs and collaboration and research are a few ways in which these corporations tend to tread towards the path of sustainable aquaculture farming.

SalMar has made efforts to source sustainable feed for their aquaculture operations. They prioritize using feed ingredients that are responsibly harvested and have a low impact on the environment. This includes reducing the reliance on wild fish stocks by incorporating alternative ingredients such as plant proteins and algae (SalMar, 2022).

Mowi continuously works to monitor and manage their environmental impact. They invest in technologies and practices that help minimize the release of effluents, excess nutrients, and other potentially harmful substances into the surrounding water bodies (Mowi, 2022). Regular monitoring helps ensure compliance with environmental regulations and identifies areas for improvement.

Disease prevention and control measures are one of the most significant factors taken into account by these corporations with respect to sustainable practices in aquacultural farming. They implement strict biosecurity protocols, including regular health checks, vaccinations, and quarantine procedures for fish stocks (Mowi, 2022). These practices help reduce the use of antibiotics and minimize the risk of disease outbreaks, promoting healthier and more sustainable farming practices.

Genetic improvement programs are integral towards breeding of fish. The companies have an active involvement in these programs, aimed at enhancing the overall performance and sustainability of their fish stocks. Through selective breeding, they aim to develop strains of fish that are more resilient, have higher growth rates, and require fewer resources to reach market size (Hatchery International Staff, 2018). This approach helps minimize the environmental footprint of aquaculture operations.

Collaboration and research are two of the most important factors that these companies look into, by actively collaborating with research institutions, universities, and other stakeholders to advance sustainable aquaculture practices. They support research projects focused on developing innovative technologies, improving fish welfare, and reducing environmental impacts (Mowi, 2021). By sharing knowledge and expertise, they contribute to the development of sustainable practices in the industry as a whole.

As a result, we can verily see that the leading corporations within the aquaculture industry in Norway are inclined towards being more sustainable in terms of both environmental as well as

financial practices in order to cope up with new demands and trends within the global demand of sustainable aquaculture. Moreover, the movement towards “sustainability” does not necessarily end with the corporation’s efforts themselves, but rather other stakeholders involved like governmental and non-governmental bodies which have a significant ‘say’ in building up industry practices. As such, the next section highlights regulatory bodies, both governmental and non-governmental and their involvement within aquaculture farming.

Regulatory Bodies and their Involvement within Aquaculture Farming

Regulatory Bodies

In the European Union, aquaculture is regulated by several bodies, both at the national level, and within Europe as a whole, though Norway is not technically in the EU they still must adhere to many of the same rules and regulations as member states, because they are a part of the European Economic Area (EEA). The main regulatory bodies involved in European aquaculture farming are as follows:

1. European Commission: is responsible for developing and implementing policies and regulations related to aquaculture farming. It also provides funding and support for research and innovation within the sector.
2. European Food Safety Authority (EFSA): is an independent agency of the European Union responsible for assessing the safety and quality of food and feed products, including those from aquaculture.
3. European Maritime and Fisheries Fund (EMFF): is a financial instrument of the European Union that provides funding and support for the development and sustainability of the European fisheries and aquaculture sector.
4. European Aquaculture Technology and Innovation Platform (EATIP): EATIP is a multi-stakeholder platform that brings together the European aquaculture industry, research community, and public authorities to promote innovation and sustainable development in the sector.

The regulatory bodies involved in European aquaculture farming have a significant impact on trade in aquaculture products such as salmon. For example, the European Commission is responsible for developing and implementing regulations related to food safety and quality, as well as trade

policies that govern the import and export of goods, including aquaculture products. These regulations and policies can have a direct impact on the availability of salmon on the European market, as well as the prices of salmon products. As such, individuals and firms interested in investing within the industry tend to look out for companies not adhering to the EU requirements since it can result in hindrance within sale of produce, leading towards a huge financial loss.

Similarly, the European Food Safety Authority (EFSA) plays a key role in assessing the safety and quality of salmon products, which can have an impact on consumer confidence and demand. If EFSA were to issue negative assessments of the safety or quality of salmon products from a particular country, region or company, this could lead to a decrease in demand and trade for those products.

The European Maritime and Fisheries Fund (EMFF) can also impact trade in aquaculture products such as salmon by providing funding and support for the development and sustainability of the European fisheries and aquaculture sector. This can lead to increased production and competitiveness of European aquaculture products, which may in turn impact the import and export of salmon products due to local companies being more efficient, effective and sustainable than international ones.

Finally, the European Aquaculture Technology and Innovation Platform (EATIP) can impact trade in salmon products by promoting innovation and sustainable development in the sector. This can lead to the development of new technologies and production methods that may impact the availability and prices of salmon products.

Overall, the regulatory bodies involved in European aquaculture farming can have a significant impact on trade in salmon and other aquaculture products through their regulations, assessments, funding, and support for innovation and sustainability.

