



# Master's degree thesis

**LOG950 Logistics**

**The New Silk Road: A comparative analysis of the railway-solution as an alternative to the sea and air routes between China and Europe/Scandinavia**

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## **Preface**

This master' thesis was written to complete the Master of Science in Logistics program at Molde University College. The research work was conducted in the time-period from November 2017 to May 2018.

The project is a case study of China's New Silk Road-project and the ongoing development of the rail solution between China and Europe/Scandinavia. The idea and objective has been to do a comparative analysis of the rail solution as an alternative to the sea and air routes between China and Europe/Scandinavia

We collaborated with the Scandinavian logistics company Greencarrier, who gave us necessary insight and understanding of the topic. The research process has been challenging, but also rewarding in terms of knowledge and understanding of the complexity of the New Silk Road-project.

We would like to thank Greencarrier and their representative Johan Ignell for their collaboration and their openness. This has helped us in our search for understanding and knowledge.

We would also like to thank our supervisor from Molde University College, Dr. Harald M. Hjelle for his enthusiasm, guidance, expertise and contributions to our thesis. We have been getting regular follow-up during our research period, and he has provided us with valuable inputs throughout the whole process.

Molde, May 2018

Eirik Haugland and Ole Harald Toppe

# Abstract

This master's thesis describes the New Silk Road and provides a comparative analysis of the railway-solution as an alternative to the sea- and air routes between China and Europe/Scandinavia. The aim is to map and examine to which role the rail-based solution play versus the sea- and air-based routes between China and Europe/Scandinavia. To supplement this research problem, two main research questions are developed: (1) What is the New Silk Road, and what is the current state of its development? (2) How well does rail transport compete with sea and air transport between China and Europe/Scandinavia?

In addition to examining the overall rail solution, relevant information from the logistics company Greencarrier is used as an example to provide the reader with firsthand experience and knowledge from a company which today offers a rail-solution of freight transport between China and Europe/Scandinavia.

The research problem focuses on understanding the whole New Silk Road-project, seeking to find relevant information and answers about the potential of the rail-solution between China and Europe/Scandinavia. A qualitative research strategy is therefore applied in conjunction with a case study design to support the research problem and to gather relevant data. However, some quantitative data is also used and analyzed to perform the comparative analysis related to the different transportation modes.

Different theories related to trade, transport economics and transport costs are described to provide a solid platform for the answering of the research questions and the research problem. A framework of characteristics related to the different transportation modes and intermodal transport is also described.

Trends related to investments and trade between China and Europe/Scandinavia are discussed, including information about the different types of goods that are being transported. Important elements like lead-time, costs and competition are examined as well as the environmental perspective. The existing sea route through the Suez Canal, the potential for a future sea route through the Arctic Sea, as well as the existing and future air routes linked to the New Silk Road-project are also discussed.

## **Abbreviations**

AIIB	- Asian Infrastructure Investment Bank
BZD	- Belarusian Railways
CAAC	- Civil Aviation Administration of China
CBM	- Cubic Meters
CRE	- China Railway Express
CFS	- Container Freight Station
EB	- Eastbound
EU	- European Union
FCL	- Full Container Load
FDI	- Foreign Direct Investment
FOB	- Free-On-Board
HO	- Heckscher-Ohlin
HP	- Hewlett-Packard
IMO	- International Maritime Organization
KTZ	- Kazakh Railways
LCL	- Less than Container Load
LSP	- Logistics Service Provider
MSR	- Maritime Silk Road
NSR	- Northern Sea Route
RZD	- Russian Railways
TEU	- Twenty-foot equivalent unit
WB	- Westbound

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# 1. Introduction

This chapter introduces the reader to the topic of the thesis and further explains the structure of the thesis.

The New Silk Road, also known as China's Belt and Road initiative, was introduced and presented to the world by the Chinese President Xi Jinping in 2013. By reviving the ancient Silk Road through investments in infrastructure, the idea is to reinvigorate the once ancient trade relationship between the "East" and the "West". With the initiation of a double-trade corridor, covering both land and sea routes, China has made deals and agreements with over 60 countries as the project has unfolded. (Arviem, 2017)

Many of China's underlying reasons for developing the New Silk Road-project are strongly commercially and geopolitically related. In recent years, China has experienced a vast industrial overcapacity, especially in the industries related to steel manufacturing and heavy equipment. The new trade routes along the New Silk Road could serve as an outlet in dealing with this challenge of overcapacity. Further, to account for a potential downturn in its domestic market in the future, opening new trade markets could help China in the process of keeping the national economy buoyant going forward. Finally, forming economic and cultural partnerships with other countries through the New Silk Road-project could help and may lead the way towards China cementing itself as a dominant player in world affairs. (Lockhart, 2016)

As Europe is China's largest trading partner, the New Silk Road-project is also important for Europe when it comes to economic as well as strategic reasons. The New Silk Road could offer European companies access to new markets in the Asia-region along the route, and further increased access to the Chinese market itself. Further, one should keep in mind that the New Silk Road is a "moving concept", being developed as it matures along the way. In this prospect, Europe may be best served by working towards developing the New Silk Road-project to become a true Europe-China initiative, making it mutually beneficial for both sides as the project moves along. (Loesenkrug-Pietri, 2015)

