Universitetet i Stavanger

UIS BUSINESS SCHOOL

MASTER'S THESIS

STUDY PROGRAM:	THESIS IS WRITTEN IN THE FOLLOWING SPECIALIZATION/SUBJECT:
Master of Science in Business Administration	Applied Finance
	IS THE ASSIGNMENT CONFIDENTIAL? No (**NB**! Use the red form for confidential theses)

TITLE:

What are the Risk Preferences (Attitude Towards Risk), Most Important Risk Sources and the Risk Management Tools Used in the Norwegian Aquaculture Industry? Empirical Study on the Norwegian Aquaculture Industry

AUTHOR(S)		SUPERVISOR:
		Bård Misund

Candidate number:	Name:
4009 …………………	Joyce Lillian Wenche Darby ………………………………….
4018 …………………	Diyar Incedursun ………………………………….

Acknowledgement

We are pleased to submit our master thesis that concludes our study program at the University of Stavanger at the Business School. We would like to take the opportunity to thank our master thesis advisor, Bård Misund, for taking the time to advise us throughout the semester. His guidance and support contributed greatly to the development of our thesis.

Abstract

This study collected thirteen responses from companies in the Norwegian aquaculture industry to gain empirical information on the risk preferences (attitude towards risk), important risk sources and the current usage of risk management tools in the Norwegian aquaculture industry. The results from the survey describe the fish farmers' attitude towards risk and places a majority of fish farmers on a spectrum of risk-neutral to risk-seeker. The most critical sources of risk are ordered from most important to least important in the following way; production risks (diseases, escaping and bio-physical shocks), price or market risk (future salmon price), institutional risks, demand, input costs, and technology and moral hazard (both are tied for last place). All respondents use insurance, while slightly over half of the respondents use future/forward contracts to mitigate risks. The fish farmers also gave a moderate rating to the overall effectiveness of insurance and their current risk management strategy. The results from the survey closely resemble a previous study conducted in the US agriculture industry.

Table of Contents

List of Figures

List of Formulas

viii

List of Tables

1. Introduction

The aquaculture industry is a large and young industry in Norway, in which fish farmers' have various risk preferences, face different sources of risk and use different risk management tools. There has been limited studies in the aquaculture industry on the risk preferences, how they rank the importance of the various risk sources, and the risk management tools used. Bergfjord (2009) addresses the limited research on Norwegian aquaculture industry as it relates to the risk perceptions and risk management by providing an empirical study.

Academics, consultants, policy-makers benefit from understanding the risk preferences, risk sources and current usage of risk management tools in the aquaculture industry. With this information, they can develop risk management strategies that include risk management tools that are more catered to the fish farmers' needs.

This paper intends to examine the risk preferences in the Norwegian aquaculture industry. More specifically this paper is collecting information on the attitudes towards risk among fish farmers. It then groups the fish farmers across the different risk preferences categories, such as risk-averse, risk-neutral, and risk-seeker. For example, if a fish farmer is considered to exhibit a high degree of risk-seeking, the fish farmer may not be interested in futures/forwards because the potential upside is limited, even if they benefit from the reduction in risk. The benefit from limiting the losses may not be sufficiently large enough for the individual to give up any potential gains. This impacts the demand of risk management tools and/or financial innovations like forwards/futures contracts.

Next, this paper intends to look at the various risk sources that the fish farmers face. The study ranks risk sources from most important to least important based on the results from the survey. There is a need to know the most critical sources of risk, because different risk management tools hedge different sources of risk. For example, Bergfjord (2009) states that insurance primarily mitigates production risk, while futures/forward contracts primarily mitigate market or price risk. As mentioned by Bergfjord (2009) other risks, such as institutional risks are prevalent and there appears to be a lack of a comprehensive framework to mitigate institutional risks. Understanding the various risk sources will allow academics,

consultants and policy-makers to design risk management strategies that use the available risk management tools and/or develop financial innovations.

Lastly, the study examines the current usage of risk management tools in the Norwegian aquaculture industry by uncovering the percentage of fish farmers that use insurance and derivatives (i.e futures/forward contracts) to reduce risk. The most common risk management tools are insurance and derivatives. Not only does this paper seek to find out what risk management tools fish farmers use, but the study intends to find out their opinions on the level of effectiveness it provides for hedging against risk. If these tools are unsatisfactory, there may be a need for other risk management tools or financial instruments. It is important to continue to meet the needs of fish farmers when it comes to reducing unsystematic risk because it is diversifiable, making it theoretically unnecessary.

The paper is set up in the following way: chapter 2 provides a background on the salmon farming industry; chapter 3 provides a summary of previous research into the risk perception and risk management in the Norwegian aquaculture industry; chapter 4 provides a theoretical chapter; chapter 5 details the methodology; chapter 6 presents the results; chapter 7 provides a discussion of the results; chapter 8 offers a conclusion.

2. Background on Salmon Farming

This section provides a background on the Norwegian salmon farming industry, which provides a general background to establish a foundation for the reader. Understanding key characteristics of the salmon farming industry provides context to the results and helps explain the results which is done in the discussion section.

2.1   Industry Revenues and Growth Rates

The aquaculture industry became established in the 1960s and 1970s, and has since grown at very high rates. Over the past 10 years, revenue has grown by 300%. Norway is the largest producer of salmon, producing over 50% of the world's salmon supply. In Norway, approximately 95% of the salmon production is exported (EY, 2018).

In 2016, revenue in the Norwegian aquaculture industry increased to NOK 212.7 billion from NOK 161.5 billion the previous year. Reorganization within the aquaculture industry attributed an estimated NOK 14 billion in revenue growth. Other factors such as the increase in demand and the reduction in supply have attributed to the increase in salmon price and therefore the revenue growth (EY, 2018).

Between 2016 and 2017, the Norwegian export value of both salmon and trout doubled since 2006. The main reasons are (1) decrease in salmon harvest volumes in Norway and Chile, causing an increase in prices (2) advantageous exchange rates, and (3) low interest rates in Norway. The industry enjoyed unprecedented levels of export value, revenue and profitability. Despite experiencing high profitability, the costs have been increasing as there has been a growing challenge with combating sea lice and diseases, and rise in feed costs (EY, 2018)

2.2   Industry Structure

Information regarding the industry structure within the aquaculture industry is gathered from Marine Harvest (2018) and summarized below.

Figure 1: Top Companies in the Atlantic Salmon Farming Industry in 2017 (Source: Marine Harvest, 2018)

	Top 10 - Norway	H.Q.	Top 5 - United Kingdom	H.Q.	Top 5 - North America	H.Q.	Top 10 - Chile	H.Q.
1	Marine Harvest	210 200	Marine Harvest	60 200	Cooke Aquaculture	57 000	Salmones Multiexport	58 700
2	Salmar	135 200	Scottish Seafarms	31 000	Marine Harvest	39 400	Cermaq**	54 000
3	Lerøy Seafood	132 000	The Scottish Salmon Co.	25 300	Cermaq**	21 000	Marine Harvest	44 900
4	Cermaq**	48 000	Cooke Aquaculture	20 000	Northern Harvest	12 500	Empresas Aquachile	43 300
5	Grieg Seafood	40 900	Grieg Seafood	12 100	Grieg Seafood	9 600	Pesquera Los Fiordos	41 000
6	Nova Sea	40 700					Australis Seafood	39 100
7	Nordlaks	40 000					Camanchaca	30 800
8	Norway Royal Salmon	31 900					Blumar	27 000
9	Alsaker Fjordbruk	25 000					Nova Austral	24 500
10	Bremnes Seashore	24 000					Invermar	23 200
	Top 10	727 900	Top 5	148 600	Top 5	139 500	Top 10	386 500
	Total	1 087 000	Total	156 900	Total	145 500	Total	521 200
	Share of total	67 %	Share of total	95 %	Share of total	96 %	Share of total	74 %

Note: All figures in tonnes GWT for 2017

* UK and North American industry are best described by top 5 producers.

** Cermaq is a fully owned subsidiary of Mitsubishi Corporation

Figure 1 is provided by Marine Harvest (2018) and lists the top companies in the Aquaculture Industry in 2017. The largest company in the salmon farming industry, in terms of production, is Marine Harvest. It is responsible for one fifth of the salmon production in Norway, approximately one third in North America and the UK.

In Norway, about 160 firms own commercial licenses for salmon and trout. It is important to mention that a portion of these firms are controlled by other firms. Previously, the industry was very fragmented and there were several small firms. The industry was very fragmented, because the government focused on decentralized structures and local ownership. The consolidation of firms is expected to continue as it has in the past 10 years. A major trend in the salmon industry is the consolidation across regions.

Several major companies in the Norwegian aquaculture industry have merged together in the last decade. As a result of the consolidation trend, production costs have continued to decline but at a diminishing rate. The expected continuance of consolidation will benefit the majority of the small companies, because they will have more access to capital and shared R&D.

2.3   Salmon Markets

Information regarding the salmon markets is gathered from Marine Harvest (2018) and summarized below.

Since 2008, the average salmon price in Norway has been NOK 39.7/kg. Similar to other commodities, the Atlantic salmon price across different markets has experienced high levels of volatility.

Figure 2: Norwegian Atlantic Salmon Prices 2008-2018 (Source: Marine Harvest, 2018)
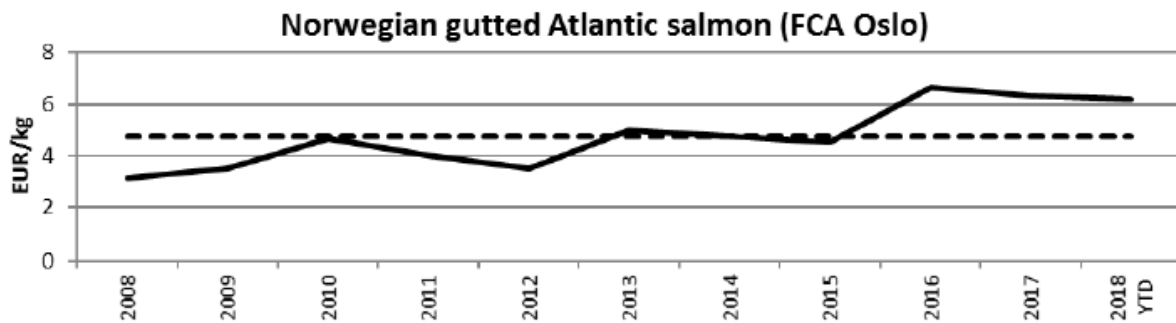
Figure 2 is provided by Marine Harvest (2018) and shows the Norwegian salmon prices between 2008 and 2018. The harvest size of the salmon vary across markets, but generally follows a normal distribution. The average is 4-5 kg, in which the market and biological risks cancel each other out. A smaller size (1-3kg) may be due to disease or to meet cash flow needs. A larger size (over 5kg), may be due to economies of scale, a reduction in production expenditures, or the plan to serve niche markets.

Prices have continued to increase due to the growth in consumer demand in both existing and new markets, and the decline in salmon volumes in 2016. The price increases primarily benefited the sea farming sub-segment, which created positive effects that spilled over to other firms within the aquaculture industry.

2.4   Salmon Demand

According to EY (2018), the main macro trends that impact demand are (1) climbing world population (2) increasing middle class, particularly in big emerging markets (3) the promotion of health benefits from seafood by health authorities (4) fisheries becoming closer to being entirely exploited (5) more efficient and environmentally friendly production than other animal production (6) increasing levels of soil erosion which drives the need to consider alternative ways to feed the world.

2.5   Salmon Supply

According to Marine Harvest (2018), the Atlantic salmon supply has risen by 417%, experiencing an 8% annual growth since 1995. Between 2005 and 2017, the Atlantic salmon

has been an experiencing an annual growth of 5%. Between 2017 and 2021, Kontali Analyse projects an annual growth of 4%.

The expected salmon supply is expected to experience a diminishing growth rate. This may be explained by the biological boundaries that the industry is currently facing at the production level.

Between 2016 and 2017, the challenges with sea lice caused a 5% decline in the Atlantic salmon harvest (or 63,000 tons wfe) from the previous year. Sea lice also increased the mortality rate from 16% to 19%, in which 53 million salmons died inside the cage. Cargill (WEOS AS) estimates that sea lice is costing the aquaculture industry NOK 10 million annually. (EY, 2018)

Figure 3: Coastlines Fit for Salmon Farming (Source: Marine Harvest, 2018)

Figure 3 is provided by Marine Harvest (2018) indicates the major coastlines that are fit for salmon farming. Due to the biological and natural constraints of salmon production, the following places are able to produce salmon: Canada, Chile, the Faroe Islands, Iceland, Ireland, New Zealand, Norway, Scotland, Tasmania, and USA.

Marine Harvest (2018) states that salmon farming relies on a set of conditions that relate to temperature, currents, and the political climate. The temperature range over 0 degrees to 18-20 degrees Celsius. The optimal temperature range for salmon farming is from 8 to 14 degrees Celsius. A salmon farm requires a current to flow through the farm, and the current needs to

be below a specific level to allow the free movement of fish in the sites. Lastly, the political climate impacts supply. Licensing systems and regulations that permit salmon farming also impact supply.

2.6   Regulations of Fish Farming in Norway

Information relating to regulations in the aquaculture industry is gathered from Marine Harvest (2018) and summarized below.

In Norway, the two most significant laws that govern fish farming firms are The Aquaculture Act (2005) and the Food Safety Act (2003). Firms must hold a license to operate a fish farm in Norway. All companies are subject to restrictions in production and ownership within the industry.

Salmon farming licenses permit salmon farming in freshwater or the sea. In 2017, both Atlantic salmon and trout in sea water were capped at 1015 licenses, while the number of licenses for farming in fresh water were not restricted. The number of farming sites are restricted to four for fish farming licenses in sea water.

Production is regulated and restricted according to the "maximum allowed biomass" (MAB). MAB represents the maximum volume of fish a firm can possess at sea at any time. Usually the MAB is 780 tonnes per license. The level of MAB varies across geographical regions as it is determined by the level of sea lice in a production area. "Green" geographical areas are permitted to grow 6%, while firms with existing licenses were permitted to grow by 2%. Additional growth are awarded to sites that comply with more stringent environmental conditions.

The government also limits the ownership of the total licensed biomass. Prior to November 2015, firms were required to go through an application process with the government to gain control of over 15% of the total licensed biomass. The approval of the application were based on a set of conditions that related to their R&D activity, fish processing and apprenticeships in coastal regions. Currently, companies are not permitted to control over 50% of the total biomass.

To facilitate investments in new farming technologies, the Norwegian government created a new category of licenses by introducing development licenses in November 2015. For the first 15 years, the development licenses will be at zero cost. Afterwards, assuming that the project being executed meets the established criteria, it may be converted into commercial licenses for NOK 10 million.

2.7   Risk Factors in the Aquaculture Industry

This paper presents and discusses the results on a survey that attempts to identify the most critical risk factors in the Norwegian aquaculture industry. It is therefore important to have a general overview of the different types of risk factors farmers face. Bergfjord (2009) designed a study to uncover the most important risk factors in the Norwegian aquaculture industry. The design of the survey was inspired by earlier studies in the agriculture industry.

Similar to the Bergfjord (2009) paper, this paper compares the results from the survey to earlier studies in the US agriculture industry in the discussion section. For comparison purposes, this paper will also categorize the different sources of risks the same way as the US Department of Agriculture (2018). The risk sources are grouped into the following categories; market or price risk, production risk, financial risk, institutional risks, and human/personal risks. (US Department of Agriculture, 2018).

2.7.1   Market or Price Risk

Market or price risk describes the uncertainties about the price producers will receive for the commodities and the costs for producing the commodities. This relates to both the input and output price volatility. In other words, market and price risk involves the uncertainties surrounding the cost of producing (input) and the sales price (output). This study on the Norwegian aquaculture industry this relates market or price risk to the uncertainties surrounding the future salmon price.

2.7.2   Production Risk

Production risk relates to issues with weather, diseases and other factors that negatively impact the volume and quality of commodities being produced. In the aquaculture industry,

production risk relates to biophysical shocks (i.e hurricane), diseases and escaping, and fish health.

According to Marine Harvest (2018), the main health risks in salmon are sea lice, pancreas disease (PD), salmonid rickettsial septicaemia (SRS), infectious pancreatic necrosis (IPN), heart and skeletal muscle inflammation (HSMI), infectious salmon anaemia (ISA) and gill disease (GD).

2.7.3 Financial Risk

Financial risk refers to the risk of borrowing money, such as the obligation for debt repayment, and fluctuations in either the interest rates or exchange rates.

2.7.4 Institutional Risk

Institutional risk refers to the uncertainties about government actions and rules that impact the company. This includes laws, policies, animal welfare and other regulatory effects in the aquaculture industry. Examples of institutional risks in the aquaculture industry include changes in animal health regulations, environmental or market regulations, modifications in the licensing system, access to areas, political shocks, and taxes.