Non-Governmental Bodies in Europe

However, there also are several non-governmental organizations (NGOs) that are involved in the aquaculture trade in Europe. While in terms of legislation, these bodies have a little to no impact on the trade of produce, their international standing and accountability converts them into prominent stakeholders, opinions of whom matter to the mass consumer market. Some of the prominent NGOs that are involved in the European aquaculture trade include:

1. The Aquaculture Stewardship Council (ASC): is an independent, international organization that sets standards for responsible aquaculture and certifies farms that meet those standards. The ASC works with aquaculture producers, retailers, and other stakeholders to promote sustainable and responsible aquaculture practices.
2. The Marine Stewardship Council (MSC): is an international nonprofit organization that sets standards for sustainable and well-managed fisheries. The MSC's certification program allows fisheries to demonstrate that their products come from sustainable and well-managed sources. The MSC certification is recognized by many European retailers and seafood buyers.
3. The European Aquaculture Society (EAS): is a professional association that brings together aquaculture researchers, producers, and other stakeholders to promote the development and sustainability of the European aquaculture sector. The EAS organizes conferences, publishes scientific journals, and provides a platform for collaboration and knowledge sharing.
4. The Sustainable Fisheries Partnership (SFP): is an NGO that works to improve the sustainability of global fisheries and aquaculture. The SFP works with seafood buyers, producers, and other stakeholders to promote sustainable practices and to encourage the adoption of sustainable seafood sourcing policies.
5. Debio: is an organization that provides certifications for all organic products in Norway, if an imported product has been certified by an accredited body, that corresponds with Norwegian rules and regulations, they receive the Ø-label from Debio. The Ø-label is given to products that reaches the requirements that allows them to be marketing as organic products.

While making sure that NGOs within Europe are not being disregarded in order to have a higher acceptance rate within the consumer and trade markets, organizations also need to take into account local NGOs, operating in Norway, to be able to sell locally.

Governmental & Non-Governmental Bodies Operating in Norway

There are several governmental & non-governmental organizations that are involved in the aquaculture trade in Norway. Some of the prominent bodies that are involved in the Norwegian aquaculture trade include:

1. WWF-Norway: The World Wide Fund for Nature (WWF) is an international NGO that works to protect the environment and promote sustainability. WWF-Norway works with the Norwegian aquaculture industry to promote sustainable practices and reduce the environmental impact of aquaculture.
2. The Norwegian Seafood Federation: is a trade association that represents Norwegian seafood producers and exporters. The organization works to promote the interests of the Norwegian seafood industry and to ensure that Norwegian seafood products meet high standards of quality, sustainability, and animal welfare.
3. The Bellona Foundation: is a Norwegian NGO that works to promote environmental protection and sustainable development. The organization works with the Norwegian aquaculture industry to promote sustainable practices and reduce the environmental impact of aquaculture.
4. The Norwegian Society for the Conservation of Nature: The Norwegian Society for the Conservation of Nature (Naturvernforbundet) is an environmental organization that works to protect Norway's natural environment. The organization works with the Norwegian aquaculture industry to promote sustainable practices and reduce the environmental impact of aquaculture.
5. Norwegian food and safety authority: Mattilsynet or the Norwegian food and safety authority is a nationwide administrative body that helps ensure safe food and safe drinking water for consumers. They promote environmentally friendly production and ethically responsible keeping of fish.

As such, government as well as non-governmental bodies play a significant role while assessing the sustainability of aquaculture farming, both in terms of environmental as well as financial sustainability. Investors who wish to invest in this industry, as a result, need to be aware of on-going events related to companies for potential investment just so the investment does not result in possible losses due to restrictions imposed upon such companies by the stakeholders in question.

While sustainability linked with environmental as well as financial practices is essential in the trend towards a sustainable world today, the other most prominent factor relates to financing within the aquaculture industry, since the entire industry is extremely costly.

Green Financing & its Impact upon Aquaculture Farming

Green financing has emerged as a vital tool in promoting sustainability across various industries, including aquaculture. As the demand for seafood continues to rise, the aquaculture industry faces the challenge of meeting this demand while minimizing its environmental impact. Green financing offers a solution by providing financial support to aquaculture companies that adopt and implement sustainable practices. This approach not only drives positive changes within the industry but also fosters environmental stewardship and social responsibility. Within this section of the paper, we will explore the concept of green financing and its significant impact on the aquaculture industry, types of green financing, their usage of possibilities, the adoption standards, certification & accreditation required for green financing and current corporation practices. By utilizing green financing, the aquaculture industry is poised to contribute to global sustainable development goals while ensuring the long-term viability of seafood production.

As a general consensus has been made in terms of how sustainable business practices needed to be implemented for a variety of concerns, the financing sector had to follow suit and, in many ways, lead in terms of accelerating the process of the “green shift” via financing. As a result, several different financial tools have been created to incentivize the push towards a “greener” future. The major tools that have been put into use are *Impact investment, sustainability-linked loans, subsidies & grants and most importantly, Green bonds.*

Impact investments

Impact investments refer to investments made with the intention of generating positive social or environmental impact, alongside financial returns. These investments seek to address specific challenges or achieve specific goals related to sustainability, social equality, or other important issues (Barber et al., 2021).

