



# Master's degree thesis

**LOG950 Logistics**

**Supply Chain Risk Management in the Aquaculture Industry - Case study of Rauma Group**

**Fredrik Bjerkelund Olsson**

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Molde, 25/5-2012



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## Preface

Aquaculture is one of the largest industries in Norway. Norwegian salmon is well known around the world. It is used in sushi in Asia and popular in seafood counters in Europe and the U.S. In that respect, it is therefore exciting to illuminate and examine important aspects for a fish farmer in Norway.

Aquaculture and fish farming is a broad field with many issues that can be head lighted. The main focus in this thesis is the regard to supply chain risks. I became interested in this topic after a guest-lecture during my first year at Molde University College. The selection of industry was because of curiosity, and the firm was selected by a coincidence. I did not have any relation to my case study firm before this semester.

It has been challenging to gather detailed information and much of the information used is based on secondary data. This can be explained by that a stock listed company owns the firm, which is used as case study.

The thesis has been written during the spring semester of 2012. To write a thesis alone within a field and subject that is totally unknown has shown to be more challenging than anticipated. However, it has also been highly instructive. I would like to thank Professor Svein Bråthen who has been supervising this process. He has been available for guidance and also given inputs that have been used. I would also like to thank CEO of Rauma Group Ingjarl Skarvøy and Sales Manager at Vikenco, Kristen Heggem that have been mine interviewees and contacts. Finally, I will thank the people around me at school that have participated in discussions or other ways been a motivating factor.

Molde 25<sup>th</sup> May 2012.



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Fredrik Bjerkelund Olsson

## Summary

It can be discussed that cost is the most significant issue for a fish farmer to be competitive in the market. This thesis takes base that supply chain risk management is an important aspect in order to reduce costs. In addition to the concept of supply chain risk management, the theories of risk management, purchasing and uncertainty, will be examined.

The case study will evaluate how the Rauma Group is managing its supply chain risks with respect to supply chain management.

Two of the main risk events are related to the outbreak of lice and fish escapes. Both of these events can impact the profits of a fish farmer significantly. Furthermore, other risk events are related to planning, demand variability and accidents, which can also significantly impact the profits of a fish farmer. These risk events are discussed in this thesis.

The case study revealed that Rauma Group operates in an environment recognized by high supply- and demand risks. Supply risks are concerned to risks upstream the supply chain, while on the other hand, demand risks are risks faced downward to market and end customers. Examples can be regard to disruption in the supply chain because of problems with suppliers or fluctuations in market demand. Strategies to cope with this, such as vertical integration and hedging, are discussed.

Furthermore, feeding is observed as the most significant cost issue for a fish farmer. Exploiting mitigating strategies regarding feeding can make Rauma Group being able to reduce production unit cost. The finding suggests that the Rauma Group utilizes multiple sourcing strategies for feeding. This strategy corresponds with the theory.

A reduction of uncertainty in the supply chain will, according to theory, result in reduced costs. Information sharing points out to be an important issue in terms of reducing costs.

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# 1 Introduction

Operating in the aquaculture industry can be recognized with harsh competition and severe fluctuations in profits. Aspects that differ from general “supply and demand” industries influence the industry. Strict rules and regulations are current, and external impacts, as weather conditions and outbreak of diseases are normal circumstances.

The master thesis aims to *identify supply chain risks and develop risk management strategies* in a company within the salmon fish farming industry.

Norway is the world’s largest producer of Atlantic salmon. The leading companies are Marine Harvest, Lerøy Seafood, Cermaq and SalMar. This thesis will examine Rauma Group, which is a salmon farmer owned 75% by SalMar.

To achieve profits a fish farmer has to produce and distribute quality products in terms of customer’s demand.

Disruptions in the supply chain can lead to loss in profits. A well-working supply chain is therefore crucial in order to make money.

The normal procedure of a fish farmer today is to produce and harvest fish as whole gutted or filets. The production lead-time is affected mainly by seawater temperature and feeding. A fish farmer has no possibility to cope with the temperature, but the feeding can be controlled.

Salmon ready for harvest has normally a production time of between 18-22 months. This implies that production planning and forecasting is important factors of being able to produce cost effective.

## **Structure of the thesis**

The thesis is structured in five chapters.

Introduction with topic, presentation of case study and conceptual model is in the first chapter. In addition to an overview of the aquaculture industry is presented here.

In the second chapter, relevant theory is presented.

The research methodology is discussed in the third chapter.

Analysis and discussion are carried out in chapter four, before chapter five will include conclusion with recommendation, limitations and suggestion to further research.

## 1.1 Rauma Group

**Rauma Group** is a producer of salmon based in the Romsdal-region in Norway with its headquarters located at Sjøholt, Ørskog. In 2010, SalMar acquired 75% of the shares of Rauma Group for about 316 Mill NOK (Fish.no 2010). Rauma Group operates as a fully integrated fish farmer, which includes all activities from roe production to processing to distribution and sales. In 2010 they had revenues of about 350 MNOK and 493 MNOK in 2011 (Rauma Group 2011, purehelp.no). Rauma Group is organized as follows:

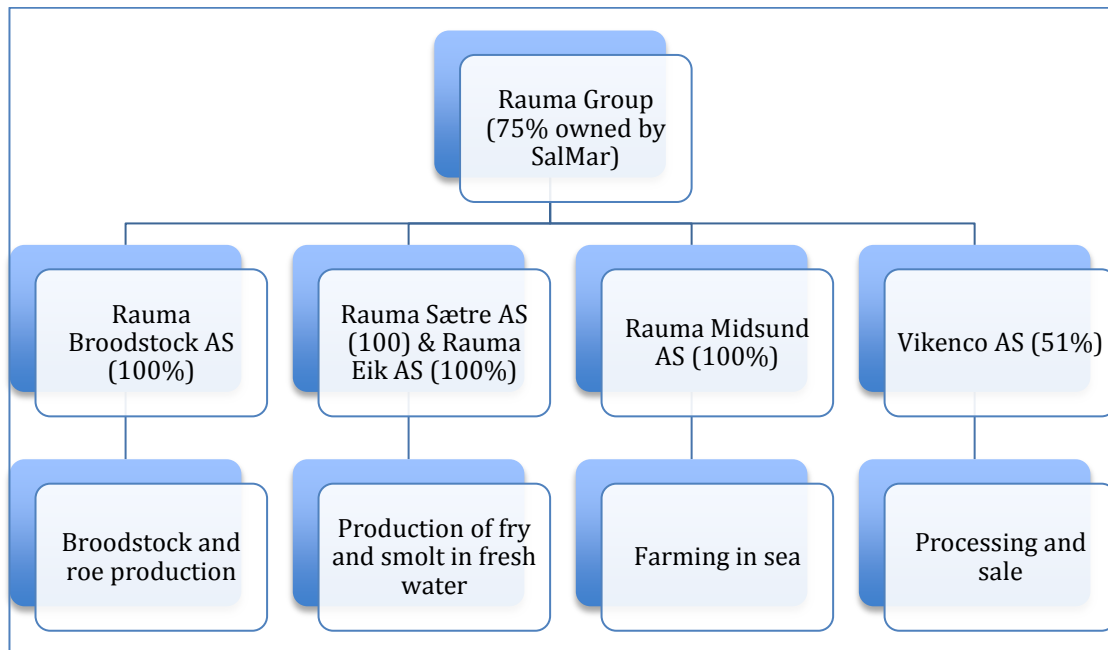


Figure 1 Overview Organization structure Rauma Group

The different business areas of Rauma Group are divided into own companies. All over, the Rauma Group employs about 100 persons.

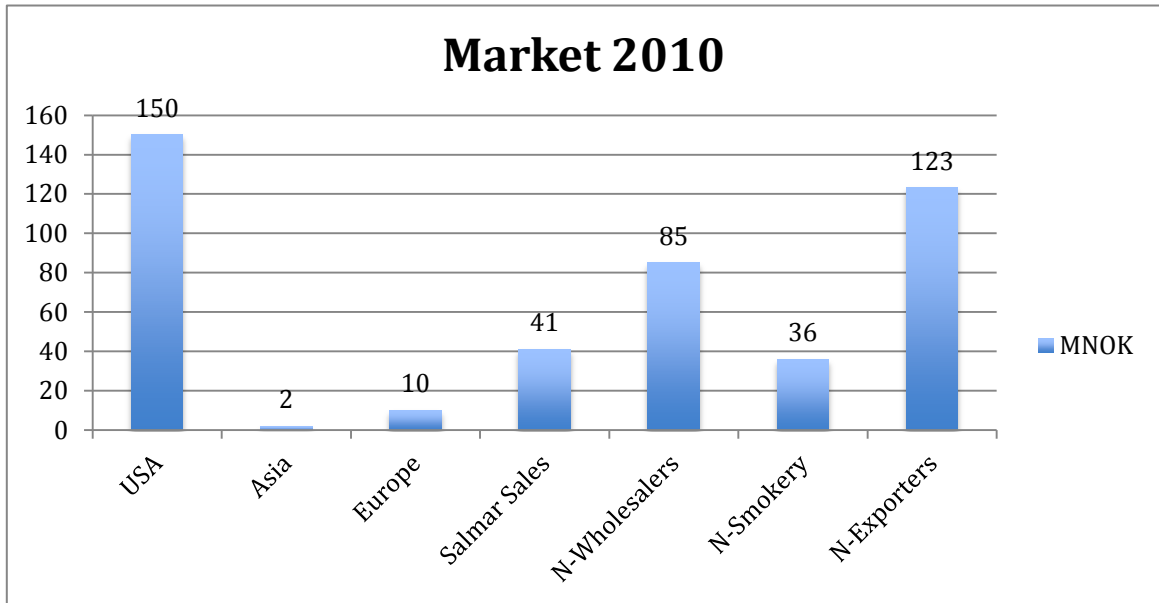


Figure 2 Market overview 2010. (Appendix 1)

As can be seen in figure 2, Vikenco's main market in 2010 is Norwegian exporters and directs sales to the U.S. This means the fish produced by Rauma Group are primarily exported abroad.

The Norwegian exporters act as intermediaries. According to Vikenco (Heggem 2012), they earn more money by sales directly to customers in the U.S. than to the exporters. However, the exporters are useful in periods when sales are difficult.

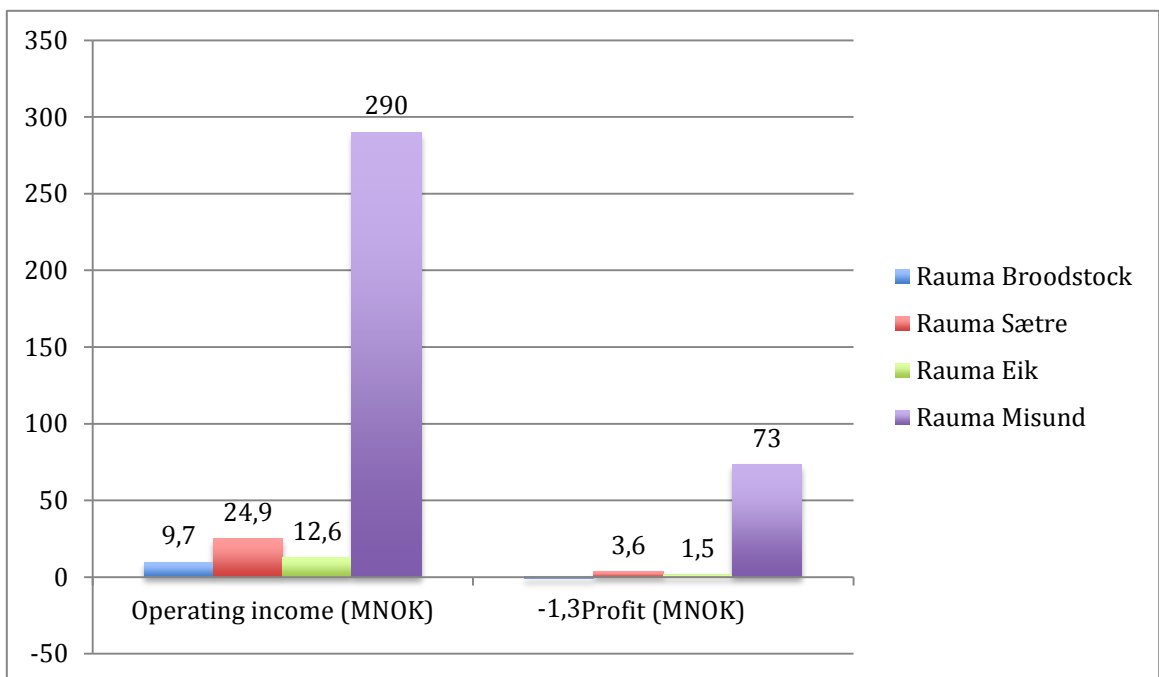


Figure 3 Financial Overview Rauma Group 2010. (Source: purehelp.no)

Figure 3 presents a financial overview of Rauma Group in 2010 not including the subsidiary Vikenco.

As can be seen in figure, Rauma Misund is the largest subsidiary in terms of operating income and profits. Rauma Misund do their sales of farmed salmon to Vikenco.

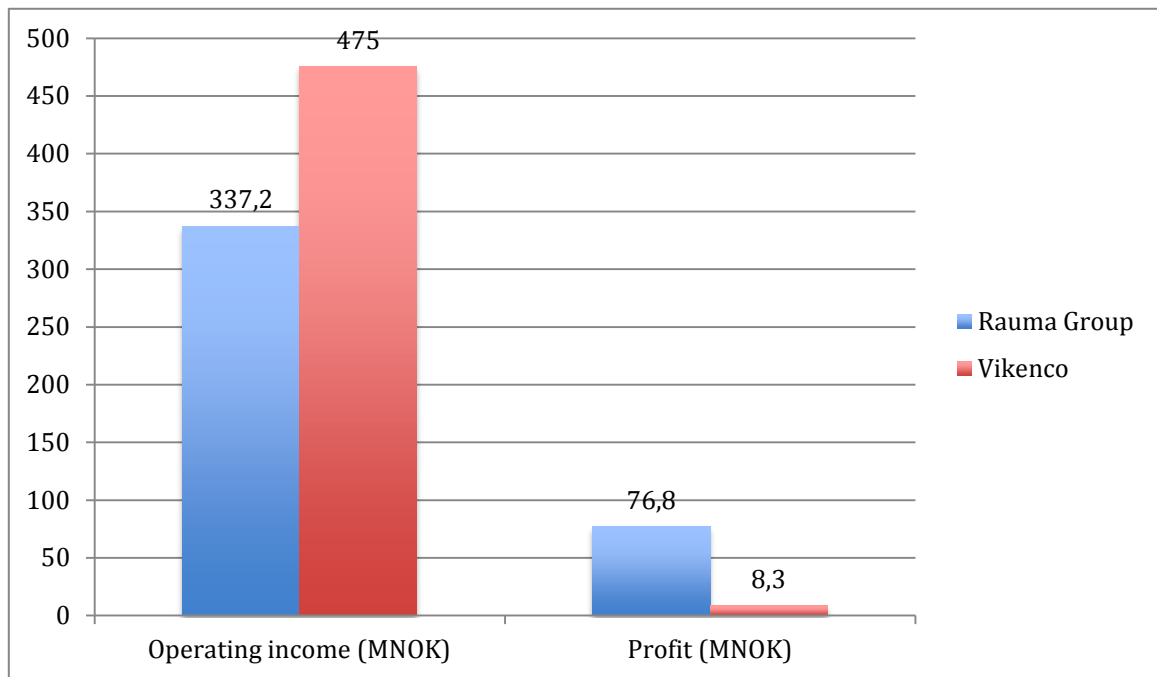


Figure 4 Financial overview Rauma Group eksl. Vikenco and Vikenco 2010. (Source purehelp.no)

This figure shows that Vikenco is considerably larger than the other businesses of Rauma Group combined, however, profit are significantly less. It can indicate that Rauma Group has interest in being owner of the distribution and sales unit of Vikenco not because of the small profit itself.

### 1.1.1 Rauma Broodstock

The subsidiary Rauma Broodstock AS carries out the broodstock- and roe production. In 2010 the revenues was approximately 9.7 MNOK with a loss in profits of about 1,4 MNOK. Rauma Broodstock is fully owned by the Rauma Group.

### 1.1.2 Rauma Sætre and Rauma Eik

The subsidiaries Rauma Sætre and Rauma Eik are responsible of the production of fry and smolt.

Today, Rauma Group has 6 licenses for farming of salmon and 2 for fry/smoltification.

### 1.1.3 Rauma Misund

Rauma Misund is responsible of the farming, which takes place in the sea. This means that Rauma Misund are the main production field in terms of lead-time. As will be covered later in the thesis, Rauma Misund is also the subsidiary with the largest financial turnover and where the major risk events may occur. The farming sites of Rauma Misund are located around the island of Misund and Romsdalsfjord.

### 1.1.4 Vikenco AS

Vikenco is a part of Rauma Group and thereby also a subsidiary of SalMar. They harvest, process and distribute salmon globally. The company is located at Aukra, Møre and Romsdal, which is relatively close to the farming sites. In 2010 Vikenco had revenues of 475 MNOK with a profit of 8.3 MNOK. The shipping of processed fish is done by truck and air. The global distribution is conducted via air cargo from London.

The farmed fish is delivered at Vikenco by boat, and in 2009 Vikenco harvested about 10.000 tons of salmon and produced almost 4.000 tons of salmon fillets.

The overall procurement of salmon in 2010 was dominated from Rauma Group.

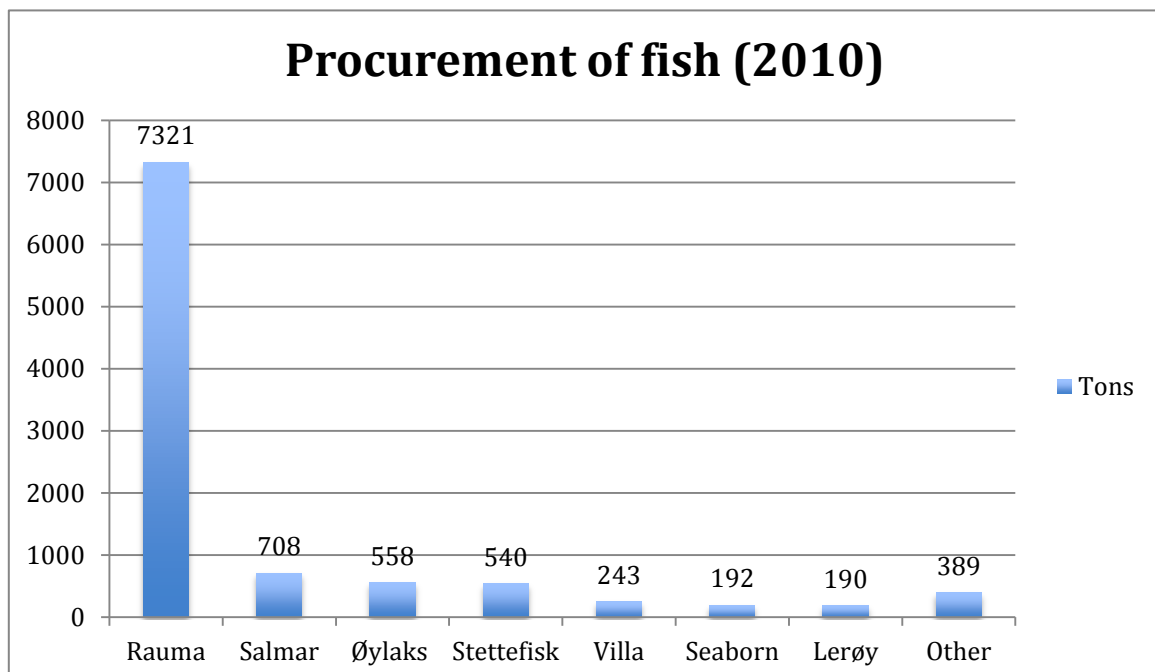
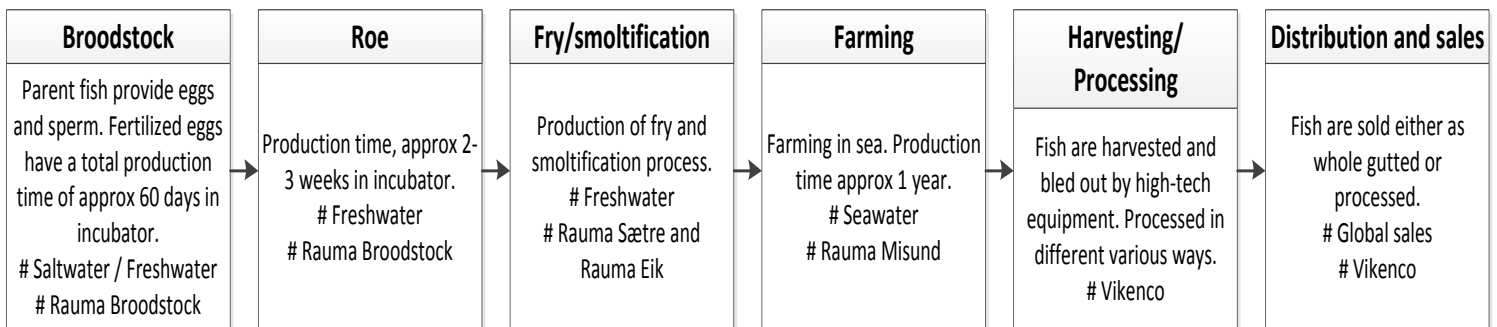


Figure 5 Procurement of fish. Vikenco 2010 (Appendix 1)

As can be seen in figure 5, Vikenco did mainly its purchase from Rauma Group. However, excess available production capacity was used to buy from other players in the market. This means, that if Vikenco has the capacity to produce more than Rauma Group is able to deliver, they will buy from other fish farmers.

## 1.2 The supply chain of Rauma Group

The supply chain of Rauma Group can be recognized as follows:



The production process begins with breeding from parent fish. The Rauma Group has its own strain, known as the Rauma-strain. Most of the roe is used in own purposes. The production of eggs and roe takes place in an incubator. In 2009 the Rauma Group produced approximately 20 million salmon eggs. It is the subsidiary Rauma Broodstock that handles the roe production.

After about 60 days in incubator, the hatched eggs are moved to fish tanks as baby fish, fry.

Still in freshwater, the fry will now undergo a transition period to become ready for sea life. The water temperature is between 10 – 14 degrees Celsius for optimal growth. When growing, the fry is moved into bigger fish tanks. Smoltification is the transition period where the fish develops grills to adapt seawater and also changes skin color. The fry is known as smolt after the fry period. Before the smoltification the fry is vaccinated.

It is the subsidiaries Rauma Sætre and Rauma Eik that takes care of the fry and smoltification process. The overall production is about 3 million smolt each year.

The smolt is moved into nets in the sea where they farm for about a year. They grow to a size between 3,5 – 10 kilos. The subsidiary responsible for farming is Rauma Misund.

Important factors concerned to farming are the sea temperature and quality of the feeding. The farmed fish is after a growth period about 10 months transported directly to Vikenco,



which is responsible for harvesting, processing and sales. The total production time from fertilized egg to a processed filet ready for sale is about 2 years.

The production process of farmed salmon can be divided into different phases as previously seen. The transportation between the different steps in the supply chain is also carried out differently.

The roe is transferred to production tanks for smoltification in polystyrene boxes by trucks covered in ice. From the tanks the smolt are so moved by well boats to the nets in the sea. Thereafter, the farmed fish are moved directly by well boats from the nets to Vikenco's location at Aukra where the harvesting and processing takes place. When the fish is harvested whole gutted or processed into fillets, it is shipped by truck to Oslo where it is redistributed. The fish that are going overseas to the US market is shipped to London where it is loaded onto for air cargo.

Today, Schenker domestically carries out the shipping. Internationally it is carried out by DHL. This means that the fish that is going to the US is redistributed from Schenker to DHL in Oslo.

Rauma Group's supply chain can be illustrated in the figure below.

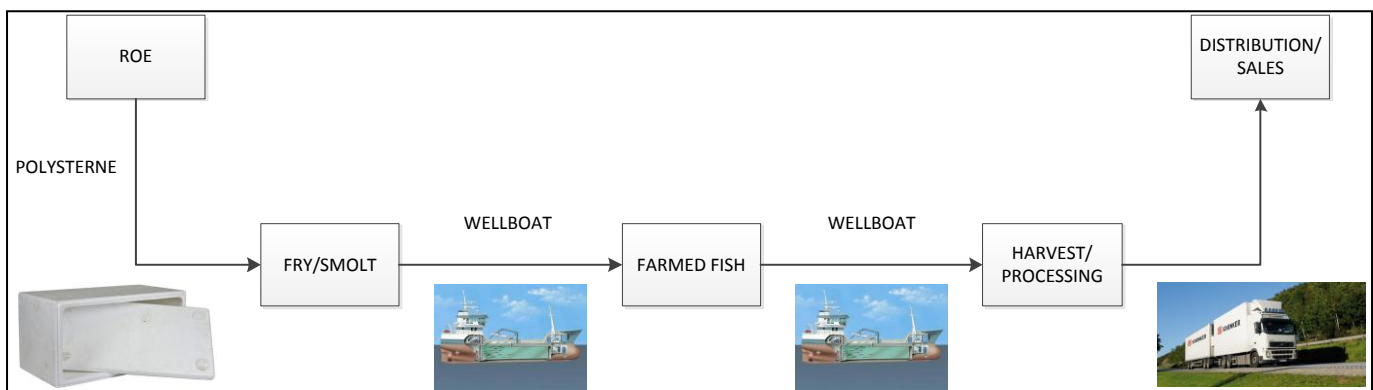


Figure 6 Supply Chain of Rauma Group

The supply chain of Rauma Group consists of several different subsidiaries. According to theory (Blanchard 2007), it is important to have a good information flow between the different members in the supply chain to achieve best possible outcome.

Strict regulations differs the aquaculture industry from other production industries. A fish farmer is licensed to have a certain tonnage of fish in the sea at any time. This is also known as MTB (maximum allowable biomass). Today Rauma Group has a MTB of 8\*780 tons, which means they are allowed to have this amount of fish at sea at any time. The

challenge with a MTB is that if a fish farmer produces more than MTB, they have to harvest the fish before reaching desired size.

Vikenco is the subsidiary responsible of harvesting, processing, and distribution and sales. In 2010 their main sales was to US market and Norwegian exporters (figure 2). The domestic Norwegian exporters serve as agents and intermediaries. The US market is dominant and this may increase in the years to come after the U.S. government in January 2012 removed the penalty tariffs at 24% on whole gutted Norwegian salmon (NTB 2012). In response to meet these new demands Vikenco believes it can transfer sales from Norwegian exporters to direct sales to the US. This is in accordance to the fact that they claim to get a better price of direct sales to the US than sales to Norwegian exporters.

### **1.3 Motivation**

It has been conducted modest research within the field of supply chain risk management in the aquaculture industry.

Delays or problem in distribution or production can have large economic consequences on the product unit cost.

There are several aspects that make focus on supply chain risk management important for a firm or organization (Christopher 2005). First of all, supply chain risk management can lead to cost savings in terms of control over sales- and market-share loss. Further, if something occurs in the supply chain, an organization can recover faster than its competitors, and thereby achieve competitive advantage. Additionally, identifying disruptions and their costs, can result in cost savings and an increase in utilization of resources.

