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The role of information technology to facilitate the movement of containers: the experience of Yara North America and their container operation

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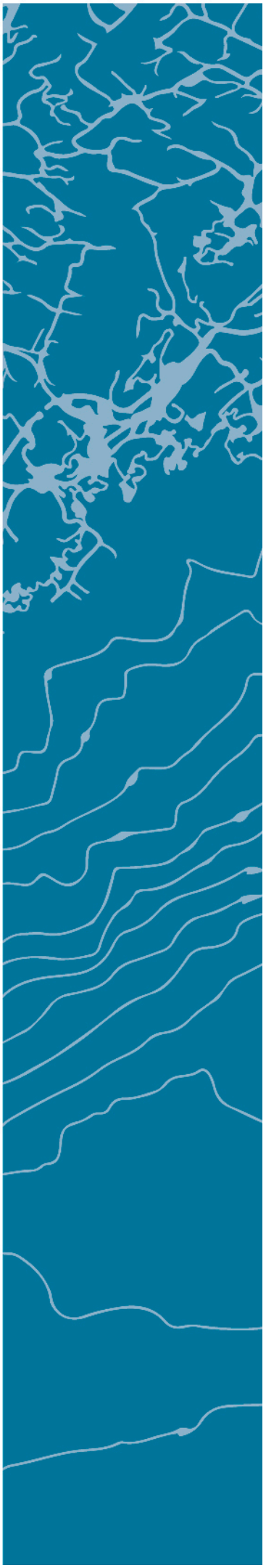

Acknowledgments

This master thesis is written as the final part of my study at the University of Agder, faculty of Business and Law, studying Business Administration. The thesis is a compulsory part of the program, and accounts for 30 credit points. This study has been conducted individually.

I would like to express my gratitude to the people that have contributed to this thesis. My supervisor – Naima Saeed with her knowledge and advices has been helpful in the process of writing this thesis.
Second the company I have conducted interviews with – Yara International ASA. A special thanks to the Yara´s North America office in Tampa for their time and eagerness to explain the container process and the new system they are working on implementing, to improve the information flow. In addition I would like to thank the production site in Porsgrunn that has explained how the container operation is from production site to customer.
At last the support of friends and family has been of great help.

This study has been interesting, to get the view of how a large Norwegian multinational company with large supply chain operation perceives technology and how they are implementing new information technology to improve their business towards customers in North America.

It has also been a challenging process, but looking back I have learned a lot about supply chain operation in a large Norwegian multinational company.

Kristiansand, 30/ 11- 2017

Line Tangvald

Abstract

Yara International ASA is a large multinational fertilizer company that utilizes containers to transport some of its product portfolio worldwide. This study has evaluated the importance of information flow around the container operation and in particular how the North American office is utilizing new technology to give even better information towards customers when it comes to their supply chain and their container operation.

The study has a qualitative approach and the data collection method was conducted with interviews. In total five individuals were interviewed with knowledge and experience of the container operation and the role of information technology in facilitating the movement of Premium Products in containers. The office in Yara North America is at a starting phase of a new tracking solution for containers. They were mainly asked about the current information situation surrounding containers as well as the container operation in general as perceived from the North American perspective. The production site in Yara Porsgrunn described how the container operation from production site to customers was organized from receiving order from a market to actually sending the container towards the market.

The thesis is basically describing the situation as of today with the current information system and technology surrounding the container operations, seen from Yara North America's perspective. Then it goes on to describe the potential benefits of a new and more advanced information technology system – the implementation of Ocean Insights that the North American sales and marketing office is currently implementing.

The study has brought forth findings and recommendations as to if the new tracking solution should be integrated into other geographical sales and marketing units in the company.

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1.0 Introduction

Today there are 7,6 billion people in the world, and the population is expected to reach 9,8 billion by 2050 (United Nations, 2017). Due to this growth it is increasingly important to grow food with an efficient agriculture. In order to do so, fertilizer is one of the key answers to help with the effective and efficient growth of crops and fields, and as such Yara International ASA is one company that can help meet this future challenge with their fertilizer production.

Yara International ASA is one of largest fertilizer companies in the world and sells their fertilizer worldwide. The main transportation mode Yara utilizes when transporting fertilizers, is by ships. As the earth is covered by 70% water, this makes shipping by sea one of the most available alternatives of transporting finished fertilizer. The products are either transported in bulk vessels or in containers from the production sites. The container provides a flexible way of transporting the cargo, due to the ability to be transported by trucks, trains and ships. It is also a great way of penetrating and testing new markets, with potentially several products in one single container.

With the advancements in technology the world is shrinking, bringing people closer to each other, and the world has become smaller and more accessible. Companies has realized that in order to stay competitive implementing information technology in their daily operations is necessary. Information needs to be accurate, timely and complete and information technology has become a facilitator of integrating and improving the supply chain. To fulfill the requirements of the information need by the customers, tracking solutions is a possible technology that could assist with this. Tracking the products in the supply chain leads to a greater visibility of the supply chain. The information from the tracking solution is given in real-time and is helpful for both the producing company and their end customers. The company is in a position where they are able to follow the product through the whole supply chain and the customer will be assured that the product will arrive on time, and more important they are kept up to date with the most current and correct information.

Customers have become more demanding of information than before, as their expectations has risen over the past years. It is critical for companies to adhere to these new demands and expectations. Utilizing the latest developments in information technology, the coordination of the flow of information can be executed in an efficient manner by the companies, benefiting customers and the company themselves.

2.0 Problem statement and research question

Yara North America receives products from the production site in Porsgrunn and other productions sites worldwide. The Premium Products that generates the highest profitability in the North American market are high in demand. These products are transported in both bulk vessels and in containers. As the Premium Product segment transported in containers has grown over the last years for the office in North America – they have an interest to improve the container operation and specifically the information flow around the container operation. Customers has become more focused on that their product arrives at time and their expectations are higher than before. With tracking it is possible for both the company and customers to follow the product through the whole supply chain, and with good tracking solutions also information quality will be increased. This is a process that third party logistics providers usually provide, and this service has been provided by the individual container shipping lines for Yara North America's container operation. The case is that Yara North America has gone from tracking on multiple websites of the container lines that they use when transporting their products, to one single website – Ocean Insights. They believe that this will give even better and more accurate information towards customers, while also improving the overall container operations.
So, the main focus of this paper is:

"The role of information technology to facilitate the movement of containers: the experience of Yara North America and their container operation"

The main objective of this research is to explore and analyze the role an implementation of a new information tracking technology - Ocean Insights - will have on facilitating the movement of containers. To address this issue Yara International ASA was selected as a company, this was in order to get the experience of how a company perceives information in

their supply chain. Ocean Insights provides a service of tracking containers and additional information about the container operation. The main research question is:

How will the implementation of Ocean Insights improve the operation in the container supply chain of Yara North America?

Sub- questions are developed on the basis of the main research question. The sub-questions are formulated into five questions, which are narrower in regards to topics that will be discussed and analyzed in this thesis. Together these sub- questions will answer and highlight the different topics related to the main research question.

1. How is the container operation from the production site in Porsgrunn to the market in North America operated today?
2. How has Yara North America experienced the information of tracking containers?
3. Will the implementation of Ocean Insights improve the satisfaction of Yara North America and the end customers?
4. How will the implementation of Ocean Insights improve the internal handling of container information in Yara North America?
5. Is it feasible for a company such as Yara to invest in Ocean Insights?

2.1 Limitations

The theory is mainly focused on inter-regional transport, more in depth, - deep-sea transport. This is due to the main transportation mode that Yara transports goods are mostly by sea, and when it comes to North America this is deep-sea i.e. outside Europe. The other forms of transportation are recognized, however it will not be emphasized in great detail. Yara uses both bulk vessels and containerships in their supply chain, to transport their products from production site to customers.
Yara North America has implemented a new technology to enhance their tracking of containers. There is not much research found on the role tracking solutions has on supply chain management; however a tracking solution can be considered as a form of information technology, since it provides actionable information to both the shipping company and its customer.

3.0 Background

3.1 Yara International ASA

Yara has its roots from the industrial firm Norsk Hydro, founded in 1905 in Notodden. Norsk Hydro developed to be an industrial firm with activities within fertilizer, oil and alloy. The agriculture division was demerged to an independent company, and Yara International ASA was presented at the stock exchange in 2004 (Yara, 2017c).

Yara International ASA is a worldwide supplier of mineral fertilizer, contributing to help feeding the growing population of the world. The production of fertilizer in Yara International ASA is divided into Premium Products: YaraBela, YaraLiva, YaraMila, YaraTera and YaraVita and Standard Product: YaraVera (Yara, 2017a).

Figure 1 - Dry fertilizer (Yara, 2017a)

Partnering with retailers, distributers, customers and farmers worldwide to improve crop quality and nutritional value, optimizing yields and reducing the environmental impact on earth is how Yara is developing its business. Yara recognizes that soils, crops and climates are different and crops have different requirement to plant nutrition. Therefore within the 6 main brands there could be up to 50 different formulas adapted to a single crop requirement of plant nutrition.

Today the company has a worldwide presence with over 15 000 employees in over 60 countries and sales to over 160 countries. The headquarters is situated in Oslo (Yara, 2017a). There are in total six sales and marketing units – they are in North America, Latin America, Africa, Asia, Brazil and Europe.

The company`s vision is a collaborative society; a world without hunger and a planet respected, while their core values are ambition, curiosity, collaboration and accountability (Yara, 2017d).

Figure 2 - Yara International ASA logo (Google)

3.1.1 Yara North America

Yara North America is the North American market unit and this market unit is responsible for sales to the US and Canadian fertilizer customers. The office is located in Tampa, Florida and the company has been present in North America for 70 years.
Yara acquired a fertilizer plant in Canada in 2007 and this factory is mainly serving the Canadian market, with 1,5 million ton of fertilizer products. However, 10-20% of the production from the fertilizer plant in Canada is exported to the Northern part of North America (Minnesota, North and South Dakota).

Today there are 10 import terminals that are situated in America and Canada. These terminals are located on both the East and West Coast of the US and Canada, however they are not connected to the fertilizer production plant in Canada. They are independent import terminals located close to agricultural areas. The terminals are able to handle both dry and liquid fertilizer. These import terminals are illustrated in figure 3 below.

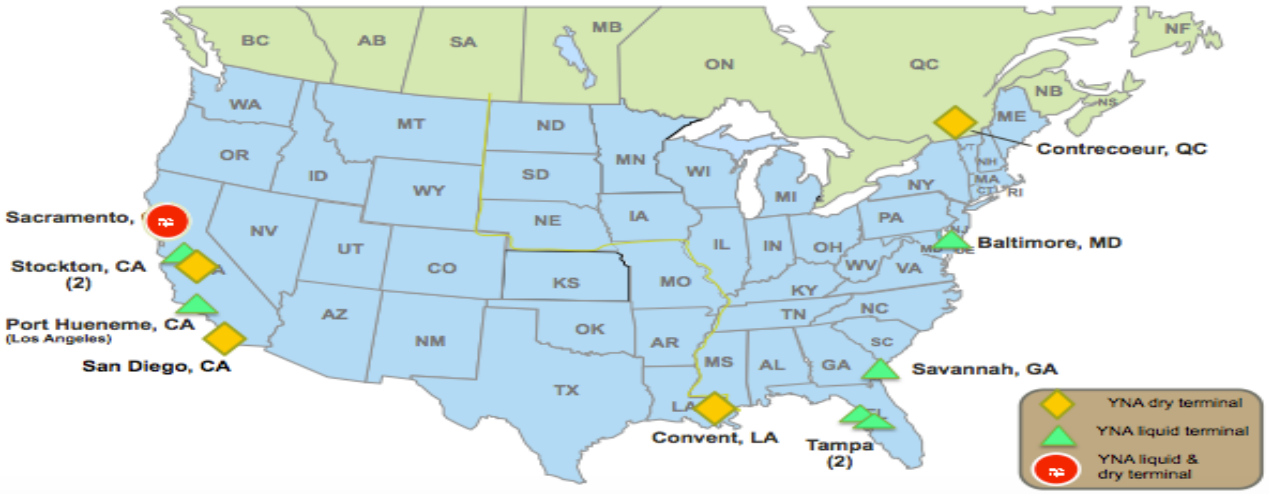

Figure 3 - Terminals that receive products from Yara production sites (Power point from interview)

In regards to the market in North America there are two production sites abroad that mainly serve the market, but they import fertilizer products from several other production units in Europe (Netherlands, Norway, UK, Germany) and Columbia. Since many of Yara North Americas Premium Products are imported from Norway (Yara Porsgrunn), this production site will be elaborated more in detail.

Yara Porsgrunn

Yara Porsgrunn, situated in Porsgrunn Norway, is one of the largest fertilizer production sites in the world. On the site there is one ammonia plant, three nitric acid plants, two NPK plants and two calcium nitrate (CN) plants. The ammonia and nitric acid plants are intermediate plants, while NPK and CN plant are producing finished fertilizer products.

The total finished fertilizer production in this plant is 3.5 million tones, and more than 15 000 containers are sent globally from the production site to more than 80 markets worldwide. An interesting part of the local supply chain in Porsgrunn is their plan be the worlds first to have a driverless feeder vessel - sailing from Porsgrunn to Brevik Port and Larvik; the ship is nicknamed the “Tesla of the sea” (Yara, 2017b). While the actual name Yara Birkeland is named after one of the founders of Hydro to honor his memory. This feeder will replace 40 000 diesel truck journeys a year, benefiting the local community and the environment with less emissions (Yara Birkeland, 2017). This is a large step towards a greener supply chain for Yara International ASA and Yara Porsgrunn. The main idea is to utilize the latest maritime technology and reduce emissions caused by container truck transport form the production site

to the two feeder ports in Brevik and Larvik. The vessel will be autonomous (i.e. no captain onboard) and have zero emissions and will be the first of its kind.