In the context of the aquaculture farming industry, impact investments can play a significant role in promoting sustainable and responsible practices. There are numerous ways in which aquaculture farming industry is affected via impact investments, a few of which are as follows; funding for sustainable practices, innovation & research, social impact, market transformation and collaboration & knowledge sharing.

Impact investments can provide capital to aquaculture farms that implement sustainable practices. This funding can be used to adopt technologies and methods that reduce environmental impacts,

such as improving water management systems, implementing efficient feed strategies, or developing closed-loop systems that minimize waste and pollution. Moreover, funding from these investments can support research and development efforts in the aquaculture industry, particularly in areas like alternative feed sources, disease management, and eco-friendly farming techniques. This can lead to the discovery and implementation of innovative solutions that improve the industry's sustainability and resilience. Furthermore, impact investments tend to address social challenges within the aquaculture farming industry by creating job opportunities in local communities, promoting fair labor practices and enhancing the livelihoods of small-scale farmers and fishers. This leads towards market transformation to an extent as investors are beginning to prioritize sustainability and ethical considerations instead of traditional business practices, which in turn influences consumer preferences, creating a drive demand for sustainably produced seafood. Lastly as impact investments are sometimes collaborations between numerous investors, industry players, researchers and non-profits etc., the collaborations tend to foster knowledge sharing & best practices resulting in a better output, both in terms of sustainable farming as well as corporate practices.

It is important to note that the effectiveness of impact investments in the aquaculture farming industry depends on various factors, such as the scale of investments, the commitment of stakeholders, and the integration of sustainability principles into business strategies. Nonetheless, impact investments have the potential to drive positive change and contribute to the long-term sustainability of the aquaculture sector. Figure 2 below shows the framework of impact investments whereby there are two sides apart from the forms of finance, namely, demand and supply sides. The demand side consists of impact seeking purchasers which are stakeholders that want organizations to indulge in activities generating impact, and impact driven organizations which want the investment to actively participate in making an impact. These demand side parties indulge into different forms of finance resulting in the supply side, that is, channels of impact capital and sources of impact capital being the finance providing entities.

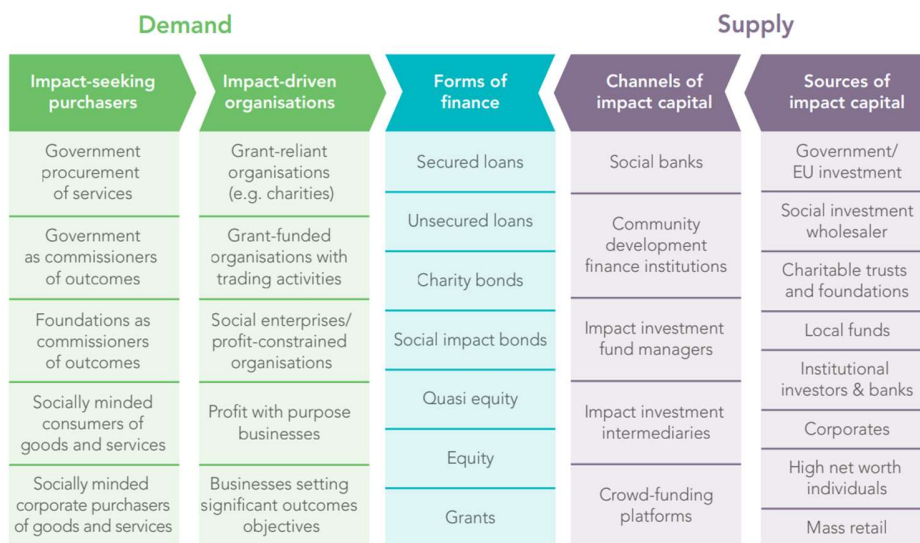


Figure 2: Social Impact Investment Taskforce: *The Invisible Heart of the Market* (2014), *Social Impact Investment Ecosystem*, <https://gsgii.org/reports/impact-investment-the-invisible-heart-of-markets/>

Sustainability-linked loans

Sustainability-linked loans (SLL) are a type of debt financing that has interest rates that are determined by the borrower reaching certain key performance indicators (KPI). These KPI's are usually linked to environmental, social and governance (ESG) targets, in contrast to green bonds where the proceeds are tied to a specific green project, a SLL can also be used for general corporate purposes. Moreover, in a scenario where a borrower fails to meet said KPI's, the rate of interest increases based upon pre-agreed terms and conditions (Du., et al 2022).} An example of sustainability linked loan can be seen in 2021, whereby a Dutch aquaculture company, Kingfish Zeeland, secured a sustainability-linked loan to fund the construction of a new land-based fish farm (Kingfish Company, 2022). The loan is tied to sustainability performance targets, such as reducing water usage and energy consumption.