### **1.4 Topic**

The thesis will seek to highlight two main research problems:

- How do Rauma Group handle supply chain risks?
- What strategies can Rauma Group utilize to mitigate supply chain risks?

## 1.5 Conceptual model

Based on interviews with representatives from Rauma Group, costs are the most important issue for a fish farmer. The overall objective for the thesis is to increase competitive advantage for Rauma Group through reduced costs. A conceptual model based on supply chain management theory has been developed in order to guide for this objective (figure 7).

In relation to the conceptual model, propositions have been developed in order to examine how Rauma Group operates.

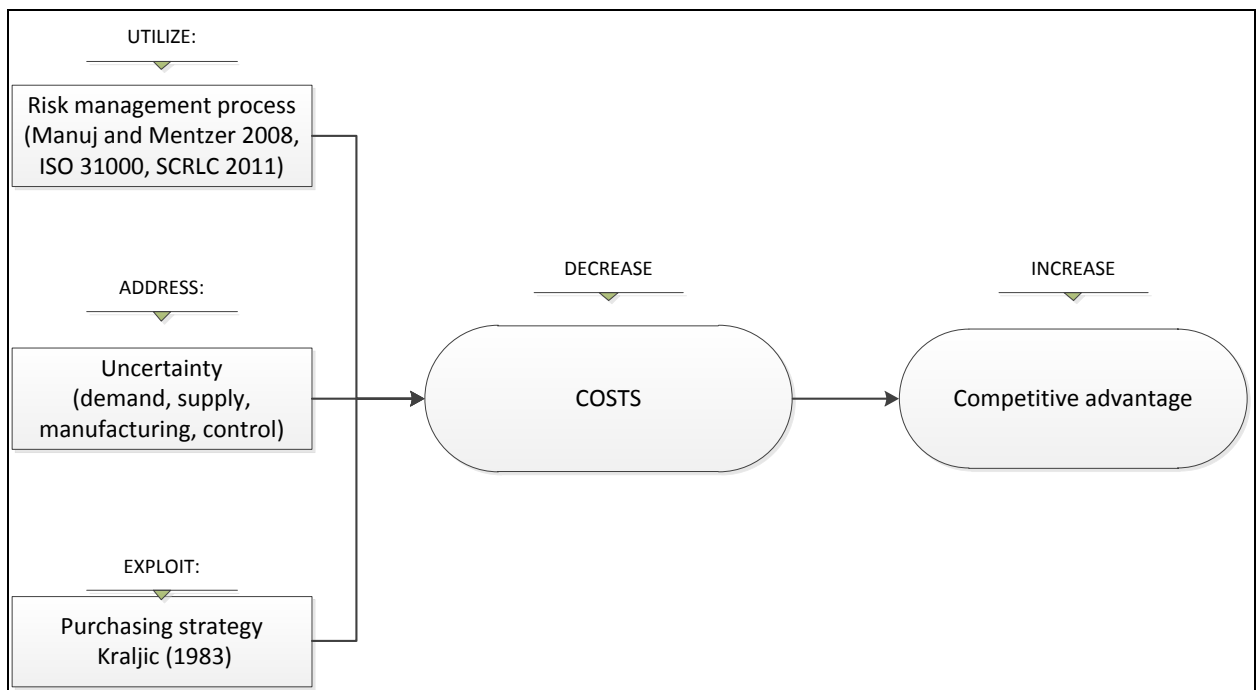


Figure 7 Conceptual model

The model implies that supply chain risk management is a factor in order for Rauma Group to reduce costs and increase competitive advantage.

In terms of supply chain risk management, the model includes three aspects that have to be maintained to achieve the objective of competitive advantage. These are regard to *risk management, uncertainty and purchasing*.

**The aspect of Risk management:** Risk management addresses how Rauma Group relates to risk events in the supply chain. The thesis will discover and examine a risk management process with objective to reduce Rauma Group's costs and consequently increase competitive advantage. This process will be presented in the theory.

**The aspect of Uncertainty:** if Rauma Group addresses uncertainty in terms of supply-,

operational-, demand- and security risks, they can experience reduced costs. Uncertainty can increase costs due to waste, longer lead-times and production failures among others. Important aspects to uncertainty concerns information flow and the bullwhip effect.

**The aspect of Purchasing:** satisfying purchasing routines and strategies can have impact on the profitability of Rauma Group. Exploiting the Kraljic (1983) purchasing model, Rauma Group can reduce its costs. The purchasing process will be discussed in the theory.

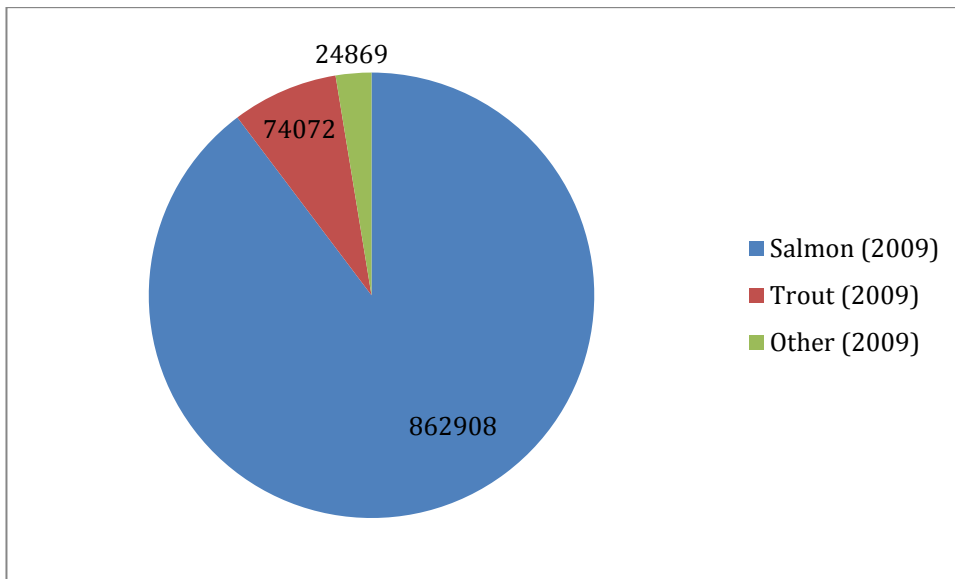
### **1.5.1 External factors**

External factors that can influence the conceptual model are in relation to the strategy and organizational structure of Rauma Group. How Rauma Group governs in terms of growth can affect the costs regardless of the three aspects in the model are fulfilled. In addition, the organizational structure of Rauma Group with subsidiaries might lead to sub optimization. The term sub optimization can be defined as: *“a situation in which an individual manager pursues goals and objectives that are in his/her own and his/her segment’s particular interests rather than in the company’s best interests”* (finance-lib.com 2012). This definition implies that a sub optimal organization does not work as best as it could. Cambridge Dictionaries Online defines sub optimization as *“a situation in which a business is not as successful as it could be because one part or department works only on its own or only for its own success”*.

David Simchi-Levi, P. K., & Edith Simchi-Levi (2004) use the terms of local optimization for sub-optimization and global optimization for the opposite, where the supply chain works to enhance all members profit. Further, they suggest different strategies a firm can utilize to avoid or minimize sub-optimization and increase global optimization. These include among others use of supply contracts, partnership and the way of distribution.

## **1.6 The Aquaculture Industry**

The aquaculture industry is the third largest export industry in Norway, after the oil and gas- and metal industry. According to SSB (2012) the Norwegian aquaculture industry produced and exported over 1 million tons of farmed fish in 2010 with a total value of about 30 Billion NOK.



**Figure 8 Overview export (SSB 2012)**

Total export in 2009: 961849 tons.

### **1.6.1 Definitions**

OECD (2006) defines aquaculture as farming of aquatic organisms, while fish farming can be recognized as commercial farming of fish (SSB 2012).

### **1.6.2 Atlantic Salmon**

The Atlantic salmon that is used in the fish farming can grow up to 150cm and 35kg (Fisheries.no 2010). It is anadromous species that means it spawns in freshwater, however lives in saltwater. The salmon lives in freshwater for 2-5 years, and during this period it becomes ready to live in the seawater. This period of change is known as smoltification. After 2-4 years in the sea as a smolt, the matured salmon turns back to the rivers for spawning.

### **1.6.3 Rainbow Trout**

The rainbow trout is species of the trout family and was introduced Europe from the U.S. in the late of the 19th century (Norwegian Seafood Council 2012). It is the species that is best suited for farming in Norway.

## ***1.7 History of the Aquaculture Industry in Norway***

The aquaculture industry began its commercial development in the 1970s. The Atlantic salmon was already established in the Norwegian fauna; however the breakthrough of fish farming came in the 1960s when it became possible to transfer trout from freshwater to

seawater (FAO 2012). In the 1970s new technological innovations with the introduction of cages made it possible to farm salmon. Consequently, in the following decades fish farming of salmon has established itself as one of the major export industries in Norway. Norway is also the world largest producer of farmed salmon.

## **1.8 Market situation**

Today the largest market is the EU; however exports of Norwegian salmon are distributed all over the world. The main single market is France where it was exported about 143.000 tons of salmon in 2011 (Norwegian Seafood Federation 2011). Other major single markets are Russia, Poland and Denmark.

Chile is the second largest producer of farmed salmon and trout (Norwegian Seafood Federation 2011). Both countries can be recognized with long coastlines and sea temperatures suitable for fish farming.

### **1.8.1 Leading companies**

Four large companies, namely Marine Harvest, Lerøy Seafood, Cermaq and SalMar, dominate the industry. Marine Harvest is the world's largest fish farmer and accounts for about 25% of all global produced salmon (Ministry of Agriculture and Food 2011).

As Norwegian companies are facing international competition, they have to be competitive regarding costs.

The structural development in the industry seems to experience an increase in the employment of people working directly with fish farming (figure 9). However, the development in the overall sales (tons) is increasing far more than the number of employees, and this implies that the industry has utilized measures to improve efficiency.

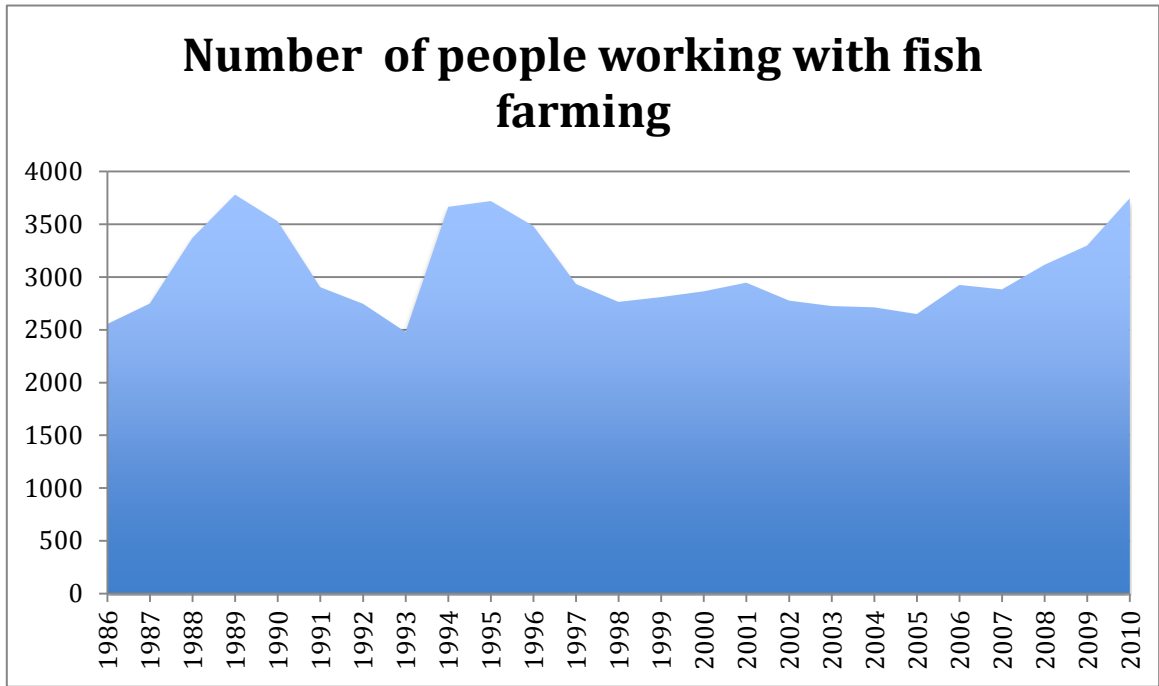


Figure 9 Number of people working - fish farming ( Source: SSB 2012)

The development in sales (tons) can reason the increase in employment.

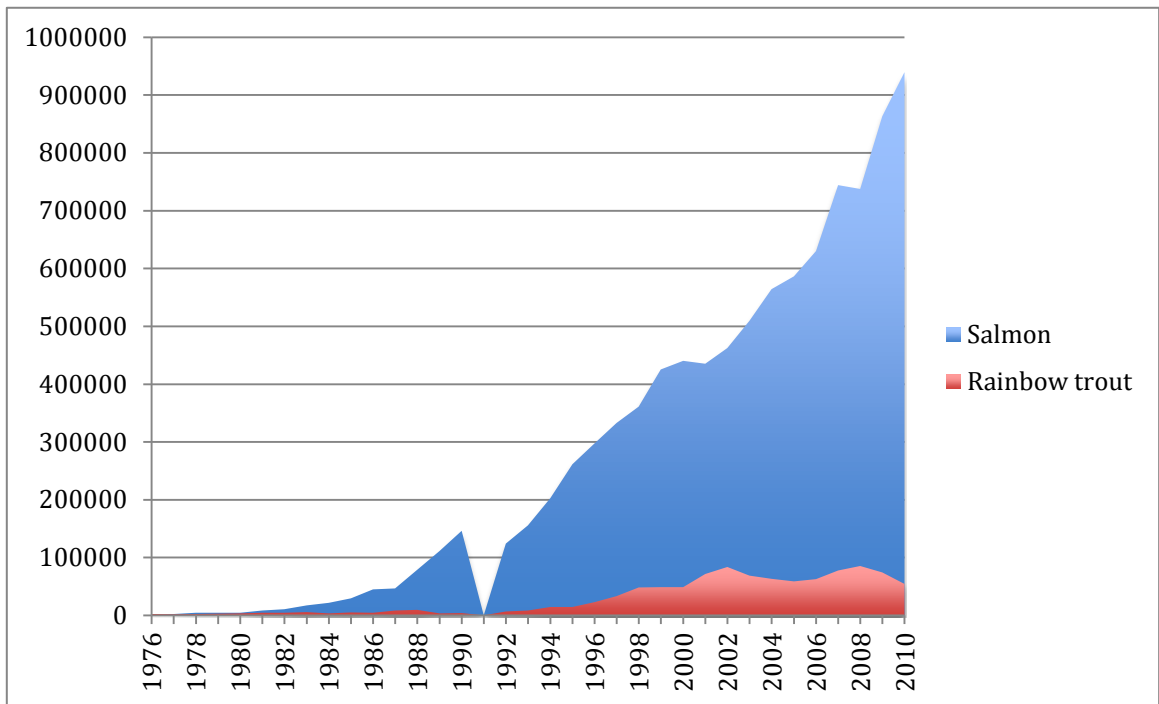


Figure 7 Sales (tons) of salmon and rainbow trout. (Source: SSB 2012)

The development in number of licenses does neither follow the increase in sales (tons) as shown in figure 11, which implies a more effective industry.

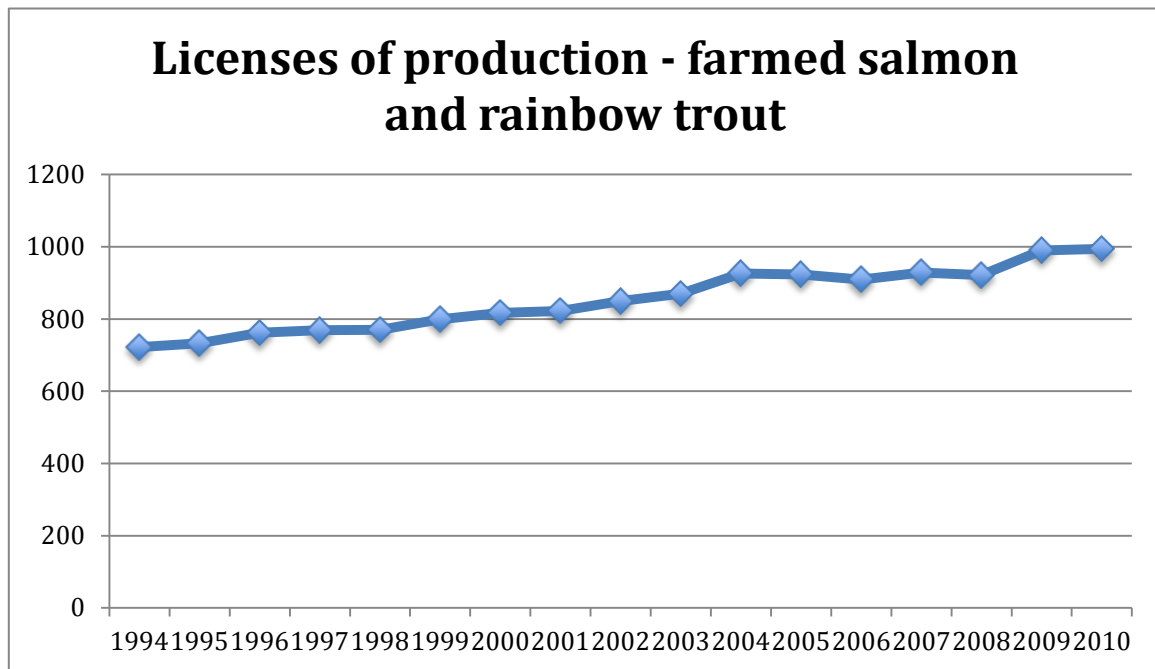


Figure 8 Licenses of production. (Source: SSB 2012)

The historical development of the leading Norwegian fish farming companies can be recognized with an expansion strategy that consists of mergers and acquisitions. This also implies a structural change in the industry where larger actors are acquiring small farmers that hold licenses.

Marine Harvest is a result of merging by Pan Fish, Fjord Seafood and Marine Harvest M.V. SalMar was established in 1991 and up to today, the company is a result of acquisitions.

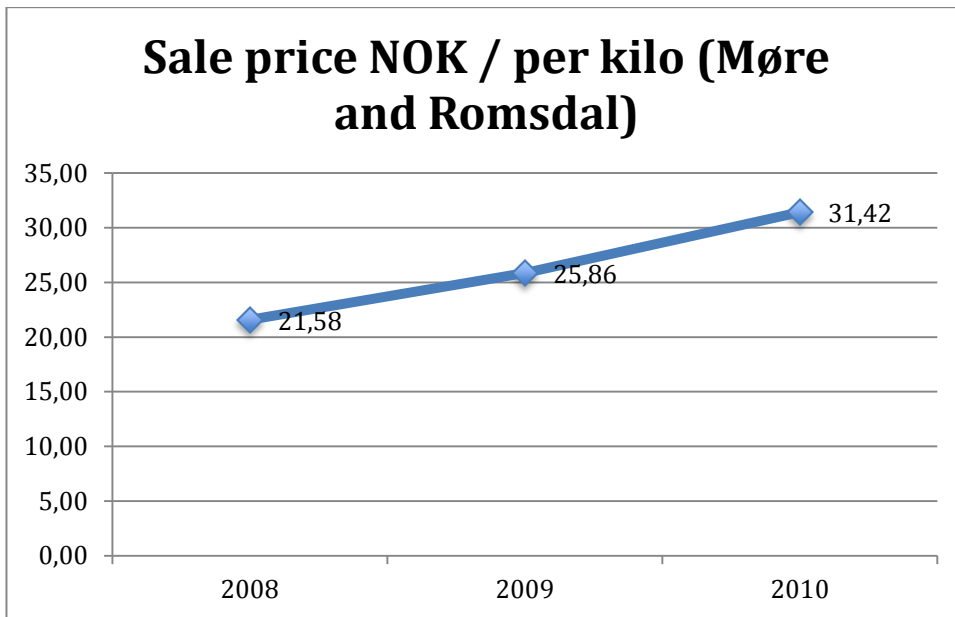
Statistics from the Directorate of Fisheries (2010) shows that it was 169 fish farming companies and 988 licenses in operation in 2010. It is a slight reduce in number of operating companies, while the number of licenses is about the same level as 2009.

### **1.9 Price/kg development**

There are large fluctuations in the price/kg. The average price/kg in 2011 was 31,93 NOK (Kystmagasinet 2012). During the last three years the price has ranged from a high of about 45 NOK to a low of 18 NOK.

In Møre and Romsdal, the sales cost per kilo have increased slightly the three last years, 2008 – 2010.





**Figure 12 Sale price Møre and Romsdal. (Directorate of fisheries 2012)**

In addition to fish farmers, the industry consists of suppliers and suppliers' suppliers that mostly are located at the rural areas along the coastline. Consequently, the aquaculture industry itself is an important contributor to jobs and communities around the country. Not all species of fish is suitable for farming. In contrast to salmon and trout that are most common for farming, typical wild-caught fish as cod, haddock and monkfish are dependent of a natural habitat. In addition, a major group of wild-caught fish is known as pelagic fish that is unsuitable because they swim in schools.

### ***1.10 The cost of producing salmon***

According to the Directorate of Fisheries the production cost of 1 kg salmon was on average of 22,64NOK for the county of Møre and Romsdal in 2010. This implies that a fish farmer with high volume and high costs will experience a great loss of money.

## Unit cost / per kilo - salmon Møre and Romsdal in 2010

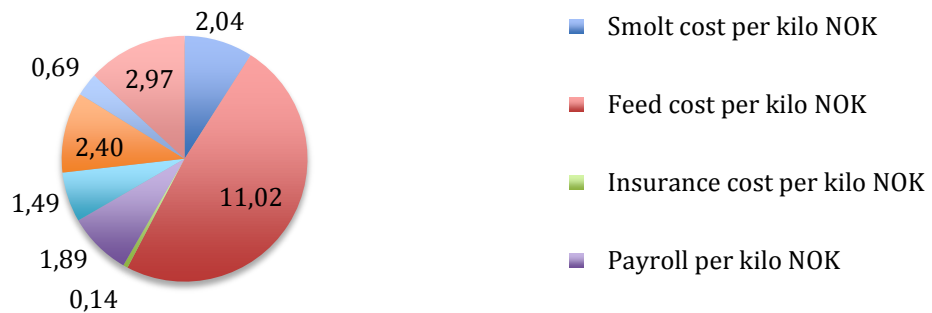


Figure 9 Unit cost / kg – Møre and Romsdal. (Directorate of fisheries 2012)

The unit cost per kilo can also be illustrated to show the development throughout the supply chain. Based on a production cost estimate from Rauma Group on 18 NOK / kg, the unit cost at roe production will be much higher.

As figure 16 demonstrates, the higher break-even level (production cost at sales and distribution), the lower profit for Rauma Group. This example shows a sales price at 20 NOK / kg, with a break-even level of 18 NOK / kg, which gives a profit margin of 2 NOK / kg.

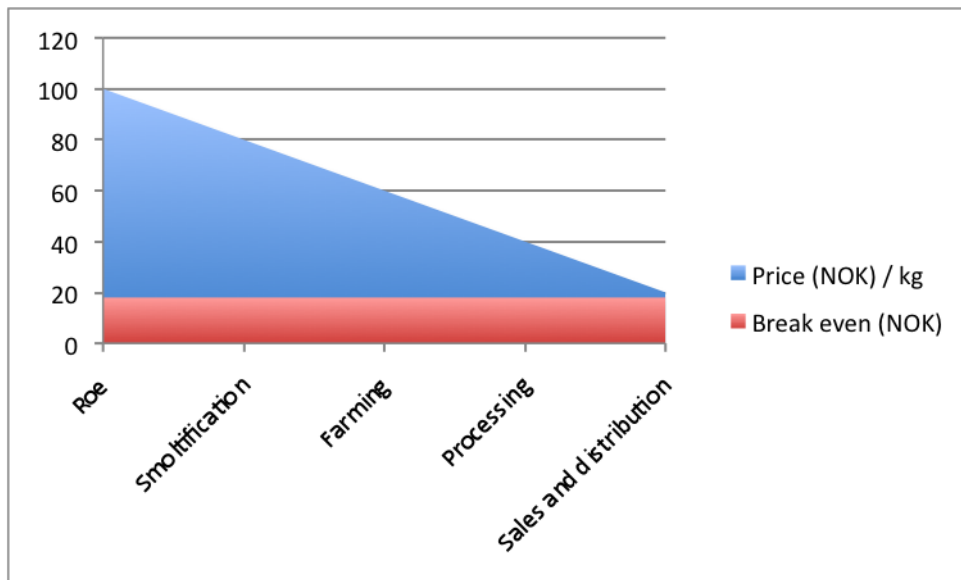


Figure 14 Unit cost

### 1.10.1 Vital equipment in production

Equipment necessary in the production of salmon includes nets, boats, feeding systems and monitoring equipment. High quality of the equipment is important due to the fact of fish safety and also to prevent disruption in the production.

## 2 Theory

In the work of examining the standing of Rauma Group, the theoretical focus will be on supply chain- and risk management theory. In addition, the thesis will include theory regard to value chain analysis, with focus on cost drivers. Understanding of how Rauma Group operates and how the money is generated is important, being able to suggest improvements in order to reduce the overall supply chain risks.

The thesis will exploit general theories such as:

- Supply chain management theory
- Risk management theory
- Uncertainty theory
- Purchasing theory

These theories should include aspects that can be suitable to achieve the objective of the thesis, which is to identify risk events and propose mitigating strategies for Rauma Group. Supply chain management theory includes definitions and explanations of relevant terms and supportive frameworks for the purpose of analysis.

The risk management theory covers topics regard to meanings, frameworks, and strategies towards supply chain risk. In addition, an external environment analysis as PESTEL is covered in the part of risk management. PESTEL can be a useful framework when examining the operational conditions of Rauma Group.

Uncertainty theory covers areas as information flow and bullwhip effect. Uncertainty can be regarded as a factor that leads to increased costs. The uncertainty circle is a framework that looks at the aspects of supply, demand, control and manufacturing. According to theory, this framework can be utilized in order to reduce uncertainty and thereby costs.

With regards to purchasing theory, the Kraljic-model will be examined. Procurement is an important activity for Rauma Group and strategies towards this aspect can help reduce costs and risk towards suppliers. Within purchasing is topics as supplier relationship and sourcing discussed.

Three factors, supply chain environment, temporal focus and supply chain flexibility, that affect a firm's choice when determine its risk management strategy is discussed later on.

However, Manuj and Mentzer (2008) claim that the supply chain environment is the most important factor and the thesis will utilize this factor as the main framework in the case study. In addition, a risk management framework developed by the Supply Chain Risk Leadership Council (SCRLC 2011) will be utilized. This framework relates to theory from Manuj and Mentzer (2008), Christopher (2005), and Waters (2011).

### 2.1.1 Theory limitations

Despite that many might argue that biological risks are the most significant to be aware in terms of fish farming, the thesis will not go deep into that area. This is mainly because of the writer has no basis to cover this area; in addition the thesis will seek to cover a generic perspective of the supply chain. However, the writer is aware of the great importance biological risks contribute to general production risk and also to the supply chain as a whole.