Figure 4 - Yara Birkeland

4.0 Theoretical framework

This chapter will highlight central terms to give a framework of the research that will be conducted further on in this thesis. First some general definitions are elaborated. The shipping market and how these forces affect the economy are explained. Then the different transportation modes the cargo can be transported by are explained briefly, and the decision within seaborne trade to choose whether bulk or liner shipping is best suited to transport the cargo in question. Within liner shipping containers is one of the ways transporting cargo, which is the main focus of this thesis. Furthermore the containerized supply chain and important participants in the supply chain is described as well as the components within a logistics system. The different aspects within information technology and the information flow and their role in influencing the supply chain management is explained. The information technology that is studied in this paper is a tracking solution, thus the benefits with a tracking solution will be highlighted.

The Council of Supply Chain Management Professionals defines a supply chain as; "the material and informational interchanges in the logistical process, stretching from acquisition of raw materials to delivery of finished products to the end user. All vendors, service providers, and customers are links in the supply chain" (Gibson, Hanna, Clifford Defee & Chen, 2014, p.1). A typical supply chain is illustrated in figure 5. This could also illustrate a global supply chain, which parts of the chain are situated in different countries making the chain more complex in nature. As the global supply chain grows, so does the complexity making information a crucial factor of importance. The importance of information flow will be discussed in more detail later in this chapter.

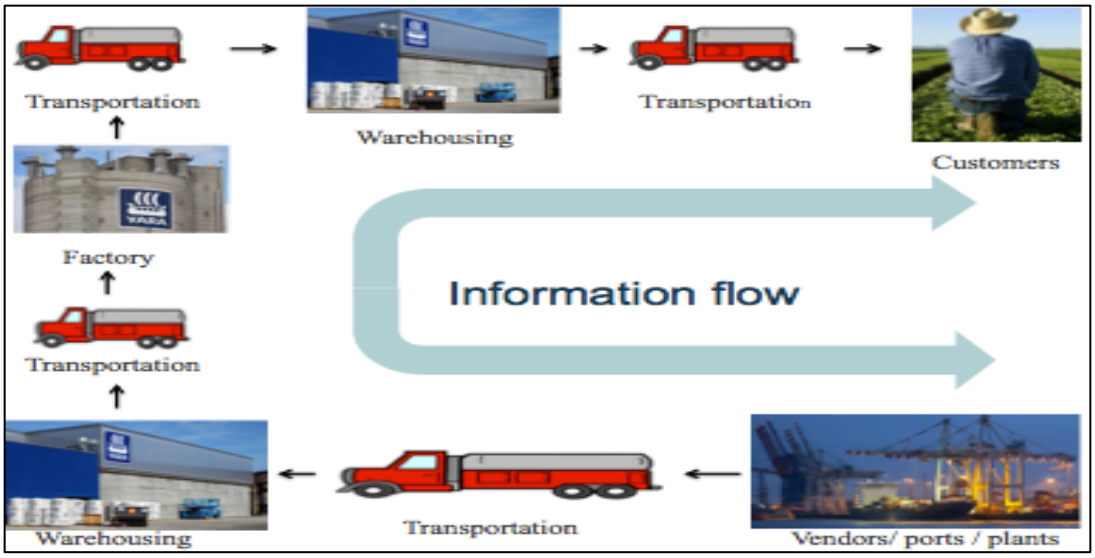

Figure 5 - A typical supply chain (Ballou, 2004, p.8)

A supply chain can be viewed in a simple way as a product that moves through a chain of organizations, and each add value to the product in some way. With the standpoint of an organization, activities moving materials into the organization – are upstream. Such activities are associated with production. While those after the organization, moving the materials out of the organization – are downstream. Activities such as distribution, marketing and sales are associated with the downstream activities.
Both activities are divided into tiers - suppliers in the upstream and customers in the downstream (Waters, 2003).

This thesis focuses on the container distribution from a production site to a downstream market and the importance of information technology to facilitate the movement of the containers.

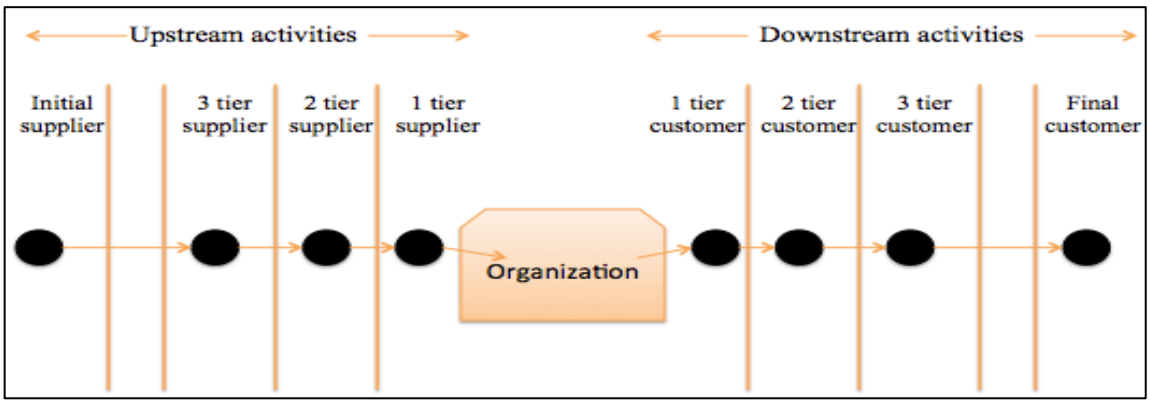

Figure 6 - A supply chain with upstream and downstream activities (Waters, 2003)

Supply chain management aims to improve the competitiveness of the whole supply chain. Integrating organizations along the chain and coordinating the material, information and financial flows to fulfill customer demand. The two main components of the supply chain management definition are integration and coordination. The integration component consists of the choice of partner, network organization and inter-organizational collaboration and leadership.

While the coordination component is compromised of the utilization of information and communication technology, process orientation and advanced planning. Too improve the competitiveness in a supply chain; closer integration and better coordination are two means of achieving this (Stadtler, 2015).

Logistics is defined by the Council of Logistics Management (1991) as "that part of the supply chain process that plans, implements and controls the effective, efficient forward and reverse flow and storage of goods and services and the related information between the point of origin and the point of consumption in order to meet the customer requirements". A widely respected definition implies that logistics are made up of materials management and distribution (Rushton, Croucher & Barker, 2017, p.5).

Logistics is responsible for the flow of materials throughout the supply chain. In more detail some of the key components of distribution and logistics are inventory, packaging and unitization, storage, warehousing, materials handling, information and control, and transport (Rushton et al, 2017 p.6).

4.1 Shipping market

The primary task of the shipping market is to move goods around the world. Shipping transports raw materials and finished goods into plants, factories and homes on a worldwide basis. Shipping plays a central part and powers the world economy. About 85-90 % of the world trade is carried by the international shipping industry, which strengthens the importance of shipping in the world economy (Clarkson, 2017).

4.1.1 Factors influencing the shipping economy

The maritime economy is complex, so simplifying the factors of greater importance that effect the supply and demand will help creating a clear understanding of the whole picture. Furthermore this does not insinuate that details are not important, rather an acceptance that too many details will hinder a clear understanding.

There are ten factors that in total affect the supply and demand, five affecting the supply and five affecting the demand for sea transport.

Shown in figure 7 are the variables explaining the supply side of the shipping market. The main factors are the world fleet, fleet productivity, shipbuilding deliveries, scrapping and freight revenues. Concerning the demand side for sea transport the five variable are the world economy, seaborne commodity trades, average haul, random shocks and transport cost. These variables fit into a model with three components; supply, demand and the freight market (Stopford, 2009, p.136). So, how do we understand this model?

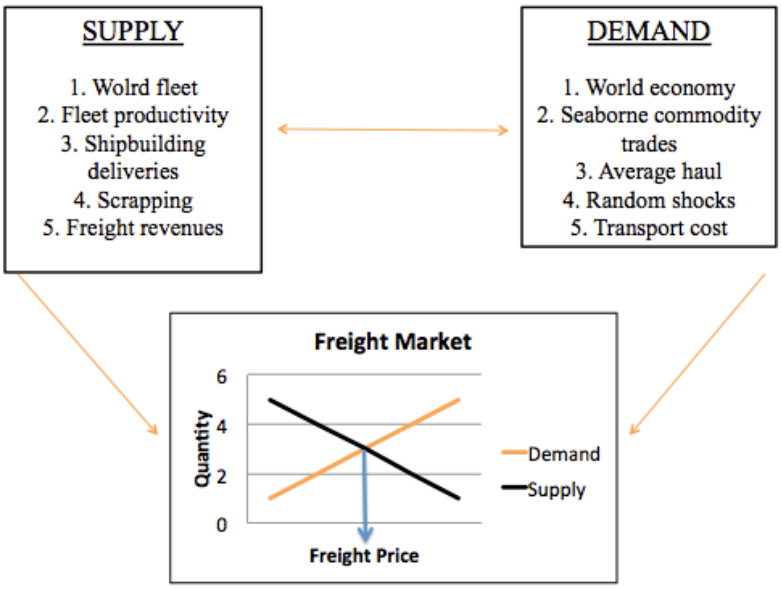

Figure 7 - Supply, Demand and the freight market (Schinas et al, 2014)

For the supply side the world merchant fleet provides a fixed stock of transport capacity. When the world economy demand is low some parts of this fleet will be traded whilst some ships will be laid up or used for storage, as is happening today for the large oil tankers. The world merchant fleet will be reduced by scrapping/demolition and increased by new building.

The amount of transport the fleet provides depends on the logistical efficiency with which ships are operated, especially in regards to speed and waiting time. In general the efficiency is referred to as the "fleet productivity". The last factor effecting supply is when freight revenues are high, the supply side will react by increasing capacity thereby being able to trade a larger quantity (Schinas, Grau & Johns, 2014).

On the demand side it is the world economy through it´s business cycles and regional growth trends that drive the volume of goods that are traded by sea. Developments in special commodity trades may modify the growth trends, as well as changes in the average haul (distance) over which cargo is transported (Stopford, 2009). Random shocks may increase or decrease the demand of products in the market could be wars, natural disasters etc. (Schinas et al, 2014, p.5). While reduced transport costs stimulate the demand for sea transport (Lun, Lai & Cheng, 2010).

Buyers and sellers are brought together in a market; here prices are set and goods or services exchanged. In shipping this market is known as the freight market (Lun et al, 2010 p.51). Here the merchant that searches for transport meets the ship owners looking for cargo. The freight market links demand and supply by acting as a regulator of the cash-flow flowing from the supply and demand sectors, and adjusting the freight rate in response to supply and demand in the market (Stopford, 2009).

In short the freight rate is the price the transportation carrier charges for moving a product from point A to B (Business dictionary, 2017). In figure 7 the freight price is illustrated as where supply and demand meet - at the equilibrium.

4.2 Transportation modes

Roads, railways, inland waterways, ocean freight and airfreight services are a part of the modern international transport system, and each with their own transport vehicle. The transport system is defined into three zones:

1. Inter-regional transport, covering deep-sea shipping and airfreight

2. Short-sea shipping, transports cargoes short distances and often distributes cargoes brought in by deep-sea services; and
3. Inland transport, including road, rail, river and canal transport (Stopford, 2009, p.50).

The focus here will be on the inter-regional transport, mainly the deep-sea shipping. When transporting high-volumes between continents, deep-sea transportation is the best alternative. While transporting by air is seen as an alternative best suited for high-value commodities.

4.2.1 Deciding on seaborne trade

The concept of parcel size distribution (PSD) explains the approach shipping business makes when deciding on transporting cargoes. A parcel is defined as "an individual consignment of cargo for shipment". This is illustrated below (Lun et al, 2010, p.8).

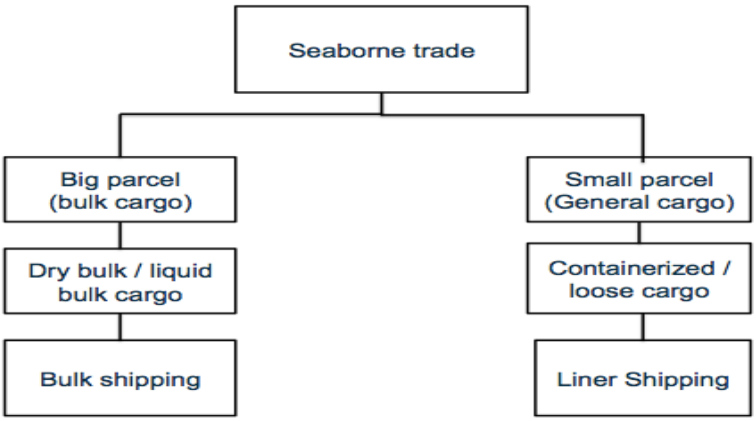

Figure 8 - The decision of seaborne trade (Lun et al, 2010)

Within seaborne trade the decision of transporting is decided on the basis of cargo – whether it is small or a bigger size of cargo. If the cargo is of a larger size then the best choice is bulk shipping. In bulk shipping the cargo is transported as dry bulk or liquid cargo.
Bulk shipping is characterized by "transporting homogenous bulk cargo in bulk vessels at an irregular time schedule" (Chen, Meersman, Van de Voorde & Frouws, 2014, p. 1).
Cargo handled by the liner shipping is known as general cargo, for this type of cargo liner shipping is the best alternative, transported in a containerized form or loose. The liner shipping will be discussed in further detail below.

Besides the parcel size, there are other important factors that decide how the cargo is shipped. In the real world different customer segments have different needs regarding the standard and level of service they are provided from suppliers. Here there is a possibility to differentiate on these factors:

1. Speed - how long time in transit?
2. Reliability – does the transport come on time?
3. Security – the damage and loss of goods in transit
4. Price – the cost of transporting (Stopford, 2009, p.61).

4.3 Liner shipping

Liner shipping provides a regular service between specified ports according to timetables and prices advertised well in advance. In principle, the service is open to all shippers; it could resemble a public transportation system (World shipping Council, 2017). As mentioned cargo handled by the liner shipping is called general cargo.