2.7.5 Human and Personal Risk

Human and personal risk relate to human health and personal relations. This includes moral hazard, accidents, illness, death or other personal issues that can cause an impact on the business.

3. Literature Review

3.1 *Risk Perception and Risk Management in Norwegian Aquaculture*; Bergfjord (2009)

This section summarizes the study conducted by Bergfjord (2009) on the Norwegian fish farmers' attitude towards risk, risk sources and the risk management strategies. While there have been studies on this topic in the agriculture industry, none have been conducted in the aquaculture industry. Bergfjord (2009) consequently attempts to extend the empirical framework from earlier studies in the agriculture industry to the aquaculture industry. The findings are designed to benefit academics and policy makers by gaining a deeper understanding of risk to develop more fitted policies.

In order to gather empirical data, Bergfjord (2009) conducted a survey on Norwegian fish farmers with the objective of finding the differences between farmers, and the relationships between risk perception, company characteristics, and behaviors. Bergfjord (2009) grouped the questions in the survey into: (1) company demographics; (2) production and sales location; (3) assessment of own attitude towards risk; (4) perceptions on various sources of risk and risk management strategies; (5) prospective salmon futures market; (6) competitiveness within the industry. This paper employs descriptive statistics, inclusive of regression analysis. The primary focus is on the results relating to the risk questions (groups 3, 4 and 5), while the results from the remaining questions are considered to be explanatory variables.

The participants were 38 out of a total of 100 salmon fish farmers in Norway where there is variation among company characteristics in the sample (size, ownership structure, geographical diversification). One of the limitations in the survey has to do with the unsatisfactory size of the data sample. However, the majority of the questions experienced low variability in the responses, which gives room for validity.

Bergfjord (2009) concludes that fish farmers are moderately risk-averse. The survey presents five statements in which the fish farmers can identify their own attitude towards risk. Additionally, statements from other questions are consistent with the farmer's own perceptions and Bergfjords conclusion. The majority is more inclined to sacrifice expected profit to limit their exposure to risk.

According to the survey, respondents perceive the aquaculture industry as being riskier than other industries. However, Bergfjord (2009) points out the possibility of fish farmers' lack of reference point in comparing to other industries, as the fish farmers are more familiar with the aquaculture industry. Findings of other questions characterizing their own attitude to risk reveals that fish farmers consider themselves moderately risk-averse.

In order to reveal what the farmers considered as the most important risk sources, Bergjord (2009) asked respondents to rate the importance of various risk sources, and afterwards, identify the three most important ones.

The most important risk sources are future salmon price (market risk), diseases (production risk), and various regulatory issues (institutional risk). The most important risk source is the future salmon price. Factors that impact salmon price include market access/trade policy, future demand and factor prices, which are also rated highly. Diseases and financial risks were also highly rated. The remaining risk sources considered to be most important fall under institutional risks. Further analysis showed that farmers from different demographic areas did not rank the importance of risk factors differently.

The result on the farmers' use of risk management strategies reveals that the most important risk management strategies reported by the farmers were (1) low cost production, (2) disease prevention (3), low debt to equity ratio (4), and high liquidity (5).

Furthermore, the survey showed that larger companies used more sophisticated management tools compared to smaller companies. Bergfjord (2009) states that this might be explained by a higher resource capacity that larger companies possess in order to pursue different management strategies, such as production diversification and technology.

The most common strategies used to manage risk are conventional in-firm strategies. The sample is limited, and some questions still remain on the effect of competitiveness and how the firms' characteristics relates to risk sources, however the main findings seem reliable. The survey asks the respondents to score four different questions on their level of agreement (1= completely disagree, 7=completely agree) relating to the salmon futures market. The

results indicate that they exhibit very little knowledge about the futures market, and show a marginal level of interest to learn more about the futures market.

4. Theoretical Chapter

4.1 Types of Risk and Risk Preferences

In a broad sense, risk can be defined as the weight and probability of undesired consequences (Lawrence, 1976). For example, in the context of investments, risk can be explained as the probability that the investment's actual return will differ from the expected return. In other words, the investors' probability of experiencing losses. Risk is synonymous with the potential downside from an investment, which signifies the potential harm of an investment (Strand & Oughton, 2009). Since risk is quantifiable and can be measured, it can be hedged or insured against.

4.1.1 Types of Risk

According to Bodie, Kane & Markus (2018), risk can be divided into two categories; systematic and unsystematic risk. Systematic risk are risk factors that the entire economy shares. Since there are spillover effects from one market to another, it can potentially cause a failure in the financial system. This type of risk cannot be eliminated by diversification, and is therefore also called undiversifiable risk. Unsystematic risk are risk factors that are specific to the firm and do not relate to market risk factors. Since this type of risk can be eliminated by diversification, it is also called diversifiable risk.

4.1.2 Risk Preferences

Risk preferences refers to the attitude individuals have towards risk. It explains how an individual acts when the individual is presented with a risky option and a safer alternative. The study of risk preferences is an important element in understanding economic behaviors and is a well-studied phenomenon in the field of finance (Rieger, Wang and Hens, 2015). By understanding how individuals or companies feel towards their exposure to certain risks, it is possible to predict economic decisions. This includes hedging with derivatives and developing risk management strategies, to align their exposure to risk with their preferred level of risk exposure.

According to Bodie, Kane & Markus (2018), individuals can be organized into three categories; risk-averse, risk-seeker and risk-neutral. Understanding the different types of risk preferences helps predict the behavior and/or actions an individual makes when dealing with risk.

4.1.2.1 Risk-Averse

Risk averse describes an individual that is hesitant towards taking on risk. This type of investor will almost always choose the safer investment. In order to protect itself from higher risks. However, this investor might contemplate investing in a risky portfolio if they are sufficiently compensated for the risk by a risk premium.

4.1.2.2 Risk-Neutral

Risk-neutral describes an individual that is indifferent towards risk and merely considers the expected return when making investment decisions. In other words, the risk-neutral investor is indifferent towards a guaranteed return on an investment, or a 50/50 percent chance of either doubling the return or losing the investment.

4.1.2.3 Risk-Seekers

Contrary to risk-averse investors, risk-seekers are described as being inclined to take on high levels of risk, even when the expected returns are relatively small. Risk-seekers will look for risky investments.

4.2   Risk Management Tools – Futures, Forwards, Options

This section defines the concepts of futures, forwards and options.

4.2.1   Forward Contracts

According to Hull (2012), forward contract is a private agreement between two parties to purchase or sell an asset at a predetermined price at a predetermined date in the future. An

individual with a long position buys a forward contract. An individual with a short position sells the forward contract.

As remarked by Hull (2012), the main features of a forward contract are (1) private contract between two parties (2) terms are not standardized (3) typically one specified delivery date (4) settled at the end of the contract (5) delivery or final cash settlement typically takes place (6) contains a small amount of credit risk.

According to Hull (2012), the over-the-counter forward market may provide a better hedge than the futures market, because of basis risk. Basis risk stems from the difference in the spot price and the futures price. This occurs when the asset being hedge and the underlying asset in the derivative have different prices, if the exact purchase or sell date is not yet determined, or if the futures contract is required to be closed out before the delivery month.

4.2.2   Futures Contracts

According to Hull (2012), a forward contract is a standardized agreement between two parties to purchase or sell an asset at a predetermined price at a predetermined date in the future. An individual with a long position buys a futures contract. An individual with a short position sells the futures contract.

Based on Hull (2012), the main features of a forward contract are (1) traded on an exchange, (2) terms are standardized (3) array of delivery dates (4) daily settlements (5) typically closed out before maturity (delivery or final settlement are rare) (6) negligible amounts of credit risk.

As stated by Bergfjord (2007), futures contracts draw interest from various user types. The main user types are investors, speculators and hedgers. Hedgers can use futures contracts to minimize or remove their exposure to price risk from an asset. Investors and speculators can enjoy diversification benefits on their investment portfolio. This is because commodity futures provide similar returns and standard deviation to equites, while equity and bond returns have a negative correlation. Moreover, speculators can bet more easily on certain price movements, because they are not required to physically own the asset or seek a counterpart on a forward contract.

As mentioned earlier, even though the over-the-counter forward market may provide a better hedge than the futures market, because of basis risk. In spite of this, the futures market offers key advantages that may make it more favorable. The key advantages include (1) the prices are available to the public (2) removal of counterparty risk (3) less difficult to seek a counterpart to the contract. As a result of these advantages, the transaction costs are lowered. (Bergfjord, 2007).

Figure 4: Payoff Functions for Forward/Futures Contract (Source: Hull, 2012)
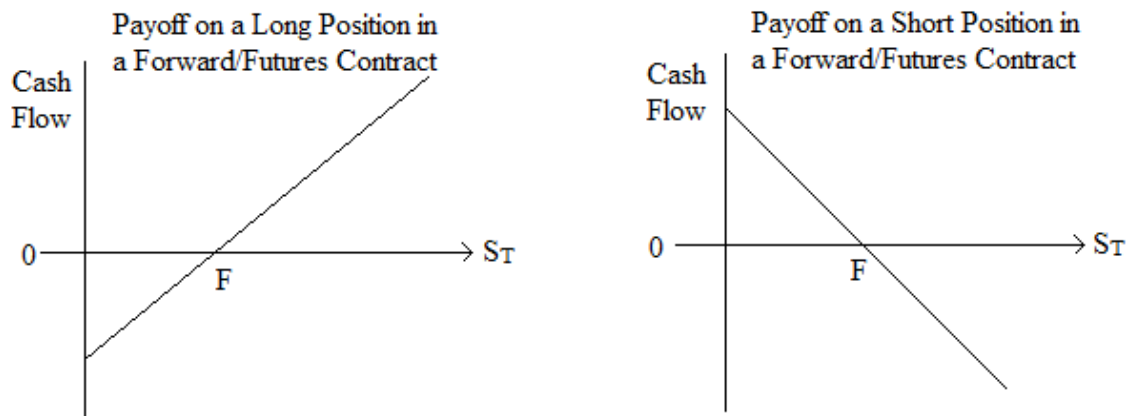
According to Hull (2012) the payoff from a long position in a forward or futures contract is $S_T - F$. The payoff from a short position in a forward or futures contract is $F - S_T$. Where S_T is the spot price and F is the forward price.

4.2.3   Options

This section defines and discusses options, which is based on Hull (2012).

An option is a type of derivative that gives the holder the right, not the obligation, to purchase or sell an asset. An American option gives the holder the right to purchase or sell an asset on or before the delivery date. A European option gives the holder the right to purchase or sell an asset at the delivery date.

An individual with a long position in an option has the right to purchase or sell an asset. An individual with a short position writes an option at a premium, and has the obligation to purchase or sell an asset.

A call option gives the holder (long position) the right to purchase an asset at a specified price. A put option gives the holder (long position) the right to sell an asset at a specified price. The specified price in an option is called the exercise price or strike price.

Options act as insurance, because the holder is given the right to purchase or sell an asset at a specified price. As shown in the diagrams below, the losses on a long position in a call or put option are limited, in which their payoff is 0. The maximum loss a holder of an option faces is the premium or the cost of the option.

The person with a short position in a call or put option receives a premium, which represents the maximum profit. However, the individual is obligated to buy or sell an asset, so they face unlimited losses.

Figure 5: Payoffs Functions on a Long Position and Short Position in a Call Option (Source: Hull, 2012)
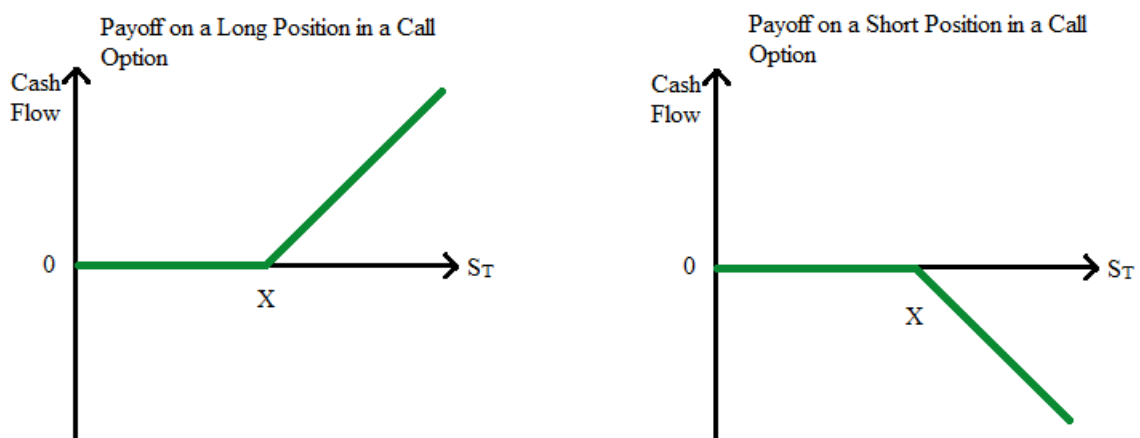
According to Hull (2012), the payoff from a long position in a call option is $\max(S_T - X, 0)$. The payoff from a short position in a call option is $-\max(S_T - X, 0)$. Where, the strike price is X, and the S_T stock price at time T.

Figure 6: Payoffs on a Long Position and Short Position in a Put Option (Source: Hull, 2012)
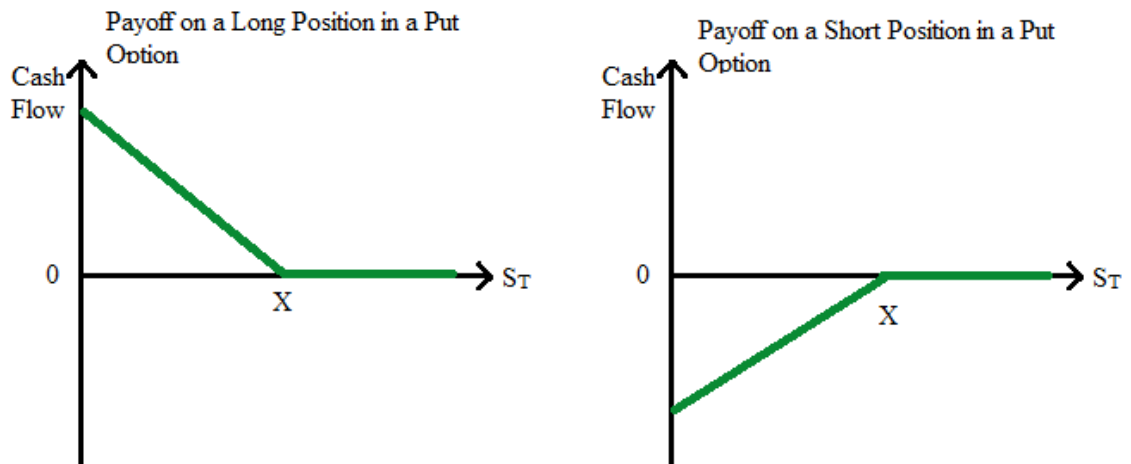
According to Hull (2012), the payoff from a long position in a put option is $\max(X - S_T, 0)$. The payoff from a short position in a call option is $-\max(X - S_T, 0)$. Where, the strike price is X, and the S_T stock price at time T.

5. Methodology

To gather empirical information regarding the risk preferences, risk sources and risk management tools in the Norwegian aquaculture industry, a study was designed and conducted to gather a minimum of ten responses. The paper presents and discusses the results from 13 respondents that completed the survey. In addition, the key findings from the survey are compared to a previous study in the US agriculture industry.

5.1   Survey Design

The survey has a total of 34 questions plus a section for an open-ended question and additional comments. The 34 questions are grouped into the following four sections: firm characteristics, risk preferences, risk sources, and risk management tools. Firm characteristics has six questions. Risk preferences has five questions. Risk sources has nine questions. Risk management tools has 15 questions. The open-ended question asks the respondent to describe a scenario where they have used insurance. The survey concludes with a section that allows the respondent to offer additional information or comments.

5.1.1   Company Characteristics

This section of the survey collected information on the headquarters zip code, number of employees, organization structure, number of suppliers, and whether or not they have a financial department.

5.1.2   Risk Preferences

Respondents in the survey are given five questions (questions 7 through 11) that relate to risk preferences, which are inspired by Guillemente & Gilliam (2012). These questions attempt to uncover the respondents' attitude towards risk and to group them across the different risk preference categories.

Survey questions 7 and 8 are multiple-choice questions with four options that the respondents can choose from. Each option has an associated rating, which represents a risk preference

category. The ratings are categorized as follows; (1) high-degree of risk-aversion, (2) risk-averse, (3) risk-seeking and (4) high degree of risk-seeking.

Survey questions 9 and 11 are multiple-choice questions with four options that the respondents can choose from. Each option has an associated rating, which represents a risk preference category. The ratings are categorized as follows; (1) high-degree of risk-aversion, (2) risk-averse, (3) risk-neutral, (4) risk-seeking and (5) high degree of risk-seeking.