## 2.2 Supply chain

A supply chain can be recognized as a network that consists of suppliers, manufacturers, distribution centers, retailers, and raw materials, work-in-process inventory, and finished products that flow between facilities (David Simchi-Levi, P. K., & Edith Simchi-Levi 2004). Mentzer (2001) defines Supply chain as “*a set of three or more companies directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to customer.*”

Based on these definitions we can make a generic illustration of a supply chain as follows:

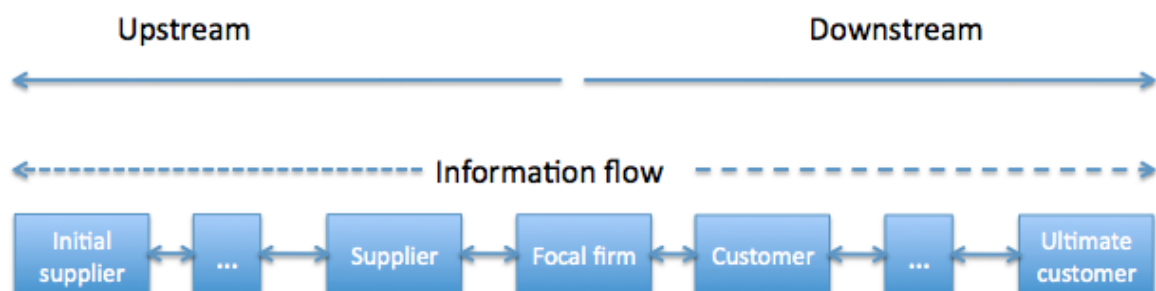


Figure 15 Supply chain Adapted from Mentzer (2001) and David Simchi-Levi, P.K., & Edith Simchi-Levi (2004)

Additionally, Mentzer (2001) distinguish between four different types of supply chains, namely a “basic supply chain”, an “extended supply chain”, an “ultimate supply chain” and a “partnership”.

**The basic supply chain** is described as a network with a focal firm with an immediate supplier and immediate customer directly linked with one or more of upstream- and downstream flows of products, services, finances and information.

**The extended supply chain** is equal with the basic supply chain, however it also includes suppliers of the immediate supplier and customers of the immediate customers, which are all linked with one or more flows of upstream- and downstream products, services, finances and information. Rauma Group can be considered to be in this category.

**The ultimate supply chain** is a network including all companies involved in all the upstream- and downstream flows of products, services, finances, and information from initial supplier to end-customer.

**A Partnership** can be recognized as a dyadic relationship that differs from the supply chains described above because it consists only of two members, a buyer and seller, where there are no simultaneous upstream and downstream relationships between the companies.

### ***2.3 Supply Chain Management***

Supply chain management can be defined in different ways; however, it seems to be a generic understanding of the expression. The overall idea is that supply chain management involves coordination of the activities between the different members in the supply chain.

David Simchi-Levi, P. K., & Edith Simchi-Levi (2004) defines supply chain management as *“a set of approaches used to efficiently integrate suppliers, manufacturers, warehouses, and stores so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time in order to minimize system wide costs while satisfying service-level requirements.”*

Tang (2006) defines supply chain management as *“supply chain management as “the management of material, information and financial flows through a network of organizations (i.e., suppliers, manufacturers, logistics providers, whole-*

*salers/distributors, retailers) that aims to produce and deliver products or services for the consumers”.*

## **2.4 Global supply chain management**

As the world becomes more globalized and companies and organizations are operating internationally, it has to be taken account for that supply chains encounters the same development. It can be hard to find a business today that operates only within a domestic supply chain. As an example, tier 2 and tier 3 suppliers of Rauma Group can be found internationally as the feeding producers are sourcing globally. On the opposite, tier 2 customers are also located internationally as Rauma Group’s sales are mainly global. Therefore, when talking about supply chains regard to the aquaculture it can be recognized as a global supply chain.

## **2.5 Supply chain risk**

There are numerous different definitions of the supply chain risk term.

The Supply Chain Risk Leadership Council (SCRLC 2011) is an organization including cross-industry manufacturing and service supply chain firms that work together to develop and share supply chain risk management practices. SCRLC (2011) defines supply chain risks as *“as the likelihood and consequences of events at any point in the end-to-end supply chain, from sources of raw materials to end use of customers.”*

Kersten (2006) also includes the potential of risk throughout the whole value chain as he defines supply chain risk as *“Supply chain risk is the damage - assessed by its probability of occurrence - that is caused by an event within a company, within its supply chain or its environment affecting the business processes of at least one company in the supply chain negatively.”*

Supply chain risks can be calculated as a function of probability of a disruption to occur and the consequences of the disruption (Aven 2007).

According to Manuj and Mentzer (2008) and Christopher (2005) supply chain risk can be categorized into different types. Christopher (2005) claims the supply chain risks are sources of potential risk to business disruptions

- Supply risks
- Operational risks
- Demand risks
- Security risks
- Environmental risks

**Supply risks** covers areas as disruption of supply, inventory, schedules, and technology access; price escalation; quality issues; technology uncertainty; product complexity; frequency of material design changes.

**Operational risks** include breakdown of operations; inadequate manufacturing or processing capability; high levels of process variations; changes in technology; changes in operating exposure.

**The demand risks** involve aspects regard to disruption in the supply chain because of variations in market demand. Christopher (2005) claims that demand for a parallel product can affect the demand for “ours” and therefore create disruption in the supply chain.

**The security risks** concern information systems security; infrastructure security; freight breaches from terrorism, vandalism, crime, and sabotage.

**Environmental risks** (Christopher 2005) are concerned to external forces that may disrupt the supply chain. These are forces or events that are difficult to forecast. An example of an environmental risk may be an oil-spill in close to a farming site of Rauma Group.

Waters (2011) talk about two different types of supply chain risks, Internal- and External supply chain risks. External risks deals with risks outside Rauma Groups` control. The important task for Rauma Group is to construct the business to work as best as possible in the environment. The internal risks concerns risks to operations that Rauma Group can control.

## ***2.6 Supply Chain Risk management***

When working with risk management SCRLC (2011) argues that it should be distinguished between risks that should be included in risk management processes and

those that should not. Risks that can cause unusual variations where the supply chain cannot respond to are those risks that should be included.

SCRLC (2011) defines supply chain risk management as *”The practice of managing the risk of any factor or event that can materially disrupt a supply chain whether within a single company or spread across multiple companies. The ultimate purpose of supply chain risk management is to enable cost avoidance, customer service, and market position.”*

According to Manuj and Mentzer (2008) a firm’s background is the basis of the supply chain risk management strategy. As will be later discussed, supply chain risk management should have a long-term focus. Manuj and Mentzer (2008) have found that factors as temporal focus, supply chain flexibility, and supply chain environment affect a firm’s approach towards risk management.

**Temporal focus** involves a short-term focus where a firm utilizes strategies that provide immediate results. In this case, the firm finds it less important to manage risk. Research shows that when a firm has short-term focus, managers are more committed to performance metrics (Mentzer and Firman 1994). As an example that can be used is where the objective is to cut costs within a short period of time, and where the manager is measured on this performance. With this focus in mind, the manager might achieve the objective by renegotiating contracts with suppliers and restructuring the company. However, it might also result in less control of second tier suppliers in terms of quality. And in a long-term perspective, the immediate objective of reducing costs, can lead to increased costs.

The second focus that affects a firm’s approach to risk management is regard to **supply chain flexibility**. Flexibility can be defined as a firm’s ability to change and react with little penalty in time, effort, cost or performance (Upton 1994). A firm’s flexibility can be a competitive advantage as it makes a firm more agile in terms of finding and initiate alternatives faster than others. Being flexible can be seen as an advantage where supply and demand is uncertain. Research by Buckley and Casson (1998) shows that being flexible is valuable for supply chains that operates with high supply- or demand risks. However, being flexible is also more costly.



The third focus is regard to **supply chain environment**. This focus concerns about the environment a firm experience in terms of high/low supply risks, and high/low demand risks. Manuj and Mentzer (2008) have developed a table, based on Lee (2002) that shows the different types of supply chain environments.

	Supply risks	
Demand risks	Low	High
Low	$S_L D_L$	$S_H D_L$
High	$S_L D_H$	$S_H D_H$

**Table 1 Supply Chain Environment. (Adapted from Manuj and Mentzer 2008)**

The table is a useful tool when developing risk-mitigating strategies.

According to Manuj and Mentzer (2008) there are six mitigating strategies a firm has to be aware of in relation to the supply chain environment.

Strategy	Supply chain environment
Postponement	$S_L D_H, S_H D_H$
Speculation	$S_L D_L, S_H D_L$
Hedging	$S_H D_L, S_H D_H$
Integration: 1) Backward 2) Forward 3) Back- and forward	1) $S_H D_L$ 2) $S_L D_H$ 3) $S_H D_H$
Security	All types
Avoidance	All types

**Table 2 Strategies and supply chain environment**

**Postponement strategy:**

Postponement deals with delaying delivery or production in order to achieve flexibility and reduce costs. Postponement can be categorized in terms of form postponement, which concerns the product regard to labeling, manufacturing, and packing. The other form of postponement is in relation to time. Time postponement covers the topic of time after a firm has received an order from customer.

**Speculation strategy:**

Speculation can be considered as the opposite of postponement. Speculation involves making decision based on expected demand. In relation to this thesis, it can be illustrated with an example where all of Rauma Group's supply chain members are producing to customer demand.

**Hedging strategy:**

Hedging, in terms of supply chain risks, concerns having more than one option when making decisions. This can be exemplified to sourcing of suppliers. Multiple sourcing can be more expensive than sole sourcing, however, a firm can experience less risks regarding quality, disruptions, price and opportunism, among others.

**Integration strategy:**

Integration concerns the element of control. The greater control a firm wants over its supply chain, the more it can integrate. On the other hand, the level of integration includes also the cost element. A highly vertical integrated firm will have higher costs. The consideration of cost / benefit in terms of integration is an important issue for a firm; therefore an analysis of the supply chain environment can provide solution.

As been seen, Rauma Group is vertical integrated in the production from roe to sales and distribution.

**Securing strategy:**

Securing strategies aims to enhance the supply chains to improve security in issues regard to information systems, terrorism, and sabotage, among others. This may not be seen so relevant to fish farmers. However, Rauma Group operating in an industry, which can be perceived unpopular by environmentalists, may experience sabotage on production sites. The information systems of Rauma Group may also be an attractive target for financial criminals who want secret corporate information.

**Avoidance strategy:**

Manuj and Mentzer (2008) split avoidance strategies into two different types. Type 1 avoidance strategy is about when there are risks linked to a certain product or geographical market, or with a supplier or customer that is undesirable. Furthermore, type 1 avoidance strategy aims to eliminate the risk.

Type 2 avoidance strategy concerns to reduce frequency and probability of risk events. Opposite of the type 1 avoidance strategy, these strategies occur when a firm realize they have to enter or be in a market with high supply and demand risks.

That being said, their studies showed that when a firm has the possibility of entering a  $S_H D_H$  - supply chain environment, the firm seeks to utilize type 1 strategy. If this is not an option, the firm will still enter the environment, if the cost/benefit analysis is appropriate with a type 2 strategy.

### 2.6.1 Supply Chain Risk Management Process

The International Organization for Standardization (ISO) has a framework in terms of risk management, known as ISO 31000. The SCRLC (2011) has used this standardization as a base to develop its framework of risk management towards supply chains. It also correlates with the risk management approach of Manuj and Mentzer (2008), Christopher (2005), Walter (2011), and Zsidisin, G. and B. Ritchie (2009). This risk management framework will be used as a basis in this thesis.

The supply chain risk management process consists of five steps:

1. Identify internal and external environments
2. Risk identification
3. Risk analysis
4. Risk evaluation
5. Risk treatment

The three steps of risk- identification, analysis, and evaluation, can be recognized as *Risk assessment*.

The process begins with **identifying the internal and external environments**. These factors can lead to a SWOT-analysis that sums up the internal strengths and weaknesses, and the external threats and opportunities.

Further, the steps of risk assessment are to identify and analyze the potential risks and their impacts.

When the risks are identified and prioritized, the last step is to do risk treatment, which means to develop mitigating strategies. Typical mitigating strategies can include measures to reduce impact in the supply chain of a disruption, plans of how to respond on risks, and strategies of how to recover from a disruption.

Combined with these steps is the continuously communication and information flow between the different members in the supply chain, in addition to monitoring and review. These actions can help on a continuously improve the risk management process.

## **2.6.2 Identify internal and external environments**

The frameworks of PESTEL can be utilized to identify and examine the internal and external environments of a firm or organization. Not only to be used with risk management, the frameworks can be used as tools when developing managerial strategies. It deals with Political-, Economic-, Social-, Technologic-, Environmental-, and Legal factors that a firm experience.

### **2.6.2.1 Political factors**

The political factor considers the government policy and interventions in the economies the organization operates in. In terms of the aquaculture industry this can be exemplified by ruling regulations and political interference both in country of production, but also in the customer's market. Obstacles from the Chinese government can be relevant in this consideration, but also ban of import of Norwegian salmon to Russia can be used as an example.

### **2.6.2.2 Economic factors**

The economic factors covers topics as growth in the market, inflation, fluctuations in currency, changes in taxation and interest rates. It is not only conditions in Norway that are relevant in this concern, but also the foreign markets. Growth in the U.S. economy might lead to increased demand for Norwegian salmon, opposite reduced growth may affect demand negatively.

### **2.6.2.3 Social factors**

The social factors take account for changes in social trends, as for example an aging population or growth in general population, and how these changes affects the organization regards to its market and customers, but also own employees.

### **2.6.2.4 Technological factors**

These factors include technological changes that can affect the industry. The aquaculture industry in Norway is investing in technological developments in order to produce more efficiently. The research organization, SINTEF, has its own department, Create, that works *“to combine world-leading companies that supply equipment and technology with prominent scientific research institutions into a centre with a common focus to innovate technology, products and solutions specifically to improve the grow-out phase of marine fish culture”* (SINTEF 2009). New technology can reduce the production unit cost. Examples of technological developments can be concerned to sea cages, feeding and equipment used in production.

### **2.6.2.5 Environmental factors**

The environmental factors relates to climate and weather changes and how this can affect an organization. These factors are obviously relevant for companies in the aquaculture industry. Examples of an environmental factor may be related to climate change, as the seawater temperature impact the growth rate of salmon.

### **2.6.2.6 Legal factors**

This is a matter of legislation and changes in the environment where the organization operates. For instance, it can be assumed that the environment differs in countries from the western- and eastern world when it comes to legislation regard to employees. Health, safety and environment (HSE) are important issues in Norway. However, countries that do not have the same policy regard to these issues may experience cost advantage.

## **2.6.3 Examples of supply chain risks**

Following is a set of examples of risks that can affect a firm and its supply chain in the aquaculture industry.

External risks	Supplier risks	Distribution risks	Internal risks
Natural disasters	Production problems	Lack of capacity	Operational
Sabotage, terrorism	Upstream supply risks	Cargo damage	Demand variability
Lawsuits	Financial losses		Financial uncertainty
Accidents			Supplier relationship
Political uncertainty			Personnel availability
Market challenges			Planning failures
Technological trends			

Table 3 Examples of supply chain risks

## 2.7 Risk analysis

A firm should initially rank its supply chain risks on a perceived level and prioritize these. After this is done the firm can focus on its inherent risks. One approach to the risk analysis is utilizing a tool known as Bow-Tie Risk Method. It is a cause and consequence analysis, which explores actions against the risk dimension (Hopkin 2012).

The bow-tie method can be illustrated as follows:

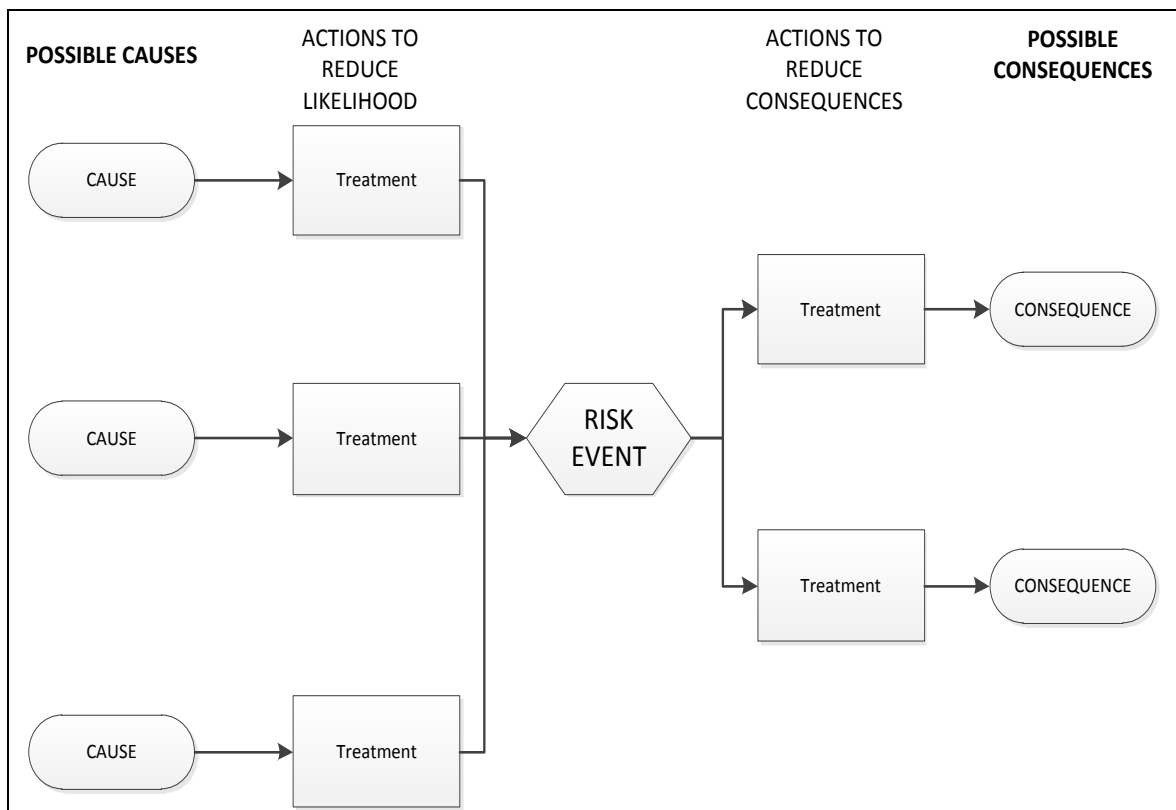


Figure 16 Bow-tie method.

The bow-tie method is utilized by putting a risk event in the middle. On the left side of the event are the source(s) and actions to reduce the likelihood of the event. On the right side is the consequence of the event and actions to reduce the consequences. Consequently, the method can lead a firm to be prepared in order if an event occurs.

## 2.8 Risk evaluation

One method of doing a risk evaluation is to utilize a heat-map that prioritizes risks by likelihood and consequences. The outcome can give a suggestion of which risks the firm should address.

PROBABILITY	High			
	Medium			
	Low			
		Low	Medium	High
	IMPACT			

Figure 10 Heat-map. Risk evaluation

A firm can rank the probability and the possible outcome for the risk event on a scale 1-5, which determines the risk's position in the map.

## 2.9 Risk treatment

When a firm has identified potential supply chain risks, the work of implementing mitigating strategies and actions to prevent disruptions can begin.

This process should involve suppliers in the supply chain and include three elements:

- Protecting the supply chain
- Responding to events
- Continuing business operations while recovering from events

### 2.9.1 Protecting the supply chain

This element consists of measures to secure and protect goods from point of origin to end-destination. It is crucial that all the members involved in these stages are aligned.

The element of protecting the supply chain work includes standards as:

<b>Standard</b>	<b>Objective</b>	<b>Measures</b>
Physical security	Prevent unauthorized access to facilities and cargo	Fencing, access control, parking control, locking devices, key control, alarm systems
Access controls	Prevent unauthorized entry to facilities, control of employees and visitors	Use of badges to identify employees and visitors
Personnel security	Screen prospective employees	Do background checks in relation to recruitment, procedures that remove badges, IT-access and uniforms for personnel that leaves
Education and training	Establish and maintain security-training program to build employee awareness of security procedures	Training, develop procedures for employees to report security incidents
Procedural security	Document and communicate procedural security measures to employees	Develop security manual, published policy, employee handbook
IT security	Protection of unauthorized access to IT-systems	Password protection, accountability
Business-partner security	Ensure all members in supply-chain has focus on security	Use of contracts
Conveyance security	Focus on security about transportation	Inspection and sealing, storage, use of 3PL transporters that has a recognized SC-security program

**Table 4** Protecting the supply chain standards

### 2.9.2 Responding to events

If a disruption or event that affects the supply chain should occur, a firm can respond to this by having a plan of crisis management. SCRLC (2011) includes four phases of proactive processes that consists of crisis management, namely:

- Preparation



- Response
- Recovery and Business Resumption
- Testing, Training and Plan Maintenance

According to SCRLC (2012) the ideal crisis response plan can look like as figure 22.

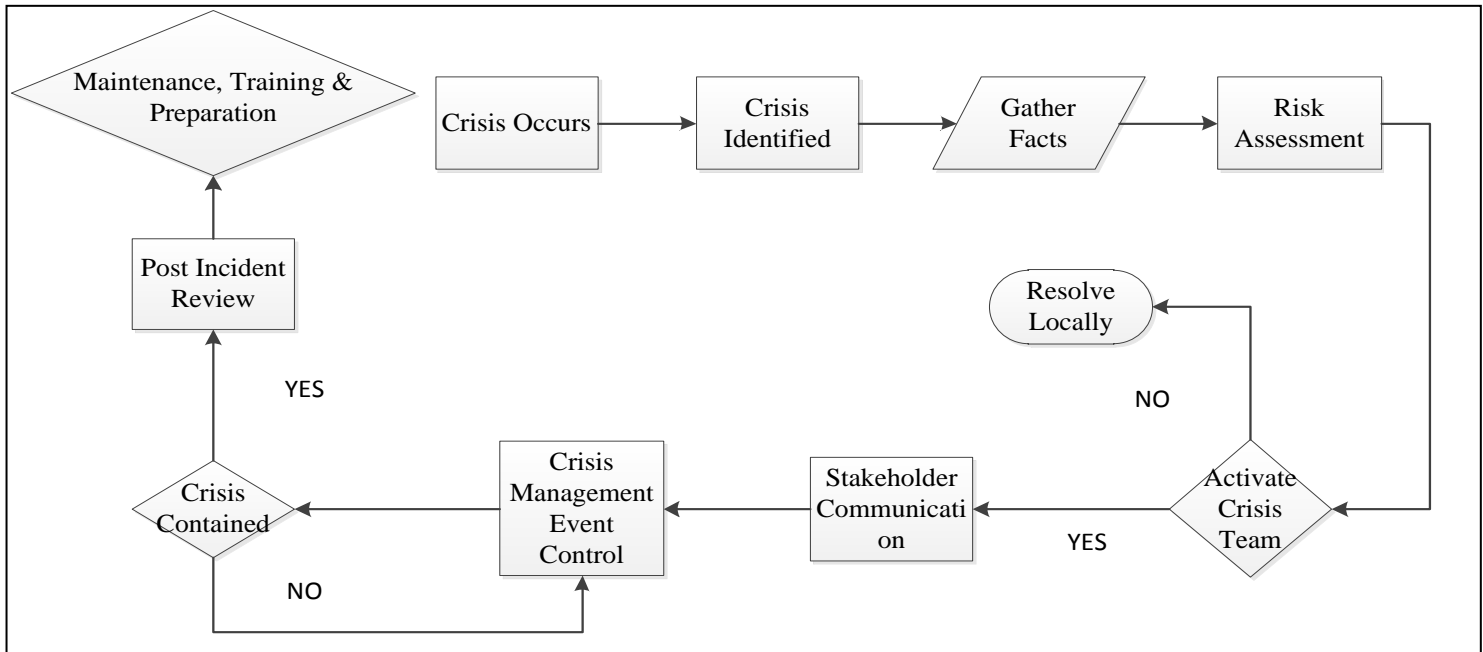


Figure 11 Crisis response plan. (Adapted from SCRLC 2011)

The response plan gives a guideline of how a firm can react if a crisis emerges. The basic principle is that a firm has different levels of crisis management teams, dependent on how severe the crisis turns out to be.

In the initiate face of a crisis, a local team will be responsible of identifying the crisis and gather information. Thereafter, a risk assessment needs to be carried out, which will determine if the crisis can be resolved locally, or if other parties have to be involved. A large crisis might affect the whole supply chain or even a region, which in turn has to be handled on a higher level due to the severity to the surroundings and communication externally.

Based on the crisis, and how it is finally solved, the firm post an incident review that can be used in later occasions.

As a closing up, the review and experience from the crisis is used to maintenance, training and preparation to the next crisis should occur.

### **2.9.3 Continuing business operations while recovering from events**

Being able to cope with crisis, disasters or other large disruptions, can be recognized as an ongoing process known as “Business continuing planning”. Business continuing planning aims to be a guideline of how a firm can keep up its work and competitive advantage throughout a major event (Christopher 2005). SCRLC (2011) suggests that business continuing planning can involve different programs as employee assistance, business-impact analysis, emergency-response planning, crisis-management planning, and business-recovery planning.

**Employee assistance** is about to take care of the employees of the firm. This can be in relation to health. However, with a public healthcare system this might not be relevant in Norway.

**The Business-impact analysis** should be updated with the latest overview of what and which functions and activities that are critical/non-critical due to a disastrous event.

**Emergency-response planning** involves procedures if a major event happens. It can include among others issues as evacuating, activating emergency operations center, assessing damage, repair and restoring facilities.

**The crisis-management planning** can be organized as previous described with management teams on different levels within the organization. The guideline of crisis-response plan can be used as a guideline in way of operating.

**Business-recovery planning** contains information of who in the organization should act during an event, what is needed to be done where and when the tasks should be done. This implies that a firm ought to rank the importance of the different activities and functions, in regard to prioritize the recovery. In relation to fish farmers, it can be argued that it is more important to recover the production sites, rather than the marketing department.

## ***2.10 Purchasing***

Purchasing has evolved to be an international activity. According to Ghodsypour, S. H. and C.O'Brien (2001), about 70-80% of the total production cost to a firm is related to purchasing activities. As a consequence, sourcing of suppliers is crucial to save costs and reduce supplier risks.

Kraljic (1983) has developed an approach to how a firm should organize its purchasing strategy in regards to purchasing power.

Purchasing power can be recognized as the balance between buyer and seller. If buyer has power over seller, this means the seller is more dependent of the buyer, and as a consequence the situation is imbalanced and the power balance is in favor of the buyer.

The purchasing strategy is based on two major factors: 1) the strategic importance of purchasing and 2) the complexity of market. The factor of strategic importance of purchasing involves terms as the value added by product line, percentage of raw material of total costs and their impact on profitability. While complexity of market consists of elements as supply scarcity, pace of technology, materials substitutes, entry barriers, logistics costs, and monopoly or oligopoly conditions.

The outcome of the factors can be illustrated in a matrix. Supply risk deals with the complexity of market while profit impact deals with the strategic importance.