General cargo accounts for a large share of goods shipped by sea, and the vast majority of general cargo is containerized, approximately 60% (Statista, 2017). Containerized, meaning the cargo is transported in shipping containers from point of origin to the final destination. A shipping container is an empty rectangular cube, which could possess additional features to accommodate the product in transit. These additional features could be open tops, refrigerated units, flat racks and platforms. Containers are mostly found in the length 20, 40 or 45 feet (Frederick, 2015).

Figure 9 – Containership (Google)

1966 was the year the international trade with containers begun, so it is relatively new form of transportation. For the development of container infrastructure to even be possible first a brand new type of ship especially constructed for containers had to be developed. Another vital component had to be addressed to handle these ships – the container terminals. The movement within the terminals needed to be mechanized, thus improving the productivity dramatically.
An international agreement on the size of standard containers had to be decided, due to different road regulations. Therefore several of sizes are to be found in the market.
At last the growth of the container service was dependent on technological developments that took place in the 1960-1970s. The revolution within communications and data processing made it easier to communicate across the world and process the paperwork in a faster speed than before.
All of these factors still see improvements following the growing container trade, especially in regards to vessel sizes and terminal infrastructure (Stopford, 2009).

The volume of international seaborne trade with container ships has risen from 102 ton in 1980 to 1687 billion ton in 2015. Which shows a growth except in the financial crises in 2009 (Statista, 2017a). According to Alphaliner, which is an analyst firm, the global container throughput growth is set to exceed 6 % in 2017 (World Maritime News, 2017).

The simple container box has been one of the major drivers of globalization, opening up markets and eased the possibility of transportation. Some of the advantages and disadvantages of containers is elaborated below.

ADVANTAGES	DISADVANTAGES
- Gone from slow, expensive and unreliable to fast, cheap and secure - Standard transport product - Management - Improvement in the efficiency - Reducing port time → increasing productivity - Economies of scale → Keeping transport costs low - Serving as own in-transit warehouse → providing security	- Site constraints - Infrastructure costs - Hacking of container tracking system - Stacking - Theft and losses

Figure 10 – Advantages and disadvantages with containers (Rodrigue & Slack, 2017)

The container itself has developed from a slow, expensive and unreliable way of transporting to a faster, cheaper and secure way. An international agreement on a standard size used worldwide, making it easier to handle and reducing port time – which then has increased the productivity. Each container carries a unique ID number, making it possible to track and better manage the containers flowing through the terminals and ports, thus improving efficiency. By shipping with containers economies of scale are obtained – which is sending a large quantity of goods with a low cost.
A container itself serves as an in-transit warehouse providing security and preventing damages to happen from point of origin to the final destination.

There are several of advantages with the use of container, however some disadvantages are to be found.
The site may bring along constraints, due to containerization requires a large area of the terminal space. The infrastructure of handling containers represents a huge investment and requires numerous of equipment to facilitate the handling process in the ports and terminals. While a system for tracking containers is a tool of great assistance, it is still a technology that is vulnerable and could face being hacked. Such as the transport and logistics company Maersk experienced in the summer of 2017.
Theft and loss of containers may occur, this in general happens when rough weather strikes, or when there is improper stacking of the containers. Stacking of containers is a complex process. Arranging the containers in the order that the first to be unloaded is not on the bottom of the pile, and avoiding restacking along the ports will increase the handling time (Rodrigue

& Slack, 2017). However theft and loss of containers has seldom occurred with Yara containers, according to the shipping site in Porsgrunn.

5.1.1 Logistics and containers

A logistics system consists of three components: Logistics services, information systems and infrastructure/ resources.

Logistics services support the movement of materials and products from input through production to consumers. The logistic services contain physical activities (transportations, storage) and non-physical activities (supply chain design, selecting contractors and freight negotiation). The information system consists of modeling and management of decision-making, and the important task of tracing and tracking products. Providing the essential data and guidance in the interaction between logistics service and target stations. While the infrastructure/ resources consists of the human and financial resources, packaging materials, warehouses, transport and communications (Sreenivas & Srinivas, 2008).

In the past logistics was considered as merely an additional cost for selling products. However it is now recognized that logistics and distribution contributes positively to the value of the product (Rushton et al, 2017). With a well-developed transportation system, advantages that logistics brings will come forth. Other beneficial outcomes are better logistic efficiency, reducing operation costs and an upgrade of the service quality. A logistics system that is well operated can increase the competitive advantage of the enterprise (Tseng, Taylor & Yue, 2005).
"Competitive advantage is defined as conditions that allow companies to produce a good or service at a lower cost or bringing more value" for the customers versus the competition (Investopedia, 2017). The competitive advantage could be attained when companies compete as a service or cost leader or a mixture of both. The service leader wants to differentiate its products with key service elements, in order to gain a value advantage. This value advantage is gained by tailored service, the use of various distribution channels to penetrate the market in different ways. Other opportunities might be an update on the status of orders on a regular basis as an example of where the supply chain activities can add value.

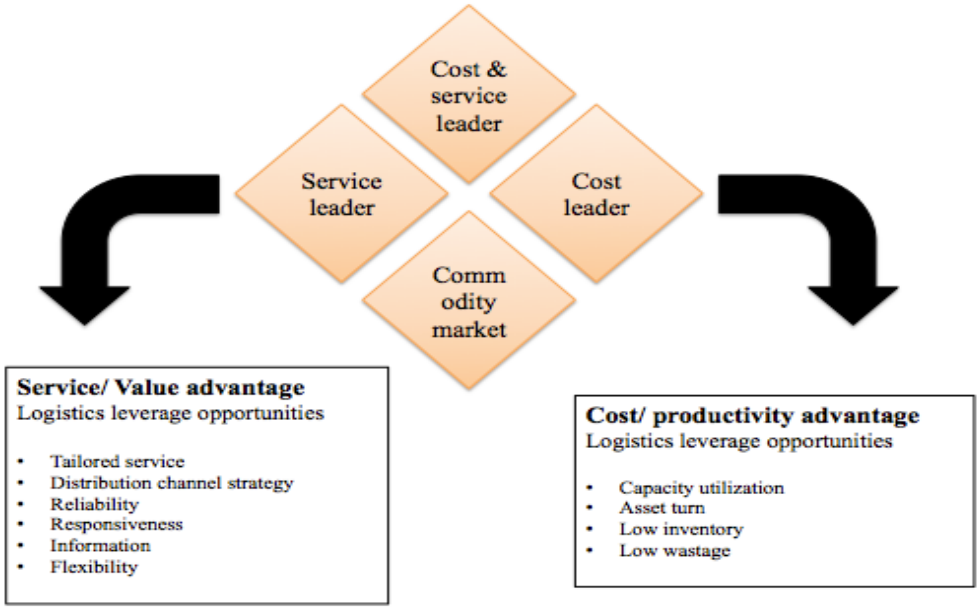

Figure 11 – Different aspects of attaining competitive advantage (Rushton et al, 2017)

The cost leader searches of a utilization of the resources in order to offer the lowest price possible, resulting in a productivity advantage. The productivity advantage is gained by different ways of minimizing the cost, for example maintaining a low level of wastage and inventory and targeting high capacity utilization (Rushton et al, 2017).

The value chain developed by Michael Porter shows the different primary and support activities to be found in a company adding value to the product and for the customers. The primary activities being: inbound logistics, operations, outbound logistics, marketing and sales and service. Support activities: infrastructure of the firm, human resource management, technology development and procurement. Yara International is working along both dimensions. With their Premium Products they are working as a service leader, while for their Standard Products they are working as a cost leader. The importance of a good supply chain and good information towards customers are important in both segments, but adds more value in the Premium Product segment.

An analyzes of the value chain could be a useful tool to define competitive strategies, understanding the origin of competitive advantage and be able to identify connections between activities creating value. The firm's profitability is a function of the attractiveness of the industry and position within that industry. By analyzing the competitors and the attractiveness in the industry this can lead the firm to a competitive strategy. A competitive

strategy is established on the basis that the firm has several ways of obtaining competitive advantage, and is focused on the activities that increase the value of product or service (Ensign, 2001).

Among the elements of the business logistics systems, the transport system is the most important economic activity.
A breakdown of the total logistics cost shows that transportation accounts for one half of the total costs. However inventory carrying and labor costs are also significant elements of the total logistic cost. Inventory carrying includes the holding cost of inventory, while labor costs are those associated with the physical handling of goods (Rodrigue, n.d). However, this is somewhat dependent on which industry the company is operating in.

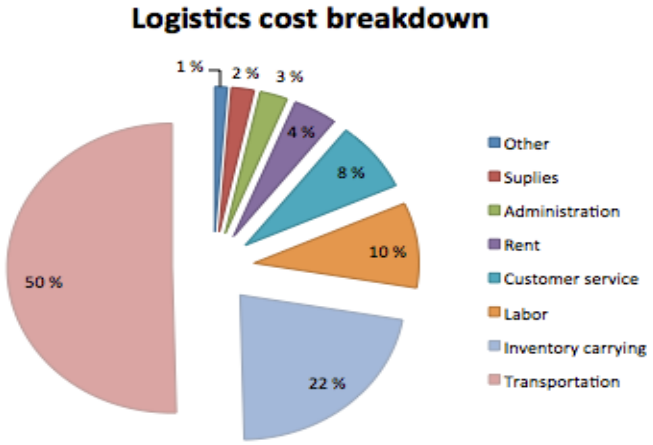

Figure 12 – Breakdown of logistic cost (Rodrigue et al, 2017)

The containerized supply chain extends throughout the world – serving as an in-transit warehouse for general cargo transported by ship and often one other transportation mode. Containers are a part of an intermodal transport network; meaning goods are moved in one single loading unit, which uses two or more modes of transportation, without any additional handling. Intermodalism originates from the maritime transportation, from the development of containers in 1966, and has integrated other modes of transportation (Rodrigue et al, 2017*)*. Such as other smaller boats known as feeders, trucks and rails. These other transportation modes are usually not wholly owned by or – vertically integrated into the supply chain of the company producing the product, but outsourced to an external company. Vertical integration is when a company takes control over business operations that are at different steps of the

supply chain involved in the creation of the product. While forward integration is concerned with expanding the production path into distribution (Investopedia, 2017).

Outsourcing logistic activities to a third party logistics (3PL) service provider is nowadays a common practice. There is no standard definition of a third party logistics provider, still one of the definitions provided is: an external logistics service provider offering single or multiple logistics activities to its customers, which typically is on contract basis. From the provider's point of view, their business covers a great number of relationships involving everything from simple logistical activities to advanced logistical solutions (Yang, 2014).
Activities that are often outsourced are outbound and inbound transportation and warehousing (Jharkharia & Shankar, 2007). Other activities are information systems, freight distribution, management and performance reports, intermodal services to name a few. The activities are outsourced to a 3PL in order for the company to concentrate on their own core competencies and thus generating higher revenues. While the external logistics service provider, 3PL, is an expert on the area outsourced and is capable on performing the task without any difficulties with the right equipment, system and experience (Yang, 2014).

The choice of Ocean Insights as a tracking/ information provider is an example of a third party logistics provider for Yara North America.

So a 3PL can play an important role in the entire logistics process, in order to obtain a competitive advantage in cost or time efficiency for the company producing the product. (Yang, 2014)
Other key participants in the container shipping industry are shippers, liner companies and charter owners. The shipper sends and receives the cargo sent in the containers. The liner companies can act as a logistic service provider in charge of seaborne and inland transportation – either operating the vessels that they own or leasing from charter-owners. While the charter owner also called the containership owner or lessors, owns a containership or leases or charters them to the liner companies (Global ship lease, 2017).

Also to be mentioned are the critical nodes in the transportation network – the ports and terminals that links the global markets together. The terminal has a major role in the container logistics. It serves as a connection between the sea and the landside transportation. The

terminal serves the material flow with two interfaces: a waterside and landside interface. At the waterside vessel and smaller boats are loaded and unloaded, while the landside interface trains and trucks are served. While a storage area is present to facilitate a temporarily storage for containers as it waits to be either loaded or discharged to another transportation mode. The deep-sea, short-sea and feeder vessel connects the ports to each other. The cargo arrives at the ports either in trains or trucks. At the seaport direction flow of containers depends on whether the container is imported, exported or transshipped. A container that is imported will leave the terminal by truck, train or a barge – that is a small vessel. While exporting the container it is delivered by trucks, trains or barges and departs the port with a vessel. When transshipping the containers they arrive and depart from the port by vessel (Kemme, 2013).

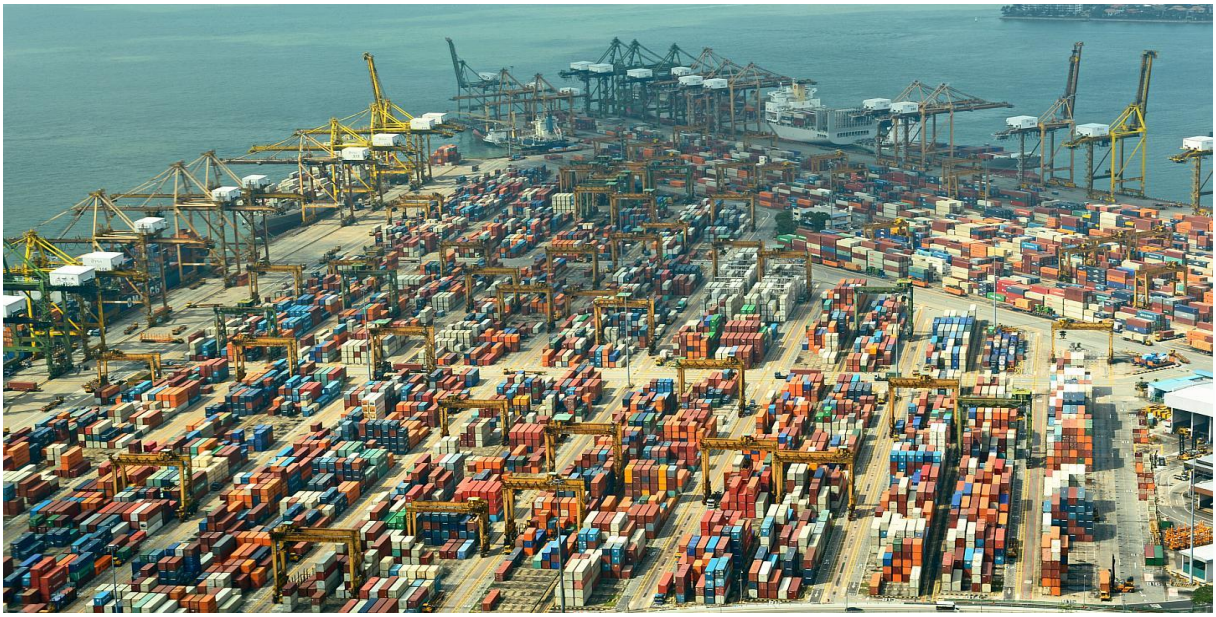

Figure 13 - Illustration of Singapore 2nd largest container terminal in the world (Google)

With several actors in the market that need to interact with each other, the interaction has to be efficient in order to provide an overall efficient system (Michel & Noble, 2008). A stable and effective communication infrastructure is critically important to manage and keep track of the logistic flow.