Grants and subsidies

Governments and non-governmental organizations (NGOs) may provide grants or subsidies to support sustainable aquaculture projects, such as the development of new technologies for reducing environmental impact or improving animal welfare. This is the case for the aquaculture industry in Norway as well whereby, in 2018, Norway spent around NOK 1.4 billion in financing services to the fisheries sector and NOK 278.8 million was reimbursed through cost-recovery charges, which are, fees paid by service users of ports or management, and taxes incurred by

resource use and associated profits. The cost-recovery charges amounted to 5.6% of the value of production, which was lower than the OECD average of 8.5% in 2018 (OECD 2021).

Green Bonds

In order to understand what green bonds are, we first need to grasp the concept of bonds and how they work.

Bonds

“Bonds are classified as a form of debt security which is a legal contract of money owed that can be bought and sold between parties” (World Bank Group, 2015). These are used by private and public companies as well as governmental bodies to raise funds. Though usually with lower yields than stocks they are considered safer, due to their fixed interest model. The size of the global fixed income market is estimated to be around 126 trillion dollars (Kolchin et al., 2022).

Green bonds

According to Flammer, C. (2021) green bonds can be defined as: bonds that are used to “finance environmental and climate friendly projects”, these projects can vary in form as long as they adhere to the previous mentioned tenets. Green bonds can and are being used to limit waste of natural resources, procuring new ways of utilizing renewable energy, renovation, or construction of factories that ensure a more sustainable practice/production.

The inception of the first modern green bond was in June 2007 by the European Investment bank (Bachelet et al., 2019) and the world bank followed that initiative in 2008 when they cooperated with Skandinaviska Enskilda Bank (SEB), to create their own fixed income product (green bonds) that was dedicated to mitigating climate change and support projects in developing countries (World Bank Group, 2015).

Though a relatively new concept the green bonds market has grown exponentially over recent years. In 2014, 37 billion dollars of green bonds were issued, which pales in comparison to the 508 billion dollars that were issued in 2021 (Statista, 2022). Though green bonds are growing rapidly, they constitute only a small fraction of the global fixed income market.

In theory the only difference between regular bonds and green bonds is the specific purpose of them, which is that green bonds are made to incentivize investments in sustainable projects.

However, policy makers, issuers and stakeholders have been implementing rules and regulations to incentivize the usage of green bonds, and depending on jurisdiction, in some cases, tax incentives can and have been put in place. One such example can be seen within a bond issued in 2016 by Indian Renewable Energy Development Agency Limited (IREDA), whereby the entire earnings from the bond were tax-free (Agliardi, E., Agliardi, R., 2019).

Some of the largest companies in the world have outstanding green bonds, since 2016, for example, Apple being one of the leading ‘tech giants’ has issued three green bonds that focused on reaching the company’s overall goal of becoming carbon-neutral (Apple, 2022).

As green bonds have a stated purpose of being used for sustainability linked purposes there needs to be a third-party verification that confirms that the proceeds of the green bond have been allocated correctly. As such the practice of third-party verification is largely to avoid the practice of greenwashing; the process of publicly stating and acting environmentally focused when in reality the entity is merely pretending to have these practices. An example of this would be Volkswagen who between 2009 and 2015 sold 500,000 cars, in the USA, that had built-in software that was designed to emit less CO₂ during testing. This became an international scandal which became known as “diesel gate” (Siano et al., 2017)

Green washing has been a growing concern, as it poses an existential crisis to green bonds, both concerning the practices' reputation and effectiveness in incentivizing companies to turn to greener approaches and investors willingness to put their money into sustainable investment opportunities.

Certification & Accreditation process of green bonds for the aquaculture industry

As green bonds are earmarked for environmental investment, domestic and multinational institutions have been pursuing guidelines, regulations, and incentives to ensure that green bonds are kept to a certain standard (Bachelet et al.,2019). The certification of green bonds is therefore done by trusted third party institutions.

- 1) Climate Bonds Standard: Developed by the Climate Bonds Initiative, the Climate Bonds Standard is a certification scheme that provides investors with a transparent and robust way

to assess the environmental credentials of bonds. It covers a wide range of sectors, including renewable energy, low-carbon buildings, and sustainable land use.

- 2) Green Bond Principles: Developed by the International Capital Market Association (ICMA), the Green Bond Principles provide issuers with guidance on best practices for issuing green bonds. The principles cover the use of bond proceeds, the selection of projects, and the reporting and transparency of the bond issuance.
- 3) Certification by third-party auditors: Some issuers choose to have their green bonds certified by third-party auditors, who provide an independent assessment of the bond's environmental credentials. These auditors typically follow a set of guidelines, such as the Climate Bonds Standard or the Green Bond Principles, to ensure the bond meets certain environmental standards.

Though there is no specific process of getting a green bond certified, the markets must trust that the project they are investing in is indeed what the issuer claims. This assurance is typically acquired through third party accreditation.

The certification of green projects in the aquaculture industry is dealt with by independent organizations such as the aquaculture stewardship council (ASC) which is the organization that certified SalMar's green bonds projects in 2022.