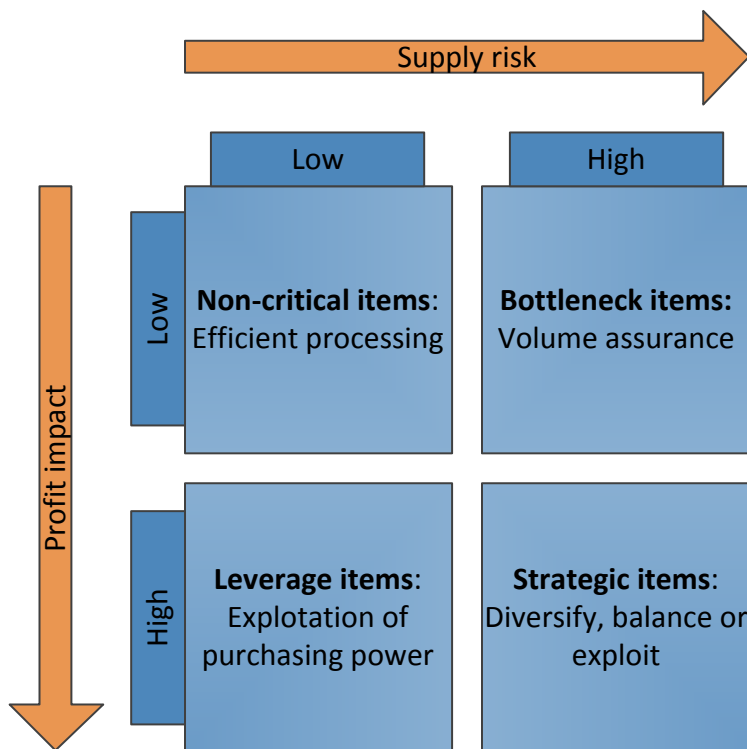


Figure 12 Purchasing matrix. (Adapted from: <http://www.12manage.com>)

Each cell in the matrix has different strategies related towards suppliers (Gelderman and Marjolein, 2005). To use the matrix products must first be classified into categories.

**Leverage items** are standardized items for a buyer and are recognized to have a high impact of the profit. There are also many suppliers available in this category. A typical example of a leverage item in the industry is electricity. Fluctuations in energy prices can

have great impact on profits. A strategy to use for the buyer can be to take advantage of the competition between suppliers in terms of negotiation and purchasing of this product.

The second category is the **Non-critical items**. These items are characterized by having a low supply risk and a low impact on the profitability for the buyer. The purchasing strategy for the Non-Critical category can include reducing the complexity of the buying process and focus on reducing cost (Olsen and Ellram 1997). Implementation of using technological intermediaries can be way to standardize procurement strategy and make a more efficient processing.

The third category covers **bottleneck items**. These are items that only can be purchased from one supplier. Yet, the products have low impact of profit. Typically items can be spare parts for unique production machinery. A procurement strategy in this case can be to build extra stock or search for extra suppliers.

**The strategic items** can be recognized of having a large impact on profits and high supply risks. Kraljic (1983) proposes in these conditions to either vertical integrate, build strategic alliances, enhance relationships with suppliers, and have long term perspective of strategies chosen.

Kraljic (1983) has also developed a 4-step approach in terms of shaping a supply strategy to minimize supply vulnerability and use buying power as an advantage. It is based on strategies and action from European companies.

The first step consists of classifying the purchased products and materials in terms of impact on profits and supply risk. Then the next step analyzes the market for these materials. After that, the third step is to determine the company's strategic supply position, before the last step, where the framework develops materials strategies and actions plans.

### **2.10.1 Classification of materials**

To classify supply items Kraljic uses the same factors in terms of impact on profits and supply risk.

Impact of profit include aspects as volume purchased, percentage of total purchase costs and impact on product quality or business growth. Supply risk can be recognized with availability of products or materials, number of suppliers, competitive demand, make-or-buy opportunities and substitution possibilities.

Based on these two factors, a company can now have classified its purchased materials into four different categories, namely strategic items, bottleneck items, leverage items and non-critical items.

Kraljic (1983) suggest that a firm has to use distinctive purchasing strategies for the different categories. In addition, the decision level of purchasing differs between the categories. This can be illustrated as follows:

<b>Category of material</b>	<b>Strategy</b>
Strategic items	Develop long –term supply relationship
Bottleneck items	Volume insurance, control of vendors
Leverage items	Exploit purchasing power, spot purchasing
Noncritical items	Standardization, inventory optimization

### **2.10.2 Vertical Integration**

A firm can choose to vertical integrate in different level by owning its upstream suppliers or downstream buyers, or both. Backward integration is when a firm owns suppliers upstream, while forward integration is when a firm owns its buyers.

When a firm considers integrating, there are mainly two important aspects to take into account; cost and control (Johnson, F., M. Leenders, et al. 2011). These aspects can also be known as a decision of make- or buy, where a firm chooses to outsource activities or have activities in-house.

The cost aspect deals with the costs of transactions between the different tiers (outsource), or on the other hand, the cost of administrate the whole supply chain (make).

Costs concerned to supply chain and transactions, are also known as transaction costs.

The control aspect concerns the ability of asset control in terms of integration. A highly integrated supply chain, where the firm makes decisions in-house can be easier to control; however, it is also more vulnerable for less efficiency and higher costs (Johnson, F., M. Leenders, et al. 2011).

#### **2.10.2.1 Benefits with vertical integration**

With a vertical integrated supply chain, the main firm can control and coordinate activities within the supply chain, unlike if the firm has to coordinate with external partners.

Therefore, improved supply chain coordination can be a result of vertical integration.

Furthermore, profits of the upstream supplier(s) and/or downstream buyer(s) will also be captured by the firm which integrates.

Additionally, gaining control upstream and/or downstream can also exploit opportunities of differentiation that normally wouldn't have been pursued.

#### **2.10.2.2 Drawbacks with vertical integration**

A disadvantage with vertical integration can be increased costs due to more control systems and bureaucratic tasks. Also, loss of competition from suppliers can lead to increased costs for the firm.

As the perspective of Rauma Group is to reduce costs in order to increase competitive advantage, it can be argued that the aspects of costs is the most important to consider.

#### **2.10.3 Incoterms**

Incoterms is an important factor in creation and determination of business contracts.

Incoterms is a set of clauses in terms of international shipment of goods (Foreign Trade Online 2012). The International Chamber of Commerce founded Incoterms to be used as a common language between countries as a standard to reduce uncertainty regard to international shipment. Incoterms are important issues when determining the conditions due to terms of shipment. According to Vikenco, the most common incoterms used is FCA and EXW.

FCA (Free carrier) is shipment where the seller, in this occasion, Vikenco, is responsible of the shipment to a certain destination. Normally, this is from Vikenco's location at Aukra to Oslo where the fish is distributed.

EXW (Ex-works) is on the other hand, where the buyer is responsible for the shipment. When these conditions are current, normal procedures is that the fish is picked up directly from the warehouse at Aukra. The transport is than arranged by the buyer.

## ***2.11 Value chain analysis***

When working with competitive advantage, it may be relevant to include the aspect of value chain analysis.

Michael Porter introduced the framework of value chain analysis in 1985. This framework maps the activities of an organization and relates them to the organizations competitive position.

Porter differentiates between primary activities and support activities.

The primary activities deal directly with the manufacture or delivery of a product or service. These activities can be classified into 5 different areas:

- Inbound logistics
- Operations
- Outbound logistics
- Marketing and sales
- Service

**Inbound logistics** covers the areas of receiving of the raw materials, warehousing and the distribution of this.

**Operations** deals with the processing of making finished products from input materials.

**Outbound logistics** is about the warehousing and distribution of finished products.

**Marketing and sales** addresses activities related to identification of customers and sales.

**The service** activities focus on after sales support to customers.

Porter argues that the primary activities are linked with support activities that help to improve efficiency. The support activities cover the divisions of:

- Procurement
- Technology development
- Human resource management
- Infrastructure

**Procurement activities** deal with purchasing materials, supplies and equipment.

**Technology development** is activities that are value creating.

**Human resource management** is concerned to activities around employees in terms of recruiting, training, development and remuneration.

**Infrastructure of the firm** includes activities as planning, information, organizational structure, control systems, organizational culture and finance.

Porter claims that the profit margin (figure 25) of a firm is a result of the effectiveness from the primary activities combined with support activities hence a customer's willingness to pay for a product is more than the cost of activities. The more effective a firm is through its activities in the value chain, the more money the firm will make. This implies that a thorough analysis of the value chain and reconfiguration can be useful in order to reduce costs and make more profit. As a consequence, a firm can achieve competitive advantage.

A basic model can illustrate the framework of value chain analysis.

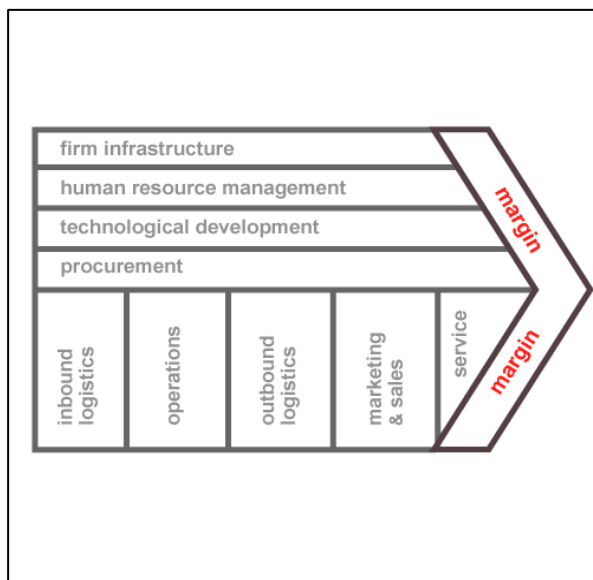


Figure 13 Value Chain. (Porter 1985)

### **Cost advantage in the value chain**

According to Porter (1985), a firm can increase competitive advantage by either reducing costs of one of the activities or reconfigure the value chain. Porter has identified ten cost drivers linked to the value chain activities.



Economies of scale	Learning	Capacity utilization	Linkages among activities	Interrelation between business units
Degree of vertical integration	Timing of market entry	Firm`s policy of cost or differentiation	Geographic localization	Institutional factors (regulation, unions, taxes, etc)

**Table 5 Value Chain Cost drivers**

Cost advantage can be achieved by controlling these drivers. When a firm has analyzed its value chain, it can assign costs to the different activities.

If a firm wants to reconfigure its value chain, this can be performed by implementing new production processes, establish new distribution channels or change the way of marketing and sales.

Supply chain risk management is not current in this framework. However, when the objective is to reduce costs, several of the cost drivers are relevant in relation to risk assessment, purchasing and uncertainty.

The cost drivers of economies of scale, interrelation between business units, degree of vertical integration and linkages among activities will be discussed in the chapter of analysis.

## **2.12 Uncertainty**

The bullwhip effect is a common phenomenon and is caused by uncertainty in the supply chain. Studies show that uncertainty leads to order fluctuations that amplify upstream the supply chain (Lee, H. L., V. Padmanabhan, et al. 1997).

A way of reducing the impact of the bullwhip effect is to reduce uncertainty. Mason-Jones & Towill (2000) argues that a holistic approach to supply chain management and utilizing a framework known as the uncertainty model, can improve the overall performance in the supply chain.

The generic model of causes of uncertainty in the *product delivery process* by Mason-Jones & Towill (2000) is illustrated below.

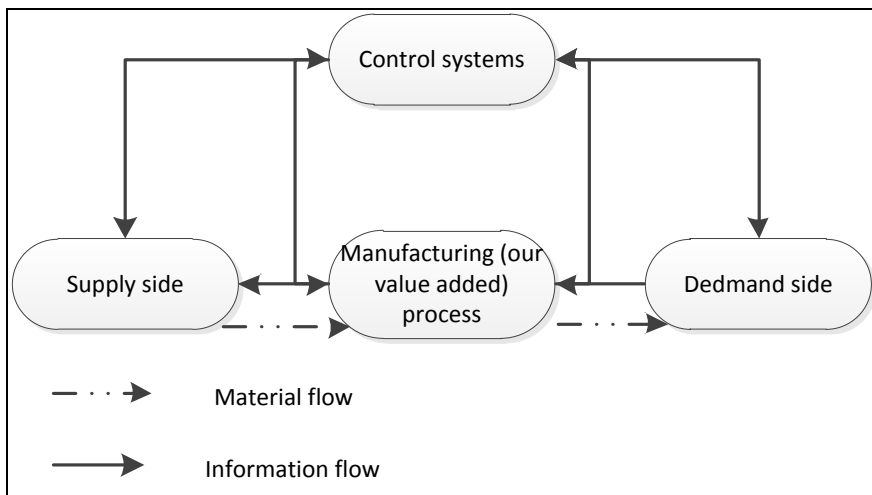


Figure 14 Causes of uncertainty.

It takes base that a company responds to customer from the demand side. The manufacturing gets their supply from different suppliers at the supply side, and it is all controlled by “control systems”. In terms of Rauma Group we can use the subsidiary of Rauma Misund as an example.

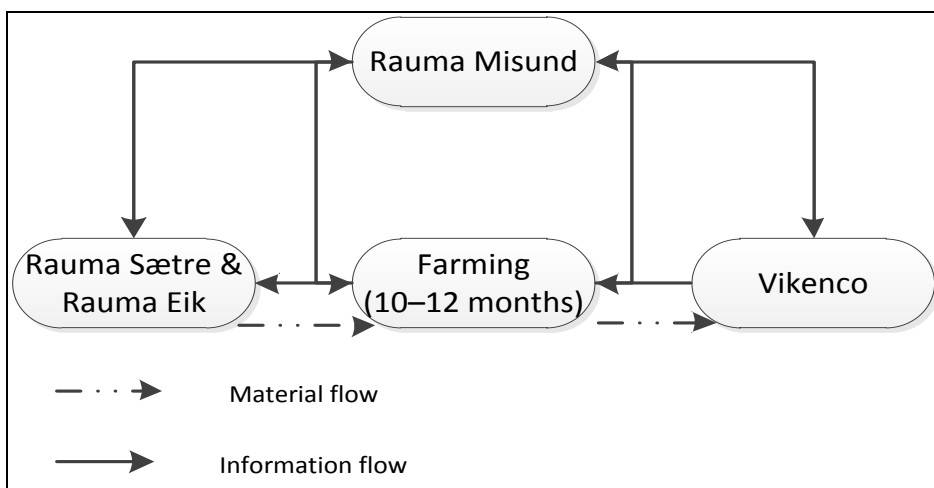


Figure 15 Causes of uncertainty Rauma Misund.

Vikenco bases its order of salmon from Rauma Misund on market demand. As a response, Rauma Misund makes its orders of fry and smolts towards Rauma Sætre and Rauma Eik. The main challenge in this process is that the lead time of farmed fish is about a year. This

implies Rauma Misund has to forecast demand, in which can cause bullwhip effect. The same applies for Rauma Sætre and Rauma Eik.

Theory (Lee, H. L., V. Padmanabhan, et al. 1997) proposes that this can cause bullwhip effect. If market demand of salmon should face a decline and Rauma Misund has forecasted an increase, this can be highly costly for the Rauma Group. Not only will Rauma Misund be affected, but also the members further upstream in the supply chain. Rauma Sætre and Rauma Eik can have forecasted increased market demand and can therefore experience overcapacity and loss of sales. As a consequence of the change in market demand, Rauma Broodstock, which is the supplier of roe, can decide to produce less roe that again can lead to difficulty to react to changes, if market demand should be higher than forecasted. This scenario is all part of uncertainty of demand from the next customer.

### **Reduce uncertainty by utilizing the Uncertainty Circle**

The framework of Uncertainty Circle concerns four aspects, or uncertainties as mentioned above, which is related to the *manufacturing process*, *the control systems*, *the demand side*, and *the supply side*. According to Mason-Jones & Towill (2000), normally these four aspects are equal in importance and significance.

However, as Mason-Jones & Towill (2000) claim, usually two of the aspects are targeted if a firm wants to reduce uncertainty; the manufacturing process and the supply side.

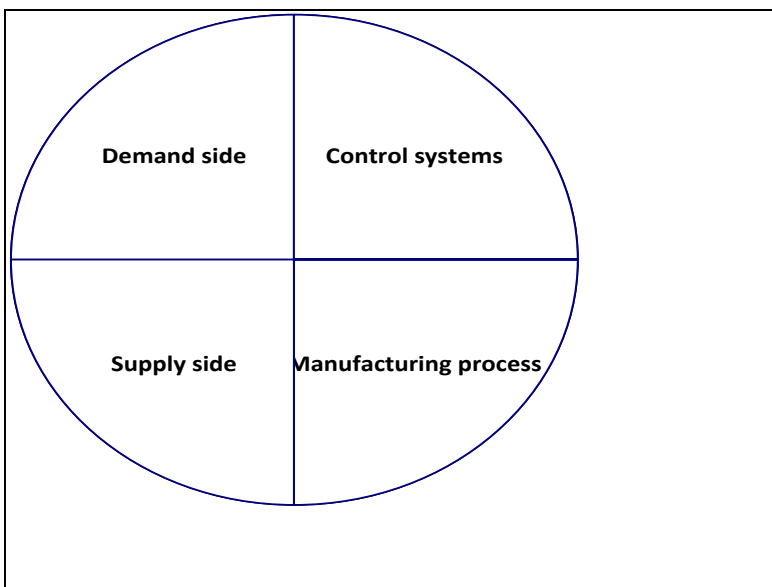


Figure 16 Uncertainty Circle.

### **Manufacturing process**

To improve lead-time and quality of deliveries and production processes, a firm can introduce lean thinking towards manufacturing. Lean thinking aims to reduce waste in order to achieve reduced costs (Staatsa, B. R., D. J. Brunnerb, et al. 2011). Waste can in this thesis be recognized as inventory, workers or other equipment and materials used in production.

Working with suppliers can give reduced lead times, improved quality and more stable delivery patterns. For Rauma Group important suppliers can be recognized to feeding. Investing in lean practices and supplier relationships are costly, and regards to theory will not reduce uncertainty and costs significantly if applied alone. All of the aspects of the uncertainty circle need to be coped with (Mason-Jones & Towill (2000)).

### **Control systems**

To manage uncertainty in terms of demand and control systems, much is related to processing of information. It can be discussed that in order to improve control and decision making in a supply chain, this might be conducted through implementing a decision support systems that relies on information. More rapid and frequent planning can also be an important feature to include when improving the control systems. However, in terms of Rauma Group with a lead time of about 2 years production time, rapid planning might concern other issues than just respond to market changes. It could also include proactive adjustments in the organization structure, customer- and supplier relationships and investments in equipment and personnel.

### **Demand side**

When looking at strategies to reduce uncertainty towards demand this is also connected in a high degree to information. If all subsidiaries of Rauma Group have access to updated market information, the conditions in terms of forecasting are improved. The decision makers can also discuss and work together as one unit when planning the production throughout the supply chain. This implies that all members from roe production to sales and distribution base their actions in interaction with another.

Another strategy a firm can utilize to reduce demand uncertainty is to postpone product customization. Today the salmon is sold either gutted or processed.

## Supply Side

The supply side of the uncertainty circle concerns the business areas towards the suppliers of a firm. Hereunder, Mason-Jones & Towill (2000) argues that a company with close relations to its suppliers may experience reduced uncertainty. In this, information sharing is a vital part. The relationship between a purchasing and sales department can be used as a relevant example.

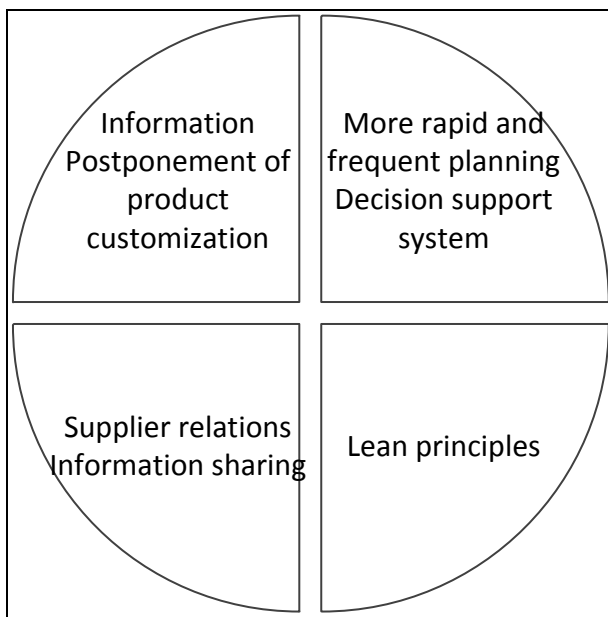


Figure 17 Approaches to reduce uncertainty circle.

Several approaches initiated combined to reduce the uncertainty circle can give significant impact on cost reduction to the members in the supply chain (Mason-Jones & Towill 2000). Suggestion to approaches can be seen in figure 29.

### 3 Methodology

The methodology of the thesis will be based on design and methods from Yin (2003). When utilizing a case study, there are two main different paths to follow, an *exploratory case study* or an *explanatory case study*. This thesis will exploit an exploratory case study method.

#### 3.1 Exploratory case study

Yin (2003) presents several definitions of the term case studies in his book. First he begins with a technical definition that states that “*a case study is an empirical inquiry*”, which examines a “*contemporary phenomenon within its real-life context*” and particularly when “*boundaries between phenomenon and context are not clearly evident*”. It implies that in relation to this thesis, utilizing a case study method can be relevant when a researcher wants to cover contextual conditions.

An exploratory case study is used when the research is unclear and the researcher’s findings are unknown.

#### 3.2 Propositions

The thesis will utilize propositions in order to describe and analyze how Rauma Group performs, and is linked to the conceptual model.

The propositions are based on the conceptual model, and if they are confirmed, this can lead to reduced costs for Rauma Group. This is because the propositions are developed in order to reveal if Rauma Group are operating according to theory.

The propositions deal with aspects of uncertainty, purchasing and risk management.

#### **PROPOSITIONS**

P0: Rauma Group operates with a holistic perspective

P1: Rauma Group experience high supply risk

P2: Rauma Group experience high demand risk

P3: Rauma Group conducts risk assessment

The first proposition deals with the organizational structure of Rauma Group and how they operate. A holistic perspective means if Rauma Group is working with all subsidiaries bared in mind. That involves including all subsidiaries when they are developing and

determine strategic decisions. Actions that affect one business area positively may affect another business area in a negatively way. An example to illustrate this can be that an investment in the upstream part of the supply chain can affect the production unit cost, which affects the sales department represented by Vikenco.

The propositions regard to supply risk and demand risk concerns elements of purchasing and uncertainty. These propositions can contribute when suggesting appropriate risk mitigating strategies. As uncertainty and procurement are broad topics, several strategic actions are possible in order to reduce uncertainty and improving purchasing activities.

The final proposition about risk assessment is developed in order to reveal if Rauma Group are utilizing risk management strategies. It should also involve elements from purchasing and uncertainty, which affects supply chain risks.

### ***3.3 Research design***

According to Yin (1994) research design is a plan of how to conduct the research. It aims to connect empirical data to the research questions, and to the conclusion.

The thesis will utilize a *single case study with holistic design*. The holistic design has both strength and weaknesses (Yin 1994). It can be a useful design when the theory used in the case study is at a general level. In addition, when no logical subunits can be identified, it is also beneficial. On the other hand, a weakness with using a holistic design is that the case study can be conducted at an abstract level. In addition, a case study`s nature can shift during the time of study.

#### **3.3.1 Case study**

For case studies there are five components that are important in the research design (Yin 2003)

1. Study questions (who, what, where, how, why)
2. Propositions
3. Unit(s) of analysis
4. The logic linking the data to the propositions
5. Criteria for interpreting findings

### **3.3.1.1 Study questions**

There are several research questions that can be asked under the subject of supply chain risk management. One will be “*why do risks occur*”. This might give an answer on how Rauma Group are doing their activities and if there could be other ways of operating. Hopefully, a question like this also can reveal what kind of strategy Rauma Group has towards risk mitigation.

Furthermore, another question can be “*where in the supply chain do the risks occur*”. This question can give an answer of where the company should focus its risk management.

Moreover, “*what measures should Rauma Group utilize to mitigate its supply chain risks*” is another question that can be essential.

Another research question that may arise is “*how does the vertical integration of the supply chain affect the company towards supply chain risk management*”. In case of Rauma Group another way of operating might be to outsource activities. However, this can give other risk aspects.

### **3.3.1.2 Propositions**

A proposition is a sentence that is either true or false (Northwestern University 2012). Yin (2003) argues that the propositions are the real study when doing qualitative work. He continues that the questions of who, what, where, how and why, are used to help answering the study propositions.

In this thesis the propositions are linked with the conceptual model of how Rauma Group performs and operate.

### **3.3.1.3 Unit(s) of analysis**

The unit of analysis covers what actually the case is about. This can be i.e. an individual, organization, an event or an entity. The unit of analysis is also linked with the research questions. Each unit can therefore have different research design and strategy of collecting data. This thesis has the organization of Rauma Group as unit of analysis and is used as an example from the aquaculture industry.



#### **3.3.1.4 The logic linking the data to the propositions**

The aspect of linking the data to propositions can be done by pattern matching. It is to compare data from two different propositions against each other, and if they both give the same outcome, it can be assumed as a pattern.

#### **3.3.1.5 Criteria for interpreting findings**

This issue deals with how the investigator interprets the findings from the case study. In a quantitative study, a researcher can obtain a statistical interpretation from a p-value of .05, which is a statistical significance level. On the other hand, in a qualitative case study, the researcher should look at alternative explanations to the findings.

### **3.3.2 Analytical generalization**

Analytical generalization concerns the possibility of generalizing the outcome of this thesis to relate to other fish farmers. In contrast to statistical generalization where one can determine results based on empirical data and statistical observations, this does not apply for case studies. Case studies can be seen as experiments and not sampling units, according to Yin (2003).

### **3.3.3 Judging quality of research design**

Yin (2003) has developed tactics for four design tests to judge the quality of the research design.

The tactics consist of:

- Construct validity
- Internal validity
- External validity
- Reliability

#### **3.3.3.1 Construct validity**

The importance for the construct validity is to measure what is supposed to be measured.

In a case study of supply chain risk management three different tactics can do it:

- Use multiple source of evidence
- Establish chain of events
- Have key informants review draft case study report

### **3.3.3.1.1 Multiple source of evidence**

Use of Multiple source of evidence has a purpose to avoid the possibility of subjective judgments. According to Yin (2003) multiple source of evidence can be related to four different types of triangulation that can strengthen the methodology of a thesis. These are concerned to *data triangulation, investigator triangulation, theory triangulation and methodological triangulation*. This thesis will mainly use data triangulation, which means use of different sources of data.

### **3.3.3.1.2 Establish chain of events**

To establish and maintain a chain of events is to increase the reliability of the case study. A chain of events will ensure that the reader can follow the origin from initial research questions to conclusions. In this thesis this should be in relation to that the reader can trace the information and sources. Use of citations and reports of information gathered are important in this matter. The thesis will include citations and references that will allow the reader to trace the sources used.

### **3.3.3.1.3 Key informants review draft of case study**

Collection of data can be done by interviews. If the interviewee gives crucial information and becomes a reliable source, they can act as key informants (Yin 2003). In order to achieve validity of the case study, key informants can review a draft and the investigator can choose to use the feedback that might emerge. The interviewees have not reviewed this thesis.

### **3.3.3.2 Internal validity**

Internal validity is not a test for exploratory studies, and will therefore not be further explained.

### **3.3.3.3 External validity**

The external validity test is about to determine if the findings of the case study can be generalized. When utilizing a qualitative, single-case study, this is performed by use of theory. In contrast of survey research relies to statistical generalization, case studies relies on analytical generalization.