5.1. Technology

Todays supply chain management has experienced a higher intense focus on technology. This is the result of companies realizing that the mission of gathering the necessary resources and

core competencies on their own that allow for an efficient and profitable operation is not enough. The need of close relations with channel partners in the global marketplace is critical in order to build and maintain a world class supply chain (Ross, 2011 s. 31)

An analysis of successful companies worldwide indicates that their success is in a great extent dependent on the ability to implement and apply information technology to their global supply chain management (Motwani, Manu & Gunasekaran, 2000). Some factors driving this is:

1. In the fast-moving worldwide setting companies has turned to computerized applications in order to manage the requirements that are when conducting business
2. Customers and suppliers demand immediate response and full information visibility in real time
3. The internet with its integrative power requires that the supply chain is able to transfer information from buyer to supplier
4. Information technology has turned into a competitive advantage (Ross, 2011, p.35)

Information technology is defined as "the technology involving the development, maintenance, and use of computer systems, software, and networks for the processing and distribution of data" (Merriam Webster, 2017).

In the past, information processes was dependent on the human effort and some forms of automation to help manage it. With the assistance of the computer, handling information and communication with large volume and speed is now possible. The infrastructure within information technology contains four vital components:

1. Database – is the core of information management. Serving as an archive of data collected from the users. A database contains different categories of information such as numbers, words and graphics.
2. Networking – A definition of a computer network is two or more computer
3. Software – In general used to maintain, display and access the information in the database, however are in various types. Basically two types:

I. Operating system software – this system controls the application software and decides how hardware works together. Theses systems are Microsoft, Mac OS X to name a few.
II. Application software – this is used to perform processing activities.

4. Configuration – the configuration of the hardware, software and application software architecture. The system architecture today takes use of PCs, links between the PC and servers and communication enablers, such as the Internet to integrate both externally and internally the people and knowledge in the process. (Ross, 2011, p.43)

Applying information technology to the business environment has revolutionized the concept and practice of supply chain management. As the importance of information to be accurate, timely and complete, information technology has become a facilitator of integrating the SC (Ross, 2011, p.63).
When supply chain management is connected with the force of technology it becomes a powerful competitive and productive force. Making customers and suppliers visible in real-time and online to all parties in the supply chain by focusing on meeting their desires, requirements and competences. (Ross, 2011)

The technology assures that the real-time coordination of information to anyone, at anytime and anywhere is possible. This has changed how the companies conduct business and the communication between customers and supplier in the supply chain. In general, the wide-ranging impact of the information technology on supply chain management permits the connection between supply chain members to be tight and the information has become more available (Ross, 2011).

According to Simchi-Levi some of the objectives of information technology in supply chain management are:

- Providing information availability and visibility
- Enabling a single point of contact for data
- Allowing decisions based on total supply chain information; and
- Enabling collaboration with partners (Nair, n.d., p.3)

Information technology has resulted in many possible alternative solutions for managing the supply chain more effectively. Therefore companies are utilizing more advanced information technology and material-handling systems to streamline the flow of product pulled through the supply chain from point of origin to end customer.
Whereas managing the in-transit performance organizations have adopted real-time communications and shipment-tracking technology (Bergmann & Rawlings, n.d.).

According to Van Oldenborgh (1994) the "ability to reduce human intervention yet oversee minutely the flow of parts and products along the entire length of the supply chain can help dramatically in cutting logistics costs and boosting customer satisfaction" (Nair, n.d, p.3).

5.1.1 Information flow

The global market place is highly competitive today. The company with the best product or service is simply not enough to survive in the market. Now another crucial factor plays an important part – having the best information will be decisive whether you are a market leader or follower (Ross, 2011).

The information flow in the typical supply chain indicates there is a two-way flow of information. The flow of information has become an important factor to achieve success in the supply chain management. The significance and importance of the information flowing downstream has increased, and come in several forms: advanced shipment notices, order status information, inventory availability information etc.
The impact of good downstream information has been to reduce uncertainty with respect to order replenishment. A related aspect of forward information flow has been increased utilization of bar codes and radio frequency tags, which can increase inventory visibility and reduce the uncertainty in the safety stock (Coyle, Novack, Gibson & Bardi, 2010, p. 22).
The information flow can be measured in terms of quality, quantity and speed.

- Quality is the accuracy and usefulness of the information.
- Quantity measures the amount of information flowing among the parties involved, and the question whether it is sufficient to meet every requirement of the parties.

- Speed refers to transferring the information to the right parties at the "right" time (Jadhav, 2015)

In order for the supply chain management to be effective it is essential that the information provides the right amount of relevant information to the right person and at the right time from the point of view of information. When information is accurate and on time this provides a window to reality that may permit companies to "minimize inventories, improve routing, scheduling of transportation, better serving the customer" and remain competitive (Mukaddes, Rashed, Malek & Kaiser, 2010, p. 226).

However one significant part in the upstream flow of information is the forecasting. There is a tie between forecasting and resource decisions. Without the link between forecasting and resource allocation the task to deliver on time would be impossible. An essential part of the forecasting is the sales forecast. The sales forecast assists with long term planning of production of the future sales thus allowing the capacity and labor needed (Wacker & Lummus, 2002).

The definition of supply chain management states that it consists of three flows: physical, financial and information flows.
Information flow is a one of the basic aspects of the supply chain management. The physical and financial flow is usually triggered by the information flow. By managing the related flow of information effectively the management of physical and financial flow is therefore predicted to be effective (Sweeney, 2009). According to Singh (1996) the overall customer demand cannot be achieved without the proper management of the physical flow and the related information flowing through the supply chain. At last the information does not to anything – it is how the people use the information that is the key to success.

Prior to 1980s the information flow between areas within an organization and between supply chain members was paper-based. The information was not considered as a valuable resource due to the value was not perceived or understood clearly by the members of the supply chain (Nair, n.d.).
The supply chain management has developed to be dependent on the information flow as it can be characterized as the facilitator of collaboration and improvements. These

improvements are achieved by integrating the information flow among the parties involved in the supply chain.
Collaboration is not new, however with the help of information technology companies exchange information more accurately than before (Madenas, Tiwari, Turner, & Woodward 2014). Collaboration within the supply chain should be based on the sharing and transferring of information. The collaborating of information can bring forth benefits to parties involved and improve the whole supply chain. However, not all parties are willing to share information (Wang, 2011).

5.1.1 Tracking and tracing part of information technology in the supply chain

The information technology that is studied in this paper is a tracking solution. Radio Frequency Identification Data (RFID), Bluetooth and global positioning systems (GPS) are among some of the technologies used. These are working in a cycle with a cloud that is computing as a service of the Internet, web portals and back-end systems supporting the back-office applications that track things ranging from equipment, animals, persons and apparel. These technologies that track and monitor has the possibility to greatly help daily operations, by providing the SC with the chance to solve or avert problems, tracking and increasing the efficiency in their operations. Also being able to provide information about patterns, trends, strength and weakness about the business. (Ross, 2011, p.59) These are some of the benefits sought after by Yara North America.

Other benefits with tracking are more thoroughly explained below.

Visibility is defined as the “right of knowing in terms of both the supply chain partner and customer”. For the customers it is important to know where their product is by order status in order to make the right choice or simply the reassurance that the product is on its way. It is also an important role in regard to customer satisfaction. This visibility is made through real-time visibility and monitoring the performance of the movement of goods and events in the supply chain. The visibility of a supply chain is set by the information flow flowing among the parties in the supply chain (Jadhav, 2015).
When the visibility of the product in supply chain is clear, control is easier to attain for the customer, and also for the company using the transporter. The company is able to control their

supply chain and logistic process. With control it is easier to take action in order to avoid disaster with the possibility of calculating "what if" situations, if the shipment is taking the wrong path and being able to act quickly if issues arise.

As the product is sent in an in-transit warehouse – the container - security is more ensured that the goods reach the destination in the same condition as they begun their journey. While the final customer is able to track and kept/ updated on the shipment all the way through the supply chain – this has become an essential part for customer satisfaction. Especially in regards to the fertilizer market that needs fertilizer in special parts of the season, the reassurance of the product arriving at the scheduled time is essential.
A tracking technology can increase the efficiency and productivity of the company, which could also lead to a reduction of costs. Also the service quality and reliability will be improved, these are tools that typically can help the company to grow their market share and revenues by keeping and satisfying the customers (Miller, 2015).

5.1. Fertilizer market and trade

Fertilizer is basically food for plants and crops. In order for the plant and crops to grow and develop, they need a supply of carbon, hydrogen and oxygen – this is provided from the air and water. In addition they need plant mineral nutrients = fertilizer (Yara, n.d). The fertilizer market is composed by three primary nutrients: nitrogen, phosphorous and potassium.

- Nitrogen (N) – essential for growth and development in plants. The plants growth, vigor, color and yield is determined by the supply of nitrogen
- Phosphorous (P) – is vital for adequate root development and helps the plant resist drought. Also important for plant growth and development, such as the ripening of seeds and fruits.
- Potassium or Potash (K) – is central to the translocation of photosynthesis within the plants and for high-yielding crops. Also assists to improve the resistance against disease and drought. (Yara Fertilizer Handbook, 2017)

All together there are thirteen nutrient elements that compose the fertilizer market, these are categorized as primary, secondary and micronutrients. As long as it contains one or more of

the thirteen nutrients and this is made accessible to the crops it will act as fertilizer (Yara, n.d).

The crops absorb the nutrients from the soil, and a large proportion of the nutrients are removed when the crops are harvested. Mineral fertilizers can provide an optimal nutrient balance to the demands of the specific crop, soil, and climate conditions. It is applied in a liquid or dry form (Yara F-H., 2017). The only substitution for mineral fertilizer is organic fertilizer that could be composed of animal manure or plant residues (Lal, 2006).

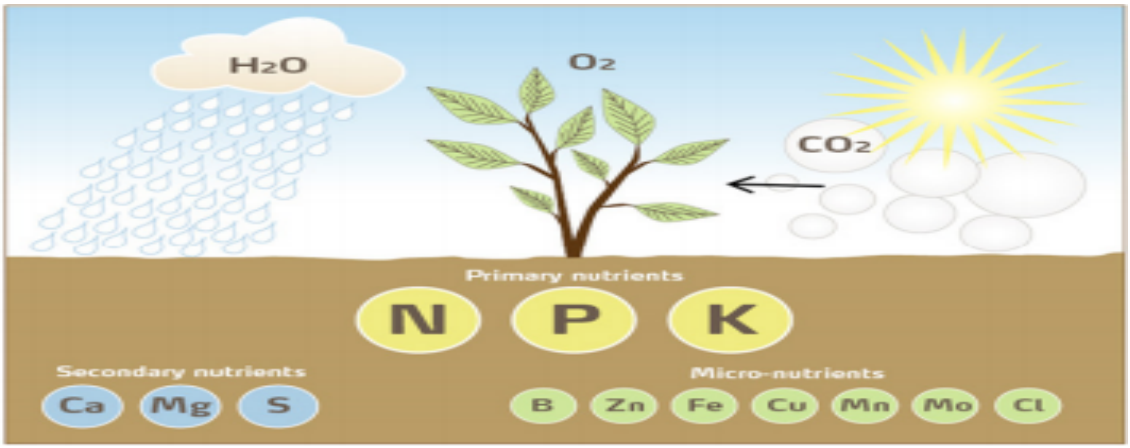

Figure 14 - Fertilizer components (Yara F-H., 2017)

Fertilizer is a seasonal business since the crops will be planted and grown at certain times of the year. In addition it is a weather dependent business as most of the crops are grown outdoors. This requires an agile and well-informed supply chain as changes can occur throughout the growing season of the crop. There are large regional differences for when the crops are planted and harvested resulting in that the fertilizer is applied at different times. Meaning that the customers rely on that the fertilizer will come when it is supposed to (Yara F- H., 2017). With this a reliable transportation system is needed to move the products around the world. If the product does not come in time it could impact the farmers ability to apply the right fertilizer at the right time.

Factors that drive the demand for fertilizer are basically the population growth and economic growth. The population today is at 7,6 billion people and by 2050 it will possibly reach 9,8 billion people (United Nations, 2017). More people means more food, which again means more need for efficient fertilizer. (Yara F- H., 2017)

The main players in the market are Yara International ASA, Agrium, PotashCorp (PCS), CF Industries and Mosaic. These five companies accounted for 33% of the global market in 2012 (Lucintel, 2012). Also smaller and local fertilizer companies exist in every country. Measured by revenues Agrium and Yara are the largest fertilizer companies (Yara F- H., 2017). However, Agrium and Potash are set to merge which will make them the largest player in the market – the new company will be known as Nutrien (Agrium, 2017).