5.1.3   Risk Sources

The section that relates to risk sources in the survey is inspired by Bergfjord (2009). The respondents are asked to rank various sources of risk from a scale of one through seven. Production risk (diseases, escaping and biophysical shocks), market or price risk (future salmon price), institutional risk, demand, input, technology and moral hazard.

5.1.4   Risk Management Tools

The respondents are asked whether or not they use insurance, futures/forward contracts and other alternatives. Additionally, they are asked to rate the effectiveness of insurance and their current risk management strategy.

5.2   Sample

The "Fiskeridirektoratet" ("Fishery Directory") provides a list of all the companies registered in the aquaculture industry. At the risk of not receiving ten responses needed from companies in the Norwegian salmon farming industry, the survey was sent out to other companies within the aquaculture industry. Since the companies within the aquaculture industry share similar characteristics and face similar risks, there are important insights that can be drawn from their responses.

5.3   Data Collection

The first batch of companies were randomly selected from the list, and the survey was sent to 38 companies. After receiving only five responses, the companies that did not respond to the

survey received a follow-up email as a reminder. With no additional responses, a new batch of companies was created with 59 companies. The second round of data collection provided eight additional responses. In total, 13 out of the 97 companies responded to the survey, creating a response rate of 13.40%.

5.4 Data Analysis

This paper uses basic descriptive statistics, such as averages and weighted-averages, and standard deviation. This section details the data analysis employed for risk preferences, risk sources and risk management tools.

5.4.1 Data Analysis on Risk Preferences

The discussion section presents a table with the averages and standard deviations for survey questions 7 through 11. Uses simple arithmetic average and standard deviation from the Excel functions. The equations are shown below.

Formula 1: Simple Arithmetic Average

The average is calculated by taking the sum of all the observations, then dividing it by the number of observations.

$$\frac{\sum x}{n}$$

Where:

x = the observation

n = the number of observations

Formula 2: Standard Deviation (Source: Microsoft, 2019)

$$\sqrt{\frac{\sum (x-\bar{x})^2}{(n-1)}}$$

Where:

x = the observation

$\bar{x}$ = the average

n = the number of observations

5.4.1.2 Grouping Respondents across Risk Preference Categories

The discussion section categorizes the respondents into the risk preferences categories, which are (1) high degree of risk-aversion, (2) risk-averse, (3) risk-neutral, (4) risk-seeker and (5) high degree of risk-seeking. The results from survey questions 9 and 11 are used to categorize the respondents. As mentioned earlier, these two survey questions have five options that the respondent can choose from. So each option is given a rating on a scale from one through five.

Table 1: Risk Preference Categories and Number of Respondents

Risk Preference Categories	Question 9 Number of Respondents	Question 11 Number of Respondents	Total Number Respondents in Risk Preference Category	Percentage in Each Risk Preference Category
High Degree of Risk-Aversion	0	0	0	0.00%
Risk-Averse	1	2	3	11.54%
Risk-Neutral	6	7	13	50.00%
Risk-Seeker	6	4	10	36.46%
High Degree of Risk-Seeking	0	0	0	0.00%

Total	13	13	26	100.00%

The first column lists the risk preference categories. The second column shows the number of respondents that belong to each of the risk preference categories in question nine. The third column shows the number of respondents that belong to each of the risk preference categories in question 11. The fourth column shows the total number of respondents that belong to each of the risk preference categories. It adds the respondents in question nine and question 11 that belong to each risk preference category. The fifth column divides the total number of respondents in each of the risk preference categories by the total number of responses.

Calculations:

Risk preference category 1 (very risk-averse): $(0+0)/26 = 0.000$

Risk preference category 2 (risk-averse): $(1+2)/26 = 0.1154$

Risk preference category 3 (risk-neutral): $(6+7)/26 = 0.5000$

Risk preference category 4 (risk-seeker): $(6+4)/26 = 0.3646$

Risk preference category 5 (very risk-seeker): $(0+0)/26 = 0.00$

5.4.2   Data Analysis on Risk Sources

The survey questions 12 through 20 relate to the risk sources. Survey questions 12 through 18 ask the respondent to rank the risk source on a scale of one through seven. In which a ranking of one is the highest risk source, while seven is the lowest risk source.

The discussion section provides a table that has each risk source and the average ranking associated with it. The table uses simple arithmetic average and standard deviation from the Excel functions. Please see Formula 1 and Formula 2 for details.

5.4.3   Data Analysis on Risk Management Tools

Survey question 22 asks the respondent to rate the effectiveness of insurance at reducing risk, where a rating of 1 is not effective, and a rating of five is very effective. The discussion section provides the average rating of the effectiveness of insurance and the company's current risk management strategy. The discussion section presents the simple arithmetic

average and standard deviations. The table uses simple arithmetic average and standard deviation from the Excel functions. Please see Formula 1 and Formula 2 for details.

6. Results

The results from the survey are divided into four sections; company characteristics, attitudes towards risk, risk sources and risk management tools. This section provides key questions from the survey with the associated responses. The results from the entire survey is found in the appendix.

The tables throughout the section present the question and the associated responses. It is followed by a description of the information collected and the importance of it as it relates to the discussion section. The goal is to present and discuss the key findings from the survey and set the stage for the following chapter, which is the discussion section.

6.1   Company Characteristics

Table 2: Does your Company have a Financial Adviser or Department? (Question 6)

Multiple Choice Options	Respondents	Percentage
Yes, our company has its own finance department	9	69.23%
Yes, but our company outsources	3	23.08%
No	1	7.69%
Total	13	100.00%

The vast majority of respondents have their own finance department, the second largest group of respondents have their own finance department but also outsources, and finally only a small group does not have a finance department and only outsources.

The results from this question is important, because the discussion section discusses common in-firm strategies. This question is to find out information about whether or not respondents use in-firm strategies as part of the risk management strategy.

6.2   Risk Preferences

Table 3: How concerned are you about the possible gains or losses when making a major financial decision? (Question 7)

Multiple Choice Options	Respondents	Percentage
Always the possible losses	0	0.00%
Usually the possible losses	2	15.38%
Always the possible gains	1	7.69%
Usually the possible gains	10	76.92%
Total	13	100.00%

When making major financial decisions, the vast majority of respondents are usually concerned about the possible gains, the second largest group are usually concerned about the possible losses, while the smallest group are always concerned about the possible gains. None of the respondents are always concerned about the possible losses.

The results from this question is important, because the discussion section discusses the fish farmers' attitude towards risk. This question is used to group the respondents into the following four categories; high degree of risk-aversion, risk-averse, risk-seeker and high degree of risk-seeking.

Table 4: How do you typically feel subsequent to making a major financial decision? (Question 8)

Multiple Choice Options	Respondents	Percentage
Very pessimistic	0	0.00%
Little pessimistic	1	7.69%
Very optimistic	4	30.77%
Little optimistic	8	61.54%

Total	13	100.00%

When making major financial decisions, the vast majority of respondents are a little optimistic, the second largest group are very optimistic, and the smallest group is a little optimistic. None of the respondents are very optimistic.

The results from this question is important, because the discussion section discusses the fish farmers' attitude towards risk. This question is used to group the respondents into the following four categories; high degree of risk-aversion, risk-averse, risk-seeker and high degree of risk-seeking.

Table 5: How would you describe your attitude towards risk? (Question 9)

Multiple Choice Options	Respondents	Percentage
Very risk-averse	0	0.00%
Risk-averse	1	7.69%
Neutral	6	46.15%
Risk-seeker	6	46.15%
Very risk-seeker	0	0.00%
Total	13	100.00%

When the respondent is asked to describe their attitude towards risk, 12 of the respondents are equally split into two largest groups, which are risk-neutral and risk-seeker. The smallest group with one respondent described their attitude towards risk as risk averse. None of the respondents describe their attitude towards risk as either very risk averse or very risk-seeker.

The results from this question is important, because the discussion section discusses the fish farmers' attitude towards risk. This question is used to group the respondents into the

following five categories; high degree of risk-aversion, risk-averse, risk-neutral, risk-seeker and high degree of risk-seeking.

Table 6: What expectations does your company have for the salmon price in the near-future? (Question 10)

Multiple Choice Options	Respondents	Percentage
Large increase	0	0.00%
Small increase	3	23.08%
No change	5	38.46%
Small decrease	5	38.46%
Large decrease	0	0.00%
Total	13	100.00%

The respondents do not expect large changes in the salmon price. When asked about their expectations of the salmon price in the near future, 10 of the respondents are equally split into two groups, in which they expect no change or a small decrease. None of the respondents expect a large increase or a large decrease.

The results from this question is important, because the discussion section discusses the fish farmers' attitude towards risk and the various sources of risk for fish farmers. This question relates to one of the sources of risk, which is market or price risk (i.e future salmon price).

Table 7: What level of risk is your company willing to take for financial decisions? (Question 11)

Multiple Choice Options	Respondents	Percentage
Very low	0	0.00%
Low	2	15.38%

Normal	7	53.85%
High	4	30.77%
Very high	0	0.00%
Total	13	100.00%

When asked about the level of risk the company is willing to take for financial decisions, the majority of respondents' selected normal level, second largest group selected high level, and the smallest group selected low level of risk. None of the respondents are willing to take very low or very high levels of risk while taking financial decisions.

The results from this question is important, because the discussion section discusses the fish farmers' attitude towards risk. This question is used to group the respondents into the following five categories; high degree of risk-aversion, risk-averse, risk-neutral, risk-seeker and high degree of risk-seeking.

6.3   Risk Sources

Table 8: On a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): salmon price (question 12)

Multiple Choice Options	Respondents	Percentage
1	3	23.08%
2	0	0.00%
3	4	30.77%
4	2	15.38%
5	2	15.38%
6	2	15.38%
7	0	0.00%

Total	13	100.00%

When asked to rank salmon price as a risk source on a scale from highest source of risk (1) to lowest risk source (7). The results varied among respondents. The majority of respondents ranked the risk source as a three, making it a moderate risk source. The second largest group of respondents grouped it as a 1, making it a high risk source. The remaining six respondents are equally split among a rating of 4, 5 and 6. This indicates that salmon price is moderately important risk source for fish farmers.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes market and price risk. All the risk sources will be ranked from most critical to least critical for fish farmers.

Table 9: On a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): diseases, bio-physical shocks (hurricane) (question 13)

Multiple Choice Options	Respondents	Percentage
1	3	23.08%
2	5	38.46%
3	3	23.08%
4	1	7.69%
5	0	0.00%
6	1	7.69%
7	0	0.00%
Total	13	100.00%

When asked to rank diseases, bio-physical shocks (hurricane) as a risk source on a scale from highest source of risk (1) to lowest risk source (7). The results varied slightly among respondents, with the majority ranking it as a high risk source. The largest group of

respondents ranked the risk source as a 2, making it a high risk source. There is an equal amount of respondents that ranked it as a 1 and a 3. Together, 84.61% ranked production risk as a very high to high source of risk. The remaining two respondents ranked the risk source as a 3 and a 6. None of the respondents ranked it as a 5 or a 6. Even though there is slight variation among responses, the vast majority of respondents rated production risk as a high risk source for fish farmers.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes production risk. The results from this table will be used to rank the various risk sources from most critical to least critical for fish farmers.

Table 10: On a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): institutional risks (market, environmental regulations, and taxes) (question 14)

Multiple Choice Options	Respondents	Percentage
1	0	0.00%
2	1	7.69%
3	3	23.08%
4	6	46.15%
5	1	7.69%
6	2	15.38%
7	0	0.00%
Total	13	100.00%

When asked to rank institutional risks as a risk source on a scale from highest source of risk (1) to lowest risk source (7). The results varied among respondents, with the majority of respondents ranking it as a moderate risk source. The largest group of respondents ranked the risk source as a 4, making it a moderate risk source. The second largest group of respondents

ranked the risk source as a 3, which also makes it a moderate risk source. The third largest
group of respondents ranked the risk source as a 6, making it a low risk source. The remaining
two respondents are equally split between a ranking of 2 and 5. None of the respondents
viewed it as a very high (1) or a very low risk source (0). This means that the responses are
clustered primarily around a moderate ranking for institutional risk as a risk source.

The results from this question is important, because the discussion section discusses the
various risk sources that fish farmers face, which includes institutional risks. The results from
this table will be used to rank the various risk sources from most critical to least critical for
fish farmers.

Table 11: On a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): input
costs (labor costs, production costs) (question 14)

Multiple Choice Options	Respondents	Percentage
1	0	0.00%
2	0	0.00%
3	1	7.69%
4	3	23.08%
5	5	38.46%
6	2	15.38%
7	2	15.38%
Total	13	100.00%

When asked to rank input costs as a risk source on a scale from highest source of risk (1) to
lowest risk source (7). The results varied among respondents, with the majority of respondents
ranking it as a moderate risk source. The largest group of respondents ranked the risk source
as a 5, making it a moderate risk source. The second largest group of respondents ranked the
risk source as a 4, which also makes it a moderate risk source. The third largest groups of

respondents ranked it as a 6 and 7, making it a low and very low risk source. The smallest group of respondents ranked it as a 3 making it a slightly high risk source. None of the respondents ranked it as a 1 or 2, so no respondents regarded input costs as a high or very high risk source. Therefore the input costs are primarily viewed as a moderate to low risk source.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes input costs. The results from this table will be used to rank the various risk sources from most critical to least critical for fish farmers.

Table 12: On a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): technology (question 16)

Multiple Choice Options	Respondents	Percentage
1	1	7.69%
2	1	7.69%
3	1	7.69%
4	1	7.69%
5	1	7.69%
6	5	38.46%
7	3	23.08%
Total	13	100.00%

When asked to rank technology as a risk source on a scale from highest source of risk (1) to lowest risk source (7). There is a lot of variation among respondents, with the majority of respondents ranking it a low to very low risk source. The largest group of respondents ranked the risk source as a 6, making it a low risk source. The second largest group of respondents ranked the risk source as a 7, which also makes it a very low risk source. The remaining five

respondents are equally split among a ranking of 1, 2, 3, and 4. Therefore technology is primarily viewed as a low risk source.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes technology. The results from this table will be used to rank the various risk sources from most critical to least critical for fish farmers.

Table 13: In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): moral hazard risk (employee/corruption) (question 17)

Multiple Choice Options	Respondents	Percentage
1	1	7.69%
2	2	15.38%
3	0	0.00%
4	0	0.00%
5	0	0.00%
6	3	23.08%
7	7	53.85%
Total	13	100.00%

When asked to rank moral hazard as a risk source on a scale from highest source of risk (1) to lowest risk source (7). The respondents are mostly split between viewing it as a very high/high risk source and a very low/low risk source, with no respondents in between. The largest group of respondents ranked it as a 7, making it a very low risk source. The second largest group of respondents ranked it as a 6, making it a low risk source. The third largest group of respondents ranked it as a 2, making it a high risk source. The fourth largest group ranked it as a 1, making it a very high risk source. None of the respondents ranked it as a 3, 4

and 5. Even though the results are very split, the majority of respondents view technology as a very low or low risk source.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes technology. The results from this table will be used to rank the various risk sources from most critical to least critical for fish farmers.

Table 14: In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): demand (sabotage from animal rights activists/health) (question 18)

Multiple Choice Options	Respondents	Percentage
1	1	7.69%
2	1	7.69%
3	2	15.38%
4	1	7.69%
5	2	15.38%
6	3	23.08%
7	3	23.08%
Total	13	100.00%

When asked to rank demand as a risk source on a scale from highest source of risk (1) to lowest risk source (7). There is a lot of variation among the responses. A ranking of 6 and 7 have the most amount of responses, in which an equal amount of respondents selected it. A ranking of 3 and 5 have the second highest amount of responses, in which an equal amount of respondents selected it. The remaining three respondents are equally split between a ranking of 1, 2 and 4. Even though there is a lot of variation in the results, the risk source appears to be between moderate and low.

The results from this question is important, because the discussion section discusses the various risk sources that fish farmers face, which includes demand. The results from this table will be used to rank the various risk sources from most critical to least critical for fish farmers.

Table 15: Select the risk sources that are most difficult to manage (more than one) (question 19)

Risk Source	Responses	Percentage of Responses
Future salmon price	7	21.21%
Production risks (diseases, escaping, biophysical shocks)	10	30.30%
Institutional risks (market / environmental regulations / taxes)	9	27.27%
Input costs (feed / labor/ machinery)	1	3.03%
Technology	1	3.03%
Moral hazard risk (employees/corrupt)	2	6.06%
Demand (sabotage from animal rights activists / health)	3	9.09%
Total	33	100.00%

The most difficult risk sources to manage are ordered from most difficult to least difficult in the following way; production risk, institutional risk, future salmon price, demand, moral hazard risk, and both input costs and technology have an equal ranking.

The results from this question is important, because the discussion section goes into more detail regarding the various risk sources and the most difficult risk sources to manage.