### **3.3.3.4 Reliability**

The test of reliability is to ensure that if an investigator would precede the same steps and case study as the previous investigator, the result would be like. As the interviewees in this thesis are with the CEO of Rauma Group, and sales manager of Vikenco, it is plausible to believe the outcome of interviews would be alike. However, since the interviews were in-depth and open-ended, differences in interpretations of results are possible. Use of structured interview guide can be a way to improve reliability.

### **3.3.4 Sources of information**

The thesis will utilize two sources of information, which is primary data from an informant in Rauma Group and respondent from Vikenco. The information from the sources is gathered by interviews.

Furthermore, extended use of secondary data is used to gather and obtain an overview of the firm, industry and market.

### **3.3.5 Collecting evidence**

When collecting the evidence for a case study, Yin (2003) argues that there are some principles that have to be followed. For the first, the investigator has to use multiple source of evidence. Further, the investigator has to create a case study database, which will enhance the reliability of the findings. In this thesis the material used for sources is stored. The information used from the interviews has been reviewed of the interviewees, which is attached, and the interviewees are coherent with the information used. The raw material of the interviews is also recorded on tape, but not written down word-by-word. Finally, the investigator has to maintain a chain of evidence that will improve the validity of the thesis. Being mentioned above, the chain of evidence aims to provide the reader to follow the information and evidences throughout the thesis.

The six most common sources of evidence in relation to case studies are:

- Documentation
- Archival records
- Interviews
- Direct observation
- Participant-observation

- Physical artifacts

The different sources have pros and cons, and used together they can give more validity to the research.

**Documentation** can be concerned to explicit data collection and various forms of information can include among others letters, agendas, administrative documents, formal studies, newspaper clippings and articles in mass media.

This thesis utilizes this form for evidence, mainly articles.

**Archival records** are often related to computer files and records, and typical records can be service records, organizational records, maps and charts, different types of lists, survey data and personal records.

**Interviews** can be recognized as guided conversations, and not structured queries.

Interviews are not rigid, however it is more open-ended and loose, where it is important that the interviewer follow its line of inquiry and where questions asked is unbiased. It can be distinguished between three types of case study-interviews; *in-depth interview*, *focused interview*, and *formal survey*.

When utilizing in-depth interviews, the interviewer can ask the respondent for his/her own opinion and also ask for suggestions to have an event can be solved. The respondent can also suggest other people to interview, or use of other types of sources to the interviewer. This can lead to the more the respondent assist the interviewer, the more the respondent acts as a key informant.

A focused interview is conducted, in contrast to in-depth interview, on a short period of time. The interview is open-ended, but is also following a certain set of questions to determine the facts the interviewer might already have. In this case, it is important for the interviewer to act as he/her does not have any opinion.

The third type of interview is known as formal survey. This type of interview can give quantitative data to the case study evidence. When using a formal case study, the questions are structured.

This thesis has utilized in-depth interviews with CEO Rauma Group and sales manager at Vikenco.

**Direct observations** are in relation to that the case study investigator can visit the site or location where the “case” takes place in order for the investigator to find some relevant behaviors or environmental conditions to observe.

The observations can be gathered by formal or casual data collection activities. Examples of formal data activities can be that the interviewer assess and observe the behavior of meetings, factory work or classroom, over a certain period of time.

Casual data collection is less formally, and is more like direct observation of the surroundings at the plant site, when an interview is going on. A direct observation of how the buildings or the in-door facilities look like, can give the interviewer insight in working conditions that might be useful in the case study.

The interviews were conducted at the sites of Rauma Group and therefore casual data collection has been exercised.

**Participant-observation** is a way of observing where the case study investigator is participating in the events that are being studied. Unlike to direct observations where the interviewer has a passive role in just observing.

**Physical artifact** is the final source of evidence, which is physical evidence. This type of source is used often in anthropological research, but is not common in other types of areas.

One of the most important ways of collecting evidence when doing a case study is done by interviews (Yin 2003). An interview can give insight and a possibility of the source to give you information you otherwise would not have gotten. There are different types of interviews, ranging from open-ended interviews to more strict and rigid forms of interviews where the interviewer is following a script. A high-quality interview can support information that will help answering the research questions. There are some important aspects when performing an interview. One is to not ask directly questions related to the research questions. An interview is meant to support evidence of information you need to answer the research question. Another aspect is for the interviewer not to be biased when asking questions. The interviewer should have no opinion of answers. In addition, when evaluating the answers from the interviews, the interviewer should work unbiased so that the answers are interpreted as meaningful as possible.

## 4 Analysis and discussion

The chapter of analysis is mainly based on information from interviews with two key informants from respectively Rauma Group and Vikenco, in addition to secondary data. The main purpose of the interviews was to reveal the propositions mentioned earlier. All of the following information in this chapter concerning Rauma Group and Vikenco is based on interviews conducted 21<sup>st</sup> and 23<sup>rd</sup> of February 2012.

This chapter is organized with analysis at following aspects:

1. Analysis and discussion - purchasing at Rauma Group
2. Analysis and discussion - uncertainty Rauma Group
3. Analysis and discussion – risk management at Rauma Group
4. Analysis of cost drivers at Rauma Group

### 4.1 Rauma Group and Purchasing

Regard to supply chain risk and purchasing, the main product that being examined is feeding. As been mentioned earlier, feeding is an essential part of fish farming. Feeding is important both to costs and production.

#### 4.1.1 Unit cost / kg

The total production cost of salmon can be calculated to about 18NOK/kg for Rauma Group (Skarvøy 2012). Of these the costs regard to materials, components and personnel consists of about 15 NOK/kg, while harvesting is about 3 NOK/kg. Transportation costs are excluded to this overview.

In a supply chain management perspective with focus to reduce costs, it implies that these parts are the one than to emphasize.

The average production unit cost / kg of salmon in Møre and Romsdal can be viewed in the overview below.

<b>MØRE AND ROMSDAL</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Smolt cost per kilo	1,91	1,81	2,04
<b>Feed cost per kilo</b>	<b>10,60</b>	<b>9,84</b>	<b>11,02</b>
Insurance cost per kilo	0,16	0,13	0,14
Payroll per kilo	2,25	1,21	1,89
Depreciation per kilo	1,54	1,39	1,49

Other operating expenses per kilo	1,86	3,04	2,40
Net financial expenses per kilo	2,00	0,76	0,69
<b>Production cost per kilo</b>	<b>20,33</b>	<b>18,18</b>	<b>19,67</b>
Slaughter cost per kilo	3,00	2,49	2,97
<b>Total cost per kilo</b>	<b>23,32</b>	<b>20,66</b>	<b>22,64</b>
Profit per kilo	-2,23	4,65	8,59

Table 6 Production unit cost. (Source: Directorate of Fisheries 2012)

This overview of production costs confirms the information from Rauma Group that feeding is the main cost.

#### 4.1.2 Feeding

Today Rauma Group purchases its feed from mainly three suppliers, Skretting, Ewos and Polarfeed. High quality of feeding gives improved quality of the salmon both in terms of growth and fish welfare, but also contribute to better environmental surroundings. As an example that can illustrate this is the use of feed needed to produce on 1 kg salmon. High quality feed can have a ratio of 1,5:1, which means that a salmon needs 1,5 kg of feed to grow 1 kg. If the feed is of poor quality the ratio may be 3:1. It is clear that a lower ratio is better for the environment, but it will be a cost / benefit issue, as high quality feed is more expensive.

According to Gelderman and Marjolein (2005) the strategic items can be characterized as products with large impact on profits and high supply risks for an organization. As the feeding accounts for about 50%-60% of the total production costs and there are few suppliers in the market, it can be recognized as a strategic item for Rauma Group. There are three different approaches that Rauma Group can utilize in terms of strategic items (Gelderman and Marjolein 2005) as seen in figure 31.

#### **Maintain strategic partnership.**

This strategy aims to reduce supply risk when there are few suppliers in the market. Its main purpose is to build and maintain close partnership with a vital supplier where mutual trust and partnership can reduce supply risk. As a consequence of the partnership, the organization will achieve improved product quality, delivery reliability, lead times, product development, product design, and cost reduction. The situation where a strategic

partnership is in place can be recognized as balanced power as the supplier and buyer are dependent of each other.

**Accept a locked-in partnership.**

In this situation, the supplier has a power balance in favor of the buyer. It can typical occur if the supplier has a patent of a product and thereby experience a monopoly. The strategy is for the buyer in this scenario is to accept the situation. As the power balance is uneven, it will not be a close partnership as the previous strategy.

**Terminate a partnership.**

This approach is to terminate the partnership when the supplier does not deliver in terms of expected quality. The buyer can by sourcing for other suppliers reduce its dependency. However, as the buyer is still dependent of the supplier, the supplier is dominant, but not in the same extent as the previous strategy of locked-in partnership.

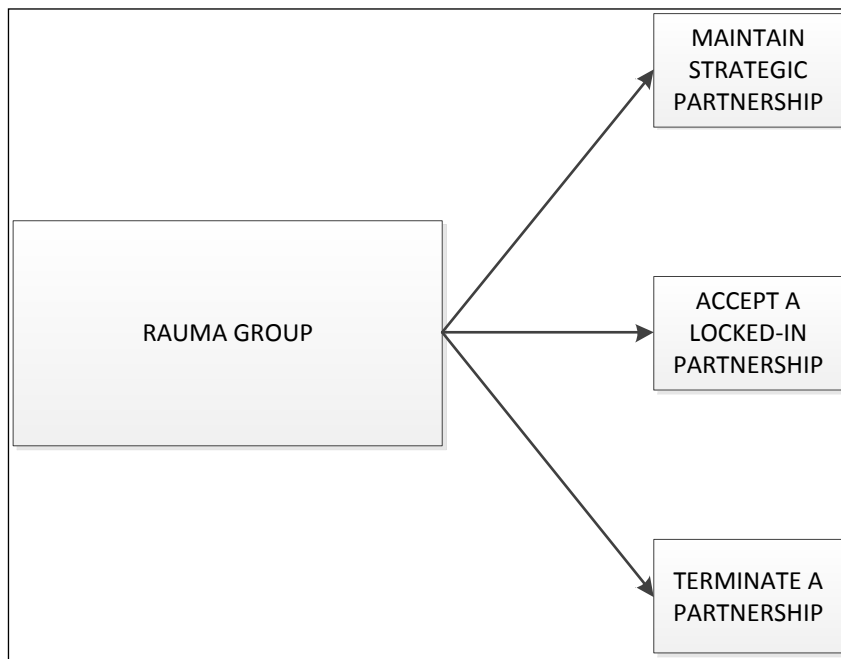


Figure 18 Approaches – strategic items.

As the main procurement of feed is handled by SalMar, Rauma Group does not have direct involvement when choosing suppliers. However, they can give feedback to the purchasing department. When operating as a large buyer, SalMar and Rauma Group can experience better bargaining power towards the suppliers.



It seems that SalMar and Rauma Group are utilizing the strategy of maintaining a strategic partnership today. They have primarily two suppliers of feed. Nevertheless, Rauma Group does not have any additional stock of feed. That means if a disruption should occur around the deliverance from Skretting, Ewos or Polarfeed, Rauma Group can face a production delay. Economically, this will have a significant impact.

Furthermore, it is reasonable to believe that the power balance between the feed suppliers and fish farmers are balanced, in which they are mutually dependent of each other.

Because there are several suppliers available, the locked-in partnership is not current.

Moreover, as long as the feed suppliers provide high quality products, it is not applicable to terminate partnership.

As described earlier, Kraljic (1983) suggested when facing high supply risk and high impact on profits, a firm should balance, diversify or exploit the situation, and the four step approach propose to build supplier relationships. This correlates with Gelderman and Marjolein.

#### ***4.2 Supply Chain Risk regard to Uncertainty***

Uncertainty can increase the overall costs to Rauma Group, as discussed in the chapter of theory. Uncertainty regard to fish farming can be in relation to supply of feed, smolt, fry, transportation and market demand, among others.

It can be argued that the demand of salmon will increase in the upcoming years. According to UN (2010), the world population will grow significantly towards year 2050.

	<b>1950</b>	<b>2011</b>	<b>2030</b>	<b>2050</b>
<b>Total world pop. (billion)</b>	2,53	6,97	8,32	9,31

Source: United Nations, Department of Economic and Social Affairs (2010)

Analysis also shows that the price of salmon now is the same in France, as for pork, chicken and beef (Nyheim 2012).

Therefore, an increasing demand of food is likely to arise. Fish farmers in Norway can benefit of this.

When it comes to uncertainty at Rauma Group, they can experience this differently at different subsidiaries.

<b>Subsidiary / Uncertainty</b>	<b>Rauma Broodstock</b>	<b>Rauma Eik &amp; Rauma Sætre</b>	<b>Rauma Misund</b>	<b>Vikenco</b>
<b>Supply of feed</b>				
<b>Transportation</b>				
<b>Smolt production</b>				
<b>Roe production</b>				
<b>Market demand</b>				

Table 7 Uncertainty events at different subsidiaries.

As the table above illustrates, different subsidiaries can experience potential uncertainty to different events. The focus on this discussion will be in relation to Rauma Misund and feeding.

Rauma Misund is the subsidiary with largest production; actual farming in the sea with 8 \* 780 MTB, and as a consequence the demand of supply is thereafter. However, as earlier discussed, they do not practice with large inventory of feed; hence reducing the uncertainty towards the supplier may be the most important issue for Rauma Misund.

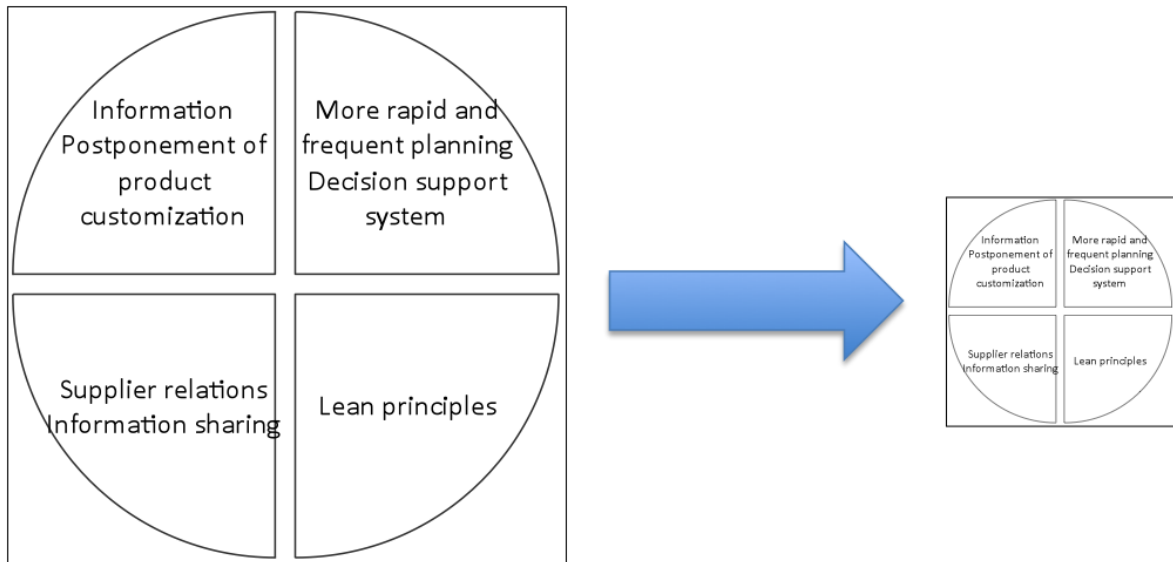
As theory proposed, the uncertainty circle recommends in this case Rauma Misund to initiate action towards the four elements of manufacturing, control, demand- and supply side in order to reduce the uncertainty to the supply of feed.

Uncertainty regard to manufacturing, in this matter, farming, can be resolved by implementing lean practices. Furthermore, Rauma Misund can work with implementing data decisions systems that aims to optimize when to purchase feed and what amount. The demand side, which is about the customer, mainly Vikenco, can be exploited through information sharing. If Rauma Misund knows in advance Vikenco's forecast of sales, and they collaborate in the discussion how the market develops, thus more prepared Rauma Misund will be when planning their production. As for the demand side, toward its suppliers, Rauma Misund can aim to build relationship and share information. In that way, the feed suppliers of Rauma Misund can participate in determination of forecasting of future supplies.

The suppliers to Rauma Misund are also the other subsidiaries, Rauma Eik and Rauma Sætre, with smolt. In these regards, the need of information sharing and collaboration is still present.

That being said, uncertainty to supply of feed correlates with the chapter and discussion about purchasing that propose Rauma Group to maintain and build strategic partnership with suppliers. In addition, Kraljic (1983) suggests building supplier relationship in these circumstances.

Theoretically, if these steps above were to occur, Rauma Misund would have reduced the uncertainty circle, in which reduces costs.



Based on feedback from interviews, Rauma Group is today not producing after lean principles. However, the philosophy of lean was not explained or discussed during the interview, so that it might be Rauma Group is utilizing some of the lean tools. That being said, producing to lean principles is a philosophy that should permeate an organization. Therefore, the thesis does not conclude either way that Rauma Group exercise lean principles, but it can seem like they are not aware of it.

Regard to demand- and supply side, Rauma Group claims to have good relationship with its customers and suppliers. As the customer of Rauma Misund is Vikenco, which is a subsidiary of Rauma, it is to believe the information sharing and relationship between the actors are decent. The interviews reveal the information is not the best. According to Vikenco, they receive information through production plans, and this is what they have to

deal with. For Rauma Misund, they demand smolt (regarded as supply) from Rauma Eik and Rauma Sætre, in addition to feed from Skretting, Ewos and Polarfeed. Rauma Misund does not plan its production due to market demand (information sharing from Vikenco), but on licenses and MTB. This indicates as well that Rauma Misund is the “stronger” part of the subsidiaries to Rauma Group. However, as the MTB is 8\*780 tons, this is also the basis when Rauma Group determines its strategy towards purchasing and production planning.

In order to reduce uncertainty, Rauma Group may enhance the information flow from Vikenco all the way up to Rauma Broodstock. In theory, this can reduce bullwhip effect in terms of overproduction of smolt, fry and eggs. On the other hand, like the farming industry is organized, it is possible to believe that overproduction can be sold along the way.

In terms of reducing the uncertainty of control, Rauma Misund can initiate measures that make them do better decisions, but also controlling the whole production. This may be first and foremost concerned to implementing IT systems that do calculations and gives a data-basis to the management of Rauma Group for its decisions.

Rauma Group has common ERP-system today between the different subsidiaries, but not own decision support systems.

### **4.3 Risk Management**

The examination takes base of the risk management framework of SCRLC (2011), ISO31000, Manuj and Mentzer (2008), Waters (2011), Christopher (2005), and Zsidisin, G. and B. Ritchie (2009) with input from interviews and secondary data in order to achieve best possible outcome for Rauma Group.

The risk management process can be illustrated as follows.



**Figure 19 Risk Management process.**

The different elements of risk management that will be covered in this section of discussion can be seen in figure 34. The frameworks of SWOT, bow-tie and heat-map will be used. In addition, analysis of the external environment and supply chain risks will be examined. To the end of risk management, an approach to risk treatment of the previous elements will be presented.

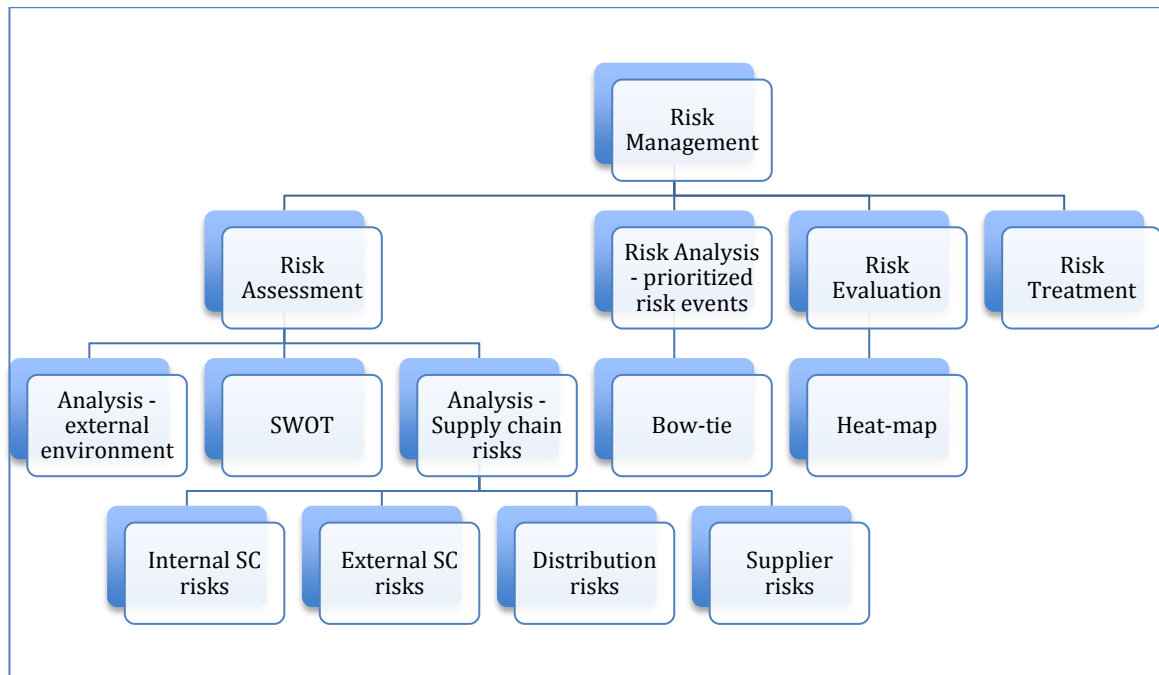


Figure 20 Structure of Risk Management.

Based on interviews, it is clearly that Rauma Group actively works towards mitigating strategies. What is special with fish farming is that some of the most crucial risk events that impact profits are likely to happen regardless what measurements are implemented. This is especially concerned to the challenges around lice. According to the industry, it is difficult today to prevent these biological factors to occur.

When a breeding place is affected of an outbreak of lice, the fish farmer normally has to undergo emergency slaughter. Not only will the fish be lost, but the location can also be laid in fallow. The firm than has to find a new location that is suitable for breeding. Regardless if some of the fish can be sold, Rauma Group will be losing money, as the fish have not reached its optimal size. It can be classified as disruption in production. The emergency slaughter will affect the price/kg in a negative way, which means a higher price per kg as the fish is smaller in size. This is not appropriate with the strategy of reducing costs.

### **4.3.1 Analysis of the external environment of Rauma Group**

#### **Political aspect.**

The political intervention in the aquaculture industry is great and can be recognized as strictly regulated and controlled. Companies can only produce fish to a certain level (MTB) and the Norwegian government regulates the overall domestic production through use of licenses. As also been discussed, the aquaculture industry can be considered as environmentally unfriendly. This can affect recruitment to the industry in a negative matter. Another challenge can be to find new, suitable locations for deployment of sea cages if the resistance towards the industry increases. Typical argument beside the environmentally issue is regard to tax income for the local authorities. Small communities have to give up parts of fjords and marine life and do not feel that the industry provides enough income through employment and local tax revenues.

As a consequence of negative campaigning and publicity in the media through the last years, the industry is running advertisements that seek to inform about the contribution the industry has to local communities and the nation as a whole.

Lobbying can also be known as a common phenomenon in the industry. Stakeholders that work to influence issues regard to locations, environment and quality can be recognized with different boards and interest groups. As examples of interest groups, laks.no and Norwegian Seafood Council, seafood.no are relevant.

#### **Approaches to affect the political factors.**

To improve the public view of the industry can be recognized as the main task for the industry. However, for Rauma Group itself, it is unlikely that they are big enough to influence the public opinion towards fish farming. On the other hand, by supporting local activities in the communities and sponsorships, Rauma Group can improve their image where they already operate.

In terms of recruitment and competence, Rauma Group can work strategically towards local high schools and universities. Not only will they obtain insight in recent theory and information, but also have the possibility of tie relationship to potential students.

#### **Economic aspect.**

Norway has characteristics as a high cost country, which means that efficiency is crucial. On the other hand, salmon farming is reluctant on certain biological conditions that suit the

Norwegian climate. As a consequence, Norwegian salmon farmers have a “duopoly” situation internationally, with Chile and Norway as the world’s leading countries of salmon farming (Nilsen, G. B. and J. Grindheim 2011). However, the domestic competition is strong.

Furthermore, the Norwegian national economy is stable and the inflation rate is steady. Operating in a predictable economic environment is an advantage when planning operations and forecasting demand. A fluctuating economy can result in more difficulty to predict the future. Economic stability can also be advantageous in terms of improved conditions in the banking and financing sector and the issues regard to loan and debt. Nevertheless, a strong Norwegian economy also contributes to challenges for Rauma Group. For the first, if the Norwegian krone (NOK) appreciates, it can be expected that export will fall due to higher prices for the customers. Compared to the USD which is the currency of the main trade partner of Vikenco’s products, the USD/NOK-relation has developed from about 1USD/9.5NOK in 2001 to 1USD/5.8NOK (Regjeringen 2010). That means if Vikenco is selling the fish at price of 35NOK/kg, in 2001 the price would have been about 3.6USD/kg, while today the price will be about 6USD/kg. As a consequence, it can result in reduced demand for salmon products.

Secondly, a strong national economy can also lead to increase in wages. This will lead to greater costs for Rauma Group. Already operating in a cost-sensitive industry, Rauma Group has to be aware of the costs even if the wages only stands for about 5-6% of the total production costs.

Thirdly, the appreciated NOK exchange rate can also involve reduced costs for the feeding companies. However, it might not benefit Rauma Group. As there are mainly three feed-companies in the Norwegian industry, it can be speculated that they are collaborating in some ways and will exploit and profit on an appreciated NOK. Besides speculation of collaboration, a fish farmer might profit on whether utilizing spot contracts or long term contracts regard to its purchasing of feeding.

As an example, the case about Skretting, which is one of the suppliers of feed to Rauma Group, can be used. Based on conversation with representative from Skretting, they claim that Norwegian feed companies purchase large amount of raw materials in USD and when the NOK appreciates, this leads to reduced costs for the fish farmers as a consequence. For Skretting particularly, 55% of the raw materials are purchased in USD, 30% in EUR and 15% in NOK. Skretting’s cost of materials is about 80 % of the cost of feed, while less

than 20 % of the cost of feed is for covering operational expenses, shipping to the fish farmer's location, and profit.

### **Strategies to cope with the economic factor.**

A strong NOK has to be taken into account when determining the strategy of Rauma Group. They have to produce more efficient and reduce costs. In order to reduce costs they can begin with analyzing their main cost drivers and focus on these.

Regard to increase in wages; two alternatives of action can be considered:

- Increase wages and keep personnel
- Reduce wages, lease of personnel, mainly foreign workers

Today Vikenco base much of its production on foreign workers at the production location. Almost 50% of the staff employed is foreign (Appendix 1).

In terms of the feeding costs, a solution for Rauma Group might be to integrate vertically in order of gaining profit of stronger exchange rates, but also controlling important an important product. As Rauma Group is owned by SalMar, it is however the parent company who has to do the integration.

### **Social aspect.**

The social aspect about salmon products can be viewed in a contradictory perspective. On one side, the general public is negative to the farming industry and the way of production. On the other side, new food trends as sushi is spreading at great speed globally. A more educated and health focused population is also concerned of consuming more healthy food. In order to meet the demand, fish farming can be recognized as a solution.