In the case of getting certified by ASC the process entails similarly to the following: An aquaculture company has a farm that they want ASC certified and contacts a Conformity Assessment Body (CAB) who are ASC-accredited. The project will then either be given the certification or not based on if they meet certain requirements. After the institution has given the certification, the company can issue a green bond to finance the project or to refinance a debt security to a green bond in retrospect.

Green bond framework

While third party verification is essential as mentioned above, there are certain organizations which provide "opinions" on companies for the public to have an understanding of how green a company/project is based upon the third party's own standards. One such company is "Shades of green", formerly known as "CICERO Shades of Green". Moreover, corporations such as SalMar,

Mowi & Grieg Seafood have their own green bond frameworks as well, which are presented as a means of overall structure of what the investment would entail, or which points it would cater to.

Shades of Green

Shades of green, owned by S&P Global, is a leading second party opinion provider on green financing. The organization provides research-based evaluations on how robust a sustainable financing framework is. Their evaluation metric comes in three “shades of green”: light green, medium green and dark green. SalMar ASA, Mowi ASA and Grieg Seafood ASA’s green bond frameworks have all received the rating of *medium green*, with a score of “excellent” regarding their governance procedures in the respective companies. (CICERO Shades of Green. 2020; 2021; 2023). Figure 3 below shows the gradients of ratings.











Shading	Examples
 <p>Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low-carbon and climate resilient future.</p>	 <p>Solar power plants</p>
 <p>Medium Green is allocated to projects and solutions that represent significant steps towards the long-term vision but are not quite there yet.</p>	 <p>Energy efficient buildings</p>
 <p>Light Green is allocated to transition activities that do not lock in emissions. These projects reduce emissions or have other environmental benefits in the near term rather than representing low carbon and climate resilient long-term solutions.</p>	 <p>Hybrid road vehicles</p>
 <p>Yellow is allocated to projects and solutions that do not explicitly contribute to the transition to a low carbon and climate resilient future. This category also includes activities with too little information to assess.</p>	 <p>Healthcare services</p>
 <p>Red is allocated to projects and solutions that have no role to play in a low-carbon and climate resilient future. These are the heaviest emitting assets, with the most potential for lock in of emissions and highest risk of stranded assets.</p>	 <p>New oil exploration</p>

Figure 3: S&P Global (2022), *Shades of Green*, <https://www.spglobal.com/ratings/en/products-benefits/products/shades-of-green>

SalMar’s green bond framework

SalMar’s green bond framework (GBF) addresses a wide range of concerns relating to the issue of sustainability, from fish welfare to green energy. This is communicated through their quote of “Sustainability in everything we do” which they state is an important pillar of SalMar’s operations.

With this vision they developed “**ocean farm 1**” which they state make salmon farming offshore feasible, which would increase fish welfare due to them being in their natural habitat and lowering sea lice levels which has plagued the aquaculture industry since its inception.

SalMar’s GBF focuses on sustainable and healthy feed, pollution prevention and circularity which all ties together to achieve a sustainable fish farming practice. The GBF also states that they are working towards 5 different United nations sustainable development goals (SDG) which are shown in Figure 4, below.



Figure 4: SalMar ASA Green Bond Framework (2021), GRI Framework, <https://www.salmar.no/wp-content/uploads/2016/06/SalMar-Green-Bond-Framework.pdf>

Mowi's green bond framework

In January of 2020 Mowi became the first seafood company in the world to issue a green bond, which has become a vital part in their debt financing strategy, as Mowi is aiming for 100% green financing by 2026 (Mowi ASA, 2022). Mowi, recently publicized a report named “Green Financing and Sustainability-Linked Financing Framework” (GSLF) that outlines their future endeavors when it comes to the company’s commitment to sustainable practices and green financing.

Mowi has used the proceeds of their newly found financing for a variety of projects that tackle the problems of sustainable aquaculture, renewable and efficient energy and water and waste management (Mowi ASA, 2023). Figure 5 below displays Mowi’s contribution towards United Nation’s sustainable development goals, which Mowi is also working towards in terms of their future endeavors towards sustainable practices and financing.