Table 16: Do you think the aquaculture industry is riskier than agriculture industry? (question 20)

Multiple Choice Options	Respondents	Percentage
Yes, riskier than agriculture	13	100.00%
No, less riskier than agriculture	0	0.00%
The risks in both industries are approximately the same	0	0.00%
Total	13	100.00%

All the respondents view the aquaculture industry as being risker than the agriculture industry. This is further examined in the discussion section relating to risk preferences.

6.4   Risk Management Tools

Table 17: Does your company use insurance? (question 21)

Multiple Choice Options	Respondents	Percentage
Yes	13	100.00%
No	0	0.00%
Total	13	100.00%

All the respondents use insurance. This is further examined in the discussion section relating to risk management tools.

Table 18: How effective is insurance at reducing risk? (1 = not effective, 5 = very effective) (question 22)

Multiple Choice Options	Respondents	Percentage
1	0	0.00%
2	2	15.38%
3	9	69.23%
4	2	15.38%
5	0	0.00%
Total	13	100.00%

The majority of respondents view insurance as being moderately effective when it comes to reducing risk. The largest group of respondents rated it as a 3. A ranking of 2 and 4 received an equal amount of responses, tying them in second place. None of the respondents ranked it as a 1 or a 5. This is further examined in the discussion section relating to risk management tools.

Table 19: Which factors does insurance reduce? (more than one) (question 23)

Risk Source	Responses	Percentage of Responses
Future salmon price	2	10.00%
Diseases, escaping, biophysical shocks (hurricanes/droughts)	13	65.00%

Institutional risks (market / environmental regulations / taxes)	1	5.00%
Input costs (feed / labor/ machinery)	0	0.00%
Technology	1	5.00%
Moral hazard risk (employees/corruption)	0	0.00%
Demand (sabotage from animal rights activists / health)	3	15.00%
Total	20	100.00%

According to the respondents, insurance reduces the following risk factors; production risk, demand, future salmon price, institutional risks and technology. The risk factors that were not selected were input costs and moral hazard risk. The factors that gained the highest number of responses are; production risk, demand, future salmon price. Institutional risks, technology and demand are also selected gained an equal amount of responses. This is further examined in the discussion section relating to risk management tools.

Table 20: Does your company use derivatives (futures/forward contracts) to minimize or eliminate risk? (hedging) (question 24)

Multiple Choice Options	Respondents	Percentage
Yes	8	61.54%
No	5	38.46%
Total	13	100.00%

The majority of respondents use derivatives for hedging purposes, while the minority does not. This is further examined in the discussion section relating to risk management tools.

Table 21: Does your company use derivatives (futures/forward contracts) to speculate in the market? (question 25)

Multiple Choice Options	Respondents	Percentage
Yes	0	0.00%
No	13	100.00%
Total	13	100.00%

None of the responses use derivatives, such as forward/futures contracts for speculation purposes. This is further examined in the discussion section relating to risk management tools.

Table 22: What knowledge do you have of the futures/forward market? (question 26)

Multiple Choice Options	Respondents	Percentage
Heard about it, but do not know what it is	0	0.00%
Know very little about it	4	30.77%
I have studied this	6	46.15%
Use it / have used it	3	23.08%
Total		100.00%

When asked about the respondent's knowledge about futures/forward market, the largest group of respondents have studied futures/forward contracts. Whereas the second largest group know very little about futures/forward. Lastly, the smallest group use/have used

futures/forward contracts. Overall, this shows that the majority of the respondents are familiar with futures/forwards. This information might be useful in the discussion section when examining risk management tools.

Table 23: Do you think that a futures/forward contract can eliminate or reduce risk? (question 27)

Multiple Choice Options	Respondents	Percentage
Yes	8	61.54%
No	5	38.46%
Total	13	100.00%

When asked about their thoughts on whether or not futures/forward contracts can eliminate or reduce risk, the largest group consisting of 8 respondents, believed that futures/forward contracts can mitigate risk. The rest disregards futures/forward contracts as a tool to eliminate or reduce risk.

Table 24: If you do not use futures/forward contracts, why not? (question 28)

Multiple Choice Options	Respondents	Percentage
It increases costs	2	15.38%
Lack of knowledge	2	15.38%
Adds volatility to revenue streams	1	7.69%
Uncommon in industry	0	0.00%
Other	8	61.54%
Total	13	100.00%

The respondents were asked to select the reason for why futures /forward contracts were not used in their company. The question aims to get an insight on whether or not the lack of knowledge on futures/forward is to blame for their disregard towards the use futures/forward contracts. This seems to be the case for two out of five respondents. The rest reported that it either increases costs, or adds volatility to revenue streams. The other 8 respondents that chose "other" are assumed to use futures/forwards, as the number of respondents are consistent with the number of respondents stating to use futures/forward.

Table 25: Are the risk management strategies formulated internally or externally? (question 29)

Multiple Choice Options	Respondents	Percentage
Internally	3	23.08%
Externally	0	0.00%
Both, but more internally	8	61.54%
Both, but more externally	1	7.69%
Both, equal amounts	1	7.69%
Total	13	100.00%

When asked if the risk management strategies are structured internally or externally, the largest group of eight respondents reported to use strategies internally and externally to manage risk, but mostly internally. The second largest group consisting of 3 respondents reported to use internal risk management strategy, whereas the rest of the respondents use both strategies; either more externally, or an equal amount. Overall, the majority mostly use in-firm strategies to manage risk. This question provides information about in-firm strategies that will be examined in the discussion section.

Table 26: Are activities from the supply chain managed internally or externally? (question 30)

Multiple Choice Options	Respondents	Percentage

Internally	6	46.15%
Externally	1	7.69%
Both, but more internally	4	30.77%
Both, but more externally	1	7.69%
Both, equal amounts	1	7.69%
Total	13	100.00%

When asked if the supply chain management is conducted internally or externally, the largest group of 6 respondents reported that activities from the supply chain are managed mostly internally. The second largest group consisting of 4 respondents reported to manage supply chain both internally and externally, but most internally. The last three respondents grouped into three different answers; (1) external (2) both but mostly external and (3) both but equal amounts of internal and external. This question also provides information about in-firm strategies that will be examined in the discussion section

Table 27: Which of the risk management tools do you use? (More than one) (question 31)

Multiple Choice Options	Responses
Insurance	13
Futures/forward contracts	8
Options	1
Other	1 (long-term contracts)
Total	23

The respondents were asked to select which risk management tools that they are using, and had the option of choosing more than one. The table shows that all thirteen respondents use insurance as a risk management tool. The second largest tool to manage risk are

futures/forward contracts with 8 respondents. Lastly, one of the respondents use options, and one respondent uses long-term contracts. This data is important when examining the different risk management tools used later in the discussion section.

Table 28: Are there areas for improvement in your current risk management strategies to reduce risk? (1- we need significant improvement, 7 = very little) (question 32)

Multiple Choice Options	Respondents	Percentage
1	1	7.69%
2	1	7.69%
3	1	7.69%
4	5	38.46%
5	2	15.38%
6	2	15.38%
7	1	7.69%
Total	13	100.00%

When asked to rate their current risk management strategies, the largest group of five respondent gave a rating of 4. Two of the respondents gave a rating of 5 and another two responded gave a rating of 6. The rest of the four respondents gave a rating of 1, 2, 3 and 7.

This shows that almost all of the respondents thinks there is room for improvement in their current risk management strategies. While some of the respondents think that there are significant areas for improvement, the majority thinks that the areas for improvement are moderate.

Table 29: Are you interested in new risk management tools? (question 33)

Multiple Choice Options	Respondents	Percentage
Yes	5	38.46%
No	8	61.54%
Total	13	100%

When asked about their interest in new risk management tools, 8 respondents reported that they are not currently interested in new management tools, whereas the rest of the respondents reported to be interested in new risk management tools.

Table 30: On a scale 1-5, how effective is your current risk management strategy when it comes to reducing risk? (question 34)

Ranking	Respondents	Percentage
1	0	0.00%
2	0	0.00%
3	9	69.23%
4	4	30.77%
5	0	0.00%
Total	13	100.00%

This question asks the respondents to rate the effectiveness of their current risk management strategies based on the ranking system on a scale from one to five. There are only two groupings; 9 respondents gave a rating of 3 on their current risk management efficiency, whereas the other four respondents gave a rating of 4. This shows their thoughts on the

efficiency of their current risk management strategies, which are neither excellent nor inadequate.

Table 31: Has there been an event where you have benefited from using insurance or another risk management tool? Yes or no? Explain. (question 35)

Respondent	Yes/No	Explanation
1	Yes	For fish mortality.
2	Yes	For water blockages and hurricane damages less effective for disease outbreaks
3	Yes	Insurance reduced the risk in cases where fish have been lost as a result of transport accidents and in biological events. Derivatives on currencies have led to both negative and positive effects, depending on the price development of NOK/EUR, NOK/USD, NOK/JPY. Thus, the use of this type of derivatives helped to eliminate the currency exposure, but at the same time we lose a potential upside.
4	Yes	For large fish mortality, where we were reimbursed for some of the lost value of the dead fish.
5	Yes	For for disease outbreaks and received reimbursement of the clean-up costs.
6	Yes	In cases of mass deaths from disease/virus outbreaks.
7	Yes	
8	Not Really	
9	Not really	

10	Yes	
11		We ensure price of parts of volume – it provides predictability
12	Yes and no	Both losses and gains on futures contracts
13	Yes	Our water pipe was affected by an underwater slide next to our facility (not the actual facility). Only the water pipe was affected, not our facility.

The respondents were asked to explain an event in which insurance or other risk management tools have benefited them. Nine out of thirteen respondents gave an explanation ranging from benefits from insurance and futures. However, the majority seems to have benefited from insurance, as most of events explained by the respondents involve some form of reimbursement. This question was intended as a supplementary question which provides useful information in the discussion section.

6.5   Additional Information

Table 32: Comments / Additional Information

Respondent	Additional Information
1	None

2	Our company runs a smolt production within a group structure (konsernstruktur) with fish production, slaughter, and cold storage. The survey is outside of our business activities, but our answers reflects the entire group. Selskapet driver med smoltproduksjon innen en konsernstruktur med matfiskproduksjon ,slakteri og fryseri. Undersøkelsen er litt på siden av det vi driv med lokalt her , men svar avspeiler hele konsernet.
3	None
4	None
5	None
6	None
7	None
8	We produce salmon with new locked/closed technology. Therefore technology is our highest risk since the technology has not been tested before.
9	None
10	None
11	None
12	None
13	None

The respondents were given a chance to give additional comments that might be relevant to the survey. This question is also supplementary, which provides useful information in the discussion section.

7. Discussion

This section is broken down into three sections; risk preferences, risk sources and risk management tools. Each section begins by highlighting the key findings from the survey on the aquaculture industry, followed by possible explanations. The subsequent subsection offers insights from previous studies in the agriculture industry. Finally, a comparison of the Norwegian aquaculture industry to the US agriculture industry is conducted to provide deeper insights to the results from the survey.

There are numerous similarities between the agriculture industry and the aquaculture industry, because they are both in the business of growing and harvesting and face similar risks. The differences primarily stem from the fact that one is on land (agriculture), the other is in water (aquaculture). Therefore the agriculture industry will serve as a benchmark, as the findings are expected to be similar.

7.1 Risk Preferences

This section discusses the fish farmers' attitude towards risk by examining the results from the aquaculture survey. It presents the average ratings for each question relating to risk preferences, where a rating of 1 is risk-averse and a rating between four and five is risk-seeker. Based on this metric system, the respondents are grouped across the risk preferences categories which a high degree of risk-aversion, risk-averse, risk-neutral, risk-seeker, and high degree of risk-seeking. The next subsection discusses an earlier study conducted in the US agriculture industry relating to risk preferences, which will serve as a benchmark. The following subsection compares the results from the Norwegian aquaculture survey with the study conducted in the US agriculture industry.

7.1.1 Risk Preferences in Aquaculture Industry

The survey contained five multiple-choice questions relating to the respondents risk preferences. Table 33 below provides an average rating assigned to each question. The first two questions had four options that the respondents could choose from, so the rating is out of four. The last three questions had five options that the respondents could choose from, so the rating is out of five. The option that demonstrates the highest level of risk-aversion is given a

one rating, while the option that displays the highest level of risk-seeking is given a rating of either four or five (depending on the number of options in the question). The table summarizes the respondents' attitude towards risk, by displaying the average rating for each question relating to risk preferences.

Table 33: 5 Risk Preference Questions and Average Ratings

Description of Risk Preference	Average Rating 1 = risk-averse 4 or 5 = risk-seeker	Standard Deviation
Emphasis on potential losses/gains	2.92/4	0.49
Feelings after financial decisions (pessimistic/optimistic)	3.23/4	0.60
Attitude towards risk (risk averse/risk seeker)	3.38/5	0.62
Salmon price expectations (decrease/increase)	2.85/5	0.80
Level of risk willing to take (low/high)	3.15/5	0.69

The table above provides the average rating associated with each survey question that relates to risk preferences. The first question asks how concerned the respondent is of possible gains or losses when making a major financial decision. The second question asks how the respondent typically feels after making a major financial decision. The third question asks the respondent to describe their attitude towards risk. The fourth question asks the respondents expectations regarding the salmon price in the near-future. The fifth question asks the respondent the level of risk the company is willing to take in financial decisions. Based on average ratings presented in the above table, a significant portion of the respondents range from risk-neutral to risk-seeker.

Based on this, there may be a level of optimism in the industry where there is less focus on the downfall of a financial decision. The level of optimism may also be explained by the level of sufficiency in their current risk management strategies in the aquaculture.

Table 34 below categorizes the respondents into five risk preferences categories. The categories are based on the questions relating to how they describe their attitude towards risk and what level of risk their company is willing to take (questions 9 and 11 in the survey).

Question nine in the survey asks "how would you describe your attitude toward risk", where the respondent could choose from high degree of risk-aversion, risk-averse, risk-neutral, risk-seeker and high degree of risk-seeking. Question 11 in the survey asks "what level of risk is your company willing to take under financial decisions", where the respondents can choose from very low, low, normal, high and very high.

Table 34: How the Fish Farmers are Grouped Across Risk Preference Categories

Risk Preferences Category	Percentage of Respondents
High degree of risk-aversion	0.00%
Risk-averse	11.54%
Risk-neutral	50.00%
Risk-seeker	38.46%
High degree of risk-seeking	0.00%
Total	100.00%

According to table 34, 11.54% are risk-averse, 50.00% are risk-neutral, and 38.46% are risk-seekers. No respondents were categorized as being highly risk-averse or high risk-seeking.

As expected, only a small minority, 11.54% of respondents are categorized as risk-averse. While half of the respondents are risk-neutral. This may be due to distinct personality traits

that are not addressed in the survey. Another possible explanation relates to the respondent's title or role within the organization. The survey does not ask what position the respondents hold, so there may be variations in titles and/or roles among respondents and therefore their incentive structure. For instance, the survey does not ask if the respondent is the owner, CEO, or regular employee. A regular employee may be more likely to be risk-neutral since they are paid a salary or a wage, in which the employee's compensation may not be directly tied to the financial performance of the firm.

38.46% of the respondents are characterized as risk-seeking. This may be due to the level of optimism in the aquaculture industry because of the market trends and growth rates within the aquaculture industry. The aquaculture industry has experienced high growth rates, and increases in price and revenues in the past recent years. The reduction in supply and increase in demand contributed to the increase in both price and revenues (EY, 2018). In spite of the number of risk sources, salmon farmers face, they appear to exhibit low levels of risk-aversion.

The salmon price expectations seem to be out of line with the rest of the responses. Where 23.1% expect a small increase, 38.5% expect no change, 38.5% expect a small decrease. So the majority of respondents expect no change or a small decrease in the salmon price. The next section addresses this, because future salmon price is viewed as a low risk source. So even though they may not appear to be optimistic about the future salmon price, the salmon price is considered to be a moderate risk source, so it does not pose a significant threat. In spite of their slightly neutral and pessimistic views on the salmon price, they appear to have a risk-neutral and risk-seeking attitude towards risk.

Lastly, 100% of respondents viewed the aquaculture industry to be riskier than the agriculture industry. Initially, this appears out of line with the findings that the majority of respondents have either a risk-neutral or risk-seeking attitude towards risk. However, they may view the aquaculture industry to be riskier because they have a deeper understanding and knowledge about the risk sources in their own industry. As an analogy, students tend to find their study programs to be more difficult than others, because they have a deeper understanding what the workload is and the level of expectations.

7.1.2   Risk Preferences in Agriculture Industry

A comprehensive descriptive analysis was conducted by economist Stephanie Rosch (2017) to measure the US farmers' risk preferences using a sample data of 30,000 respondents from the USDA's agricultural resource management survey in 2014. The statistics shows that approximately 24% are risk-averse, 41% are risk-neutral, and the remaining 35% are risk-seekers.