### **Technological aspect.**

Technological development is important in the industry to gain more efficient production and reducing costs through preventing escapes and outbreak of lice. Examples of technological development may be regard to new ways of producing, new equipment or means of transport between the different sites. Technological development can also result in new salmon products.

Today, much of the production of whole gutted fish and filets are a combination of technology and labor. According to Rauma Group and the aquaculture industry,



technological improvements is worked on a continuously basis. The effort on developing tools to prevent escapes from the sea cages will have huge impact on the profits. As will the same apply for technological innovations that prevents outbreak of lice. For instance, if a sea cage containing 100000 fish ready for harvesting breaks, value of about 1.5 MNOK will be lost.

New products can be developed with technological improvements. As an example of product innovation is salmon cuts.

### ***Strategies towards enhancing technological improvements***

Rauma Group is through SalMar and other actors in the aquaculture industry working with universities and research institutions to gain technological breakthroughs.

However, if Rauma Group wants to experience local development they might establish and maintain contact with local institutions.

### **Legal aspect.**

There are many legal factors and procedures involved in the aquaculture industry to be followed. However, these factors apply for all companies and are not unique for Rauma Group. Rauma Group has to follow rules among others regard to the biological environment, working environment and competition.

Legislation about competition leads to a variety of companies and prevents major companies being too dominant. The competition act can also prevent unserious actors in the industry. On the other hand, it can also be a constraint in terms of Rauma Group to grow. If the government desires several actors in the industry, they can control this when handing out licenses.

### ***Strategies around the legal factors***

A consequence of strong rules and regulations can be a more serious industry. This can give a competitive advantage over fish farmers in other countries that have lack of legislation. As an example, Chile had loss of control over the aquaculture industry in early 2000s. Fish farmers in Chile had no strict rules and regulations to follow and they produced too much compared to what the fjords and sea was environmentally capable of (Hjeltnes 2009). The amount of antibiotics used in Chile was 75 times more per produced kilo salmon than in Norway (Claude, M., J. Oporto, et al. (2000).

Therefore, being positive and encourage strong legislation is something Rauma Group should focus to continue.

### **4.3.2 SWOT**

#### **Internal strengths at Rauma Group.**

Being a subsidiary of SalMar, the Rauma Group operates under a strong brand. It can also be argued that in terms of size, Rauma Group is a favorable customer for 3PLs, which is important regard to economic issues. According to Vikenco (Heggem 2012) they have options when selecting transporters. The two largest 3PL transporters in Norway, Schenker and Bring Cargo, both have regular sales meetings with Vikenco. This implies that Vikenco constantly obtain competitive prices.

Norwegian salmon can also be recognized holding a strong position to customers abroad. While this is not unique for Rauma Group, it can be seen as a necessary to operate in the market.

Furthermore, SalMar is a strong, financial owner being one of the leading companies in Norway.

Rauma Group also controls its supply chain through vertical integration, which can be favorable in terms of reacting to market changes. It can also be advantageous to control the distribution network, especially when Rauma Group is producing according to licenses and allowances (MTB).

Rauma Group has its own strain, the Rauma-strain.

#### **Internal weaknesses at Rauma Group.**

High costs regard to several subsidiaries can be recognized as a weakness. Furthermore, not having control over suppliers of feed and transporters (3PL) might be a challenge. Being located at Sjøholt, Ørskog, might make it difficult to recruit people. However, the location can also be beneficial in the matter that people already living and working at Rauma Group will be less interested in moving because of fewer work possibilities in the area.

As an integrated farmer, Rauma Group has also tied up a lot of equipment and capacity. This can be a weakness if they need to react to changes and are less flexible.

## SWOT MATRIX

<p><b><u>STRENGTHS:</u></b></p> <ul style="list-style-type: none"> <li>• Financial basis</li> <li>• Product and product category</li> <li>• Own strain (Rauma-strain)</li> </ul>	<p><b><u>WEAKNESSES:</u></b></p> <ul style="list-style-type: none"> <li>• Costs</li> <li>• Administrative localization</li> </ul>
<p><b><u>OPPORTUNITIES:</u></b></p> <ul style="list-style-type: none"> <li>• Level of integration</li> <li>• Population development in the world</li> <li>• New markets</li> <li>• Technological innovations</li> </ul>	<p><b><u>THREATS:</u></b></p> <ul style="list-style-type: none"> <li>• Competition</li> <li>• World economical situation</li> <li>• Environmental aspect</li> <li>• Prospects of growth (licenses)</li> </ul>

Figure 21 SWOT-matrix

Summarized, Rauma Group can be viewed as a company with internal strengths towards a strong financial basis, they operate within an industry that can see growth, and they own their own strain. In addition, they might experience opportunities in terms of the world population development, which can lead to entry in new markets. Since they are highly integrated Rauma Group can also react to market changes. The industry is highly technological, and as discussed, is becoming more and more effective. This can benefit Rauma Group in competition with other fish farmers or even food industries.

On the other hand, high costs are a weakness to the company. This aspect is however not unique for Rauma Group. The administrative localization is also an aspect that can be a weakness in order to recruit competent people.

Threats that might evolve are linked to competition, the world economic situation, the environment, and prospects of growth. In terms of competition, Rauma Group does not only face domestic competition, but also internationally competition, mainly from Chilean and Scottish fish farmers. Furthermore, the world economic situation might tend consumers to cheaper types of fish, which can reduce the demand for salmon. The environmental aspect might be a cause that makes it harder to gain areas to farming in Norway, but also less regulated rules abroad can tighten the international competition. The

environmental issue can also be linked with the prospect of growth, which is regulated by licenses. As been seen, the number of licenses has not increased in the same way as the increase in sales.

### 4.3.3 Analysis - External supply chain risks

According to Rauma Group, they fear the external risks regard to lice and escape from sea cages the most. Today, these events are inevitable to experience.

However, there are also several other external risks that might occur for Rauma Group.

The ones being discussed in this thesis are regard to:

- Fish escape
- Outbreak of lice
- Natural disasters
- Accidents

#### 4.3.3.1 Escape of fish

SalMar experienced in 2011 that 176.000 fish ready for slaughtering escaped from a sea cage in Møre and Romsdal (Sved 2011). The total loss was valued about 10 MNOK, half of which were related to clean-up and re-fishing.

If this happens to Rauma Group, which has a turnover of about 493MNOK, it will have a huge impact on the profit.

The figure below illustrates the development in terms of escaped fish during the last 10 years.

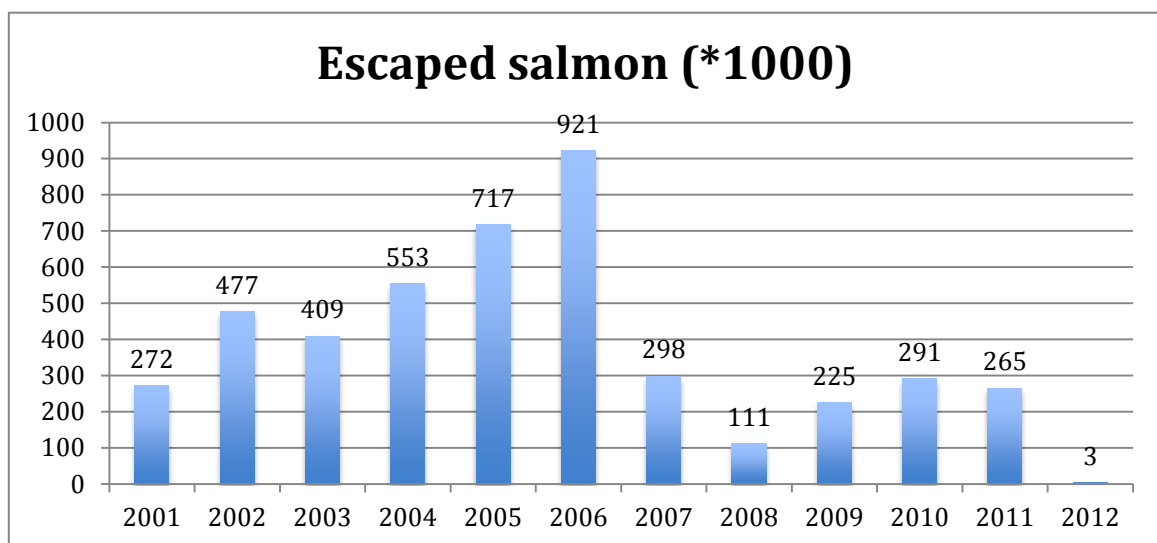


Figure 22 Escaped salmon. (Directorate of Fisheries 2012).

As can be observed the development in the period from 2001 to 2006 shows an increase in escaped salmon. From 2008 and until today the development seems to be on an increasing trend as well.

#### **4.3.3.2 Lice**

Another important external risk factor is related to lice.

According to ScienceNordic (Spilde 2005), lice are small crustaceans that chew on the skin of the salmon. This is a problem because the wounds make the salmon vulnerable for infections. In addition, the balance of salt in the fish body can also be affected of all the wounds and result in death.

The lice are spreading rapidly and can infest large areas if they are not controlled. It begins with small larvae, that floats in the water and attach to fish that swim past. The larvae originate from nits that are produced from female lice, which continue to produce nits if not disrupted. Therefore, controlling the number of female lice in the sea is important. Outbreak of lice in a sea cage can affect all the fish if not preventive or reactive actions are utilized.

The development of lice is stable and has been at the same level over the past 3 years (Lusedata 2012).

#### **4.3.3.3 Natural disasters**

Events in the nature affecting the supply chain are mainly related to fish escapes. A typical natural disaster may be related to the weather, and especially in these regards to wind and waves. Bad weather is a challenge for the aquaculture industry. Localization and quality of the equipment being used may contribute to reduce the impact of weather.

#### **4.3.3.4 Accidents**

As the fish is transported both by road-, sea- and air transport, accidents are likely to happen. A typical truck that departs Vikenco is filled with about 18-20 tons of fish (Heggem 2012). Great value is therefore involved, and an accident can be costly both in terms of value and customer satisfaction.

More costly however can accidents related to transportation of smolt and feed become. Smolt and fish ready for slaughter are shipped between the different locations in well boats

especially made for these purposes. These boats contain more fish in value than a truck to Oslo, so if an accident occurs to a well boat, it will affect Rauma Group more hardly. Skretting and Ewos ship the feed by boat, and if one of these is exposed of an accident, this will affect the production to the extent where new supply arrives.

Approaches to prevent disruption caused by accidents may be related to development and measuring of standards towards HMS, personnel routines, quality requirements for 3PLs, safety stock level of feed and route planning, among others.

#### **4.3.4 Analysis of Supplier risks**

Supplier risks are in relation to the dependency Rauma Group has towards its suppliers in terms of production.

Examples of supplier risk for Rauma Group can be recognized to concern:

- Production problems
- Upstream supply risks
- Financial losses

##### **4.3.4.1 Production problems**

Production of farmed salmon is much concerned to feed and sea water temperature. Other production facilities where disruption can occur are at the harvesting location. Therefore, avoiding and preventing disturbance in production can be argued to rely on developing strong and good production routines and training of employees.

##### **4.3.4.2 Upstream supply risks**

Upstream supply risks seek to cover the possibility of risk events happening because of events in the supply chain of a supplier to Rauma Group. Theory recommends when dealing with strategic items to control and examine the supplier's suppliers (Kersten 2006). In the case of Rauma Group this can be concerned to its feed-suppliers.

If Skretting or Ewos experience problems in their supply chain, this may hit Rauma Group in terms of higher costs due to longer lead-time or less quality of feed. Skretting has developed a system, NuTrace, which allows the fish farmer to trace the feedback to its origin so that the farmer can control the feed quality (Skretting 2012). This also opens up for the end customers to trace the whole value chain of a farmed fish.

Another approach to reduce upstream supply risks can be to use several suppliers, which is what Rauma Group is doing today. This also consists with purchase theory in terms of diversifying regard to strategic items.

#### 4.3.4.3 Financial losses

Risks regard to financial losses concerns how the economic situation is for the suppliers of Rauma Group, and how this eventually is a potential supply chain risk factor.

2010	Skretting	Ewos	Polarfeed
Operating margin (%)	4,69	5,77	-0,55
Current ratio	0,89	0,85	0,66
Equity ratio (%)	19,90	29,8	2,90
Debt ratio	4,03	2,36	33,26
Total profitability (%)	8,60	14,9	-1,10

Table 8 Financial overview Skretting, Ewos and Polarfeed. (Source: Purehelp.no)

As the table shows, both feed suppliers seem to be financially solid. Therefore, it can be argued that financial losses are not a current issue for Rauma Group.

#### 4.3.5 Analysis of Distribution risks

Distribution risks are concerned to the actual transportation in the supply chain.

Distribution risks can be recognized with the following examples:

- Lack of capacity
- Cargo damage

##### 4.3.5.1 Lack of capacity

Today, Schenker is the sole transporter of finished products from Vikenco. However, Vikenco claims that competitors address themselves to get transportation contracts. This implies that Vikenco can negotiate good terms about distribution and do not experience lack of capacity in terms of transportation.

##### 4.3.5.2 Cargo damage

Damage to the fish during transportation can be categorized as risk as this event can result in loss of sales, and also influence the brand of Rauma Group and SalMar. If a customer is constantly experience less quality of delivered products because of poor transportation services, it is not certain that the customer will directly see that the transporter is the one to

blame, and not Rauma Group. Moreover, if Rauma Group still uses transporters that provide poor service, Rauma Group can be recognized as being indifferent to the problem.

#### **Strategy to cope with cargo damage:**

Maintain and monitor the 3PLs. Use survey on customers to find customer satisfaction on products delivered. Use of incoterms in contracts.

#### **4.3.6 Analysis of Internal risks**

The internal risks are opposite to external risks, events that can occur within Rauma Group and affect the costs.

The internal risks that will be covered in this section are concerned to:

- Operational risks
- Demand variability risks
- Financial uncertainty risks
- Supplier relationship risks
- Personnel availability risks
- Planning failures risks

##### **4.3.6.1 Operational risks**

Operational risks can be concerned to mechanical failures, processing issues, quality and loss of inventory.

Mechanical failures can be in terms of breakdown or other disruptions of machineries.

Processing issues can involve processing reliability and lead-time variability. Reliability might be most relevant to Vikenco as they produce filets where reliability towards size and quality is important. Lead time variability can be influenced among others by seawater temperature and quality of feeding.

##### **4.3.6.2 Demand variability**

The demand of fish is expected to grow in the years to come (FAO 2011). However, the economic situation in the world is uncertain and the outcome of the financial crisis may turn the demand of salmon products in either way. An important feature of the supply chain to Rauma Group is then to be flexible and to be able of responding to changes in market demand.

Representatives from Rauma Group claims the importance of providing fish to market, regardless of market demand, so the actual risk is concerned to Vikenco and their ability to sell the fish that is coming from production. This implies that Vikenco need skilled personnel within sales and logistics.



#### 4.3.6.3 Financial uncertainty

Rauma Group has a strong owner in SalMar. SalMar achieved a profit of 900MNOK in 2010 (purehelp.no). Being under the wings of a strong and solid owner can make Rauma Group able to concentrate on future strategies and growth.

#### 4.3.6.4 Supplier relationship

The internal risks concerned to supplier relationship include Rauma Group's communication with its suppliers. In addition, aspects as information sharing as EDI, planning and forecasting with the suppliers are linked to this.

Today, Rauma Group's relationship with its suppliers regard to feed and transportation can be categorized as professional, but not personal. Rauma Group have regular meetings with its suppliers towards transportation as this being part of the planning operations. The same applies for feeding. However, supplier relationship is an important issue as discussed regarding uncertainty and purchasing.

#### 4.3.6.5 Personnel availability

Personnel availability involves aspects around Rauma Group's ability to keep and maintain qualified personnel. Rauma Group's regional location can be challenging in terms of recruiting. However, it might also be an advantage as personnel working for Rauma Group have less job opportunities in the areas where they are localized.

The main workforce in the facilities at Vikenco is contracted from Lithuania.

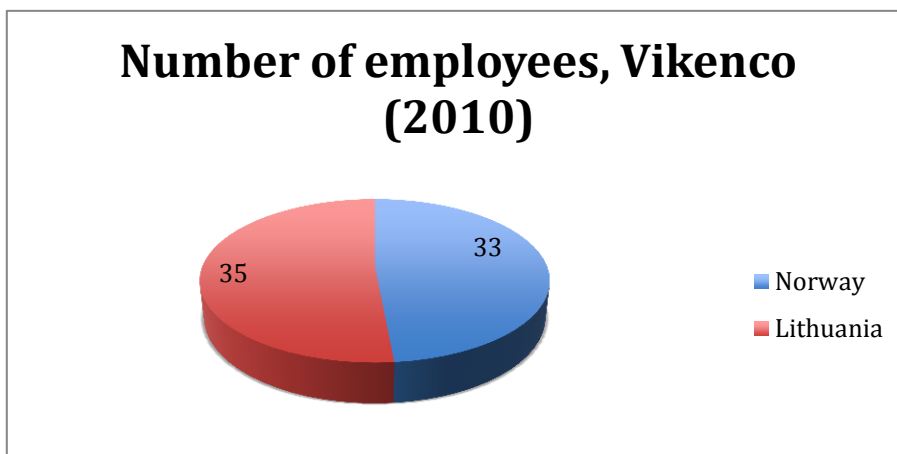


Figure 23 Number of employees, Vikenco. (Source: Appendix 1 Presentation SalMar 2011)

#### **4.3.6.6 Planning failures**

The production as mentioned earlier is not based mainly on market demand, but on MTB's, which is the allowance of how much fish Rauma Group can have in the water at any time.

This implies that Rauma Group therefore has to plan the production at best possible way. Poor production planning can result in production disruption and consequently loss of sales. As the yearly production at Rauma Group (2009) is 8000 tons of salmon, and Vikenco harvest 10000 tons of salmon and produce 4000 tons of salmon filets, this field can be recognized as important.

The management of Rauma Group can cope this element of risk by utilizing information systems that communicate between the different subsidiaries. This will provide updated data that are available for all actors in the production process. In addition, recruiting and obtaining skilled personnel within production planning can be crucial in order to gain the best possible outcome of planning activities.

#### **4.3.7 Risk Analysis – prioritized risk events**

Ranking the risk events can give a guideline on what risk events Rauma Group should focus on. The bow-tie method, as mentioned earlier, is one way of doing this. The bow-tie examines the possible causes of the risk event, actions to reduce likelihood of event, actions to reduce consequences of the event and finally possible consequences of the event.

As the dominant risk events are concerned to lice and fish escape, these will be the objective here.

The first event is concerned to **outbreak of lice**.

##### *Causes*

According to the Ministry of Environment (1999) there can be several reasons why outbreak of lice occurs. These are mainly concerned to salinity in the sea, water exchange, sea temperature, and the presence of farmed, wild and escaped salmon.

The bow-tie method can illustrate how the outcome of an outbreak of lice will look like.

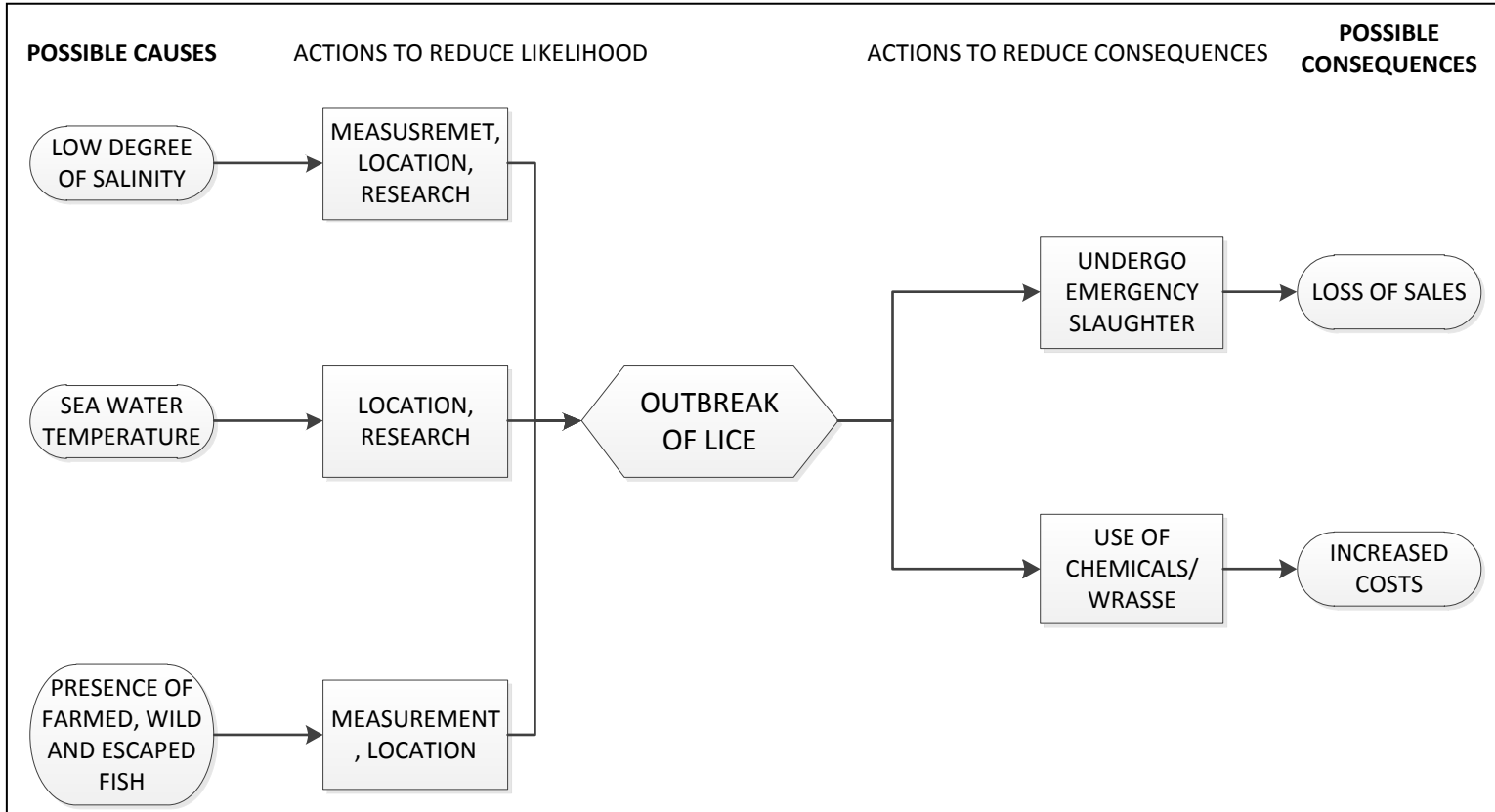


Figure 24 Bow-tie method, Outbreak of lice.

The salinity, sea water temperature and presence of farmed, wild and escaped fish are all concerned to biological factors. However, Rauma Group may take these causes into account when applying and determine where to locate its facilities. To reduce likelihood of the salinity, Rauma Group can invest in research on how salinity affects lice. In addition, Rauma Group can try to avoid locations with a high degree of salinity.

The second aspect is concerned to sea water temperature. Lice tend to favor a given sea water temperature. It is not much Rauma Group can do to this aspect, however, they can also here invest in research to learn and discover how lice is affected by sea temperature in similar areas as Rauma Group is present today. Rauma Group can try to locate its facilities based on the research about sea temperature.

The third cause regard to the presence of farmed, wild and escaped is concerned to the fact that the more fish that is present in an area, the larger is the possible occurrence of lice. Therefore, having control over and knowledge about how the sea and sauna is before locating in an area, can prevent outbreak of lice.

However, if all the actions are taken in consideration, but still an outbreak of lice occurs, Rauma Group can execute mainly two activities to reduce the consequences. These are either undergoing emergency slaughter or use of chemicals.

### Consequences

Emergency slaughter is used when the fish is in a condition where it still can be sold on the market. This action has a consequence of **loss in sales** for Rauma Group because the fish may not have reached desired size. The emergency slaughtering also creates changes in the production planning.

The other consequence, increased costs, arises from that Rauma Group can use chemicals to delouse the fish. Not only is it costs concerned to the chemicals and the working hours, but the location of the outbreak may also need to be laid in fallow. The problems around lice can also affect negatively image in the media, and therefore an outbreak might have several costs issues.

### Fish escapes

#### Causes

The environmental organization Bellona (2009), presents an overview that shows the most common incidents of fish escapes are concerned to “farm failures”. These include causes like hole in the nets for different reasons, weather conditions where the fish farmer should have taken bad weather into account, and escapes during shipment, among others.

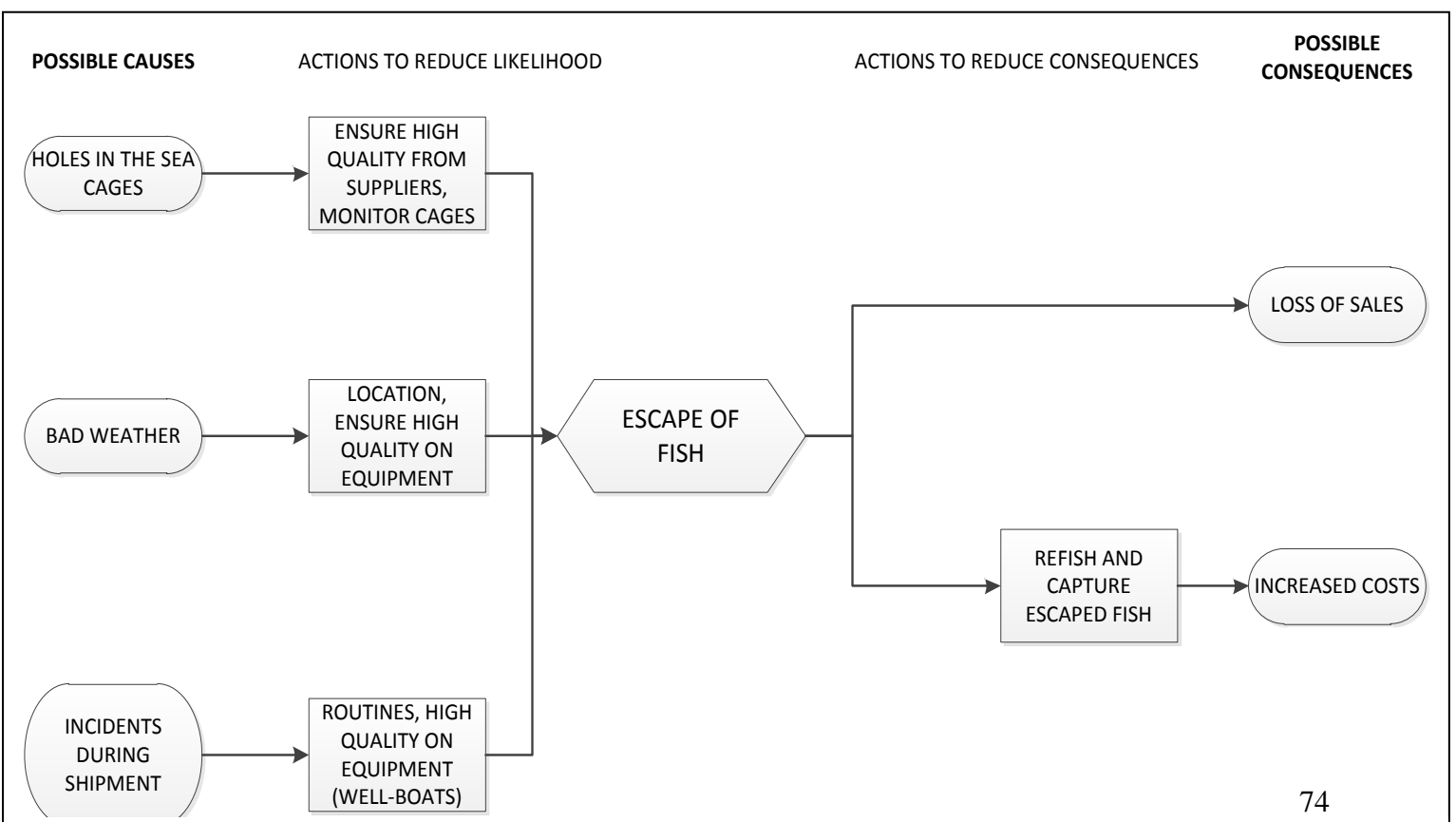


Figure 25 Bow-tie method. Fish escapes.