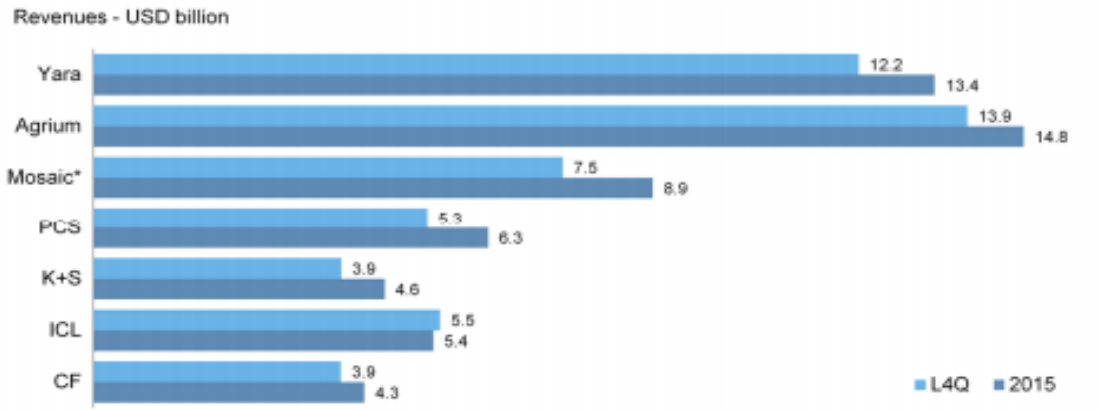

Figure 15 – Comparison of fertilizer companies based on revenues from 2015 (Yara F-H., 2017)

5.0 Methodology

Research in a common phraseology “refers to the search for knowledge”. Another definition is research as a scientific and systematic search for relevant information on an explicit topic (Kothari, 2004, p.1). There are different ways of collecting the information that is needed to shed light on the specific topic. This chapter will explain in detail how the research was conducted with which methods applied and a frame for the analysis.

5.1 Research design

There are a number of different types of research. The two most basic approaches to research is quantitative and qualitative research.

Quantitative research is defined as “research as explaining phenomenon by collecting numerical data, that are analyzed using mathematically based methods, in particular statistics” (Grant, Clark, Reershemius, Pollard, Haynes & Plappert, 2017, p. 5). The goal of the quantitative research is to “show relationships between variables, statistical description, establishing facts, prediction and control and testing hypotheses” (Castellan, 2010, p.5). Applying standardized methods such as observation and surveys are conducted when collecting data in quantitative research. The data will be connected to specific variables, and will then be quantifiable in a numerical form that can be described in tables, graphs or some statistical measurements (Befring, 2015).

Qualitative research is designed “to explore the human elements of a given topic, where specific methods are used to examine how individual see and experience the world” (Given, 2008a). The researcher is allowed to observe and understand the context where decisions and actions take place. The context is best understood by talking to the individuals involved (Myers, 2009). When the focus of the research is studying a particular topic in-depth, exploration and developing an understanding the qualitative method is best suited. The methods that are most often used in qualitative research are case study, interviews, observations and focus groups (Mason, 2002). My research is a case study of Yara with interviews to get in depth of the topic.

In this study of Yara International ASA the qualitative research was applied. The use of qualitative research instead of quantitative research is due to fact that I wanted to hear the Yara experts experience of the how the situation was before with the tracking solution and the new solution they are trying out. I also wanted to explore and describe the container process of Yara to get a better and deeper understanding of how the supply chain for containers works. Conducting a quantitative research of this topic would be difficult due to the office is at the start phase of implementing the system and there are no numerical or historical data on the topic yet.

5.1.1 Background for problem statement and research question

"The role of information technology to facilitate the movement of containers: the experience of Yara North America and their container operation"

This problem statement came to light by the office in North America. The original thought was to assess how the company can use new and existing technology to enhance the logistics with containers from Yara´s production to their customers in North America. After finding out that they were in the start phase of implementing a new tracking solution – Ocean Insights this would be more specific in regards to a technology. Since a technology that tracks containers should enhance and make the logistics operations with containers better in terms of better information towards the customers and more efficient operations in total. Adding the total Yara container operation was done in order to understand the bigger picture of how the container operation is from production to customer. Selecting one specific production site where I could schedule an interview – and the closest is in Porsgrunn – was done to get the view of the container operation from production site to customer. With some help by my supervisor – the current problem statement came to life.

Figure 16 - Illustration of the problem statement

On the basis of the problem statement one main research question was developed together with five sub-questions that will be answered and discussed in the analysis section of this thesis. The main research question is:

How will the implementation of Ocean Insights improve the operations in the container supply chain of Yara North America?

Five sub- questions are developed with narrower topics of the main research question. By answering the sub-questions the main question will be highlighted by the different topics in the sub –questions.

1. How is the container operation from the production site in Porsgrunn to the market in North America?
2. How has Yara North America experienced the information of tracking containers?
3. Will the implementation of Ocean Insights improve the satisfaction of Yara North America and the end customers?
4. How will the implementation of Ocean Insights improve the internal handling of container information in Yara North America?
5. Is it feasible for a company such as Yara to invest in Ocean Insights?

5.5 Data collection

A trip to the office in North America was made. First planned in the start of September, however this trip was delayed due to Hurricane Irma that hit Florida/Tampa with full force. Therefore the interviews were moved to midst of September. This trip was made in order to meet up with employees at the office in Tampa.
The interviews conducted with employees at Yara´s office in North America and Porsgrunn was face-to-face and in a semi-structured nature, which is one of the most common approaches to interviewing in qualitative research. Benefits of interviewing are the possibility to ask additional questions that follow up the response of the interviewee and make them elaborate their answers in more detail. There is a great flexibility surrounding the interviews, however this semi-structure frame also ensures that the desired questions will be covered and the answers are rich with detail (Bryman & Bell, 2011). The opportunity to observe how the respondent's facial expressions and body language are could result in a better understanding of what they are explaining.
However, measurement error may occur as the interviewers presence and the behavior when conducting the interview may affect the respondent's answer (Lavrakas, 2008).

First the themes of the questions were sent to the interviewees, this because I wanted them to be prepared of what I was interested in. One day was set up to interview three of the total four individuals. One of the interviews started with a small presentation of Yara North America in addition to a demonstration of Ocean Insights and the already existing internally developed database. After this my role as an interviewer started by asking the questions that are presented in the appendix. The questions were centered around the container operation, the old and new tracking systems, and information in general about their business with some additional follow-up questions.

An interview with an individual with a financial view and also with insight from the production site in Porsgrunn due to working there at an earlier stage of the career was also conducted on my visit in Tampa. Also this interview started with a power point with information about products and the operations in North America. All the power points showed in the interviews were then given to me on a memory stick.

As I came back from Tampa, I had scheduled a meeting with an individual at the production site in Porsgrunn with insight into the container operation. This person also gave me a lecture on the container market and the forces behind. All interviews were in the length of one hour.

5.6 Population and sampling

Sampling is the process of selecting the right individuals, objects, or events as representatives for the entire population. A population refers to the entire group of people, events, or things of interest for the researcher to investigate. In this research the company Yara International ASA refers to the population. While a sample is a subset of the population, that in this instance will be the employees in the company (Sekaran & Bougie, 2013). The employees are sampled from the office in North America and the production site in Porsgrunn with special knowledge about the container operations and the fertilizer market in North America.
In regards to sampling the purposive sampling that is a part of nonprobability sampling is performed (Sekaran et al, 2013). Purposive sampling is confined to a specific type of people that can provide the desired information (Sekaran et al, 2013). Since the research question is specific in terms of organization – Yara International ASA, the importance of expertise and inside knowledge of this area is essential.

The interview subjects are from different areas of the supply chain, purposively from Yara and individuals with insight of containers and the new tracking solution in North America. In total 5 individuals were interviewed. The three of the individuals interviewed in North America had direct experience with the old and new tracking solution and the container operation. While the interview conducted at the production site in Porsgrunn was to get the view of how the container operation was from site to market unit and tracking solutions used there. The last respondent had previously worked in Porsgrunn and with insight in the financial perspective and market positioning of Yara North America in the North American fertilizer market.

In-depth interview is a time-consuming method of data collection, and due the limited time frame the sample is limited. However with such a small sample, generalizing the findings one has to be careful.

5.6.1 The privacy and anonymity

The interviewees' privacy was looked after during the interview however a voice recorder was used, with the consent of the interviewee. After the transcription of the audio files, they were deleted.
The privacy requirement of the individuals was taken care of, and for that reason reporting and seeking approval of the Norwegian Center for Research data was not necessary. The interview guide and data management method was designed to meet the requirements. The recordings were not stored on a computer and kept safe, and the interview questions do not include any information that is personally identifiable. There are no direct references to the individuals that are interviewed in the text, although some quotations may be indirectly referable to the office they are situated in.

5.7 Validity and reliability

Validity is the evidence that the process used to measure a concept does indeed measure the intended concept (Sekaran et al, 2013). In the case of qualitative research, the method used is an interview. This means that the validity of the investigator in question- that the data collected by the investigator, represents what it is intended to measure.

Reliability is defined as the consistency of a measure, in which extent that a measuring procedure yields the same result on a repeated trial (Carmines & Zeller, 1979).
The focus in this study has been to explore and get a better understanding of the container operation and the role information technology has on the movement of containers operationally and how it can enhance the customer experience in the case of Yara North America. So the overall goal was to present my findings in the perspective of Yara North America, not to generalize for the entire population. Transferability will be more useful in this study. Transferability implies "that the results of the research can be transferred to other contexts and situations beyond the scope of the study context" (Given, 2008) i.e. in other sales and marketing units in Yara. This will also be considered in this thesis.

5.8 Data analysis

An analysis of interviews aims to uncover and/ or understand the bigger picture. Using the data from the interviews to describe the phenomenon and the meaning of it. When analyzing interviews a technique that is often used is coding (University of Leichester, n.d).
Coding is a system of classifying and stating what is of interest or importance found in the data. Identifying differences in the data, and labeling the data to organize the information collected from the interviews (Bloomberg & Volpe, 2008).

Transcribing every singular word of the interview to get the essence of the whole picture was done with intention – and re-reading the transcripts plenty of times was also done. A pattern started to emerge and the analysis was divided into two levels.
The frame of the analysis consists of two levels – a basic and a higher level. The basic level was used to describe the current situation, based on the data gathered from the interviews. The main themes here are the container operation, technology in specific the old system and the new tracking solution Ocean Insights and the problems encountered in the container operation. This was to build a frame for the higher level a further discussion and analysis, which is centered around the five sub-questions mentioned earlier in this section.

Quotations are used in both levels to mark important matters said during the interviews. There could be several points where important information may have been misinterpreted or overlooked. However this approach of the analysis was considered to be best suited for presenting the data in a clear and understandable manner.

6.0 Situation now

Yara North America has a logistics and planning department, covering the United States and Canada. Their tasks are forecasting and planning, operations, documentation and back office. These five tasks stand for a large part of the daily operations, and is an important overall part of the sales and marketing activities in North America. Getting the right product at the right time to the customer is highly important for their fertilizer customers.
As the amount of containers prior to 2012 was less than 100, the container process was integrated into other departments. However as the amount of containers has risen every year the importance of this segment has also grown. Yara North America had received about 700 containers from production sites overseas in the midst of August.

The production site in Porsgrunn is a 3.5 million ton fertilizer production operation. It produces approximately 3.5 million tones, and of this amount most is shipped to Asia - which is the largest market for this production site. In total 15 000 containers are sent out yearly to the markets. On a worldwide basis Yara International ASA together sends out 50 000 containers a year from all its sites. In 2016 a total of about 340 of the 15 000 were shipped to the market in North America from Porsgrunn. The market in North America receives products from other production sites in Canada, United Kingdom, Columbia, Brazil, Germany, Netherlands and Chile.
At the production site in Porsgrunn they produce NPK known as YaraMila and the bi-product of this is calcium nitrate (CN) called YaraLiva. In total there are 40-50 products produced in Porsgrunn. Most of the products produced are considered Premium Products.

As mentioned in the start Yara has a set of Premium Products and Standard Products. How the products are shipped is based on the demand of the product – whether there is a large demand or a smaller demand - as illustrated earlier in figure 8. When the parcel is big then the best choice is bulk vessels – while sending a smaller amount of products containers can be best suited. The choice is also dependent on what is cost efficient. If the price for sending a container is lower than for a bulk vessel per ton – then the product will be sent in container regardless of volume. YaraLiva is one of the products that is produced in the site in Porsgrunn and shipped to North America in containers.

To get an image of how many containers the market receives roughly 70 % of the 15 000 containers are sent to Asia – while the remaining part is sent to the rest of the world. So the total of 340 containers sent to North America represents a small percentage of the whole capacity in Porsgrunn. In 2016 the market in North America sold a total of 3.1 million ton fertilizers.

6.1 Container operation in North America

"The container process is touched by many hands", was said while talking about the container process in figure 17 showing that there are many people involved in the process.

The whole process starts with the sales representative that forecasts the demand of products. The sales representative forecast on the basis of previous demands, visiting customers and a general view of the fertilizer market. Then he/she places the order to the business unit planner that collects all the demands in the market into a requirement plan and sends it to Central Planning Unit in Oslo.

The Central Planning optimizes and maximizes the output on the different production units based on seasons and the requirements from the markets, and then the production sites (i.e. Porsgrunn) receive each month a production plan (from the Central Planning unit) how much to produce and ship to each market.

When a customer places an order the container order flow diagram will look like this in the eyes of North America, illustrated in figure 17.