7.1.3   Comparison between Agriculture Industry and Aquaculture Industry

This section compares how the farmers are grouped among risk preference categories between the US Agriculture Industry and the Norwegian Aquaculture Industry.

Table 35: Risk Preferences in Aquaculture Industry and Agriculture Industry

Risk Preferences Category	Aquaculture Industry	Agriculture Industry
High degree of risk-aversion	0.00%	N/A
Risk-averse	11.54%	24.00%
Risk-neutral	50.00%	41.00%
Risk-seeker	38.46%	35.00%
High degree of risk-seeking	0.00%	N/A
Total	100.00%	100.00%

As expected, the results from the survey regarding the risk preferences in the Norwegian aquaculture industry are similar to prior research studies on the risk preferences in the US agriculture industry. There are only slight differences between the categories of risk-averse, risk-neutral and risk-seeker. In the agriculture industry, there are more respondents in the risk-aversion category, less respondents in both the risk-neutral and risk-seeker categories.

The small differences between the two industries may be because of the differences in not only the industries but also the countries. For example, the differences may be explained by the industry size, growth rates, political/regulatory environment, economic structure and cultural differences between Norway and the US.

Another possible explanation behind the small differences is that the Norwegian aquaculture survey conducted in this paper have 13 respondents, while the US agriculture industry study has 30,000 respondents. There might be more variation in the responses in the US agriculture industry, because their study has more respondents.

7.2   Risk Sources

This section is broken into two parts. The first subsection examines the risk sources in which the respondents rank the risk sources from highest (1) to lowest (7). This section also attempts to explain the reasons behind the rating associated with each risk source. The second subsection shows the percentage of respondents that selected a risk source for being most difficult to manage. This is followed by possible explanations behind the results.

Table 36: Risk Sources and Average Ranking

Risk Source	Average Ranking out of 7 (1=highest, 7=lowest)	Standard Deviation
Production risk (diseases, escaping and bio-physical shocks)	2.46	1.39
Price or market risk (future salmon price)	3.46	1.76
Institutional risks	4.00	1.15
Demand	4.77	2.01
Input costs	5.08	1.19
Technology	5.08	1.98
Moral hazard	5.54	2.26

Table 36 above ranks the risk sources from most important to least important according to its average ranking.

7.2.1 Production risk (Diseases, Escaping and Bio-physical shocks)

The largest risk source is production risk, which entails diseases, escaping and bio-physical, which has an average rating of 2.46 out of seven. Where a rating of one is the highest source of risk, and a rating of seven is the lowest source of risk. Production risk is the most critical risk source because there are numerous types of diseases fish can be exposed to. According to Marine Harvest (2018), the main health risks in salmon are sea lice, pancreas disease (PD), salmonid rickettsial septicaemia (SRS), infectious pancreatic necrosis (IPN), heart and skeletal muscle inflammation (HSMI), infectious salmon anaemia (ISA) and gill disease (GD).

Additionally, diseases have a strong negative impact on production, revenues and profits. Between 2016 and 2017, the challenges with sea lice caused a 5% decline in the Atlantic salmon harvest (or 63,000 tons wfe) from the previous year. Sea lice also increased the mortality rate from 16% to 19%, in which 53 million salmons died inside the cage. Cargill (WEOS AS) estimates that sea lice is costing the aquaculture industry NOK 10 million annually (EY, 2018).

7.2.2 Market or Price Risk (Future Salmon Price)

The future salmon price is the second most important risk source according to the respondents. Salmon price has a rating of 3.46 out of seven, which shows that it is not a very high source of risk, but a moderate risk source. Salmon price is ranked as the second most important risk source because it directly impacts financial performance in terms of sales revenue and profits. On the other hand, 38.5% respondents expect only a small decrease in the future salmon prices, and 0% expected expect a large decrease. Additionally, derivatives help mitigate the future salmon price risk.

7.2.3 Institutional Risks

The third largest source of risk are institutional risks with a rating of 4.00 out of seven. The risk source appears to be moderate source of risk. Institutional risks relate to regulation, fish safety and health. The Norwegian aquaculture industry is highly regulated in terms of restrictions in production and ownership within the industry (Marine Harvest, 2018). Since

the laws and regulations put restrictions on production, it is expected to be a very important risk source in the aquaculture industry.

7.2.4 Demand

The fourth largest source of risk is demand of salmon with a rating of 4.77 out of seven. The risk source appears to be moderate source of risk. This is an important risk source, because it has a direct impact on the number of fish sold and the salmon price. Together these impact both revenues and profits.

It is possibly only moderate because the main market trends are predicted to increase demand, because (1) climbing world population (2) increasing middle class, particularly in big emerging markets (3) the promotion of health benefits from seafood by health authorities (4) fisheries becoming closer to being entirely exploited (5) more efficient and environmentally friendly production than other animal production (6) increasing levels of soil erosion which drives the need to consider alternative ways to feed the world (Marine Harvest, 2018). On the other hand, the number of animal rights activists and vegetarianism have increased in recent years, causing a decrease in demand.

7.2.5 Input Costs

The fifth largest source of risk are input costs rating of 5.08 out of seven. The risk source appears to be a low source of risk. Input costs such as feed and other costs associated with prevention and treatment of fish have increased by 99.2% between 2005 and 2017. Which is an approximate 65% increase when adjusted for inflation (Bærekraft i Havbruk, 2019). This is low in comparison to the revenue growth of 300% between 2007 and 2017 (EY, 2018). Since the input cost increases have been small relative to the revenue increase, it may be reasonable to expect input costs to be viewed as a low source of risk.

7.2.6 Technology

The sixth largest source of risk pertain to technology with a rating of 5.08 out of seven. Technology may pose as a low risk because respondents may not have plans to test new technology or use new technology. One respondent indicated that technology is currently

their highest risk source, because they are producing salmon with a new locked/closed technology that has not been tested before.

7.2.7   Moral Hazard

The seventh largest source of risk is moral hazard with a rating of 5.54 out of seven. This might be a low risk source, because many organizational structures have mechanisms in place that detect and prevent moral hazard. Yet it is still a relevant risk source because moral hazard can still go undetected and not only harms the financial performance of the company, but can damage its reputation and relationships with partners.

7.3   Most Difficult Risk Sources to Manage

The respondents were given a list of various risk sources and were asked to select the most difficult risk sources to manage, in which they can select more than one risk source. Table 36 below summarizes the findings by presenting the risk source and the number of respondents that selected it. The risk sources with the most amount of responses is considered the most difficult risk source to manage, while the risk source with the least amount of responses is considered the least difficult risk source to manage.

Table 37: Most Difficult Risk Sources to Manage

Risk Source	Percentage of Responses
Production risks (diseases, escaping, biophysical shocks)	30.30%
Institutional risks	27.27%
Future salmon price	21.21%
Demand	9.09%
Moral risk	6.06%
Input costs	3.03%

Technology	3.03%

7.3.1   Production Risks

Diseases, escaping and biophysical shocks is seen as the most difficult risk source to manage. This may be because it is very difficult to control a disease outbreak and impossible to control a natural disaster, such as a hurricane. Insurance primarily mitigates production risks, which include diseases, escaping and biophysical shocks (Bergfjord, 2009). However the effectiveness of insurance as a risk management tool depends on the extent of the insurance coverage.

7.3.2   Institutional Risks

Institutional risks are ranked as the second most difficult to manage risk source. This makes sense, as Bergfjord (2009) points out the lack of research into how firms should manage institutional risks. One of the suggested methods is maintaining a strong relationship with the government, which is very ambiguous. However, there appears to be a lack of framework to model and manage institutional risks, making it a more difficult risk source to manage.

7.3.3   Market or Price Risk (Future Salmon Price)

Academic literature suggests that forward/futures can be used to mitigate commodity price risk (Hull, 2012). At first it seemed surprising that the future salmon price is ranked as the third most difficult risk source to manage, because it directly impacts a company's revenue, and therefore financial performance.

This may not be a difficult risk source to manage, because of the availability of risk management tools, such as derivatives that help mitigate market or price risk. Looking at the results from the survey, 61.54% of the respondents use/used forward/futures contracts to minimize or eliminate risk. The respondents may therefore believe that market or price risk is not a very difficult risk source to manage.

Not only does the majority of the respondents use or have used futures/forwards, but they are educated about the risk management tool. When asked about how much knowledge the respondent has of the future/forward market, 69.23% of the respondents have studied it, or use it or have used it.

7.3.4   Demand

The fourth most difficult risk source to manage is demand. Only three respondents selected demand as a difficult risk source to manage. There is a growing trend among vegetarians and vegans, which directly impacts demand. There is also a growing number of food product substitutes, such as vegetarian meat products. Perhaps there is a lack of risk management tools that mitigate risks associated with demand.

7.3.5   Moral Hazard Risk

The fifth most difficult risk source to manage is moral hazard risk. As stated earlier, organizational structures cannot be designed to anticipate all forms of moral hazard. It is difficult to supervise all the actions of each employee, so there is a level of difficulty when it comes to mitigating this type of risk. However it may be low because many organizational structures have mechanisms in place to mitigate moral hazard risk (HMS; arbeidstilsynet, 2011)

7.3.6   Input Costs

The input costs may be low because the respondents may not view it as an important risk factor. As stated earlier, costs have been fairly stagnant relative to revenues.

7.3.7   Technology

Technology is the least difficult risk source to manage. Respondents may view technology as more of a benefit than a risk source. As mentioned earlier, only one respondent viewed technology as a risk source, because they adopted new technology that has not been tested before. Technology in this industry may be reliable and stable, where technological improvements are not fast-paced and does not disrupt the industry.

7.3.8   Risk Sources in Agriculture Industry

Several studies have been conducted on what types of risks farmers face, and the degree of concerns surrounding these factors. USDA's Agricultural Resource Management Study conducted a nationwide survey in 1996 on producers' attitude towards risk. The survey indicates that producers are mostly concerned about government laws and regulations (institutional risk), decrease in crop yields or livestock output (production risk), and uncertainties in commodity prices (market/price risk) (Harwood et al. 1999).

An example of institutional risk, the 1996 Farm Act impacted the producer's concern about yield and price variability in program crop, such as wheat, corn soybean, tobacco and cotton. The legislation resulted in higher limitations on government interventions in the market for program crops, leading to a larger focus on price risk. Across all farms, the biggest risk concern were changes in government laws and regulations (institutional), decrease in crop yields or livestock production (production), and uncertainty in commodity prices (market/price risk) with a score of 3.02, 2.95 and 2.91, respectively. Where a rating of one is not concerned, and a rating of four is very concerned.

Another study was conducted by Patrick and others (1985) covering 12 different states. (Harwood et al. 1999). Their survey showed fairly similar results as USDA ́s RMA study on producers' risk preferences. Weather (production risk) and output risk (market/price risk) were ranked the highest risk factors. Other risks such as inflation, diseases, world events, safety and health that were also reported to be important risk factors.

7.3.9   Comparison between Agriculture Industry and Aquaculture Industry

This section compares the top three risk sources between the US Agriculture Industry and the Norwegian Aquaculture Industry.

Table 38: Top Three Risk Sources in Aquaculture Industry and Agriculture Industry

Aquaculture Industry	Agriculture Industry

1. Production risks (diseases, escaping and bio-physical shocks)	1. Institutional risks
2. Market or price risk (future salmon price)	2. Production risks
3. Institutional risks	3. Market or price risk (future commodity price)

As expected, the results from the Norwegian aquaculture industry are similar to the earlier studies performed in the US agriculture industry. The major risks that impact both industries are price or market risk, production risk, and institutional risks. Both face price or market risk, which relates to the future commodities price when they sell and the costs of producing the commodities. Both face similar production risks, which relate to technological shocks, biophysical shocks (hurricanes) and diseases. Both face biological or natural constraints, and requires certain environmental conditions, such as temperature and climate. Both face institutional risks, because changes in the regulatory or political environment impacts production, revenues and costs.

The small differences between the two industries may be because of the differences in industry size, growth rates, political/regulatory environment, economic structure and cultural differences between Norway and the US. Additionally the differences in the survey design, methodology and sample size between the Norwegian aquaculture industry survey and the USDA's agricultural industry survey may contribute to the differences in the results.

7.4   Risk Management Tools

This section is broken into two parts. The first subsection presents the number of respondents that use risk management tools such as insurance and futures/forward contracts. Then it precedes to explain the reasons behind the results. The second subsection displays a table with the average rating of the overall effectiveness for insurance and the future/forward contracts. Then it continues with possible explanations behind the results. The third subsection describes the reported risk management strategies in the US agriculture industry. The fourth subsection compares the risk management tools used in the Norwegian aquaculture to the US agriculture industry, with the expectation of similar results.

7.4.1   Use of Insurance and Futures/Forward Contracts in the Aquaculture Industry

This section discusses the percentage of fish farmers that use insurance and futures/forward contracts in the Norwegian aquaculture industry. The findings are summarized in table 39 below.

Table 39: Percentage of Respondents that Use Different Risk Management Tools

Risk Management Tool	Percentage of Respondents
Insurance	100.00%
Futures/Forwards Contracts	61.54%

7.4.1.1 Insurance

All the respondents have insurance to mitigate production risks. The aquaculture insurance covers real assets, such as buildings, equipment, ships, boats, vehicles. In addition, it covers accidents or injuries to employees. Lastly it covers incidents that damage goods during the transportation. (Secretan, 2007)

When all 13 respondents were asked to select risk factors that insurance mitigates, 13 respondents chose production risks (diseases, escaping, biophysical shocks), three respondents selected demand, two selected future salmon price, one selected institutional risks and one selected technology.

It makes sense that all respondents use insurance. As stated earlier, production risk is ranked as the highest risk source with an average rating of 2.46 out of seven (1=highest and 7=lowest risk source) across all respondents. Based on this, it is expected that all respondents will use insurance to mitigate a risk source that is regarded as the most important one.

It is difficult to understand why the minority of respondents state that insurance helps reduce risks relating to demand, institutional risks and technology. This might be because they have

different insurance policies and different types of coverage. The survey does not ask them to describe their insurance policies and types of coverage. On the other hand, the survey did ask them to describe an experience where they have used insurance, but zero respondents described a scenario that relates to the risks associated with demand, institutional and technology.

7.4.1.2 Futures/Forward Contracts

61.54% respondents use futures/forward contracts to mitigate risks. The remaining 38.46% of respondents do not use futures/forward contracts. When asked why they do not use forwards/futures, 15.38% states that it increases costs, this might be because it may require expertise. 15.38% responded that they have lack of knowledge. It is expected that many have little knowledge regarding the futures market for salmon. 7.69% of respondents state that they do not use futures/forwards because it may add volatility to their revenue streams.

7.4.2   Effectiveness of Risk Management Tools

Respondents were asked to rate insurance on a scale of one through five. Rating of one indicates that it is not very effective, while a rating of five indicates that it is very effective. Respondents are asked to rate their current risk management strategy on a scale of one through seven. Rating of one indicates that it needs significant improvement, so it is not very effective. While a rating of seven indicates that it needs no improvement, so it is very effective.

Table 40: Effectiveness of Different Types of Risk Management Tools

Type of Risk Management Tool	Average Rating for Effectiveness 1 = not very effective 5 or 7 = very effective	Standard Deviation
Insurance	3.00/5	0.58
Current risk management strategy	4.23/7	1.64

7.4.2.1 Insurance

When it came to the overall effectiveness of insurance the average rating is 3.00 out of five, which is very moderate. 53.85% of respondents said they have used insurance on at least one occasion, and detailed an experience where they have used insurance. Across the 53.85% of respondents, insurance has covered losses against fish mortality, fish diseases, water clogs ("vannstopp") and hurricane losses.

The effectiveness of the insurance may be because of the type of insurance policy and the coverage it provides. Insurance policies vary on the portion of the damages that are reimbursed, and the premiums associated with them. Additionally, it is possible that other risk management tools or strategies are more effective or the respondents employ more effective tools than insurance when it comes to mitigating risks.

7.4.2.2 Futures/Forward Contracts

61.54% of respondents reported that futures/forward contracts are effective at reducing risk. The same amount of respondents, 61.54%, use futures/forward contracts. It is possible that all the users of derivatives believe that it is effective at reducing risk based on their experience using them. While the remaining 38.46% of respondents do not use futures/forward contracts because they do not perceive them as an effective means to minimize risks. They may therefore turn to other risk management strategies such as geographic diversification (Bergfjord, 2009).

7.4.2.3 Options

The risk management tool section of the survey mostly centered around insurance and futures/forward contracts. When the respondents were asked to select the risk management tools that they use, only one out of 13 respondents use options. The survey did not ask what the underlying asset is of the option. Perhaps it is uncommon to use options because options act like insurance, and all the respondents already have insurance (Hull, 2012). Insurance limits the losses for a policyholder, because the insurance company will cover a portion of their losses, specified in the insurance policy. While the holder of the option face limited losses, the maximum loss is the premium paid for the option.