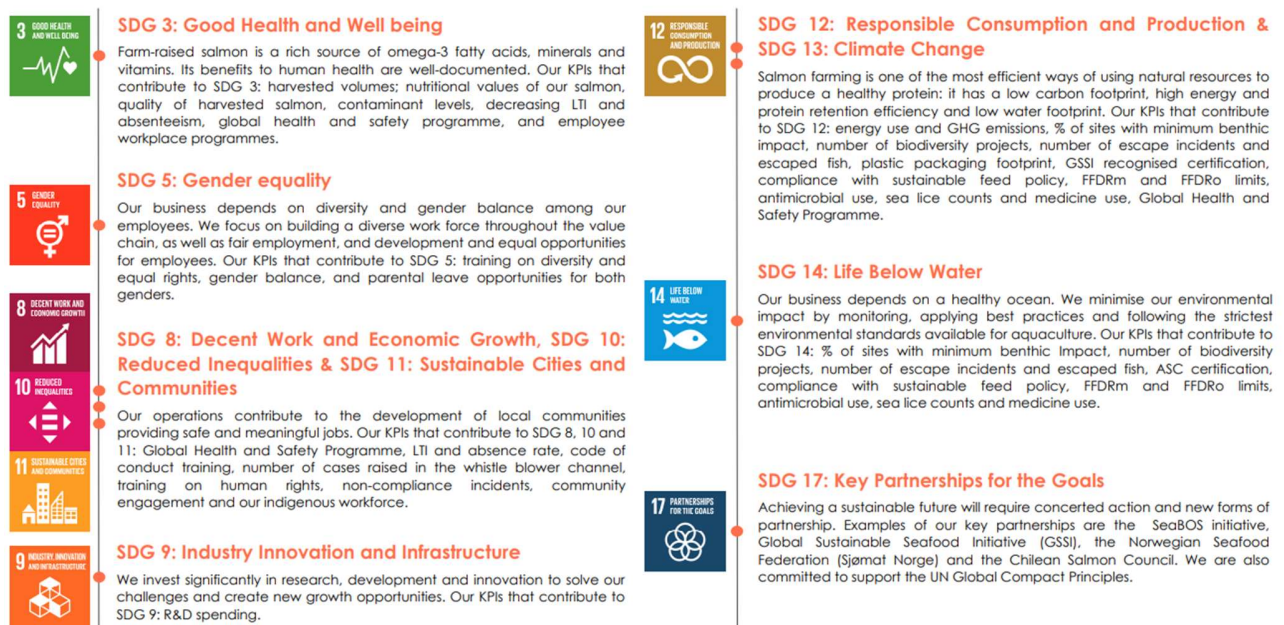


Figure 5: Mowi ASA: Green and Sustainability-Linked Financing Framework (2023), Mowi’s contribution to the UN Sustainable Development Goals (SDGs), https://mowi.com/wp-content/uploads/2023/05/GSLF_Framework_Mowi_2023.pdf

Grieg Seafood's green bond framework

Grieg seafood separates their framework into five pillars that include: “healthy ocean, sustainable food, profit and innovation, people and local communities” (Grieg Seafood ASA, 2020).

In figure 6 below are the main SDG's that Grieg seafood finds particularly important to them, however they also state they have multiple other SDG's that they are actively pursuing as well.

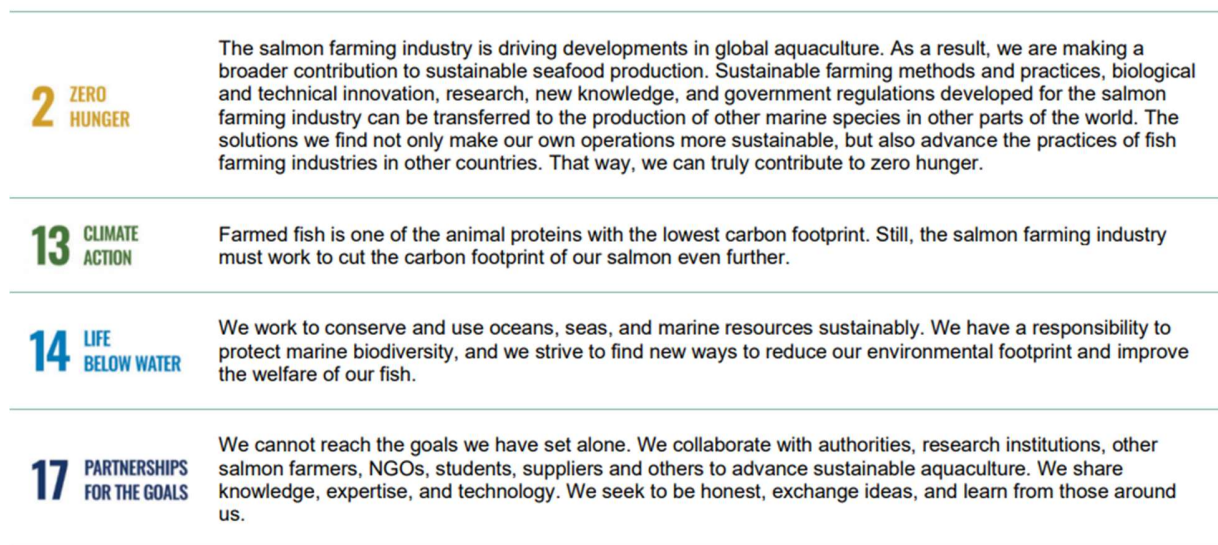


Figure 6: Grieg Seafood ASA (2020), Green Bond Framework, <https://cdn.sanity.io/files/lgakia31/production/92d0d3e7903ee90e2a409a1f02f963be1a389787.pdf?dl>

Much alike Mowi and SalMar, Grieg has put the proceeds of the green bonds that they have issued in green projects that tackle environmentally sustainable aquaculture, pollution prevention and control, water and wastewater management and waste management (Grieg Seafood ASA, 2020)

Pursuing Green Financing – Practices of SalMar, Mowi & Grieg Seafood

SalMar ASA

As of November 2022, SalMar ASA had 3.5 billion NOK outstanding in green bonds in three different “green” projects (SalMar ASA, 2022), which were named as follows; InnovaNor, smolt facilities and new production licenses.