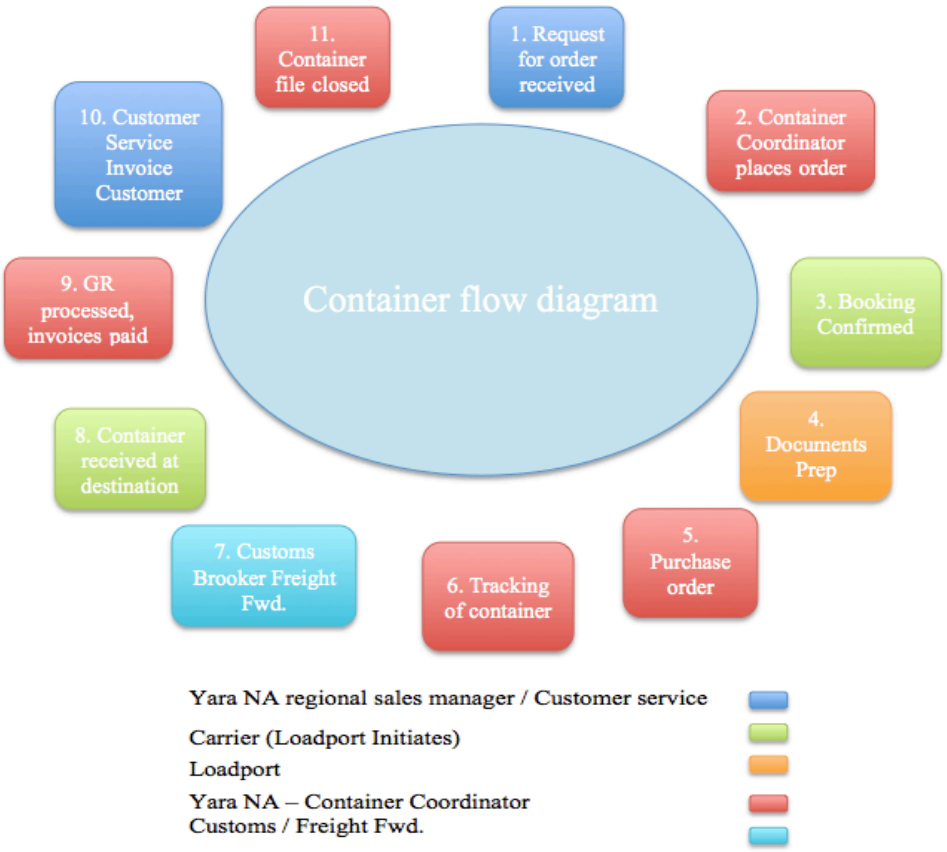

Figure 17 - Hands touching the container flow (Power point from interview)

It all starts with a request for order that is received by the regional sales manager or the customer service then the container coordinator places the order and will receive a booking confirmation by Porsgrunn that the vessel/container has been booked. At the production site the bagging is done and the container is loaded. The documents such as the bill of lading and the packaging slip come from the loading port and will be sent to the container coordinator.

The container coordinator in the US receives the documents and creates a purchasing order and will do the custom clearance if needed. While in transit the container coordinator tracks the container, and could also see if the customs and the freight broker will send the arrival notice. Then the container is received at the destination. The goods of receipt is processed by the container coordinator and this is sent over to customer service that will invoice the customer if needed. The process is ended and the container file is closed and then it starts all over again.

During this whole process some of the more demanding customers would like to know where in the process their container is and this is where the importance of good information and tracking comes into play.
One of the individuals that were interviewed said, “All needs to be in a timely manner. Everything is time sensitive”.

6.1.1 Yara Porsgrunn

The production site in Porsgrunn, Herøya is situated near the ocean as figure 19 illustrates. A feeder terminal and seaport in Brevik and also in Larvik 20 min away are used to transport the products from the production site. The product is sent by truck to the feeder terminal. From the feeder terminal in Brevik and Larvik the product is sent to Rotterdam, and then it is transshipped to North America.

Figure 18 - Trucks transporting containers (Google)

At the production site a container terminal area is already in place, however in the recently years it has not been used in to a great extent. The container terminal at the port will now go under rebuilding and upgrades to be used when their driverless feeder – Yara Birkeland will by 2020 by fully autonomous. The feeder will go from the terminal in Porsgrunn to Larvik or Brevik. Being the first in the world – this will be a new and interesting part of the local supply chain from the production site in Porsgrunn.
The fertilizer is produced in the production site and when shipped in containers - the fertilizer is bagged in bags of 25 or 50 kilo. Figure 19 shows the production site in Porsgrunn, and it

illustrates where the different products are produced and where the material handling areas are with seaport is situated, storage and bagging.

Figure 19 - The production site in Porsgrunn (Power point from interview)

"There is a lot happening behind one order – forecasting and production planning personnel are important parts for the production site in Porsgrunn. Since the factory in Porsgrunn is very often sold out/overbooked this can be both a blessing and a "curse". Nothing is better than to be sold out, this means that the production cite has full capacity utilization. However the flexibility is reduced towards customers in some extent, in the way that could result in markets not getting all products they wanted since we have to allocate product to the best paying markets – this will sometimes create frustration with the individual sales and marketing units" was said during the interview at the production site.

The production plants are continuously producing (365 days per year) receiving raw material by ships and trucks, and are planning production on five integrated production units (ammonia, nitrate and finished fertilizer) on a daily basis. In addition bagging has to be planned on two units in addition to booking ships, trucks and containers for outbound traffic. The fertilizer production in Porsgrunn and its associated port operation is the one of the busiest in Norway due to high volume of inbound raw materials and outbound finished production (more than 5 million tons of raw materials and finished products into the site per year).

6.1.2 Customers and products

The customers that Yara North America serves are divided into two segments: warehouse order direct which means to that the container will go to a warehouse of Yara. The other segment is customer order direct, which means that the container will go directly to customer.

The customer direct segment is obviously the most time and information sensitive, since the customer is getting the container to their own warehouse.
With the container delivery to the customer direct the total time is depending on the lead time from the different production units. Which is the actual time it takes to place the order to the customers receive the product. Lead time is something that all members of the supply chain have to adhere to – and is different from each production site. Meaning that it will take 6-8 weeks to receive from Porsgrunn while from a supplier in Chile it could take up to three months. The aspect of the normal lead time is important for the container personnel in North America to be aware of in order to secure product towards the customers in correct timing.

The majority of containers are sent directly to customers – "about 90%". YaraLiva is the product that is mostly sent to customers direct from the production site in Porsgrunn. While some of the YaraLiva products will also be sent into warehouses. This means that the sales and marketing office in Tampa has a large proportion of time and information sensitive container customers. YaraLiva is clearly considered a Premium Products, where the customer is time and information sensitive.

Some of the customers are more demanding than others wanting to track the container almost all the way while others accept that the process takes the time it takes. In general since 90 % of the deliveries of YaraLiva go directly to the customers this is an information sensitive customer group.

6.1.3 Containers and the container lines

About 90% of the products that are produced at the production site in Porsgrunn is sent out with sea going vessels – either in containers or bulk. Sending the products in containers brings

more flexibility to the transportation; since a container can be transported on trucks, trains and ships with a wide range of products transported in the same container.
Some advantages of the container that has not been mentioned, which came to light in the interviews is that, the container is a great tool to penetrate and opening new markets. Instead of shipping bulk in vessels that has a minimum volume of 5000 ton, the possibility to test the market with smaller volumes in containers that has volumes as low as 16 tons depending on the country is possible. An example of this is the newly opened market in Myanmar – not knowing how the market responds to the product and the demand is unknown, sending in smaller batches with products is a smart way of penetrating and testing a new market.

Container lines

Companies use different container lines. The companies that Yara North America uses for container transportation is from most to least is:

1. Hapag Lloyd – A German company
2. Maersk AP. Møller – A Danish company
3. Hamburg – A German company
4. CMA – Compagnie Generate Maritime – A French company
5. MSC - Mediterranean Shipping Company – An Italian company

Currently, Maersk is the largest container shipping company on a global basis. Followed by MSC, CMA, COSCO and Hapag-Lloyd. Each of these shipping companies have their own website online, where they also offer an own tracking system so end customers and companies are able to track their container.
The competition in the container line market is intense, with huge players in the market and a heavy competition. In regards to which container line is used to transport the cargo for Yara International an employee at Porsgrunn has the responsibility to set up contracts with the container lines for a freight rate set in advance – these contracts are valid for one year or less. There are also some adjustment clauses in the contract (i.e. bunker adjustment clauses that mean if the oil price will increase or decrease a certain level, the freight rate will be adjusted). The container market is connected with the whole global economy. The global economy is getting smaller and smaller, so what happens in China, Asia, Russia, USA, Brazil, Australia

and the EU influences us all much faster than before. The key here is China, China, and China. Said in one of the interview was that “when China cools down the demand of products this results in less transport need, affecting the whole world”.

6.2 Ocean Insights and Yara North America container database

Yara North America was in search of a company that could feed them better and more efficient information about their container operation. A couple of different companies that specialized in tracking containers was found and after some phone interviews, the choice fell on Ocean Insights.

However, before Ocean Insights they first started with an in-house developed container database. The container database was a way of keeping all information about a container shipment in one place. The database in North America has been improved to be more user friendly and it has been upgraded with more features like fee tab, checkpoint for documents to name a few. In the fee tab you can view all the costs such as demurrage, storage fees and overweight fees. The checkpoint for documents allows checking if all the documents that should be in place are done. The database is more a total information archive than an actual tracking tool, it is an important part of the total management of the container operation in Yara North America since it also contains tracking information. Below in figure 20 shows how the internal database looks after the upgrading the functionality.

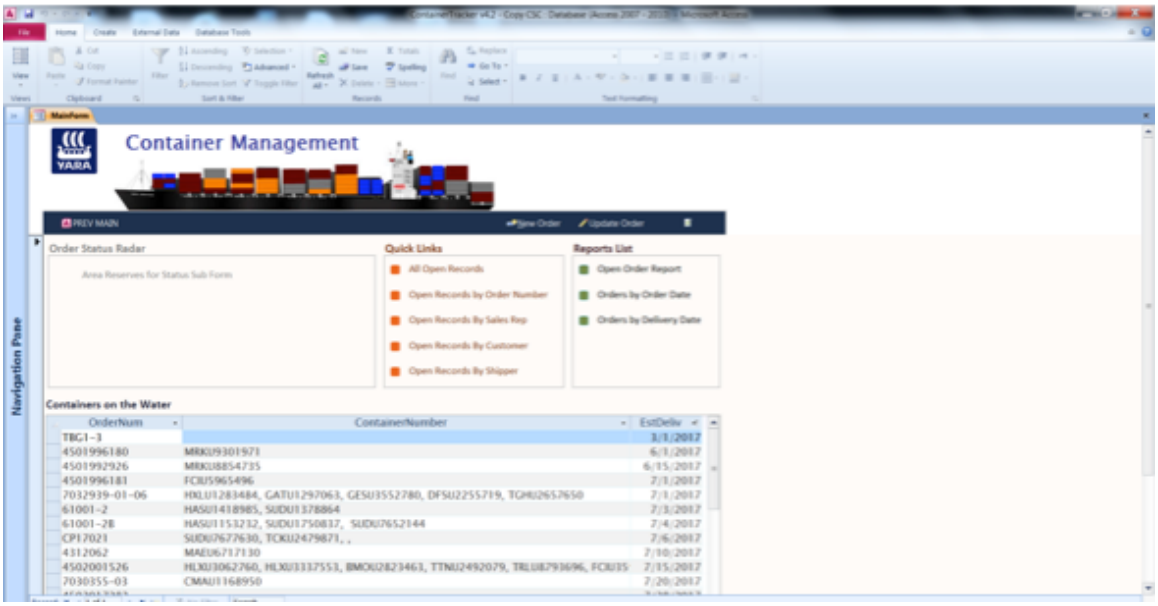

Figure 20 - The new and improved internal database (Power point from interview)

They have now improved their database and are at the moment in a trail with the 3P service provider called Ocean Insights to integrate some of their information into their existing database.

Ocean Insights was founded in Hong Kong. This firm is an expert on ocean freight by consolidating and evaluating several sources of information to guide logistics team all around the globe to stay on top of business. Tracking is done by satellite tracking vessels, and will track all of the different container firms that are shipping goods for the customer.

The founder was challenged at his previous job to find additional information about all the shipping lines and analyze this market, based on analytical and strategic decisions to find carriers that were the most reliable. A system that combined all relevant information like sailing schedules, on-time performance reports, slot sharing agreements and tracking data was not present. With this in mind, a business opportunity was identified and Ocean Insights was founded.

“ We want to revolutionize the whole market and we have big visions for future projects,” says the founder of Ocean Insights Konstantin Borek (Splash 24/7, 2013, p.1).

This website tracks all the containers on one site, which leads to timesaving for users that often are utilizing several container lines to transport their goods. The information on the website is noticeably in a more detailed form, giving the opportunity of seeing statistics of the

different container lines, percentage of delays and on-time delivery and much more. So in addition to giving one point of reference for container data, it also gives comparable information on how the container lines are performing.

The possibility to actually see where the containers are delayed and the reason why has been a shortage of the old tracking solution in Yara North America, and it is believed that the new service from Ocean Insights can improve the customer satisfaction when it comes to better information towards them.

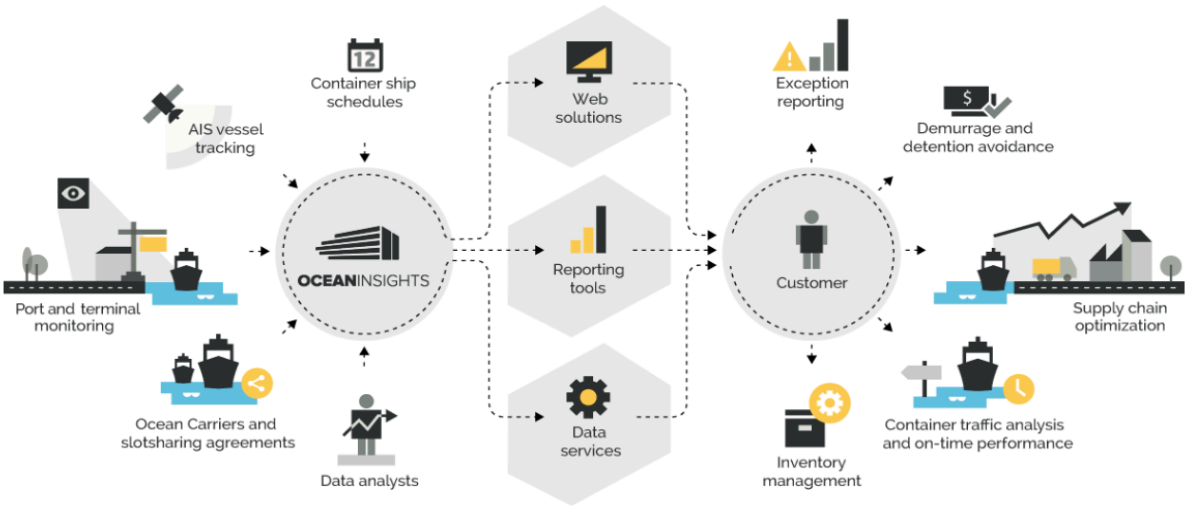

Figure 21- Ocean Insights (Ocean Insights, 2017)

A simple figure shows how Ocean Insights consolidates data from multiple sources. The data analysts are a team of experts that continually monitor and ensure the quality of data. Thus providing information that is reliable (Ocean Insights, 2017). The slot sharing agreements is "when shipping companies buy a certain number of slots from another carrier" (Talking logistics, 2017). The ports and terminals monitor the containers flowing through in order to know what is coming in and going out. The AIS vessel tracking is an automatic identification system that is widely used in the maritime world (Marine traffic, n.d.). Container ship schedules are found on the individual websites of the container lines. These sources are where Ocean Insights gathers their information from in order to present high quality tracking information.