7.4.2.4 Common In-Firm Strategies

The majority of the respondents have common in-firm strategies as part of their risk management strategy and supply chain management. Having control over the supply chain and risk management strategies allows for deeper knowledge and therefore more comprehensive planning. In addition, managing these internally allows for quick responses to changing market trends or threats to the company. Furthermore, it allows for on-time production. If part of the supply chain management is external and there are issues with one of the suppliers, it can delay production and harm other phases in the supply chain (Radford, 2017).

Respondents were asked whether the risk management strategies are formulated internally or externally. 61.54% of respondents reported that their risk management strategy is formulated both internally and externally, but mostly internally. 23.08% of respondents reported that their risk management strategy is formulated internally. Only one respondent, 7.69% of respondents reported that their risk management strategy is formulated both internally and externally, but mostly externally.

Respondents were asked whether activities in the supply chain are managed internally or externally. 46.15% of respondents manage the supply chain activities internally. 30.77% of respondents manage the supply chain activities both internally and externally, but mostly internally. While 7.69% of respondents manage the supply chain activities both internally and externally at equal amounts. 7.69% of respondents manage the supply chain activities both internally and externally, but mostly externally. Lastly, 7.69% of respondents manage the supply chain activities externally.

Respondents in the survey were asked whether or not their company has a financial advisor or department. 69.23% of respondents selected that their company has its own finance department. 23.08% of respondents selected that their company has their own finance department but outsources. 7.69% of respondents selected that their company does not have their own finance department.

Based on the results, the majority of the respondents have common in-firm strategies as it relates to supply chain management, the formulation of risk management strategies and

financial decisions. In addition to using insurance and derivatives, these in-firm strategies may be part of their overall risk management strategy.

7.4.3 Perceptions of Current Risk Management Strategy

According to the survey, the respondents appear to be moderately satisfied with their current risk management strategy, with a rating of 4.23 out of seven. However, only 38.46% of respondents are interested to learn about other risk management strategies and/or tools. Perhaps the 61.54% of respondents that are not interested in learning about new risk management tools do not feel a sense of urgency to address the various risk sources.

Additionally, there may be a lack of knowledge or expertise to learn about and use new risk management tools. Therefore, they may be unwilling to commit time and financial resources required to educate themselves about other risk management tools. Another possible explanation is that the respondents may have other risk management strategies that they are satisfied with and find more effective than the tools described in the survey.

7.4.4 Reported Use of Risk Management Strategies in US Agriculture Industry

Several studies have been conducted on the usage of risk management strategies by farmers in agriculture over the last decades. The surveys attempted to answer the question of how the farmers used the tools and strategies to manage risk (Harwood et al. 1999). The survey asked the farmers whether or not they use hedging, insurance, forward contract, diversifications, holding cash or if other strategies were used to manage risk.

According to Harwood et al. (1999), the studies done on the subject of risk management strategies and tools in the agriculture show various results, however, the use of risk management tools such as futures, forward, options or cash on hand may have improved compared to earlier studies done in the mid-1980s on the farmers' use of marketing tools. Results from the USDA ARMS (1996) show that about 40% of the farmers in the Corn Belt and Northern Plains used forward contracts, and nearly 25% used futures.

Only a minority of producers in the US agriculture industry use options for hedging purposes. This is demonstrated in a Kansas study where options are used by approximately 10-15 % of

wheat producers, 10% on corn and cattle producers, and less than 5 % by soybean, grain and hog producers (Goodwin and Schroeder; Harwood et al. 1999).

After several research attempts, there is a lack of concrete information on the percentage of farmers in the US agriculture industry using insurance. This may be because farmers have access to the federal crop insurance program and private insurance (USDA, 2019). Therefore, there will not be a comparison regarding insurance between the Norwegian aquaculture industry and US agriculture industry.

7.4.5   Comparison between Agriculture Industry and Aquaculture Industry

The results from the aquaculture industry show that 61.54% of respondents use futures/forward contracts. According to Harwood et al (1999), the USDA's survey shows that 65% of respondents use futures/forwards in the US agriculture industry. Table 7 below shows the findings between the Norwegian aquaculture industry and the US agriculture industry.

Table 41: Comparison of the Usage of Futures/Forward Contracts in Aquaculture Industry and Agriculture Industry

Risk Management Tool	Aquaculture Industry Percentage of Respondents	Agriculture Industry Percentage of Respondents
Futures, Forwards Contracts	61.54%	65.00%

According to table 7, the results from the survey are very similar to the study in the agriculture industry. The agriculture industry has 3.46% more respondents using futures/forward contracts than the aquaculture industry. This may be because the agriculture futures/forward markets is more established in the US.

Bergfjord (2007) investigates the likelihood of success of a salmon futures market by using the existing literature on the success factors for a futures market and applying the criteria to the salmon futures market. The paper finds that the salmon futures contract may struggle to survive in the short-term and offers different methods to manage the market or price risk in the salmon industry. It is therefore possible that the futures/forward market on agricultural commodities is more established in terms of liquidity than the futures market for salmon.

The survey conducted on the aquaculture industry showed that only 7.69% of respondents use options to reduce risk. This is expected, because only a minority of producers in the US agriculture industry use options for hedging purposes. The use of options varies across commodities, between 5% and 15% of agricultural producers use options for hedging purposes (Goodwin and Schroeder; Harwood et al. 1999). As stated earlier, it may be uncommon to use options because according to Hull (2012), options act like insurance.

7.5   Methodology Strengths and Weaknesses

The design of the survey gives a strong general overview of the risk preferences, risk sources and risk management tools in the agriculture. It provides key findings that may serve as a foundation for further research. One of the main weaknesses of the survey is the sample size, because the study collected 13 responses, which does provide a representative sample of the entire Norwegian aquaculture industry. On the other hand, there are important insights that can be gathered from the study, and the results are compared to agriculture industry. The results from the aquaculture industry survey are similar to an earlier study on the US agriculture industry, which offers a level of validity.

This paper attempts to provide possible explanations behind the results, but is not tested by statistical analysis, such as regression analysis. The results should therefore be interpreted with care.

Some of the questions in the survey were excluded of "other/don't know" options, forcing the respondents to answer the questions and selecting the option that most accurately answers their question. On the other hand, having respondents choose an option that is most similar to the response instead of giving them the option to write a response that perfectly matches their answer may cause less accurate responses.

In order to preserve the respondents' motivation to start and finish the survey, the survey purposely avoids questions that require detailed responses. This tradeoff was therefore deemed necessary even though it might omit useful information.

Another weakness in the survey design is that the survey does not ask the respondent what position or role they have within their company. When answering questions relating to risk preferences, it is not known what role or position the respondent has within the firm. The incentive structure, in which the financial performance of the firm is directly linked to the individual's pay. Additionally, the validity of their responses may be questionable as they might lack the knowledge to answer company related questions.

7.6   Areas for Further Research

The survey finds the risk preferences (attitude towards risk), critical risk sources and the risk management tools. The survey does not ask the respondents the why and how questions. For example, when the respondent is asked to rate their current risk management strategy, the study only finds out about the general effectiveness of it. The survey does not find out why the respondent has provided a specific rating to the current risk management strategy. In this case, interviews may have been an effective method to gain deeper insight into the questions posed in the survey for further research.

An area for further research could be to examine the relationship between the risk management tools used and company characteristics. This can be done by employing statistical analysis, such as regression analysis. This can provide a method for predicting economic behavior as it relates to derivatives. It can help predict which companies are more likely to use futures/forward contracts.

8. Conclusion

The majority of fish farmers' attitude towards risk lie on the spectrum of being between risk-neutral and risk-seeker. The fish farmers in the aquaculture industry are grouped in the following way: 0.00% high degree of risk-aversion, 11.54% risk-averse, 50.00% risk-neutral, 38.46% risk-seeker, 0.00% high degree of risk-seeking. A study on the risk preferences in the US agriculture industry served as a benchmark for this paper's Norwegian aquaculture industry survey results. Since both industries are very similar, the results from the aquaculture industry are expected to be similar to the agriculture industry, adding a level of validity to the aquaculture study.

The main risk sources are production risks (diseases, escaping and bio-physical shocks), market or price risk (future salmon price), institutional risks, demand, input costs, technology and moral hazard. The results are compared to an earlier study in the US agriculture industry. Both industries listed production risks, market or price risk, and institutional risks as the top three most important risk sources. The ordering of three risk sources differed, as the study in the agriculture industry ranked the risk sources in the following way: institutional risks, production risks and market/price risks.

The marketing risk management tools in the aquaculture industry are insurance, futures/forward contracts and options. 100% of respondents use insurance, 61.54% of respondents use futures/forward contracts, and 7.69% of respondents use options. The results from the aquaculture industry met expectations because they were similar to the results from a previous US agriculture study. Fish farmers gave a moderate rating to the overall effectiveness of insurance as risk management tool and their current risk management strategy as moderate. The majority of fish farmers did not appear to be interested to learn about additional risk management tools.

9. References

- Aksnes, V. (2017). *Aquaculture Structures: Current development trend*. Retrieved from http://www.imamhomepage.org/imam2017/images/IMAM 2017 Keynote Lecture - V Aksnes.pdf

- Barentswatch. (2019, June). *Kostnader*. Retrieved from https://www.barentswatch.no/havbruk/kostnader

- Bergfjord, O. J. (2007, May 25). *Is there a Future for Salmon Futures? An Analysis of the Prospects of a Potential Futures Market for Salmon*. Retrieved from https://doi.org/10.1080/13657300701370317

- Bergfjord, O. J. (2009, January). *Risk perception and risk management in Norwegian aquaculture.* Retrieved from https://www.researchgate.net/publication/240530078_Risk_perception_and_risk_man agement_in_Norwegian_aquaculture

- Bodie, Z., Kane, A., & Marcus, A. (2018). *Investments* (11th ed.). 2 Penn Plaza, New York, NY: The McGraw-Hill Education.

- EY. (2017). *Norwegian Aquaculture Analysis 2017*. Retrieved from https://www.ey.com/Publication/vwLUAssets/EY_-_The_Norwegian_Aquaculture_Analysis_2017/$FILE/EY-Norwegian-Aquaculture-Analysis-2017.pdf

- Fellesforbundet, Fiskeri- og havbruksnæringens landsforening, & Arbeidstilsynet (Eds.). (2011, January). *Arbeidsmiljø og sikkerhet i havbruk*. Retrieved from https://sjomatnorge.no/wp-content/uploads/2014/04/Arbmiljo_havbruk.pdf

- Fiskeridirektoratet. (2014, November 14). *Akvakulturregisteret*. Retrieved from https://www.fiskeridir.no/Akvakultur/Registre-og-skjema/Akvakulturregisteret

- Guillemette, M., Gilliam, J. E., & Finke, M. (2012, May). *Risk Tolerance Questions to Best Determine Client Portfolio Allocation Preferences*. Retrieved from https://www.researchgate.net/publication/256021785_Risk_Tolerance_Questions_to_Best_Determine_Client_Portfolio_Allocation_Preferences

- Harwood, J., Heifner, R., Coble, K., Perry, J., & Somwaru, A. (1999, March). *Managing Risk in Farming: Concepts, Research, and Analysis*. Retrieved from https://www.ers.usda.gov/publications/pub-details/?pubid=40971

- Hull, J. C. (2012). *Options, Futures, And Other Derivatives.* Pearson (Eighth ed.) New York.

- Marine Harvest. (2018). *Salmon Farming Industry Handbook 2018*. Retrieved from http://hugin.info/209/R/2200061/853178.pdf

- Microsoft Support. (2019). *STDEV.S function*. Retrieved from https://support.office.com/en-us/article/STDEV-S-function-7D69CF97-0C1F-4ACF-BE27-F3E83904CC23

- Radford, R. (2017, June 5). *How Important is the Internal Supply Chain?*. Retrieved from https://www.allthingssupplychain.com/how-important-is-the-internal-supply-chain/

- Rieger, M. O., Wang, M., & Hens, T. (2014). *Risk Preferences Around the World*. Retrieved from https://pubsonline.informs.org/doi/10.1287/mnsc.2013.1869

- Rosch, S. (2017, May). Selected Paper Prepared for the 2017 AAEA Annual Meeting in Chicago, IL July 30 – August 1, 2017: *Risk Attitudes of US Agricultural Producers*. Retrieved from https://econpapers.repec.org/paper/agsaaea17/258025.htm

- Secretan, P. (2007). *Aquaculture insurance*. Retrieved from http://www.fao.org/3/a1455e/a1455e02.pdf

- Šotić, A., & Rajić, R. (2015). *The Review of the Definition of Risk*. Retrieved from http://www.iiakm.org/ojakm/articles/2015/volume3_3/OJAKM_Volume3_3pp17-26.pdf

- Statistisk Sentralbyrå. (2018, October 25). *Aquaculture*. Retrieved from https://www.ssb.no/en/fiskeoppdrett

- Strand, R., & Oughton, D. (2009). *Risk and Uncertainty – as a Research Ethics Challenge*. Retrieved from https://www.etikkom.no/globalassets/documents/publikasjoner-som-pdf/risk-and-uncertainty-2009.pdf

- United States Department of Agriculture. (2019). *Crop Insurance*. Retrieved from https://www.ers.usda.gov/agricultural-act-of-2014-highlights-and-implications/crop-insurance/

- United States Department of Agriculture. (2018). *Risk in Agriculture*. Retrieved from https://www.ers.usda.gov/topics/farm-practices-management/risk-management/risk-in-agriculture/

- United States Department of Agriculture. (2018). *Risk Management Strategies*. Retrieved from https://www.ers.usda.gov/topics/farm-practices-management/risk-management/risk-management-strategies/

10. Appendix

Exhibit 1: Survey Questions in English

1. What is the name of your company? (optional)

_____

2. What is the postal code of the company's headquarters?

_____

3. Number of employees in the company

(1) ❑ 1-5 employees

(2) ❑ 6-10 employees

(3) ❑ 11-20 employees

(4) ❑ 21-50 employees

(5) ❑ 51-100 employees

(6) ❑ over 100 employees

4. Company structure

(1) ❑ Corporation

(2) ❑ Public Limited Company

(3) ❑ Sole Proprietor

(4) ❑ Limited Liability Company

5. Number of suppliers

(1) ❑ 1-20

(2) ❑ 21-50

(3) ❑ 51-100

(4) ❑ 101-200

(5) ❑ Over 300

6. Does your company have a financial advisor or department?

(1) ❑ Yes, our company has its own finance department

(2) ❑ Yes, but our company outsources

(3) ❑ No

7. How concerned are you of possible gains or losses when making a major financial decision?

(1) ❑ Always the possible losses

(2) ❑ Usually the possible losses

(3) ❑ Always the possible gains

(4) ❑ Usually The possible gains

8. How do you typically feel subsequent to making a major financial decision?

(1) ❑ Very Pessimistic

(2) ❑ Little pessimistic

(3) ❑ Very optimistic

(4) ❑ Little optimistic

9. How would you describe your attitude towards risk?

(1) ❑ Very risk-averse

(2) ❑ Risk-averse

(3) ❑ Neutral

(4) ❑ Risk-seeker

(5) ❑ Very risk-seeking

10. What expectations does your company have for the salmon price in the near-future?

(1) ❑ Large increase

(2) ❑ Small increase

(3) ❑ No change

(4) ❑ Small decrease

(5) ❑ Large decrease

11. What levels of risk is your company willing to take for financial decisions?

(1) ❑ Very low

(2) ❑ Low

(3) ❑ Normal

(4) ❑ High

(5) ❑ Very high

12. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): salmon price
_____

13. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): diseases, bio-physical shocks (hurricane)

_____

14. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): institutional risks (market, environmental regulations, and taxes)
_____

15. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): input costs (labor costs, production costs)

_____

16. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): technology

_____

17. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): moral hazard risk (employee/corruption)
_____

18. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): demand (sabotage from animal rights activists/health)

_____

19. Select the risk sources that are most difficult to manage (more than one)
(1) ❑ Future salmon price

(2) ❑ Diseases, escaping, biophysical shocks (hurricane/drought)

(3) ❑ Institutional risk (market/environmental/regulations/taxes)

(4) ❑ Input costs (feed/labor/machinery)

(5) ❑ Technology

(6) ❑ Moral risk (employees/corruption)

(7) ❑ Demand (Sabotage from animal activists / health)

20. Do you think the aquaculture industry is riskier than agriculture industry?
(1) ❑ Yes, riskier than agriculture

(2) ❑ No, Less riskier than agriculture

(3) ❑ The risks in both industries are approximately the same

21. Does your company use insurance?
(1) ❑ Yes

(2) ❑ No

22. How effective is insurance at reducing risk? (1 = not effective, 5 = very effective)
_____

23. Hvilke risikofaktorer er det forsikringen reduserer?

(1) ❑ Future salmon price

(2) ❑ Diseases, escaping, biophysical shocks (hurricane/drought)

(3) ❑ Institutional risk (market/environmental/regulations/taxes)