InnovaNor is a new processing plant located in northern Norway which is meant to be a flagship plant of SalMar that emphasizes their commitment to local production. The idea behind investing

in local processing plants is to shorten the value chain thus curbing transport emissions and making their internal and external auditing more transparent.

Smolt facilities are crucial for any fish farm as the constant inflow of new fish is at the center of SalMar’s business. Therefore, the recent investments that they have made in new smolt facilities signals their commitment to further expanding their operations while also addressing the concerns of older smolt facilities being outdated both in terms of production and sustainability.

New production licenses are needed to stay competitive in the aquaculture industry and SalMar is proving this by investing over 1 billion NOK into their sustainable coastal fish farms which they state is needed as they have the ambitious goal of having all their fish farms certified either by ASC or Debio by 2025.

As shown in figure 7 below, we can see the amount of allocation of the green bonds to these different projects and what kind of an impact this will have upon “green savings”.

Project	Project Category As Presented in Framework	Allocated Proceeds	Green Savings
InnovaNor	Local and Sustainable Processing	NOK 1,191,856,000	42,000 tons CO _{2e} per year in Scope 3
New Smolt Facilities	Waste and Wastewater Management	NOK 1,192,953,000	865 million m ³ freshwater per year
	Sustainable Facilities for Smolt Production		100% RAS facilities
New Production Licences	Sustainable Coastal Fish Farms	NOK 1,115,191,000	Increase in % of sea sites certified by the ASC

Figure 7: SalMar ASA (2022), Green Bond Report, <https://www.salmar.no/wp-content/uploads/2016/06/Green-Bond-Report-2022.pdf>

Mowi ASA

Mowi issued its first green bond in January of 2020 valued at EUR 200 (Mowi ASA, 2020). Mowi split their allocation of the proceeds from their green bonds in two areas; water-use efficiency and sustainable feed. The majority of the proceeds went to the sustainable feed category while the remaining was allocated to the water-use efficiency as shown in figure 8 below.

Project Category	Allocated Proceeds, EURm	Avoided emissions attributable to allocated proceeds, tonnes CO ₂ e/year	Impact: Avoided emissions per EUR 1 million invested, tonnes CO ₂ e/year	Water saving attributable to allocated proceeds, million m ³ /year	Impact: Water saving per EUR 1 million invested, million m ³ /year
Water-use efficiency ⁽¹⁾	35.8	n/a	n/a	121.0	3.4
Sustainable feed	164.2	64,572	393.2	n/a	n/a
All categories	200.0	64,572	322.9	121.0	0.6

⁽¹⁾ Proceeds allocated to the water-use efficiency category will also have a positive biological impact as increased freshwater capacity contributes to reduced production time in sea, thereby reducing the number of sea-lice treatments, and exposure to other external risks.

Figure 8: Mowi ASA (2020), Green Bond Impact Overview, <https://mowi.com/wp-content/uploads/2021/03/Mowi-Green-Bond-Impact-Report-2020.pdf>

According to the Green Financing and Sustainability-Linked Financing Framework report, Mowi is seeking to finance a variety of new innovative solutions to problems that target their entire supply chain (Mowi ASA, 2023). Shades of Green states that Mowi’s current focus with the new financing is feed production, farms and processing facilities, R&D, electrification of vessels and farming sites and waste solutions.

Grieg Seafood ASA

Grieg Seafood ASA issued their first green bond in 2020 at a value of NOK 1 billion in June and another NOK 500 million in November of 2020 with a tap issue, resulting in a total of NOK 1.5 billion in green bonds issued. Of the total, 60% was spent on investments into recirculating aquaculture systems (RAS), which is a system that cycles water into a filtration system making the water fit for reuse. The rest of the funding was used for various other sustainable projects such as feed, pollution prevention, and waste management. At year-end, 2021, the green bond accounted for 47% of Grieg’s total debt financing.

From the green bond frameworks of these three companies, that together constitute a large part of the Norwegian fish farming industry, we can clearly see that there is an emerging trend of heavily investing in sustainability and the companies are almost moving in lockstep with each other in terms of strategy to achieve their respective goals. In order to reach their goals, the organizations are all pursuing green financing which was a practice that was until recently non-existent. If this trend continues, the financing aspect of the Norwegian fish farming industry could be wholly reliant on green bonds and other methods of green financing in the future. Furthermore, as these companies are not only major players in Norway, but also globally, there is a possibility of other companies within the industry to follow suit.