Holes in the sea cages can be a result from incidents as accident with propellers or problems during maintenance of the cages. Risk mitigating actions towards problems around the sea cages can be for Rauma Group to ensure high quality from the suppliers. Furthermore, Rauma Group can monitor the cages while at sea to seek control over the cages' condition.

The second plausible cause of fish escape is concerned to bad weather. It can be argued that it is impossible for a farmer to control the weather; however, Rauma Group can bring the weather condition into consideration when determining its location. Rauma Group can also make sure of using top quality equipment that can handle rough weather conditions.

A third possible cause of fish escapes can be related to incidents during shipment between the locations. Sloppy work can result in fish escapes during loading or unloading.

Accidents during shipping can also occur. Therefore, actions to reduce the likelihood of these events can be to ensure strict routines and training of personnel. In addition, high quality of equipment, well-boats and gear used to handle the fish, can mitigate the risk of escapes.

#### *Consequences of a fish escape*

First and foremost, an escape is a direct loss of sales to Rauma Group. Therefore, it is reasonable to believe that actors within fish farming try to mitigate the possibility of escapes.

Furthermore, an escape might involve an order to re-fish and capture the escaped fish. In these circumstances, the escaped fish might be captured, but it will be costly for Rauma Group.

#### **4.3.8 Risk Evaluation: risk events for Rauma Group to address**

So far, the risk events outbreak of lice and fish escapes have been examined and classified as the most present. However, other supply chain risks might also occur in the presence of fish farming.

From the suggested categorizes of supply chain risks; External risks, Supplier risks, Distribution risks, and Internal risks, it can be argued that Cargo Damage, Demand variability and Planning failures can be other relevant risks to be aware of.

As previous discussed, a risk heat-map can be utilized to give suggestion of what supply chain risks Rauma Group should address. Based on the risk-position, Rauma Group can develop mitigating strategies.

OUTBREAK OF LICE				
PROBABILITY	High			X
	Medium			
	Low			
		Low	Medium	High
IMPACT				

FISH ESCAPES				
PROBABILITY	High			X
	Medium			
	Low			
		Low	Medium	High
IMPACT				

Cargo Damage				
PROBABILITY	High			
	Medium			
	Low		X	
		Low	Medium	High
IMPACT				

Demand Variability				
PROBABILITY	High			
	Medium		X	
	Low			
		Low	Medium	High
IMPACT				

Planning Failures				
PROBABILITY	High			
	Medium			
	Low			X
		Low	Medium	High
IMPACT				

Upstream supply risks				
PROBABILITY	High			
	Medium	X		
	Low			
		Low	Medium	High
IMPACT				

**Critical risk events:**

Outbreak of lice and fish escapes

**Major risk event:**

Planning failures

**Minor risk events:**

Cargo damage, demand variability and Upstream supply risks.

Based on the heat-maps, Rauma Group should address the critical and major risk events.

**4.3.9 Risk treatment**

So far, the critical risk events of outbreak of lice, fish escapes, and planning failures have been identified and analyzed and evaluated as the most urgent and current issues for Rauma Group. As a three-step process, Rauma Group can implement strategies to mitigate

supply chain risks in terms of protecting the supply chain, responding to events, and continue business operations while recovering.

### *Protecting the supply chain*

All members of Rauma Group's supply chain have to be active in order to achieve best possible outcome through physical protection of the supply chain.

#### **Outbreak of lice**

Actions that Rauma Group can employ in order to mitigate the possibility of an outbreak of lice is to have access control and strict standards of whom and why people are in and around the farming locations. However, with already strict regulations regard to environmentally issues it is likely to believe that standards are by this time present. Furthermore, having qualified and skilled personnel can be crucial to understand the problems about lice. It is conceivable that Rauma Group is enjoying the ownership by SalMar on this issue. For example, if Rauma Group has difficulties to recruit professionals within the field of, they might benefit from its owners.

#### **Fish escapes**

Regard to fish escapes it is important that the equipment being used is in shape and of high quality. The personnel must also be qualified and skilled to work with processes at sea in order to minimize the chance of fish escapes. As previous examined the main reason of fish escapes are due to farm failures. This implies that equipment and personnel are important factors.

#### **Planning failures**

As for the two previous events, the personnel are a crucial aspect for Rauma Group in terms of planning. Based on a set production rate due to regulations, 8\*780 MTB, it can be argued that it is important for Rauma Group to have production planners that are reliable, but also flexible to change the planning as a reactive response.

Another important aspect is IT security. Operating in a market with tense competition and fluctuating profit margins, Rauma Group has to be aware of new technological threats. Important and sensitive information can be lost through hacking.

### *Responding to events*

Proactive actions to limit the damage if a risk event should occur can help Rauma Group to save money, and also recover back to normal business as fast as possible. Proactive actions

include aspects of preparation, response, recovery and business resumption and testing, training and plan maintenance.

According to Waters (2011), Rauma Group can examine the supply chain and do studies where they remove different important parts to see how the supply chain will react. An example can be if Rauma Group constructs a disruption regard to supply of feed.

In this scenario, they may discover where the weak links are, and where to put in effort.

The last process of risk treatment is concerned to *continuing business operations while recovering from events*. This can also be known as business continuity management.

Business continuity management aims to ensure that operations work normally (Waters 2011). The process takes base to be proactive in order to manage to produce even if an event has occurred. A typical example is the Nokia/Ericsson-fire case from the U.S. in the early 2000s. A huge fire struck a microchip manufacturer that supplied both Nokia and Ericsson. While Nokia immediately responded by changing their suppliers and even re-engineered phones to adapt other suppliers' microchips, Ericsson chose to be patient and wait the fire out in hope for the event to go quickly over. However, this did not happen, and Ericsson lost a lot of money and failed to recover in the mobile competition thereafter. A way for Rauma Group to avoid ending up in a situation like Ericsson, can be to exploit several suppliers, and not commit to sole sourcing. As the analysis has explored, feeding, the main strategic item is supplied from three sources. The 3PL regard to transportation may be another aspect that Rauma Group can use several suppliers.

#### **4.4 Cost drivers of Rauma Group**

As a limitation due to insufficient information, this value chain analysis assumes the value chain is as effective as it can be. However, some of the cost drivers will be discussed, as they seem appropriate regard to supply chain risks and the aspects of risk assessment, purchasing and uncertainty. Previously described in the chapter of theory, controlling the cost drivers can give competitive advantage.

<b>Cost driver / Field</b>	<b>Risk assessment</b>	<b>Purchasing</b>	<b>Uncertainty</b>
<b>Economies of scale</b>			
<b>Linkages between activities</b>			



<b>Business unit relationship</b>			
<b>Level of vertical integration</b>			

Table 9 Analysis of cost drivers.

**Economies of scale** are advantages that can be a result of purchasing. It assumes that the unit cost of input decreases when the purchase of units increases (Baumol and Blinder 2009). Feeding can be an appropriate unit to consider the possibility of economies of scale. It can be argued that the more Rauma Group purchases of feed, the more will the unit cost of feed decrease. On the other hand, today Rauma Group does not practice with inventory of feed. Therefore it can be seen as a trade off between cost and benefit in terms of the gain of building inventory to achieve economies of scale.

Based on the fact that the production sites of Rauma Group are localized at different places in the Møre and Romsdal County, it can be expensive to build either a centralized warehouse or several smaller inventories. These considerations of localization will also be a trade-off between cost and benefit, and therefore, the way Rauma Group are operating today seems to be the most appropriate.

**Linkages between activities** deal with how the different activities in the value chain impact each other. This means, if Rauma Group decides that they want to build inventory or introduce new production technology, it can impact the other activities in a negatively way. Building inventory of feed may in the short run give a profit of economies of scale, but in long run reduce the quality of feeding. It also might lead Rauma Group to miss out new improved feeding because they have to use from inventory.

On the other hand, introduction of new technology can give cost advantages in several activities as operations-, outbound logistics, and HR. In the operation activities, Rauma Group may experience increased efficiency. Increased efficiency in operations may enhance efficiency at the outbound logistics activities, which in turn results in reduced need for personnel.

What seems to be related to both examples of introduction to new technology and procurement of feed is that they relate to different activities. In terms of supply chain risks, this implies that when determining risk-mitigating strategies, the factor of linkage between the different activities have to be taken account for.

**Business unit relationship** concerns in this case study the possibility of synergy between the different subsidiaries of Rauma Group.



Figure 26 Value chain Rauma Group.

Examples of synergy-activities that may be current for Rauma Group can be regard to procurement of equipment that can be shared by the different subsidiaries. Training of personnel through deployments at the different business units may also be an area where Rauma Group can experience synergy. It can be argued that relationships between the business units reduce uncertainty in terms of better information flow and increased knowledge and control over the value chain. However, it is reasonable to believe the consequence of sharing and enhancing synergy effects can be increased overall costs due to coordination and an enlarged administrative department.

The last cost driver is related to the **level of vertical integration**. This factor can be relevant towards risk assessment and uncertainty as it covers topics of what Rauma Group should produce in-house and what activities they can outsource.

Today, Rauma Group is vertical integrated all the way from producing eggs from their own strain, until production and sales. However, the activities concerning transportation and feeding are outsourced.

The more vertical integrated a company are, the more control the company have over its activities, which also is more costly. This implies that the level of integration is a cost / benefit issue for Rauma Group.

The remaining activities such as transportation and feed production are important activities for a fish farmer. However, when it comes to transportation, it may be way to expansive for Rauma Group to cope with this, whether they choose to focus on only internal transportation or external transportation. It will require huge investments, not only in the

equipment itself as trucks and/or well-boats, but also a significant increase in personnel. In that respect, this alternative seems unrealistic.

The other option, integration of feed production may be more realistic. Rauma Group, or SalMar, can benefit of acquire shares in a producer. They will not necessarily need to increase the overall number of personnel, or change their routines. Securing control over feed supply may be the strongest argument in this case. Rauma Group may also benefit in terms of gaining potential profit from the supplier, or loss on the other hand.

## 5 Conclusion and recommendations

Based on the part of analysis, there are several recommendations that can be suggested to Rauma Group.

Some of which are concerned to the risk events itself, while others are in the way of organizing and operating the firm. The research questions of “where in the supply chain do the risks occur”, “why do risks occur”, “what measures should Rauma Group utilize to mitigate its supply chain risks”, and “how does the vertical integration of the supply chain affect the company towards supply chain risk management” seems to have been examined. In summary, one can say supply chain risks for Rauma Group occurs because of the complexity of the environment and supply chain risks occur at the whole of supply chain, but Rauma Misund and the issues about feed distinguishes itself. Furthermore, the level of integration can be seen as an advantage in terms of control, but disadvantage to costs. Several suggestions of mitigating strategies have been discussed, but the ones pointing most out will be described later in this chapter.

### **Purchasing:**

The aspect of purchasing will cover recommendation in terms of feeding.

Rauma Group is expiring a supply chain environment that can be recognized with high supply risk and high demand risk. According to Manuj and Mentzer (2008) the different strategies that might be appropriate for Rauma Group operating in a  $S_H D_H$ -environment are:

- Hedging
- Vertical integration – backward and forward
- Security
- Avoidance – type 2

Based on the analysis and supply chain environment, it can be concluded that Rauma Group should exploit strategies of hedging, vertical integration, security and avoidance type 2.

Rauma Group can exercise hedging by utilize multiple sourcing of suppliers and increase stock of feed, so that an event does not need to disrupt the supply of feed. As been examined in the analysis, Rauma Group practices with two suppliers of feed, but does not

maintain larger inventories of feeding. The use of multiple sources corresponds with solutions from Kraljic (1983) and Chopra and Sodhi (2004).

Still the feed costs have increased the last three years, as seen in figure 14, it can be suitable for Rauma Group to continue the way of operating today. A different suggestion of building inventory can be to build and maintain supplier relationship. With this follows the possibility for Rauma Group to be able of fast deliveries of feed if an accident or disruption of supply should occur.

Another possible strategy is, as discussed, integrate and acquire direct into a supplier. This can be an alternative if the price of feed increases or the supply becomes more difficult and complex. However, today it does not seem natural that Rauma Group with its size is able to acquire and integrate with a supplier of feed. Thus, if SalMar acquires a supplier, it is likely to believe that Rauma Group will enjoy benefits of this.

When it comes to security strategies, the main threat may be concerned to sabotage from environmentalists or that the information systems are being hacked. In terms of sabotage, Rauma Group's sites are located at sea and the access is rather difficult to reach. However, monitoring systems and cameras can be installed to survey the facilities, but will not have any direct impact if someone wants to sabotage the sites.

According to hacking, vital company information as production plans, sales, and contracts are examples of information that can be valuable for competitors. In addition, since SalMar is a listed company on the Oslo Stock Exchange, access to the IT-systems can be attractive. In that respect, Rauma Group should have strong focus on IT-security measurements. This can range from e-mail settings on mobile phones to limiting permission on the computers. Having a competent IT-department may also be a good investment.

Regarding the avoidance strategy type 2, Rauma Group has to work trying to reduce the likelihood of disruption of supply as far as possible. It is not possible to eliminate the risk entirely, but implementing the measures discussed above can reduce it.

Towards feeding, SalMar and Rauma Group should continue to diversify the purchase of feed. In addition, Rauma and SalMar should build relationships towards its strategic suppliers within feed in order to reduce supply disruptions. Diversifying the procurement to more than one supplier can also reduce supply risk in case of unforeseen events at the supplier. A diversified supplier portfolio can lead to a continuous improvement of the

products in terms of competition between Skretting, Ewos and Polarfeed. It might also result in reduced costs as the suppliers are played against each other.

Therefore, it seems like Rauma and SalMar are utilizing a wise approach.

### **Summarized purchasing:**

It seems that Rauma Group is doing many things right in relation to procurement, but two mitigating approaches can be exploited:

- Build and maintain relationship with suppliers
- Keep focus on IT-security

### **Uncertainty:**

Regard to uncertainty, the base of recommendation is to utilize the framework of uncertainty circle. In the part of analysis and discussion, the subsidiary of Rauma Misund has been examined, and this is also the unit that will be the link in this chapter.

Rauma Misund relies on mainly two sorts of suppliers concerned to raw material. One sort of raw material is feeding, and the other is smolt. As already been discussed, the suppliers of feed are Ewos and Skretting. The suppliers of smolt are Rauma Sætre and Rauma Eik. In order to reduce the uncertainty regard to its suppliers, the uncertainty circle implies to implement similar measures as regard to purchasing, namely building relationship. In this, information sharing is an essential part. Information sharing can be exercised by linking ERP-systems together with each other. In terms of purchasing, Rauma Misund and its suppliers can develop systems that allow them to place automatic orders of for instance feed. By doing this electronically, the level of uncertainty towards suppliers can be reduced.

When it comes to the control aspect of uncertainty, Rauma Group can exploit the use of Decision Support System. This should give them better basis of important decisions. Operating in a competitive environment, with large quanta of materials both in terms of fish, smolt, roe, and feed, a decision support system can be a helpful tool controlling inventory and production overview.

The demand aspect can be reduced, as for the suppliers, by information sharing. It is likely to believe a consequence of information sharing can lead to more accurate and precise

orders, and less wrong orders if the orders are executed through an information system opposite to a verbal deal. Rauma Group may also experience more satisfied customers if they get access to production data. The customers may also get an opportunity to trace the fish back to its roots if they get this kind of information. Postponement is another way of reducing uncertainty concerned to demand. As earlier discussed, there are two different types of postponement, form postponement and time postponement.

Since Rauma Misund operates with a product that maintains a higher price the more fresh it is, it does not seem natural to exploit time postponement. In addition, the MTB allowance of 8\*780tons production supports the problem with time postponement. If Rauma Misund postpone delivery of fish to Vikenco in order to reduce demand uncertainty, they are still not allowed to produce more, so it will turn to loss in sales and increased costs anyways. Form postponement is the other way of postponement. This concerns as discussed earlier with packing, labeling, and product. In the case of Rauma Misund that produces for Vikenco, the main product is salmon ready for harvesting. Therefore, it seems unnatural with form postponement as well.

Furthermore, Rauma Group might try selling more gutted fish directly to its customer without processing, in order to reduce uncertainty at Vikenco.

Introducing the production philosophy of lean can reduce the last aspect of uncertainty to manufacturing. Lean is a way of thinking, but also includes tools that can be implemented in the organization. What may seem the issue at Rauma Group, and Rauma Misund, is their way of operating with focus on low inventory and reducing waste on their sites. They are not actively working with lean in mind, but still practices lean principles. With lean being a way of reducing waste, in order to reduce costs, it may seem appropriate for Rauma Misund to implement this philosophy. However, changing the way of operating can be costly, so it has to take base on a cost / benefit analysis.

### **Summarized uncertainty:**

Mitigating actions to reduce uncertainty at Rauma Misund:

- Implement decision support systems
- Build relationship with suppliers/customers and develop IT-systems (ERP) that speaks with each other
- Introduce lean philosophy, if it pays off

### **Risk assessment and risk management:**

The analysis of risk assessment and risk management process has revolved the current concerns for a fish farmer as Rauma Group to be related to outbreak of lice and fish escapes. In addition, the risk event of planning failure has been discussed. The SWOT analysis has revealed areas that Rauma Group can bear in mind when considering new strategies. The analysis of the external environment showed that there are several aspects that Rauma Group can approach.

- Corporate social responsibility (CSR) with aim to improve industry image
- Work with research and development

The 5-step risk management process concerns several of the topics about purchasing and uncertainty, and focuses on these aspects combined should lead to reduced costs for Rauma Group.

It is quite clear that Rauma Group is aware of and has routines regarding the findings in this thesis. One might believe that the actors in the fish farming industry is more concerned about risk events compared to other industries because of the large amount of money involved and certainly because of the biological issues. An outbreak of lice can lay an area intended for fish farming in fallow. An escape will not result not only in loss of sales, but can also create biological changes in the natural habitat if wild and farmed salmon mixes, which in turn might make even stricter regulations and harder to gain licenses.

The cost drivers that are present for Rauma Group should be addressed and worked to reduce. Rauma Group should utilize the risk management process and work to address and identify the risk events they feel are present. Each subsidiary of the Rauma Group can have unique events that are present; therefore, this is something that should be exercised at all members.

### ***5.1 Suggestion for further research***

To give more concrete suggestions of approaches to how Rauma Group can reduce its costs, it could be interesting to examining the different subsidiaries in more detail. Case studies of Rauma Group or other fish farmers that includes more observation of processes



actually going on, will give a broader insight in actions that can improve the overall production.

It would also be interesting to compare different fish farmers and see if there is difference in perceived risk events, differences in how to reduce uncertainty and if different farmers have different strategic items in terms of purchasing.

Since much of the results in this thesis take basis on qualitative and theoretical assumptions, it could be exciting to have a quantitative view on the industry, where the research could calculate on different cost/benefit issues.

Other ways of producing fish could also be an interesting study. Here, it is particularly to think about onshore farming.

## **5.2 Limitations**

The thesis has some limitations. To cover a company that has five large subsidiaries, with each of its own business areas has been more extensive than anticipated. Therefore, the thesis has tried to see supply chain risks in a broad overview covering the whole of Rauma Group. Each of the subsidiaries should be examined and examined individually in order to achieve the best possible outcome, which has not been possible within the time frame of this thesis.

It has also been difficult to get actual information about the company studied. This has resulted in more use of secondary data compared to what was expected before the work on this thesis commenced. This gives a limitation since the data presented in this thesis may not be accurate for the current situation for Rauma Group.

Furthermore, it has been challenging to write a master thesis about an industry that is heavy regulated, and consequently does not mainly produce depending on market demand, but on access to production licenses.

In addition, as SalMar owns 75% of Rauma Group, and they are doing much of the overall strategic decisions, the Rauma Group has limited possibility to decide on supply chain risk mitigation strategies themselves, and thus most of the discussions can be viewed as hypothetical.

## 6 Bibliography

### 6.1 Internet

12manage (2012). "Kraljic model." Retrieved 27/1-2012, 2012, from [http://www.12manage.com/methods\\_kraljic\\_model.html](http://www.12manage.com/methods_kraljic_model.html).

Akvafakta - <http://akvafakta.fhl.no/category.php?categoryID=16>  
Online, C. D. (2012). Retrieved 7/2, 2012, from <http://dictionary.cambridge.org/dictionary/business-english/sub-optimization>.

Bellona (2009). "Causes and liabilities." Retrieved 28/3, 2012, from [http://www.bellona.org/aquaculture/artikler/Escape\\_causes](http://www.bellona.org/aquaculture/artikler/Escape_causes).

Directorate of Fisheries (2010). "Statistikk fra akvakultur." Retrieved 12/3, 2012, from <http://www.fiskeridir.no/statistikk/akvakultur>.

Ministry of Environment (1999). "Lakselus – årsaker til økte forekomster og mulige konsekvenser på villfisk." Retrieved 23/3, 2012, from <http://www.regjeringen.no/nb/dep/md/dok/nou-er/1999/nou-1999-09/17.html?id=352418>.

FAO (2011). "Meeting growing demand for fish." Retrieved 23/5, 2012, from <http://www.fao.org/news/story/en/item/94232/icode/>.

FAO (2012). "Milestones In Aquaculture Development." Retrieved 12/2, 2012, from <http://www.fao.org/docrep/field/009/ag158e/AG158E02.htm>.

Finance-lib (2012). Retrieved 7/2, 2012, from <http://www.finance-lib.com/financial-term-suboptimization.html>.

Fish.no (2010). "SalMar kjøper Rauma Gruppen." Retrieved 16/2, 2012, from <http://www.fish.no/oppdrett/2869-salmar-kjoper-RaumaGroup.html>.

Fisheries (2010). "Atlantic salmon and rainbow trout ". Retrieved 19/1, 2012, from [http://www.fisheries.no/aquaculture/aquaculture\\_species/Atlantic-salmon-and-rainbow-trout/](http://www.fisheries.no/aquaculture/aquaculture_species/Atlantic-salmon-and-rainbow-trout/).

Foreign Trade Online (2012). "Incoterms." Retrieved 17.jan 2012, 2012, from <http://www.foreign-trade.com/reference/incoterms.cfm>.

Hjeltnes, B. (2009). "Hvorfor gikk det galt i Chile?". from <http://www.njff.no/portal/pls/portal/docs/1/45215021.PDF>.

Kystmagasinet (2012). "Redusert verdi for norsk lakseseksport ". Retrieved 23/4, 2012, from <http://www.kystmagasinet.no/Nyheter/2012/Redusert-verdi-for-norsk-lakseseksport/>.

Lusedata (2012). "Informasjon om lus på laks i Norge." Retrieved 23/5, 2012, from <http://www.lusedata.no/Sider/Statistikk.aspx?sID=1>.

Northwestern University (2012). "Logic." Retrieved 7/2-2012, 2012, from <http://www.math.northwestern.edu/~mlerma/courses/cs310-04w/notes/dm-propositions.pdf>.

Ministry of Agriculture and Food (2011). "Verdikjeden for fangst, oppdrett, fisk og sjømat." Retrieved 16/2, 2012, from <http://www.regjeringen.no/nb/dep/lmd/dok/nou-er/2011/nou-2011-4/4/8/3.html?id=640194>.

Nilsen, G. B. and J. Grindheim (2011). "The World`s 30 Biggest Salmon Producers." Retrieved 13/5, 2012, from <http://www.intrafish.com/global/industryreports/article1256834.ece>.

Norwegian Seafood Council (2012). "Aquaculture in Norway." Retrieved 25/1, 2012, from <http://en.seafood.no/Sustainability/Aquaculture-in-Norway2/Aquaculture-in-Norway>.

Norwegian Seafood Federation. (2011). "Nøkkeltall for havbruk." Retrieved 17/2, 2012, from <http://www.fhl.no/sjoematfakta/noekkeltall-for-havbruk-article174-43.html>.

NTB (2012). "USA fjerner straffetoll på norsk laks." Retrieved 27.feb, 2012, from <http://www.aftenposten.no/okonomi/innland/USA-fjerner-straffetoll-pa-norsk-laks-6750118.html>

OECD (2006). "Glossary of Statistical Terms." Retrieved 17/2, 2012, from <http://stats.oecd.org/glossary/detail.asp?ID=23>

Regjeringen (2010). "Kursutviklingen for norske kroner." Retrieved 15/3, 2012, from <http://www.regjeringen.no/nb/dep/ad/dok/nouer/2010/nou-2010-04/10.html?id=603481>

Sintef (2009). "The Objective of Create." Retrieved 17/2, 2011, from <http://www.sintef.no/Projectweb/CREATE/About-CREATE/Objective/>.

Skretting (2012). "NuTrace". Retrieved 13/5, 2012, from <http://www.skretting.no/internet/SkrettingNorway/webInternet.nsf/wprld/79EFF725C54C0A74C12573EE0028A452!OpenDocument>

Spilde, I. (2005, 4/4-2005). "Hva er lakselus?". Retrieved 26/3, 2012, from <http://www.forskning.no/artikler/2005/april/1112356418.12>.

SSB (2012). "Fiskeri og havbruk." Retrieved 18/1, 2012, from [http://www.ssb.no/fiskeri\\_havbruk/](http://www.ssb.no/fiskeri_havbruk/).

Sved, B. (2011). "Tapte ti millioner på lakserømning." Retrieved 22/2, 2012. from <http://www.adressa.no/nyheter/okonomi/article1637876.ece>.

Aandahl, P. T. (2011). "Redusert verdi for norsk lakseeksport." Retrieved 9/2, 2012, from <http://www.seafood.no/Nyheter-og-media/Presse/Pressemeldinger/Redusert-verdi-for-norsk-lakseeksport>.

## 6.2 Articles

Aven, T.(2007). A unified framework for risk an vulnerability analysis covering both safety and security. Reliability, Engineering & System Safety, 92(6): 745-754.

Buckley, P.J. and Casson, M.C. (1998). “Models of the multinational enterprise”. Journal of International Business Studies, 29(1): 21-44.

Caniëls, M. C. J. and C. J. Gelderman (2005). "Purchasing strategies in the Kraljic matrix—A power and dependence perspective." Journal of Purchasing and Supply Management **11**(2-3): 131 – 145.

Chopra, S. and M. S. Sodhi (2004). "Managing Risk To Avoid Supply-Chain Breakdown." MIT Sloan Management Review **46**(1): 53 - 61.

Ghodsypour, S. H. and C.O'Brien (2001). "The total cost of logistics in supplier selection, under conditions of multiple sourcing, multiple criteria and capacity constraint." International Journal of Production Economies **73**(1): 15 - 27.