(4) ❑ Input costs (feed/labor/machinery)

(5) ❑ Technology

(6) ❑ Moral risk (employees/corruption)

(7) ❑ Demand (Sabotage from animal activists / health)

24. Does your company use derivatives (futures/forward contracts) to minimize or eliminate risk? (Hedging)
(1) ❑ Yes

(2) ❑ No

25. Does your company use derivatives (futures/forward contracts) to speculate in the market?

(1) ❑ Yes

(2) ❑ No

26. What knowledge do you have of the futures/forward market?

(1) ❑ Heard about it, but do not know what it is

(2) ❑ Know very little about it

(3) ❑ I have studies this

(4) ❑ Use it / have used it

27. Do you think that a futures/forward contract can eliminate or reduce risk?

(1) ❑ Yes

(2) ❑ No

28. If you do not use futures/forward contracts, why not?

(1) ❑ It increases costs

(2) ❑ Lack of knowledge

(3) ❑ Adds volatility to revenue streams

(4) ❑ Uncommon in the industry

(5) ❑ Other

29. Are the risk management strategies formulated internally or externally?

(1) ❑ Internally

(2) ❑ Externally

(3) ❑ Both, but more internally

(4) ❑ Both, but more externally

(5) ❑ Both, equal amounts

30. Are activities from the supply chain managed internally or externally?

(1) ❑ Internally

(2) ❑ Externally

(3) ❑ Both, but more internally

(4) ❑ Both, but more externally

(5) ❑ Both, equal amounts

31. Which of the risk management tools do you use? (More than one)
(1) ❑ Insurance

(2) ❑ Futures/forward contracts

(3) ❑ Options

(4) ❑ Other

32. Are there areas for improvement in your current risk management strategies to reduce risk? (1- we need significant improvement, 7 = very little):
 _____

33. Are you interested in new risk management tools?
(1) ❑ Yes

(2) ❑ No

34. From a scale 1-5 How effective is your current risk management strategy when it comes to reducing risk?

 _____

35. Has there been an event where you have benefited from using insurance or another risk management tool? Yes or no? Explain. _____
_____
_____
_____
_____

36. Comments/ additional information
_____
_____
_____
_____
_____

Exhibit 2: Survey Questions and Responses in English

1. What is the name of your company? (optional)
   - Smøla Klekkeri og Settefiskanlegg
   - Urke Fiskeoppdrett AS
   - Cermaq Norway
   - Blom Fiskeoppdrett
   - Smølen Handelskompani med underliggende selskaper (Nekton Havbruk, Smøla Klekkeri og Settefisk, Sagafisk)
   - RyFish
   - Arnøy Laks
   - SinkabergHansen AS
   - Namdal Settefisk AS group

2. What is the postal code of the company's headquarters?
   - 6570
   - 6170
   - 8286
   - 5337
   - 5640
   - 6570
   - 6533
   - 4110
   - 9180
   - 8764
   - 7900
   - 8909
   - 7819 Fosslandsosen

3. Number of employees in the company
   - 1-5 employees
   - 1-5 employees
   - over 100 employers
   - 51-100 employees
   - 51-100 employees

- 21-50 employees
- 1-5 employees
- 1-5 employees
- 51-100 employees
- over 100 employees
- over 100 employees
- 11-20 employees
- 21-50 employees

4. Company structure
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation
    - Corporation

5. Number of suppliers
    - 1-20
    - 1-20
    - over 300
    - 101-200
    - 51-100
    - 21-50
    - 21-50

- 1-20
- 51-100
- 101-200
- 51-100
- 51-100
- 1-20

6. Does your company have a financial advisor or department?

   - Yes, but our company outsources
   - Yes, our company has its own finance department
   - Yes, our company has its own finance department
   - Yes, our company has its own finance department
   - No
   - Yes, our company has its own finance department
   - Yes, our company has its own finance department
   - Yes, but our company outsources
   - Yes, our company has its own finance department
   - Yes, our company has its own finance department
   - Yes, but our company outsources
   - Yes, our company has its own finance department
   - Yes, our company has its own finance department

7. How concerned are you of possible gains or losses when making a major financial decision?

   - Usually the possible gains
   - Usually the possible gains
   - Usually the possible gains
   - Usually the possible gains
   - Usually the possible gains
   - Usually the possible gains
   - Usually the possible losses
   - Usually the possible gains

- Usually the possible gains
- Usually the possible losses
- Always the possible gains
- Usually the possible gains
- Usually the possible gains

8. How do you typically feel subsequent to making a major financial decision?
- Very optimistic
- Little optimistic
- Very optimistic
- Little optimistic
- Little optimistic
- Very optimistic
- Little optimistic
- Very optimistic
- Little optimistic
- Little pessimistic
- Little optimistic
- Little optimistic
- Little optimistic

9. How would you describe your attitude towards risk?
- Risk-seeker
- Risk-seeker
- Risk-averse
- Risk-seeker
- Neutral
- Risk-seeker
- Risk-seeker
- Risk-seeker
- Neutral
- Neutral

- Neutral
- Neutral
- Neutral

10. What expectations does your company have for the salmon price in the near-future?

- Small decrease
- Small increase
- Small increase
- Small increase
- No change
- Small decrease
- No change
- No change
- Small decrease
- Small decrease
- Small decrease
- No change
- No change

11. What levels of risk is your company willing to take for financial decisions?

- High
- Normal
- Normal
- High
- Normal
- Normal
- High
- High
- Normal
- Low
- Low
- Normal

- Normal

12. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): salmon price
    - 3,00
    - 5,00
    - 3,00
    - 1,00
    - 6,00
    - 4,00
    - 3,00
    - 6,00
    - 5,00
    - 3,00
    - 1,00
    - 1,00
    - 4,00

13. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): diseases, bio-physical shocks (hurricane)
    - 2,00
    - 1,00
    - 4,00
    - 2,00
    - 1,00
    - 2,00
    - 2,00
    - 2,00
    - 6,00
    - 3,00
    - 3,00
    - 1,00
    - 3,00

14. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): institutional
    risks (market, environmental regulations, taxes)

    - 4,00
    - 5,00
    - 4,00
    - 4,00
    - 2,00
    - 3,00
    - 4,00
    - 3,00
    - 4,00
    - 6,00
    - 6,00
    - 4,00
    - 3,00

15. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): input costs
    (labor costs, production costs)

    - 5,00
    - 5,00
    - 3,00
    - 5,00
    - 4,00
    - 5,00
    - 4,00
    - 6,00
    - 5,00
    - 7,00
    - 7,00
    - 4,00
    - 6,00

16. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): technology

- 4,00
- 6,00
- 2,00
- 5,00
- 6,00
- 6,00
- 6,00
- 1,00
- 3,00
- 6,00
- 7,00
- 7,00
- 7,00

17. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): moral hazard risk (employee/corruption)

- 7,00
- 7,00
- 1,00
- 7,00
- 2,00
- 6,00
- 6,00
- 7,00
- 2,00
- 7,00
- 7,00
- 7,00
- 6,00

18. In a scale from 1-7, rank the risk factors (1= highest risk, 7 = lowest risk): demand (sabotage from animal rights activists/health)

- 3,00
- 4,00
- 1,00
- 6,00
- 5,00
- 6,00
- 7,00
- 7,00
- 3,00
- 6,00
- 7,00
- 2,00
- 5,00

19. Select the risk sources that are most difficult to manage (more than one)
    - Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)
    - Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)
    - Salmon Price / institutional risks (market, environmental regulations, taxes) / demand (sabotage from animal rights activists/health)
    - Salmon Price / Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)
    - institutional risks (market, environmental regulations, taxes) / moral hazard risk (employee/corruption)
    - Salmon price / institutional risks (market, environmental regulations, taxes) / moral hazard risk (employee/corruption)
    - Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)
    - Diseases, bio-physical shocks (hurricane) / Technology
    - Salmon price / Diseases, bio-physical shocks (hurricane) / input costs (labor costs, production costs)
    - Diseases, bio-physical shocks (hurricane)

- Salmon price / Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)
- Salmon price / Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes) / demand (sabotage from animal rights activists/health)
- Salmon price / Diseases, bio-physical shocks (hurricane) / demand (sabotage from animal rights activists/health)

20. Do you think the aquaculture industry is riskier than agriculture industry?
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture
- Yes, riskier than agriculture

21. Does your company use insurance??
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes

- Yes
- Yes
- Yes
- Yes

22. How effective is insurance at reducing risk? (1 = not effective, 5 = very effective)

- 4,00
- 2,00
- 2,00
- 4,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00

23. Hvilke risikofaktorer er det forsikringen reduserer?

- Diseases, bio-physical shocks (hurricane) / demand (sabotage from animal rights activists/health)
- Salmon price / Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane) / Technology
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane)
- Diseases, bio-physical shocks (hurricane) / institutional risks (market, environmental regulations, taxes)

- Diseases, bio-physical shocks (hurricane)
- Salmon price / Diseases, bio-physical shocks (hurricane) / demand (sabotage from animal rights activists/health)
- Diseases, bio-physical shocks (hurricane) / demand (sabotage from animal rights activists/health)

24. Does your company use derivatives (futures/forward contracts) to minimize or eliminate risk? (Hedging)
    - No
    - Yes
    - Yes
    - Yes
    - Yes
    - Yes
    - Yes
    - No
    - No
    - No
    - Yes
    - Yes
    - No

25. Does your company use derivatives (futures/forward contracts) to speculate in the market?
    - No
    - No
    - No
    - No
    - No
    - No
    - No
    - No
    - No

- No
- No
- No
- No

26. What knowledge do you have of the futures/forward market?
    - Know very little about it
    - I have studies this
    - I have studies this
    - Know very little about it
    - Use it / have used it
    - I have studies this
    - Use it / have used it
    - Know very little about it
    - I have studies this
    - Use it / have used it
    - I have studies this
    - I have studies this
    - Know very little about it

27. Do you think that a futures/forward contract can eliminate or reduce risk?
    - No
    - Yes
    - Yes
    - Yes
    - Yes
    - Yes
    - Yes
    - No
    - No
    - Yes
    - Yes

- No
- No

28. If you do not use futures/forward contracts, why not?

- Other
- Other
- Other
- It increases costs
- It increases costs
- Other
- Other
- Lack of knowledge
- Adds volatility to revenue streams
- Other
- Other
- Other
- Lack of knowledge

29. Are the risk management strategies formulated internally or externally?

- Both, equal amounts
- Both, but more internally
- Both, but more externally
- Internally
- Both, but more internally
- Both, but more internally
- Both, but more internally
- Both, but more internally
- Internally
- Both, but more internally
- Internally
- Both, but more internally
- Both, but more internally

30. Are activities from the supply chain managed internally or externally?

- Both, equal amounts
- Both, but more internally
- Both, but more internally
- Internally
- Both, but more internally
- Internally
- Internally
- Externally
- Internally
- Internally
- Internally
- Both, but more externally
- Both, but more internally

31. Which of the risk management tools do you use? (More than one)

- Insurance
- Insurance/ Futures/forward contracts
- Insurance/ Futures/forward contracts
- Insurance
- Insurance/ Futures/forward contracts
- Insurance/ Futures/forward contracts / Options
- Insurance/ Futures/forward contracts
- Insurance
- Insurance / Futures/forward contracts
- Insurance / Futures/forward contracts
- Insurance / Futures/forward contracts
- Insurance / Other
- Long-term contract. Other

32. Are there areas for improvement in your current risk management strategies to reduce risk? (1- we need significant improvement, 7 = very little)

- 5,00
- 2,00
- 1,00
- 4,00
- 4,00
- 3,00
- 6,00
- 7,00
- 4,00
- 4,00
- 4,00
- 5,00
- 6,00

33. Are you interested in new risk management tools?

- Yes
- Yes
- No
- Yes
- No
- Yes
- No
- No
- No
- No
- Yes
- No
- No

34. . In a scale 1-5 How effective is your current risk management strategy when it comes to reducing risk?)

- 4,00

- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 4,00
- 3,00
- 3,00
- 3,00
- 4,00
- 3,00
- 4,00

35. Has there been an event where you have benefited from using insurance or another risk management tool? Yes or no? Explain

- Yes, for fish mortality.

- Yes, for water blockages and hurricane damages less effective for disease outbreaks...
- Yes, Insurance reduced the risk in cases where fish have been lost as a result of transport accidents and in biological events. Derivatives on currencies have led to both negative and positive effects, depending on the price development of NOK/EUR, NOK/USD, NOK/JPY. Thus, the use of this type of derivatives helped to eliminate the currency exposure, but at the same time we lose a potential upside.

- Yes, for large fish mortality, where we were reimbursed for some of the lost value of the dead fish..

- For for disease outbreaks and received reimbursement of the clean-up costs.

- Yes, in cases of mass deaths from disease/virus outbreaks.

- Yes

- Not really

- Not really

- Yes

- We ensure price of parts of volume – it provides predictability

- Both yes and no - Both losses and gains on futures contracts

- Yes, Our water pipe was affected by an underwater slide next to our facility (not the actual facility). Only the water pipe was affected, not our facility.

Comments / Additional information

- None

- Our company runs a smolt production within a group structure (konsernstruktur) with fish production, slaughter, and cold storage. The survey is outside of our business activities, but our answers reflects the entire group. Selskapet driver med smoltproduksjon innen en konsernstruktur med. matfiskproduksjon, slakteri og fryseri. Undersøkelsen er litt på siden av det vi driv med lokalt her , men svar avspeiler hele konsernet.

- None

- None

- None

- None

- None

- We produce salmon with new locked/closed technology. Therefore technology is our highest risk since the technology has not been tested before..

- None

- None

- None

- None

- None

Exhibit 3: Survey Questions in Norwegian

1. Hva er navnet på ditt selskap? (valgfri)

_____

2. Hvor ligger ditt selskaps hovedkvarter (postnr)?

_____

3. Antall ansatte i deres selskap

(1) ❑ 1-5 ansatte

(2) ❑ 6-10 ansatte

(3) ❑ 11-20 ansatte

(4) ❑ 21-50 ansatte

(5) ❑ 51-100 ansatte

(6) ❑ over 100

4. Type selskapsform

(1) ❑ Aksjeselskap (AS)

(2) ❑ Allmennaksjeselskap (ASA)

(3) ❑ Enkeltmannsforetak (ENK)

(4) ❑ Ansvarlig selskap (ANS/DA)

5. Antall leverandører

(1) ❑ 1-20

(2) ❑ 21-50

(3) ❑ 51-100

(4) ❑ 101-200

(5) ❑ over 300

6. Har deres selskap en finansiell rådgiver / personell?

(1) ❑ Ja, selskapet har sitt eget finansavdeling

(2) ❑ Ja, men vi outsourcer til andre selskaper

(3) ❑ Nei

7. Når store finansielle beslutninger skal tas, ligger fokuset mer på potensielle gevinst eller tap?

(1) ❑ Alltid det potensielle tapet

(2) ❑ Vanligvis det potensielle tapet

(3) ❑ Alltid den potensielle gevinsten

(4) ❑ Vanligvis den potensielle gevinsten

8. Hvordan føles det etter finansielle beslutninger blir tatt i selskapet?

(1) ❑ Veldig pessimistisk

(2) ❑ Litt pessimistisk

(3) ❑ Veldig optimistisk

(4) ❑ Litt optimistisk

9. Hvordan vil du forklare deres risiko preferanser?

(1) ❑ Veldig risikoavers

(2) ❑ Risikoavers

(3) ❑ Nøytral

(4) ❑ Risikosøkende

(5) ❑ Veldig risikosøkende

10. Hvilken forventning har dere til prisen for laks i nærmest fremtid?

(1) ❑ Stor økning

(2) ❑ Liten økning

(3) ❑ Ingen endring

(4) ❑ Liten reduksjon

(5) ❑ Stor reduksjon

11. Hvilke nivå av risiko er deres selskap villig til å ta under finansielle beslutninger?

(1) ❑ Veldig lav

(2) ❑ Lav

(3) ❑ Normal

(4) ❑ Høy

(5) ❑ Veldig høy

12. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): lakseprisen

_____

13. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): sykdom, virus, bio-fysiske fenomener (orkan)

_____

14. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): institusjonell risiko (marked, miljømessig reguleringer, skatt)

_____

15. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): input kostnader (lønn og produksjonskostnader)

_____

16. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): teknologi

_____

17. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): moralsk risiko (ansatte/korrupsjon)

_____

18. I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): etterspørsel (sabotasje av "animal rights" aktivister)

_____

19. Huk av de risikokildene som er vanskeligst å håndtere (flere enn én)

(1) ❑ Lakseprisen

(2) ❑ Sykdom, virus, bio-fysiske fenomener(orkan)

(3) ❑ Institusjonell risiko (marked, miljømessig reguleringer, skatt)

(4) ❑ Input kostnader (lønn og produksjonskostnader)

(5) ❑ Teknologi

(6) ❑ Moralsk risiko (ansatte/korrupsjon)