Ocean Insights with the assistance of reporting tools, web solution and data services provides information made accessible and comparable and actionable for the customers to help in their

logistics operation. Helping to better manage their inventory by making the inventory more visible and by giving detailed and accurate information of products that are coming in and out. Statistics and facts are gathered on the container lines to give a realistic picture of the efficiencies of the different container lines. It could help Yara with optimization of the supply chain in reducing overall costs, by choosing the more reliable and overall total cost effective supplier.
Assisting with demurrage and detention avoidance, which is costs that may emerge when exceeding the standard free time applicable by the container carrier or storing the container at the terminal site (CMA CGM, 2017).
Exception reporting will show irregularities or changes that could impact the business operation negatively. By communicating this in a timely manner, the companies can in the future make corrective actions in order to remove or reduce the negative impact on the supply chain operations (Milliken, 2011). This is also one of the benefits of Ocean Insights, the ranking of inefficiencies of the container lines.

The website provides a service of tracking containers. Yara North America claims that " for the price we pay for this service – it is pennies" and the more containers moved the fee per container will be less. The price is 4.75 $ per container and they track a total of 800 containers – this will be in total 3600$ a year. North America has a restriction of 16 ton in the containers, resulting in that the price for tracking per ton is (4,75$ / 16 ≈) 0,30cent. This is not a high price for all the other features that this service provides.

The way the system tracks the containers is that when the bill of lading is initiated and the name Yara N.A or the chartering manager of containers appears and it will start tracking. So Ocean Insights will pick up the information automatically and track it. The bill of lading also allows the company to view what is in the container. E-mail is sent to the office in North America daily with a run down of what is at the point of destination or the terminal, and when estimated time arrival (ETA) or if there are any changes in the ETA or if there is anything stuck in port of disport or transshipment somewhere.

The company allows not only Yara, but also customers to track on their website as well. The end customers will not be able to access the same dashboard as the company. The tracking information will be adapted to the customer as not all the information as statistics of the

container lines will show. A pictogram of the processes is shown or if the customer is interested in looking and numbers and facts this is also a possibility.

Yara North America says, “the sky is the limit,” the high praises and belief in this new system will improve their daily operations to the better. “We have come a long way, and we are heading further – and we are excited about that”.

The initial testing of Ocean Insights service is good according to Yara North America and they feel they are getting value for the money with better information to run their operation in addition to better information towards their customers. However, more time to test the system would be needed in order to confirm this in more detail since they are in the early stages of utilizing this new tracking solution.

6.2 Problems with the current container operations

The main problem was the manual nature of updating the database and the process of tracking containers, as the container coordinator needed to enter every container site to track the container – resulting in a very time consuming activity. “Even though the documents are received and you know it is moving it is like sometimes you get notices and sometimes you would not”, one of the individuals that were interviewed claimed. Then the coordinator will have to go on each individual website to track it. The quality of information found on numerous websites was varying, not giving sufficient enough or good quality. If wanting more information calling all the individual container lines is the only option. With the previous system the not knowing why it was delayed or where it was delayed was a problem. Although the container is loaded onto the vessel that does not mean that it will go directly to the disport, while in route this may change and reroute to pick up other containers. This would not be possibly to know without good quality information from the tracking solution.

North America experiences that the bagging at the production site is what causes mostly the delays in the supply chain. The demand for products in Porsgrunn is so high – as is the demand for bagging, resulting in possible delays at this point.

Another problem is that sometimes the vessel does not come in time for further transshipment. However it is the bagging that is considered the largest problem in the view of the office in North America.

Overall the quality of operation in Yara International is good, however the North American office wants to make it even better.

7.0 Analyzes and discussion

It is obvious that the new system will bring forth changes that will make the workday of the employees at the logistics and planning department in North America easier. Still they are in the start of the trial, and have recently been through a training of the new system. Time will show if this system of tracking suits Yara North America and their needs.

How is the container operation from the production site in Porsgrunn to the market in Yara North America?

As mentioned earlier the amount of containers to the market in North America is rather small in comparison to others. From the production site in Porsgrunn 70% of the products are sent to Asia – which is the largest market for Porsgrunn and the remaining part to all other parts of the world. However the growth of the container segment has been steady for the past years in North America. Prior to 2012 the market received 100 containers, as of 23 August 2017 a total of 700 containers has been received. Improving the operations around the containers to improve the efficiency of the information seems to be needed. Nevertheless, the other business units managing a farther larger amount of containers have not adopted this new tracking solution, still using the tracking provided by the container lines. Is the office in North America stretching to far with adopting a new technology to track containers, or is this a need that the other business units and their customers also would benefit from. If the tracking solution brings forth the benefits that makes Ocean Insights a better tracking solution than the tracking from the container lines this 3P tool could be extended to other sales and marketing units in Yara worldwide.

A factor that is not in North Americas favor is that the road infrastructure is not of a great standard. This is reflected in the amount of payload that is allowed in the containers transported on the roads. Illustrating this with an example to comparison the different payloads in the country is that when shipping to Asia the payload of the container can be as high as 28 ton, while in US it is 16 ton. This makes it more cost effective per ton to use containers as a way of transporting to Asia versus North America. Yara pays the same amount for transporting 28 versus 16 tons. So the full utilization of the container is not optimal when shipping to the US, however for some products the customer can only be served with a container solution.

There are many places where an error may occur, that could affect the whole process, resulting in additional costs, delays of documents or products in the worst case scenario. It is essential that the operation is done in a timely manner and relying on other people to play their part in the operation.

At the production site errors are few – it is said to be at 99+% level. As the production site is all about planning – this sounds reasonable to some extent. Sending the containers to the wrong place is said to be 10 out of the 15 000 containers that are shipped to the markets – which is a small percentage. However the reason for this is due to human mistakes done by someone having a bad day or there is just a mistake done.

" We are one team, and we help each other" the individual at the production site said. All offices work together and communicate with each other. Although human mistakes may occur in all types of businesses, both offices in Porsgrunn and North America point out that the human resources in the company is a huge asset. The container operation is a huge process and on a worldwide basis needs employees that are skilled and dedicated.

Forecasting of sales is highly important when receiving products from the site in Porsgrunn. The site is always sold out – which makes the sales forecast of the market in North America important. Fertilizer is seasonal so the demand for fertilizer will vary from season to season. North America and Canada are together two large countries with different climates and seasons. Which means that there are different needs of when the fertilizer needs to be applied to the fields. If the sales rep forecasts are not accurate this will affect other parts that are

upstream in the supply chain, as well as the customer. For planning the distribution of fertilizer and by receiving products from the production site in Porsgrunn that is always sold out the forecasting of the markets is essential. The volumes that are to be sent to the different markets are set based on the forecasts, and the possibility to get additional products from Porsgrunn will mean that the central planning in Oslo will evaluate if one market will get less, resulting in another market receiving more.

One could say that in regards to competitive advantage – the Premium Products are centered around the service leader concept of competitive advantage while the Standard Products are based on the cost leader side. The Premium Products results in higher revenue and profitability for Yara and is tailored to the special needs of the plants. While the Standard Product does not lead to a very high profit as the profitability of the product is less per ton. The competitors of Yara mostly operates with a product portfolio of Standard Products, while Yara's product portfolio has an advantage of a more diverse range of Premium Products to sell to their customers as well as their Standard Product. Some of these Premium Products are delivered in containers and good management of the container operations is then important to have satisfied customers.
The possibility for customers to go directly to the warehouse brings forth flexibility for the customers who wants the product right now or are not a customer. The lead-time towards the customer direct is set – there is little to do about this. As the majority of the containers approximately 90 % are sent directly to the customers in North America.

The 700 containers that are sent to Yara North America from Porsgrunn every year is Premium Products where good quality information is important.

How has Yara North America experienced the information of tracking containers?

The site in Porsgrunn uses the tracking solution provided by the container lines. From the view of Porsgrunn the information on the sites is said to be good. The sites are upgraded all the time and they are professional. "It is flexible, very ok and transparent", was said during one of the interviews.
The team in North America has another experience of the information found on these sites. The information on the different web sites was not alike – making the information not

consistent from all the parties involved. When not having the information – calling the container lines is the only option to receive that additional information needed. Another thing is that there was not always sent conformation or notice on where the product was, resulting in that the container coordinator would constantly need to enter the websites and check the status of where the container was.

So the perception of the quality of the information seems to be different from the two perspectives. However it is more likely that the business units instead of the production sites see the potential of this tracking solution. Essentially it is the business units that are interested in tracking the information surrounding the product since they are closer to the customer. The priority of the production site is first of all planning and producing the product, bagging them and ship them out of the site. While the business units are closer to the end customers – and this is their first priority.

Regarding the quality, quantity and speed of the information flow. All of the above is considered a must in a modern supply chain. With tracking from the container line websites, the lack of consistent quantity and quality was the largest problem. The aspect of speed was also not at the most optimal level – this was due to entering all the container websites from the point of view of Yara North America that was a highly time consuming activity. To get the image of how many containers the container coordinator had to handle and track – one of the interviewees brought this large folder with them - showing the orders for only September. Imagining how time-consuming it would be to go over all the papers to find the right one if information was missing. The container coordinator handling the tracking of containers in this paper-based form would have to be really organized. It was said, “It is easy to loose track of all the containers coming in and out”. Since there is not always a conformation that is sent on the whereabouts or changes, automating this process will benefit and ease the stress element for the container coordinator and making the information flow more efficient.

Will the implementation of Ocean Insights improve the satisfaction of Yara North America and the end customers?

A satisfied customer leads to larger profits and potentially new customers as the popularity increases through word of mouth and recommendations, while a dissatisfied customer may not return.

Yara North America was not pleased with the information from the container lines and as it is important for the company to have information that is accurate, timely and complete to pass on to customers as well as using this themselves. Automating the process of tracking will ease the stress element of the container coordinator responsible for tracking all the containers, and saving the individual for a lot of time. By actively seeking out a new service provider they are doing something with the situation they are in now, to better the information flow related to their customers that receive the product in containers.

Customers are becoming more demanding in terms of information – which is the result of the technology developments. Before customers had a lot fewer expectations when it came to delivery time. The possibility to track products has increased the customer expectation, forcing companies to pay close attention to potential problems that can occur in the supply chain. However it not all the customers that are demanding visibility and information along the supply chain, some just accept the time it takes to arrive. The challenge is to find the balance of satisfying the most demanding customers and the internal expectations to information.
In todays competitive business environment, as well as the consumers who has high expectations and are more informed than ever before, it is crucial for the companies to develop a customer-driven operation to create a distinct experience through their supply chain. As product or service and the pricing is no longer enough to meet the customers expectations, meaning a generic supply chain will most likely not meet the expectations of the consumers.

It is still to early to guarantee that Ocean Insights will improve the customer satisfaction; however with a tracking solution that provides more information to the demanding customers, will most likely increase their satisfaction. The team in North America believes that Ocean

Insights is a great tool that will improve the information towards their customers, and help the office in North America with their internal handling of containers.

Will the implementation of Ocean Insights improve the internal handling of container information in Yara North America?

The office in North America is the only out of the total six business units: Europe, Asia, Africa, Latin- America and Brazil using another form of tracking than the tracking solution provided by the container lines.
The manual nature of updating the database with the latest information from the individual container lines website and that the container coordinator had to enter all the sites in order to track the container was seen as a challenge. The information from the individual container lines was seen as somewhat scattered and unreliable. To improve the situation a search for a tracking system that could feed them the information to make the whole process more automatized and with better information towards the customers was started, and the choice fell upon Ocean Insights.
Receiving an email of the changes early in the morning instead of entering each website of the container lines will save a lot of time spent on tracking. The system catches the order by Yara North America as their name or the name of the charter manager appears and will automatically start tracking the order.

Moving from a manual to a more automated process of tracking will first of all save the employees a lot of time spent on tracking containers, in addition they now also get information about the container lines that can be used to optimize their business. They will also be able to inform their customers in a better way.
An example is that the statistics in the exception reporting provided by Ocean Insights ranks the carrier efficiency. This could be used when negotiating the freight rates. If the container line is not efficient enough – " why do you raise the price?" By presenting and being able to compare performance over time, across the container lines this is a great asset and sets the decision based on solid ground.
The possibility to see more exactly where and why the delay occurs in the supply chain, with knowledge of this it makes the company more aware and be able to prevent "disasters" from

happening. The features in Ocean Insights makes it more unique than the one provided from container lines, as there are additional features that are not provided by the container lines.

Ocean Insights gathers information from multiple sources as shown in figure 21 which all together is quality assured so the information that is present on the site is of good quality. By collecting information and tracking containers on one website, saves the container coordinator the time spent on scrolling through X amount of the websites of the container lines.
Since Ocean Insights is not a container line itself; by providing only a web service of tracking containers in the supply chain leads to an objective part presenting the information in an unbiased way in the supply chain.
The container lines are a part of the supply chain to the company – and may be a biased part in the supply chain. As they are most likely not willing to give their inefficiencies up, thus the chance for losing customers that is not satisfied when realizing how "inefficient" they really are.