Harland, C., R. Brenchley, et al. (2003). "Risk in supply network." Journal of Purchasing & Supply Management **9**: 51-62.

Kraljic, P. (1983). "Purchasing must become supply management." Harvard Business Review: 109 - 118.

Lee, H. L., V. Padmanabhan, et al. (1997). "Information distortion in a supplychain: The bullwhipeffect  
" Management Science **43**(4): 546 - 558.

Lee, H.L. (2002). “Aligning supply chain strategies with product uncertainties.” California Management Review, 44(3): 105-119.

Mentzer, J.T and Firman, J. (1994). “Logistics control systems in the 21<sup>st</sup> century.” Journal of Business Logistics, Vol.15(1): 215-227.

Mentzer, J. T. (2008). "Global Supply Risk Management." Journal of Business Logistics **29**(1): 133 - 151.

Olsen, R.F, and Ellram, L.M. (1997). "A Portfolio Approach to Supplier Relationships." Industrial Marketing Management **26**, 101-113.

Roth, A. V., A. A. Tsay, et al. (2008). "Unraveling the Food Supply Chain: Strategic Insights from China and The 2007 Recalls." Journal of Supply Chain Management **44**(1): 22-39.

Staatsa, B. R., D. J. Brunnerb, et al. ( 2011). "Lean principles, learning, and knowledge work: Evidence from a software services provider." Journal of Operations Management **29**: 376 - 400.

Tang, C. S. (2006). "Perspectives in supply chain risk management." International Journal of Production Economics **103**: 451 - 488.

Upton, D.M. (1994). "The management of manufacturing flexibility." California Management Review, 36(2): 72-89.

### **6.3 Books**

Baumol, W. and A. Blinder (2009). Microeconomics: Principles & Policy, South-Western Cengage Learning.

Blanchard, D. (2007). Supply Chain Management Best Practices, John Wiley & Sons, Inc.

Christopher, M. (2005). Logistics and Supply Chain Management, Creating Value-Adding Networks, Prentice Hall.

David Simchi-Levi, P. K., & Edith Simchi-Levi (2004). Managing the Supply Chain, The McGraw-Hill Companies.

Hopkin, P. (2012). Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management. 2nd edition. " Kogan Page Publishers.

Johnson, F., M. Leenders, et al. (2011). Purchasing and Supply Management, The McGraw Hill Companies.

Kersten, W. (2006). Managing Risks in Supply Chain. Berlin, Erich Schmidt Verlag.

Mentzer, J. T. (2001). Supply Chain Management. Thousand Oaks, California, Sage Publications.

Porter, M. E. (1985). Competitive Advantage. New York, Free Press

Waters, D. (2011). Supply Chain Risk Management: Vulnerability and Resilience in Logistics, Kogan Page Limited.

Yin (1994). Case Study Research: Design and Methods, Sage Publications, Inc.

Yin (2003). Case Study Research: Design and Methods, Sage Publications, Inc.

#### **6.4 Reports**

Claude, M., J. Oporto, et al. (2000). The Inefficiency of Salmon Aquaculture in Chile: Social, Economic, & Environmental Aspects. F. Terram. Santiago.

SCRLC. (2011). Supply Chain Risk Management: A Compilation of Best Practices.

#### **6.5 Newspaper article**

Nyheim (2012). Euro-appetitt på laks. Dagens Næringsliv: 16<sup>th</sup> of May 2012. Page 19.

## **6.6 E-mail**

Rune Martens. Rune.martens@skretting.com. Et lite spørsmål rundt styrket kronekurs / førkostnader oppdrettsindustrien. 15th March 2012.

## **6.7 Interviews**

Conducted 21<sup>st</sup> and 23<sup>rd</sup> of February 2012.  
Ingjarl Skarvøy, CEO, Rauma Group.  
Kristen Heggem, Sales Manager Vikenco.



## 7 Appendix

### 7.1 Appendix 1. Presentation SalMar 2011.

Vikenco AS

10.02.2011

Vikenco AS (1985)



## Eiere

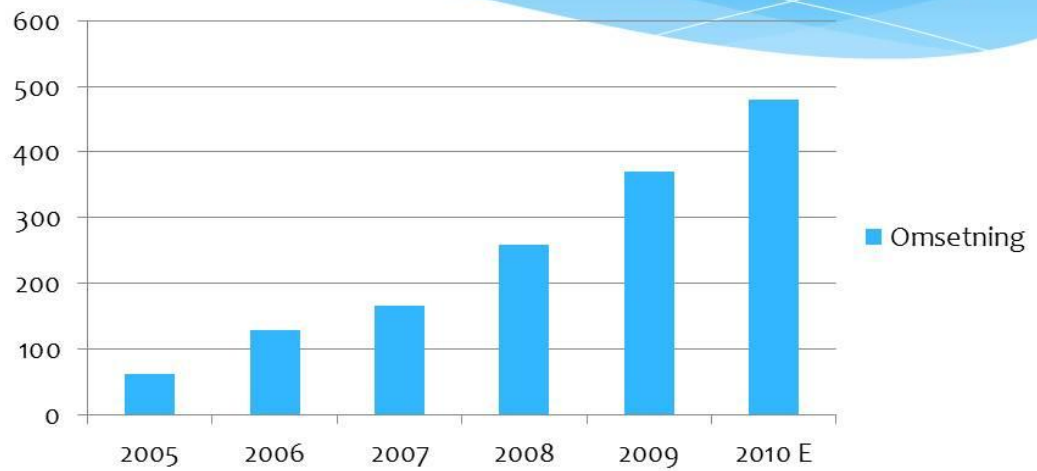
* RAUMA GRUPPEN AS		51,00 %
* SalMar ASA	75 %	
* Finansielle inv	25 %	
* Romsdalsfisk AS		49,00 %
* Jonny Småge	35 %	
* Per Olav Mevold	35 %	
* Kristofer Reiten	30 %	

## Regnskap

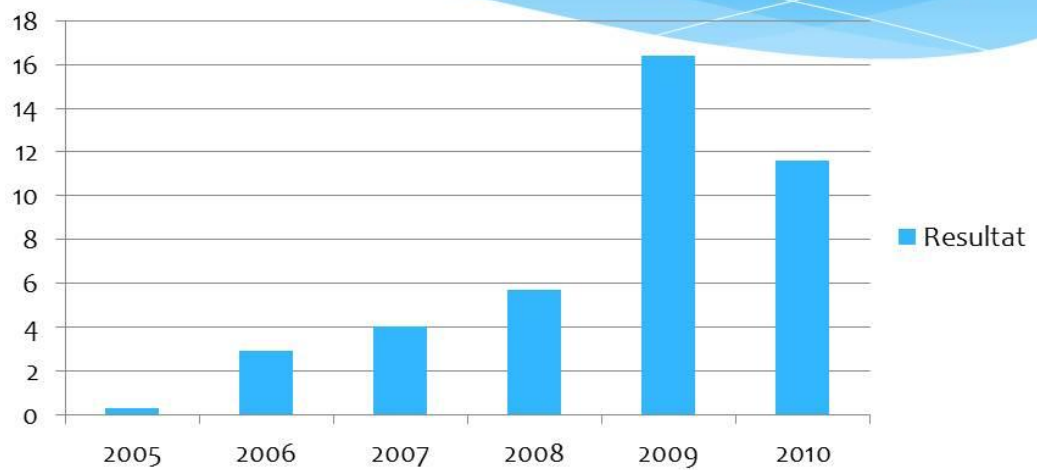
	<u>2009</u>	<u>2010</u>
* Omsetning	371,9 mill	475,2 mill
* Driftsres.	16,7 mill	11,5 mill
* Resultat f.s.	16,4 mill	11,6 mill
* EK	12,9 mill	*22,4 mill
* EK andel	24,6 %	*32,2 %

\* (EK er anslagsvis trukket 3 mill mht skatt)

## Omsetning - mill



## Resultat - mill



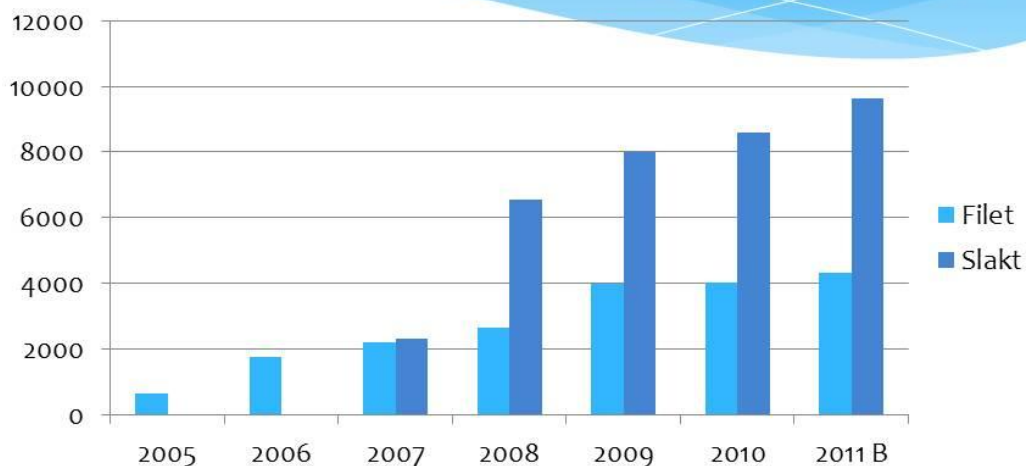
# Budsjett 2011

* Omsetning	490,8 mill	
* Resultat f.skatt	3,8 mill	
* Slaktet vekt	9.620 tonn	
* Eksternt kjøp	1.190 tonn	
* Sum	10.810 tonn	
* Til filet	7.050 tonn	= 4.320 tonn filet

7



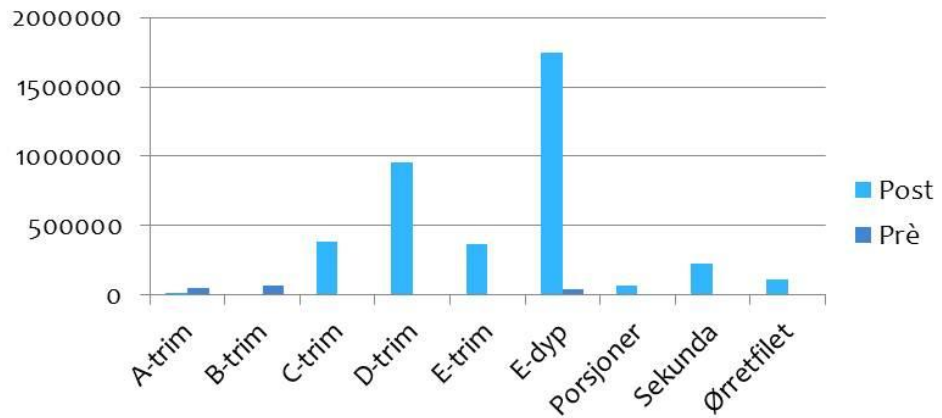
## PRODUKSJON I TONN



## Nøkkeltall

	2009	2010
<b>* Slakt (sløyd vekt)</b>		
* Rauma	6.600 tonn	7.320 tonn
* Øvrige	1.400 tonn	1.240 tonn
* <b>TOT</b>	<b>8.000 tonn</b>	<b>8.560 tonn</b>
<b>* Kjøp isopor/bil</b>		
* Laks	1.250 tonn	1.510 tonn
* Ørret	750 tonn	175 tonn
* <b>TOT</b>	<b>2.000 tonn</b>	<b>1.685 tonn</b>
<b>* Filet , råvare</b>	<b>6.377 tonn</b>	<b>6.551 tonn</b>
<b>* Filet, produktvekt</b>	<b>3.950 tonn</b>	<b>4.020 tonn</b>
* Snitt utbytte	61,95 %	61,40 %

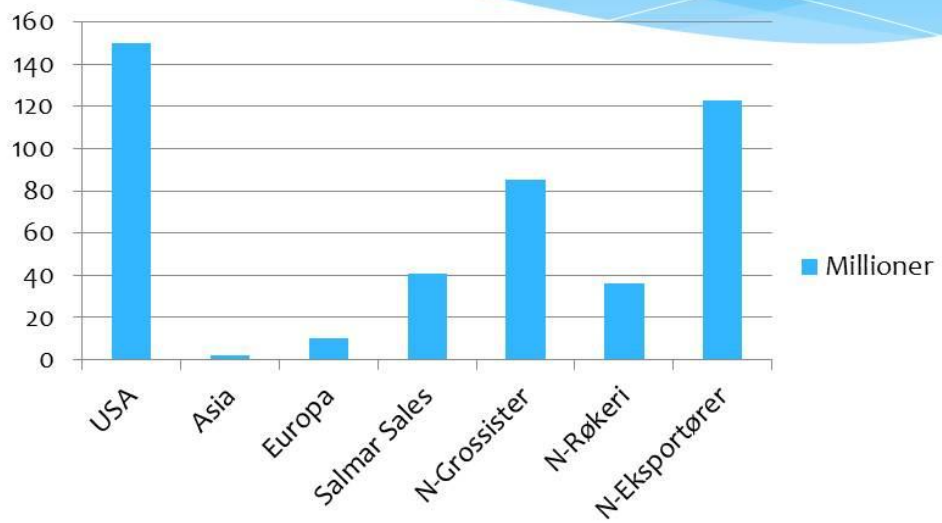
## Produktfordeling 2010



11

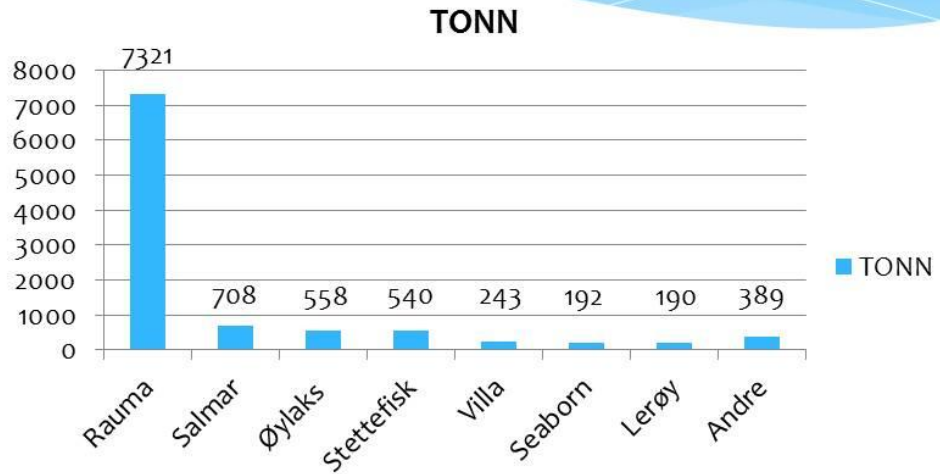
## Marked 2010

Millioner



12

# Kjøp 2010



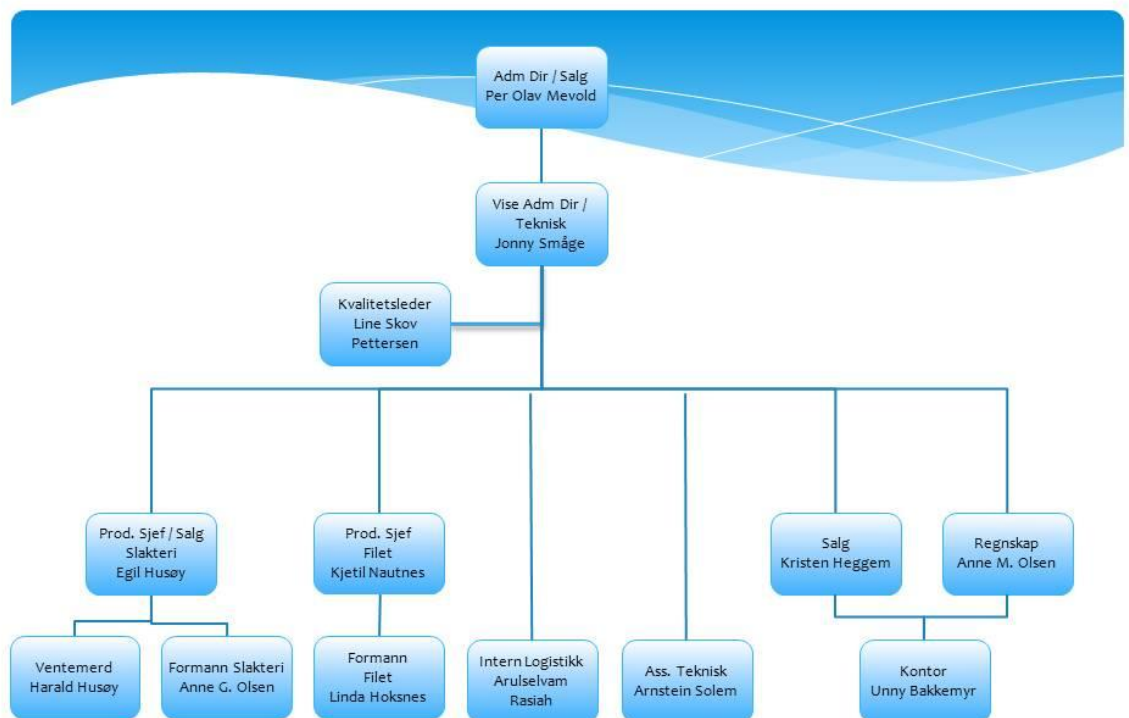
13

# Råvarepriser Vikenco 2009-2011



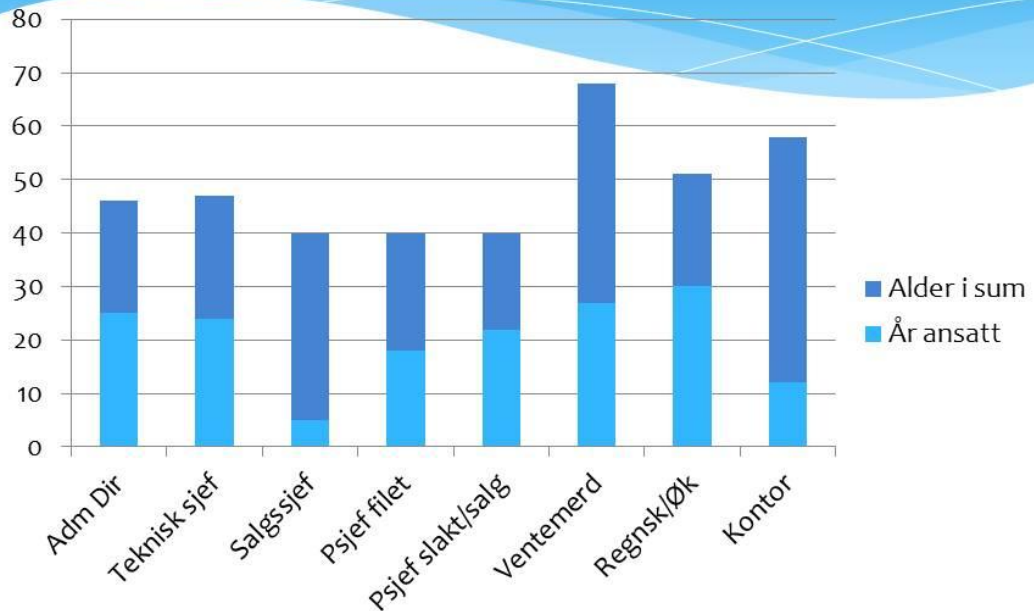
# Personal

- \* Totalt 68 ansatte
- \* 35 innleid fra Litauen





## Ansiennitet og alder



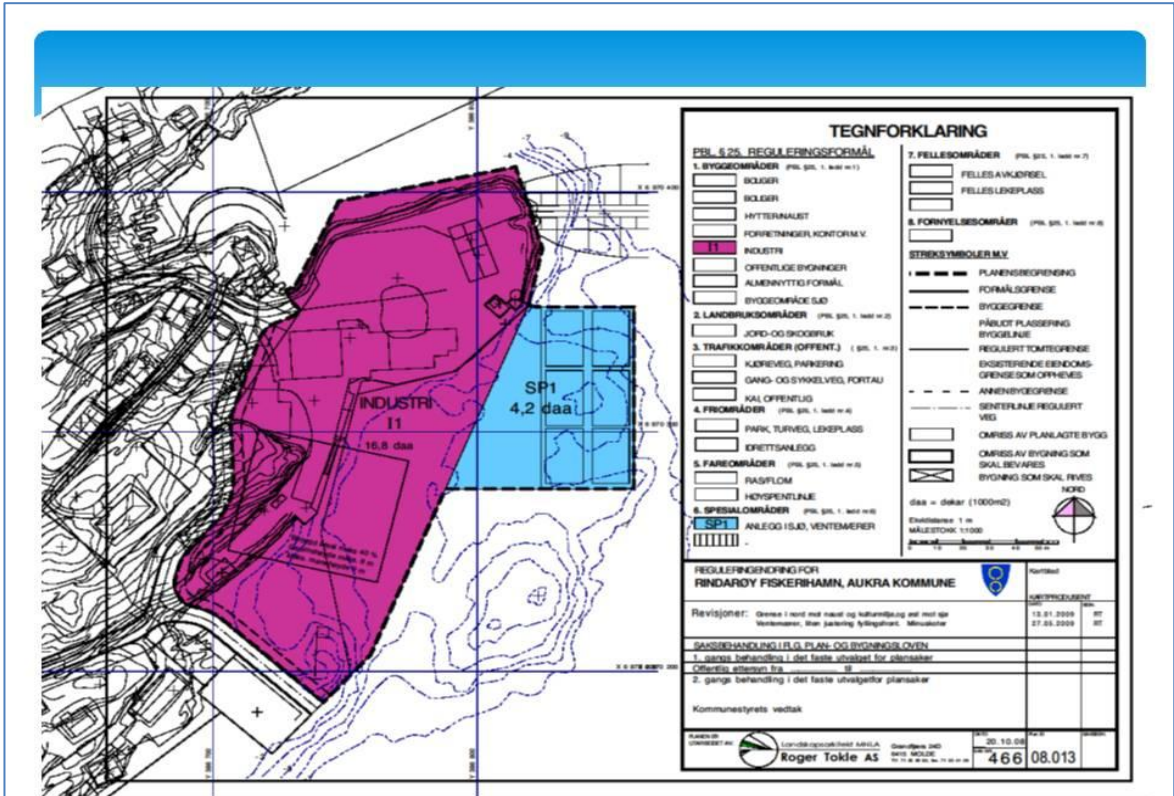
## Investeringsplaner

### Vedtatt:

* Ventemerdder, utlegging	1,6 mill
* Lagerhall	0,8 mill (1,3 mill)
* Vakuum anlegg filet	0,3 mill
* Ventilasjon filet	0,3 mill

### Forestående:

* Avfallshåndtering	0,5 mill
* Låssystem	0,1 mill
* Inngjerding mot sjø	0,1 mill
* 400 V	0,3 mill
* Isanlegg	2,5 mill
* Brunkjøtt fjerner	0,8 mill
* Utblødingstank	1,0 mill
* Bløggesystem	2,0 mill
* RSW slakteri	1,0 mill
* Lokkpålegger	0,8 mill
* Utvidelse tomt i sjø	4,0 mill
* Ny prod.hall 3000 m2	40,0 mill



## 7.2 Appendix 2. Standard Agreement



Høgskolen i Molde

### STANDARD AGREEMENT

This agreement is between

FREDRIK OLSSON.....(Student(s)).

PROF. SVEIN BRÅTHEN (Faculty Advisor at Molde University College),

RAUMA GRUPPEN..... (Company/Institution),

And Molde University College/MSc Logistics Program Coordinator, concerning the use of specifications and results reported in the Master's degree thesis in accordance with the study plan for the Master's degree program in Logistics at Molde University College.

1. The student will complete the work assigned for the Master's degree thesis in cooperation with the company/institution RAUMA GRUPPEN (Optional):.....

The title of the thesis is: SUPPLY CHAIN RISK MANAGEMENT IN THE AQUACULTURE INDUSTRY - CASE STUDY OF RAUMA GROUP

2. The student has copyrights to the thesis. Those copies of the thesis submitted for evaluation along with descriptions and models, such as computer software that is included as part of or as an attachment to the thesis, belongs to Molde University College. The thesis and its attachments can be used by the College for teaching and research purposes without charge. The thesis and its attachments must not be used for other purposes.

3. The student has the right to publish the thesis, or parts of it, as an independent study or as part of a larger work, or in popularized form in any publication.

4. The company/institution has the right to receive a copy of the thesis with attachments, and the College's evaluation of it. The company/institution will have three (3) months from the time the thesis is submitted to the College for censoring to determine whether a patent is possible and to apply for a patent for all or part of the results in the thesis. The specifications and results in the thesis can be used by the company/institution in its own activities.

5. An additional confidentiality agreement may be entered into between the parties, if the company/institution sees this as necessary.

6. Each part of the agreement should have one copy of the agreement. The final signature should be from the Program Coordinator/Dean validating the agreement.

Place MOLDE.....

Date of final signature 29/5-12.....

Fredrik Olsson  
Student(s)

Svein Bråthen  
Faculty Advisor

Rauma Gruppen  
Company/Institution

Ellen Ohn  
Program Coordinator / Dean

### 7.3 Appendix 3. E-mail confirmation Ingjarl Skarvøy

Rauma Gruppen:

- Før står for 50-60% av kostnadene  
OK
  - Benytter seg av EWOS og Skretting som forleverandører  
Også Polarfeed inne nå.
  - Strategisk innkjøp av før og risikostyring blir håndert sentralt av SalMar  
Ja
  - RG kan produsere 780MTB  
RG har 8 x 780 tonn MTB
  - RG produserer ikke bevisst etter Lean filosofi  
OK
  - RG produserer etter lisens og ikke først og fremst markedsetterspørrel, det er viktig for RG å kunne tilby markedet med fisk.  
Det er viktig for RG og tilby våre kunder fisk året rundt.
  - RG har fokus på risikostyring i hele verdikjeden  
OK
  - største risikomomenter (kostnader) er knyttet til lus og rømming og sykdom
- 
- Lus og rømming er nesten umulig å beskytte seg mot  
Det jobbes kontinuerlig med å unngå rømming og å holde lusenivået på et lavt nivå.
  - Informasjonsflyten mellom de forskjellige datterselskapene er "så som så". Markedsinformasjon fra Vikenco blir ikke oppdatert oppover i verdikjeden (Rauma Misund/Sætre/Eik/Stamfisk) gjennom f.eks intranett og ukentlig e-post oppdateringer.  
Det er god informasjonsflyt mellom datterselskaper. Produksjonen styres i stor grad av pålegg og rammebetingelser gitt av myndigheter.
  - RG har ikke nært samarbeid med sine leverandører, mer et "profesjonelt" forhold  
Har et godt og profesjonelt forhold til sine leverandører.
  - RG har likt informasjonssystem (ERP) hos de forskjellige datterselskapene  
OK
  - RG har en produksjonskostnad på ca 18/kg  
Ønsker ikke å si noe om det. 18/kg er unyansert (rund, sløyd, ved not, eller i kasse)
  - Høykvalitetsfør er dyrere, men gir også bedre produksjon (laksen tar opp mer av føret og trenger mindre)  
OK
  - Rauma Misund produserer først og fremst til Vikenco  
Slater all fisk hos datterselskapet Vikenco
  - RG deler ikke ERP/informasjonssystem med sine leverandører  
OK