(7) ❑ Etterspørsel (sabotasje av "animal right" aktivister)

20. Tror du akvakultur industrien har høyere risiko enn landbruksindustrien?

(1) ❑ Ja, høyere risiko enn landbruk

(2) ❑ Nei, lavere risiko enn landbruk

(3) ❑ Risikoen er nesten lik

21. Bruker dere forsikring?

(1) ❑ Ja

(2) ❑ Nei

22. Hvor effektiv er forsikring til å redusere risiko? (1= ikke effektivt, 5= veldig effektivt)

_____

23. Hvilke risikofaktorer er det forsikringen reduserer?

(1) ❑ Lakseprisen

(2) ❑ Sykdom, virus, bio fysiske fenomener(orkan)

(3) ❑ Institusjonell risiko (marked, miljømessig reguleringer, skatt)

(4) ❑ Input kostnader (lønn og produksjonskostnader)

(5) ❑ Teknologi

(6) ❑ Moralsk risiko (ansatte/korrupsjon)

(7) ❑ Etterspørsel (sabotasje av "animal right" aktivister)

24. Bruker dere derivater "futures/forward" kontrakter for å minimere eller eliminere risiko? (hedging)

(1) ❑ Ja

(2) ❑ Nei

25. Bruker dere derivater "futures/forward" kontrakter for å spekulere i markedet?

(1) ❑ Ja

(2) ❑ Nei

26. Hvilke kunnskaper har du om "futures/forward" markedet?

(1) ❑ Har hørt om det, men vet ikke helt hva det innebærer

(2) ❑ Vet veldig lite om det

(3) ❑ Har studert om dette

(4) ❑ Bruker det

27. Tror du "futures/forward" kontrakter kan eliminere/redusere risiko?

(1) ❑ Ja

(2) ❑ Nei

28. Dersom dere ikke bruker "futures/forward" kontrakter, ligger det en grunn for det?

(1) ❑ Det øker kostnaden

(2) ❑ Mangel på kunnskap

(3) ❑ Inntekten blir mer volatil

(4) ❑ Ingen i industrien bruker det

(5) ❑ Annet

29. Er strategier for risikostyring konstruert internt eller eksternt?

(1) ❑ Internt

(2) ❑ Eksternt

(3) ❑ Begge, men mest internt

(4) ❑ Begge, men mest eksternt

(5) ❑ Begge, likevekt

30. Er aktiviteter som verdikjede/leverandørkjede og logistikk styrt eksternt eller internt?

(1) ❑ Internt

(2) ❑ Eksternt

(3) ❑ Begge, men mest internt

(4) ❑ Begge, men mest eksternt

(5) ❑ Begge, likevekt

31. Hvilke risiko-styringsmidler blir brukt?

(1) ❑ Forsikring

(2) ❑ Futures/forward kontrakter

(3) ❑ Opsjoner

(4) ❑ Ingen

(5) ❑ Annet _____

32. Ser du noen områder innen risikostyringen som kan forbedres for å redusere risiko mer effektivt? (1= trenger en signifikant forbedring, 7= trenger ingen forbedring)

_____

33. Er dere interessert i nye risiko-styringsmidler?

(1) ❑ Ja

(2) ❑ Nei

34. I en skala fra 1 – 5. Hvor effektiv er deres risiko-styringsmidler for å redusere risiko? (1= ikke effektiv, 5= veldig effektiv)

_____

35. Har det vært scenarioer der bruken av forsikring eller andre risikostyring midler har vært til gode for selskapet? Ja eller nei? Forklar

_____

_____

_____

_____

_____

36. Andre kommentarer / tilleggsopplysninger

_____

_____

_____

_____

_____

Exhibit 4: Survey Questions and Responses in Norwegian

Hva er navnet på ditt selskap? (valgfri)

- Smøla Klekkeri og Settefiskanlegg
- Urke Fiskeoppdrett AS
- Cermaq Norway
- Blom Fiskeoppdrett
- Smølen Handelskompani med underliggende selskaper (Nekton Havbruk, Smøla Klekkeri og Settefisk, Sagafisk)
- RyFish
- Arnøy Laks
- SinkabergHansen AS
- Namdal Settefisk AS group

Hvor ligger ditt selskaps hovedkvarter (postnr)?

- 6570
- 6170
- 8286
- 5337
- 5640
- 6570
- 6533
- 4110
- 9180
- 8764
- 7900
- 8909
- 7819 Fosslandsosen

Antall ansatte i deres selskap

- 1-5 ansatte
- 1-5 ansatte
- over 100

- 51-100 ansatte
- 51-100 ansatte
- 21-50 ansatte
- 1-5 ansatte
- 1-5 ansatte
- 51-100 ansatte
- over 100
- over 100
- 11-20 ansatte
- 21-50 ansatte

Type selskapsform

- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)
- Aksjeselskap (AS)

Antall leverandører

- 1-20
- 1-20
- over 300
- 101-200
- 51-100

- 21-50
- 21-50
- 1-20
- 51-100
- 101-200
- 51-100
- 51-100
- 1-20

Har deres selskap en finansiell rådgiver / personell?

- Ja, men vi outsourcer til andre selskaper
- Ja, selskapet har sitt eget finansavdeling
- Ja, selskapet har sitt eget finansavdeling
- Ja, selskapet har sitt eget finansavdeling
- Nei
- Ja, selskapet har sitt eget finansavdeling
- Ja, selskapet har sitt eget finansavdeling
- Ja, men vi outsourcer til andre selskaper
- Ja, selskapet har sitt eget finansavdeling
- Ja, selskapet har sitt eget finansavdeling
- Ja, men vi outsourcer til andre selskaper
- Ja, selskapet har sitt eget finansavdeling
- Ja, selskapet har sitt eget finansavdeling

Når store finansielle beslutninger skal tas, ligger fokuset mer på potensielle gevinst eller tap?

- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis det potensielle tapet

- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis det potensielle tapet
- Alltid den potensielle gevinsten
- Vanligvis den potensielle gevinsten
- Vanligvis den potensielle gevinsten

Hvordan føles det etter finansielle beslutninger blir tatt i selskapet?
- Veldig optimistisk
- Litt optimistisk
- Veldig optimistisk
- Litt optimistisk
- Litt optimistisk
- Veldig optimistisk
- Litt optimistisk
- Veldig optimistisk
- Litt optimistisk
- Litt pessimistisk
- Litt optimistisk
- Litt optimistisk
- Litt optimistisk

Hvordan vil du forklare deres risiko preferanser?
- Risikosøkende
- Risikosøkende
- Risikoavers
- Risikosøkende
- Nøytral
- Risikosøkende
- Risikosøkende
- Risikosøkende
- Nøytral

109

- Nøytral
- Nøytral
- Nøytral
- Nøytral

Hvilken forventning har dere til prisen for laks i nærmeste fremtid?

- Liten reduksjon
- Liten økning
- Liten økning
- Liten økning
- Ingen endring
- Liten reduksjon
- Ingen endring
- Ingen endring
- Liten reduksjon
- Liten reduksjon
- Liten reduksjon
- Ingen endring
- Ingen endring

Hvilke nivå av risiko er deres selskap villig til å ta under finansielle beslutninger?

- Høy
- Normal
- Normal
- Høy
- Normal
- Normal
- Høy
- Høy
- Normal
- Lav
- Lav

- Normal
- Normal

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): lakseprisen

- 3,00
- 5,00
- 3,00
- 1,00
- 6,00
- 4,00
- 3,00
- 6,00
- 5,00
- 3,00
- 1,00
- 1,00
- 4,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): sykdom, virus, bio-fysiske fenomener (orkan)

- 2,00
- 1,00
- 4,00
- 2,00
- 1,00
- 2,00
- 2,00
- 2,00
- 6,00
- 3,00
- 3,00
- 1,00

- 3,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): institusjonell risiko (marked, miljømessig reguleringer, skatt)

- 4,00
- 5,00
- 4,00
- 4,00
- 2,00
- 3,00
- 4,00
- 3,00
- 4,00
- 6,00
- 6,00
- 4,00
- 3,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): input kostnader (lønn og produksjonskostnader)

- 5,00
- 5,00
- 3,00
- 5,00
- 4,00
- 5,00
- 4,00
- 6,00
- 5,00
- 7,00
- 7,00
- 4,00
- 6,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): teknologi

- 4,00
- 6,00
- 2,00
- 5,00
- 6,00
- 6,00
- 6,00
- 1,00
- 3,00
- 6,00
- 7,00
- 7,00
- 7,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): moralsk risiko (ansatte/korrupsjon)

- 7,00
- 7,00
- 1,00
- 7,00
- 2,00
- 6,00
- 6,00
- 7,00
- 2,00
- 7,00
- 7,00
- 7,00
- 6,00

I en skala fra 1 – 7, ranger risikofaktorene (1= høyest risiko, 7= lavest risiko): etterspørsel (sabotasje av "animal rights" aktivister)

- 3,00
- 4,00
- 1,00
- 6,00
- 5,00
- 6,00
- 7,00
- 7,00
- 3,00
- 6,00
- 7,00
- 2,00
- 5,00

Huk av de risikokildene som er vanskeligst å håndtere (flere enn én)

- Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)
- Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)
- Lakseprisen / Institusjonell risiko (marked, miljømessig reguleringer, skatt) / Etterspørsel (sabotasje av "animal right" aktivister)
- Lakseprisen / Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)
- Institusjonell risiko (marked, miljømessig reguleringer, skatt) / Moralsk risiko (ansatte/korrupsjon)
- Lakseprisen / Institusjonell risiko (marked, miljømessig reguleringer, skatt) / Moralsk risiko (ansatte/korrupsjon)
- Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)
- Sykdom, virus, bio-fysiske fenomener(orkan) / Teknologi
- Lakseprisen / Sykdom, virus, bio-fysiske fenomener(orkan) / Input kostnader (lønn og produksjonskostnader)
- Sykdom, virus, bio-fysiske fenomener(orkan)

- Lakseprisen / Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)
- Lakseprisen / Sykdom, virus, bio-fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt) / Etterspørsel (sabotasje av "animal right" aktivister)
- Lakseprisen / Sykdom, virus, bio-fysiske fenomener(orkan) / Etterspørsel (sabotasje av "animal right" aktivister)

Tror du akvakultur industrien har høyere risiko enn landbruksindustrien?

- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk
- Ja, høyere risiko enn landbruk

Bruker dere forsikring?

- Ja
- Ja
- Ja
- Ja
- Ja
- Ja
- Ja
- Ja
- Ja

- Ja
- Ja
- Ja
- Ja

Hvor effektiv er forsikring til å redusere risiko? (1= ikke effektivt, 5= veldig effektivt)

- 4,00
- 2,00
- 2,00
- 4,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 3,00

Hvilke risikofaktorer er det forsikringen reduserer?

- Sykdom, virus, bio fysiske fenomener(orkan) / Etterspørsel (sabotasje av "animal right" aktivister)
- Lakseprisen / Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan) / Teknologi
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan)
- Sykdom, virus, bio fysiske fenomener(orkan) / Institusjonell risiko (marked, miljømessig reguleringer, skatt)

- Sykdom, virus, bio fysiske fenomener(orkan)
- Lakseprisen / Sykdom, virus, bio fysiske fenomener(orkan) / Etterspørsel (sabotasje av "animal right" aktivister)
- Sykdom, virus, bio fysiske fenomener(orkan) / Etterspørsel (sabotasje av "animal right" aktivister)

Bruker dere derivater "futures/forward" kontrakter for å minimere eller eliminere risiko? (hedging)

- Nei
- Ja
- Ja
- Ja
- Ja
- Ja
- Ja
- Nei
- Nei
- Nei
- Ja
- Ja
- Nei

Bruker dere derivater "futures/forward" kontrakter for å spekulere i markedet?

- Nei
- Nei
- Nei
- Nei
- Nei
- Nei
- Nei
- Nei
- Nei
- Nei

- Nei
- Nei
- Nei

Hvilke kunnskaper har du om "futures/forward" markedet?

- Vet veldig lite om det
- Har studert om dette
- Har studert om dette
- Vet veldig lite om det
- Bruker det
- Har studert om dette
- Bruker det
- Vet veldig lite om det
- Har studert om dette
- Bruker det
- Har studert om dette
- Har studert om dette
- Vet veldig lite om det

Tror du "futures/forward" kontrakter kan eliminere/redusere risiko?

- Nei
- Ja
- Ja
- Ja
- Ja
- Ja
- Ja
- Nei
- Nei
- Ja
- Ja
- Nei

- Nei

Dersom dere ikke bruker "futures/forward" kontrakter, ligger det en grunn for det?

- Annet
- Annet
- Annet
- Det øker kostnaden
- Det øker kostnaden
- Annet
- Annet
- Mangel på kunnskap
- Inntekten blir mer volatil
- Annet
- Annet
- Annet
- Mangel på kunnskap

Er strategier for risikostyring konstruert internt eller eksternt?

- Begge, likevekt
- Begge, men mest internt
- Begge, men mest eksternt
- Internt
- Begge, men mest internt
- Begge, men mest internt
- Begge, men mest internt
- Begge, men mest internt
- Internt
- Begge, men mest internt
- Internt
- Begge, men mest internt
- Begge, men mest internt

Er aktiviteter som verdikjede/leverandørkjede og logistikk styrt eksternt eller internt?

- Begge, likevekt
- Begge, men mest internt
- Begge, men mest internt
- Internt
- Begge, men mest internt
- Internt
- Internt
- Eksternt
- Internt
- Internt
- Internt
- Begge, men mest eksternt
- Begge, men mest internt

Hvilke risiko-styringsmidler blir brukt?

- Forsikring
- Forsikring / Futures/forward kontrakter
- Forsikring / Futures/forward kontrakter
- Forsikring
- Forsikring / Futures/forward kontrakter
- Forsikring / Futures/forward kontrakter / Opsjoner
- Forsikring / Futures/forward kontrakter
- Ingen
- Forsikring
- Forsikring / Futures/forward kontrakter
- Forsikring / Futures/forward kontrakter
- Forsikring / Futures/forward kontrakter
- Forsikring / Annet
- Langsiktig avtaler. Annet

Ser du noen områder innen risikostyringen som kan forbedres for å redusere risiko mer effektivt? (1= trenger en signifikant forbedring, 7= trenger ingen forbedring)

- 5,00
- 2,00
- 1,00
- 4,00
- 4,00
- 3,00
- 6,00
- 7,00
- 4,00
- 4,00
- 4,00
- 5,00
- 6,00

Er dere interessert i nye risiko-styringsmidler?

- Ja
- Ja
- Nei
- Ja
- Nei
- Ja
- Nei
- Nei
- Nei
- Nei
- Ja
- Nei
- Nei

I en skala fra 1 – 5. Hvor effektiv er deres risiko-styringsmidler for å redusere risiko? (1= ikke effektiv, 5= veldig effektiv)

- 4,00

- 3,00
- 3,00
- 3,00
- 3,00
- 3,00
- 4,00
- 3,00
- 3,00
- 322,00
- 4,00
- 3,00
- 4,00

Har det vært scenarioer der bruken av forsikring eller andre risikostyring midler har vært til gode for selskapet? Ja eller nei? Forklar

- Ja. Ved fiskedød.

- Ved vannstopp og orkantap , mindre effekt ved sykdomsutbrudd...

- Ja. Forsikringer redusert risikoen i tilefeller hvor fisk har gått tapt som følge av transportulykker og ved biologiske hendelser.
  Derviater på valuta har ført til både negative og posotive effekter alt etter kursutviklingen på NOK/EUR, NOK/USD, NOK/JPY. Således har bruken av denne type derivater vært med på å eliminere valutaeksponeringen, men samtidig mister vi en potensiell oppside.

- Ja, ved stor dødelighet hvor vi har fått dekket noe av verditapet fra dødfisken.

- Ved sykdomsutbrudd og har fått dekket oppryddingskostnader

- Ja, ved hendelser som har ført til massedød ved sykdoms/virusutbrudd.
- Ja

- Ikke ktuelt

- Ikke aktuelt

- Ja.

- Vi sikrer pris på deler av volum - det gir forutsigbarhet

- ja og nei - både tap og gevinst på future-kontrakter

- Ja ved undersjøisk ras ved et av vår anlegg,ikke selve anlegget men ved utbygging like ved, vår vannrør ble be rørt i raset.

Andre kommentarer / tilleggsopplysninger

- Ingen.

- Selskapet driver med smoltproduksjon innen en konsernstruktur med matfiskproduksjon ,slakteri og fryseri. Undersøkelsen er litt på siden av det vi driv med lokalt her , men svar avspeiler hele konsernet.

- –

- Nei

- Ingen kommentar

- Ingen

- Nei

- Vi skal produsere laks i ny lukket teknologi. Derfor er teknologisk risiko høyest da teknologien ikke er tetstet ut før.

- Ikke aktuelt

- .

- Nei

- .

- Nei