The former database in North America – " it worked" according to the team. However with the new and improved internally developed database this will assist the container operation in a better way. It is possible to download the files from Ocean Insights into the database, which saves time for the container coordinator that had to manually type in the information from the container lines into the database. By adding the document tab this will help the employees to keep track of documents. If the documents are not done it will visualize the paper trail that needs to be done. If the papers for a container are not in place – for example when the container reaches the point of destination and the office in North America does not have the documents it will sit there until everything is sorted out and the cost of demurrage will occur. For the fees that may occur a fee tab was also integrated into the new database, which gives the company an overview of the costs. By this the company can go back and see where the costs normally occur, and be able to pinpoint one port Yara has a problem with and knowing a little bit more where the issues arise.

The new and improved information from Ocean Insights, that is possible to integrate and upload into the database, is believed to improve the information towards customers and give efficiencies in the local supply chain organization in North America but with respect to actual

operation of the process and also potentially to pinpoint more accurately cost saving areas in the supply chain.

Is it feasible for a company as Yara International to invest in Ocean Insights?

An aspect that the company has to take into consideration when evaluating this is the cost of this. Tracking containers on the website of the container lines is free of charge as you are paying the container lines to transport the container. Ocean Insights provides tracking as a service and charges an amount per container that is tracked by their system. By tracking a larger amount of containers the amount per container will be reduced. If the costs weigh up for the benefits with the information provided by this system it should be considered as a service to implement in other business units. Other markets such as in Asia, where the payload of the container is 28 ton, the price per ton of tracking will be 0,16 cents. Resulting in a lesser cost than in the US (0.30 cents), due to the weight restrictions of the amount transported in the container. Most of the other business units have a higher payload in their containers, resulting in that containers are on average tracked at a lower cost than in the US. Most likely Yara International could also negotiate a lower cost if it negotiated as Yara International and not only Yara North America.

Yara International is a company with a large supply chain and with over about 50 000 containers set worldwide every year, a service as Ocean Insights would bring a more customer centric approach and lead to higher customer satisfaction for a quite low cost. In addition the information from Ocean Insights could also be used to negotiate better rates towards the container lines and in addition it would lead to less local operational cost to follow up the container operations.

7.1 Findings, recommendations and limitations

As Ocean Insights is an unbiased part in the supply chain, they are able to provide information and other additional features that the container lines lack. These additional features will make Yara North America capable of pinpointing more accurately where potential cost saving areas in the supply chain are, with a more detailed picture of where the delays occur and why. Helping to make the operation of tracking containers move from a

manual to a more automated process will save time for the employees involved in this process and the information towards customers will be more efficient, hopefully leading to a satisfied customer.

Recommendations

If Ocean Insights gives the benefits that are predicted by the office in North America then the next step would be integrating the tracking solution in the other business units in the world – such as in Latin- America, Asia, Africa, Europe or Brazil. With having one uniform information platform the tracking information would be more consistent throughout the organization. Also by negotiating as Yara International with all their container operations worldwide, one could maybe also get a better price from Ocean Insights.

The process of tracking in a manual fashion when handling that large amount of containers would from an outsider's point of view seem impossible. As handling more containers an upgrade of the systems surrounding this seems to be recommended. When imagining the other business units receiving far more containers it could be an even bigger potential in this for Yara International ASA in total.

The cost aspect of this has to be evaluated before eventually rolling out this service to all or some of the other business units, since tracking of containers by the container lines are free and Ocean Insights charges an amount per container tracked. This will be an additional cost when transporting their products, so this will be something that the company has to evaluate. Weighing the benefits and challenges against the cost of implementing and tracking the service on a world basis should and could be done. One benefit that weighs up for implementing Ocean Insights is the possibility to rank the container lines by their efficiency. This provides the person responsible for negotiating the freight price with another argument in the negotiations. The possibility of pinpointing potential cost savings areas could also be seen as a great advantage that Ocean Insights makes visible in the supply chain.

In today's global market, companies are forced to satisfy the more demanding customers in order to obtain competitive positioning and competitive advantage. The development of the Internet World Wide Web has increased the speed of information between the companies and

customers. As Yara is the customer of the service provided by Ocean Insights they have shown that they are also demanding better information with respect to quality, quantity and speed. The container lines were not providing the information that they desired, thus a better solution was needed in order to improve the information flow, and this is where Ocean Insights has found a niche in the market, and Yara North America has found a better information service provider.
Customers expect to be updated all the time, consequently resulting in companies searching for better ways of updating the customers at all time. With companies taking an active role to be different and seeking out better solution to optimize their supply chain they have a higher chance of surviving in the market and satisfying the customers.
It is now not enough with the best product or price, the information has become another important factor a company can differentiate on, as experienced by Yara North America.

The customer placing an order for fertilizer is dependent on the product to come at the time it is planned to arrive so that the farmer is able to fertilize the fields when they are supposed to do so. Therefore timely and accurate information is important to keep the customer satisfied. The experience of getting good information will lead to a satisfied customer – and a satisfied customer will come back and do business with the company.
There could be further upside for Yara International to improve the customer experience with an even better information flow towards customers, thus improving the customer experience and creating a competitive advantage versus other fertilizer companies in the market.

The management in Yara International should evaluate if it makes sense to roll out in other sales and marketing units worldwide.

Limitations

Limitations with this study may be the possibility to make this global for the business units in Yara International ASA. It might be just right for the business unit in North America, due to a small amount of containers in comparison to some of the other business units. However on the other side more containers with Premium Products in other markets (e.g. Asia) should mean the opposite, i.e. a potential for improved customer satisfaction for the customers in the other regions.

Ocean Insights is one of several tracking solutions in the market and is just one of many possibilities that could help them track container. The other tracking systems may be as good as or even better than Ocean Insights, however the office in Yara North America had to start somewhere in order to improve their container information, and the choice ended upon Ocean Insights after some evaluations.

Whenever implementing a new system other stakeholders may be reluctant to come on board with this. However as Yara is such a large company – if the management feels it is the better solution – this will be implemented in other business units regardless of the level of reluctance.

There is also a limitation with this thesis that no actual customers were interviewed. By interviewing the customers their view on how the previous tracking solution was perceived and eventually the problems they encountered would be underlined. In addition the importance of information for the customers would be highlighted. This would have given a "complete" view of the whole supply chain, however as Yara North America is also a customer of receiving and tracking information this view is somehow indirectly reflected via the Yara North America sales and marketing office. Yara North America is still in the start phase of this tracking solution, thus conducting a study when it has been up and running for some time would be more beneficial to get the real experience from the customers of the supply chain.

Figure 22 - Customer of Yara International ASA (Yara, 2017)

8.0 Further study

Further study of this would be going back to see if this new technology – Ocean Insights - has given the benefits that the Yara North America had hoped for. They were still in the implementation and start phase of the technology, so this was to early to quantify at this time. However, when the company is well on their way conducting a quantitative research when the technology is well embedded in the container operation would yield better results to get the picture of a cause-and- relationship factors.

Another interesting part is that this technology can be integrated in other business units of Yara International in Asia, Africa, Latin- America, Europe and Brazil. As the office in Yara North America is the only out of the in total six business units using another tracking solution than the one provided by the container lines, it would be interesting to hear the different experience the other business units has with the current tracking solution.

The view of the customer is another interesting part that could be investigated in more detail. Finding out if the customers of Yara North America has noticed any changes with the new tracking solution that is implemented. Are the customers more pleased with the information surrounding tracking or not and the reasons for this. The customers are the ones that the company wants to please and brings profit, satisfying the customer is one of the main goals for every company.

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10.0 Appendix

10.1 Interview guides

North America:

Explain how the container process is here in North America?

- What happens when a customer wants a product? The process around that.
- How many containers are received?
- Who are your customers?
    - Which are the most demanding?
- Forecasting role in the process?

The old information technology.

- Advantages/disadvantages and challenges
- How was it used?

The new information technology

- Advantages and disadvantages so far?
- How does it function?
- Why switch from the old technology?
- Where do they get their information from?
- Can customers themselves check where there orders are?
- Where do you see this technology go?
- Is there any other technology used to keep an overview of containers?

Porsgrunn:

The production site in Porsgrunn – explain.

- Amount produced here?
- Products that is produced here?
- Operations in this facility?

How is the container process?

- Containers that are handled here?
- Markets and customers you are serving?
- Advantages and disadvantages with the use of containers?
- How many people are involved in the process?

Information and information technology

- What is used here?
    - How is that working?
    - Are there any problems with it?
    - Any additional support to have a overview of containers?
- Thoughts about ocean-insight used in North America?

10.2 Reflection paper

My master thesis is about the how information technology can improve customer satisfaction and improve the actual operation in the supply chain of Yara North America. Yara North America wanted to improve the information flow around their shipment of Premium Products in containers, and has implemented a new information technology of tracking containers – Ocean Insights. The findings are that Ocean Insights will save a lot of time spent on the tracking process, and is seen as a better information platform than the container lines tracking system in the perspective of Yara North America. In addition it will benefit other part of the supply chain, by possible cost –savings and better grounds for negotiating rates with the container lines.

International forces

The unit of analysis in this thesis is Yara International ASA. Yara is a fertilizer company with a worldwide presence; meaning international forces are highly relevant. The shipping market and the fertilizer market are relevant for Yara when conducting business. For transporting the products ships are the transportation mode that is mostly used. The forces affecting the shipping market are explained in the thesis with this model. These forces affect how many ships are available in the market, and what affects the demand of ships. In this picture Yara International ASA will try to seek out the most cost effective and customer oriented solution.

The fertilizer market is mainly affected by the population growth and the economic growth of the countries. As the population is growing, so is the need for more food. A 50% increase in

food production is needed to feed the world by 2050, and fertilizer will help the farmers produce more food crops. The supply of fertilizer is dependent on the access of natural gas and the natural minerals in the ground such as potash and phosphate.
Other market forces that could affect Yara is the merger between two of the competitors of Yara to become one giant fertilizer company, this means that competition will be more intense in the market. A way Yara is dealing with this is by acquiring plants that produce fertilizer, to expand their production capacity on a world basis.

The fertilizer market is seasonal so the environmental forces will affect the sale of fertilizer, with forecasting as an important part of the supply chain this deals with the seasonality of the demand. The weather conditions and climate is different all over the world resulting in different seasons for fertilizer to be applied to the fields. Since Yara sells their fertilizer worldwide the seasonality will not impact their business in a large scale.

Regarding the ethical and moral forces Yara has for the past years been in the newspaper in connection with corruption. This is not seen as ethically right, and the employees caught in this scandal was fired and put in jail. A normal practice in each office now is assigned a job where an individual is in charge of ethics and corruption. In another aspect something Yara is doing that is ethically right is the new electric autonomic feeder boat that will remove about 40 000 trucks from the road with zero emissions which is a great step in towards a greener supply chain.

The social forces are what drive the consumers choice of buying products. The world is seeing a change in food habits as some countries are craving more meat mostly the developing countries, while others are demanding a more rich diet of vegetables and fruits. Yara´s product portfolio consists fertilizers to plants and crops as well animal nutrition. In this way Yara is safeguarded towards the changing food habits of the world.

Innovation

In my master thesis the market unit in North America has implemented a new technology called Ocean Insights, which provides the company with the service of tracking containers. This was a need that the market unit found to be necessary for an improvement of the

information flow of tracking internally and also externally towards the customers. This can be seen as an innovative approach to solve the gap. As the tracking that is provided from the containers lines was seen as scattered and unreliable. However as all the other market units are using the tracking service provided by the container line, there is a gap of consistency in regards to a tracking solution.

Meaning is there also a unified gap in regards to the perception that the information from the container lines is not satisfying? If this is a fact then an implementation of Ocean Insight on a world basis in the market units should be considered or another tracking solution. First of all a team should be set up in order to investigate this matter. All market units have been using the tracking from the container lines, so first of all there should be analyzes of how the market perceives the information from the container lines. Before an implementation a cost analysis has to be performed to consider the cost aspect, as tracking from the container lines is free of charge. Weighting the benefits against the possible disadvantages with implementing Ocean Insights in the other market units needs to be considered. However if this is not considered a solution that meets the requirements, then the question if the tracking from the containers lines is satisfying enough or the search continues for a better solution than Ocean Insights to implement in tracking containers in the supply chain.

Corporate social responsibility

Corporate social responsibility, (CSR) is a corporation's initiatives to assess and take responsibility for the company's effects on environmental and social wellbeing.

Some of the potential ethical challenges with Yara International are that as a multinational company with a worldwide presence, it will potentially meet ethical challenges of some sort in every country. Some examples of this are that since fertilizer helps the crops to grow more effective and efficient. A problem that the market unit in Latin America has experienced is that fertilizer produced by Yara is used in growing cocaine plants. This is not a growth area that Yara wants to support, however it is difficult to prevent.

Here in Norway the focus of no palm oil in products is enormous, however as oil palm plantations are customers of Yara in Asia. Yara claims that they are mitigating these effects in the sense that their products are more effective and as such lead to less need for cutting down rainforest.

Operating in many countries where bribery is seen as a part of doing business and getting things done, this is a potential challenge that the company can meet when conducting business.

As bribery and corruption is not seen as a practice that Yara wants to be a part of, there is now a much more thorough process of accessing the business partners and each market office - also Yara North America has an Ethics and Compliance function that ensures that bribery and corruption is not happening.

Some specific actions that can be undertaken in order to strengthen responsibility is that as Yara is transporting most of their products in ships. As their most used transportation mode is ships making them more eco friendly. Yara Porsgrunn in corporation with Kongsberg Maritime are building the first fully electric and autonomous feeder vessel, with zero emissions. This feeder will have a capacity of 120 containers, and the plan is that it will set sail in 2020. This is a great CSR initiative as it is reducing the truck and associated pollution in the local community.
As a leading global fertilizer company with a mission to feed the world and protect the planet, investing in this zero emission vessel to transport the crop nutrition solutions fits the strategy well.