Green Financing – A trending future

In 2022 an initial bill was proposed by the Norwegian government to be implemented within the aquaculture industry, called a resource rent tax that would be at a rate of 40% on top of the 22% corporate tax, however, it was first revised in March 2023, to 35% and then later in May 2023, to 25% as a special tax on top of the 22% corporate tax. The special tax is only applicable to companies that earn profits of more than 70 million NOK (Norwegian Government, 2023). This tax implementation, even though lower than the originally proposed, still includes an excessive tax upon the industry whereby profits would decrease significantly. While this certainly causes a financial strain upon existing companies within the industry as well as becomes a barrier to entry for emerging companies which want to invest within the industry, it also provides companies with an incentive to invest in green projects or seek green financing. Keeping this newly imposed financial strain in mind, the confluence of sustainability, green financing, accreditation and certification presents a need for the Norwegian aquaculture industry to chart a more sustainable future by gaining investment from green financing (Berenguer et al., 2017).

Moreover, as the industry grapples with environmental concerns and strives to meet the increasing demand for seafood, embracing green financing as a catalyst for change can pave the way for a more responsible and resilient aquaculture sector. The Norwegian aquaculture industry holds a unique position globally, renowned for its expertise and dedication to sustainable practices (Frankic & Hershner, 2003). However, the industry faces a conundrum when it comes to achieving sustainability goals while navigating the complexities of accreditation and certification.

Today, simply espousing that the company is working towards a “greener/sustainable” future is not sufficient enough. Since the access to green bonds, which is a cheaper way of debt financing (Li et al., 2020), is locked behind the barriers of certain key performance indicators set by the third-party verifiers, the players within the industry need to properly commit themselves to the concept of sustainability in order to be profitable in the long run.

Hence, by leveraging green financing, stakeholders in the Norwegian aquaculture industry can invest in cutting-edge technologies and infrastructure that promote resource efficiency, reduce environmental impacts, and safeguard biodiversity. From innovative feed solutions and efficient production systems to advanced waste management strategies and disease control measures, green

financing enables the implementation of sustainable practices that address the conundrum of sustainability and financing.

Furthermore, like stated earlier, green financing can facilitate the adoption of rigorous accreditation and certification schemes that ensure the industry's commitment to responsible aquaculture practices. By incentivizing investments in certifications such as the Aquaculture Stewardship Council (ASC), green financing strengthens the credibility and marketability of Norwegian aquacultural products. This, in turn, cultivates consumer trust and stimulates demand for sustainably sourced seafood both locally as well as internationally.

To navigate the conundrum of sustainability, financing, accreditation, and certification effectively, collaboration and knowledge sharing among stakeholders is essential. Green financing can support research and development initiatives, training programs, and industry-wide partnerships that promote the exchange of best practices, technological advancements, and regulatory frameworks. By fostering a collective commitment to sustainability, green financing empowers the Norwegian aquaculture industry to overcome the challenges and complexities associated with future demands, due to the need of environmentally friendly produce.

As the industry strives to balance economic viability with environmental and social responsibility, green financing emerges as a critical enabler for a more sustainable future in Norwegian aquaculture. By aligning financial investments with environmental and social objectives, green financing encourages the industry to progress towards a greener, more resilient, and transparent model of aquaculture production.

Concluding Remarks

In conclusion, this thesis has explored the intricate conundrum of sustainability in the Norwegian aquaculture industry, focusing specifically on the challenges surrounding green financing, accreditation, and certification. Through an in-depth analysis of the industry's dynamics and the perspectives of various stakeholders, several important findings have emerged.

Firstly, it has become evident that while there is a growing recognition of the importance of sustainability in aquaculture, the implementation of green financing mechanisms remains complex. Financial institutions, policymakers, and industry players need to collaborate closely to

develop innovative financing models that incentivize sustainable practices while considering the unique characteristics of the aquaculture sector.

Secondly, accreditation and certification schemes play a crucial role in ensuring the environmental and social integrity of aquaculture operations. However, there is a need for greater harmonization and transparency among these schemes to avoid duplication of efforts and confusion for stakeholders. A unified framework that incorporates best practices and encourages continuous improvement should be developed to enhance the credibility and effectiveness of accreditation and certification processes.

Moving forward, it is imperative that the Norwegian aquaculture industry takes proactive steps to address the identified challenges. Stakeholders must engage in open dialogue and knowledge-sharing to foster a culture of sustainability, promoting responsible practices that safeguard marine ecosystems and secure the industry's long-term viability.

To achieve this, we propose the establishment of collaborative platforms where financial institutions, aquaculture companies, regulatory bodies, and environmental organizations can come together to share experiences, develop guidelines, and drive innovation. These platforms should facilitate the exchange of ideas and foster partnerships, ultimately leading to the adoption of more sustainable financing mechanisms and streamlined accreditation and certification processes.

To summarize, this thesis contributes to the understanding of sustainability in the Norwegian aquaculture industry, shedding light on the complexities surrounding green financing, accreditation, and certification. It is our hope that the insights and recommendations presented here will bring clarity related to any queries regarding sustainability, green financing, accreditation and certification, for relevant stakeholders, to be used for amelioration of the Norwegian aquaculture industry.

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