Being a major infrastructure project with a long-term perspective, the New Silk Road-project includes several strategic and visionary investments along the way. Today, one of the most interesting and highlighted investments in the project is centered around the idea of a long-distance rail connection between China and Europe, as the demand for rail have increased in recent years. As shippers typically have used two options for transporting their goods between Asia and Europe, either by sea which is cheap but slow, or by air which is fast but expensive, the New Silk Road-railway offers an alternative which is faster than sea and cheaper than air. For customers who have time-sensitive goods, such as special promoted merchandise in the apparel industry, or capital-intensive goods such as automotive parts or electronics, this transport alternative may have a market potential following the huge ongoing infrastructure developments as a result of the New Silk Road-project. (Arviem, 2017)

This thesis focuses on the development of the New Silk Road, and its alternative routes for transportation of goods between China and Europe, with a specific focus on the goods between China and Scandinavia. The main focus will particularly be on the rail-solution, mapping and analyzing the solution's potential today and in the future, as well as comparing it to the sea and air routes between China and Europe/Scandinavia. By the sea and air routes, we here refer to the sea routes through the Suez Canal and the Northern Sea Route (NSR), in addition to the various air links between China and Europe/Scandinavia.

To get a better understanding of the transportation of goods by rail along the New Silk Road between China and Europe/Scandinavia today, we will use a logistics company that performs these services today to serve as an example in the thesis. The company we have chosen is the Scandinavian logistics company Greencarrier.

The remainder of chapter 1 provides an insight into the background and motivation behind this thesis. An introduction to the project and the research problem is given, and the boundaries of the paper are defined.

Chapter 2 provides an overview of the different research methods and tools applied.

Chapter 3 provides insight into the most important terms used and the theoretical backdrop applied throughout the thesis.

Chapter 4 explains the New Silk Road-project in depth, while a thorough description of Greencarrier as a company and its solutions is provided in chapter 5. This chapter also covers how Greencarrier conducts its logistics-activities.

Chapter 6 describes maritime transportation and its characteristics regarding the maritime routes and container shipping in general. It also touches upon the development in the shipping market.

Chapter 7 covers alternative air solutions from China to Europe/Scandinavia and related statistics for analysis.

Chapter 8 contains a discussion and an analysis of the various elements in the thesis.

In chapter 9, conclusions are drawn based on the main findings of the discussion and analysis.

## **1.1. Background and motivation**

This thesis is inspired by both authors' choice of Transportation as specialization-field during our Master in Logistics-studies at Molde University College. Through courses like Maritime Transportation and Air Transport Economics we have gained further interest in the field of transportation related to logistics operations, solutions and activities, etc.

The New Silk Road represents an interesting, complex, and evolving transportation and infrastructure-project. The initiatives and investments related to the project include several infrastructure and transportation routes, both on land and sea, which further create new opportunities and perspectives in areas like trade, economics, geopolitics, etc. Being a Chinese initiative, we wish to explore China's perspective for the New Silk Road, as well as the European perspective. Also, we especially wish to explore the Scandinavian countries' perspective in meeting the challenges and opportunities the project presents. To compare the different modes of transport along the route will be a large part of the work. Further, to explore the potential of the railway-alternative will be of particular interest given the developments and investments related to the solution along the New Silk Road in

recent years. Here, Greencarrier will serve as an example of a logistics company offering a rail-solution along the New Silk Road.

## **1.2. Research problem**

Our research problem is based on the introduction which explains the development of the New Silk Road, and thereby also the rail connection between China and Europe/Scandinavia.

### ***Research problem:***

***“Which role do rail-based solutions play versus sea- and air-based routes along the New Silk Road between China and Europe/Scandinavia?”***

The structure of the research is defined further in section 2.2 where our research questions also are developed.

## **1.3. Limitations of study**

As we see it, the limitations of this study relate to data availability and the fact that the New Silk Road is an ongoing project, continuing developing as we speak.

The first point is based on the fact that there is a lot of literature on the subject, but not that much literature regarding lead-times and goods along the route. Our research relies, to some extent, on reliable information provided by the logistics company Greencarrier. The information that we have obtained and gathered from Greencarrier provide much of the ground work for our analysis, but additional sources are also used.

Secondly, the fact that the development and history of the New Silk Road-project is ongoing and fairly new to this day, limits the amount of scientific literature available related to the project.

## **2. Research methodology**

Methodology can be defined as how we come to know the world. Methodology is closely related to epistemologies, but the nature methodologies are more practical than epistemologies. While epistemologies give a more philosophical view of how we come to know the world, methodology approaches the same subjects with a more practical view. Methodology can further be described as the philosophy of methods, and the objective is to describe how one could study a given problem or issue. (Eriksson & Kovalainen, 2008)

In this part of the thesis the different research strategies are described. Based on these strategies, the research structure for this thesis is defined. The choice of research strategy given the nature of the study is discussed, and further elaborations on the research design is conducted. The different research methods used will be explained, and the applied tools will be demonstrated in the chapters in this section.

The methodology section is divided into some of the main steps of a qualitative research based briefly on the illustration by Bryman & Bell, (2011):

*Research strategy and choice of research strategy, Research problem and Research questions (RQ), Research design, Research method, Data collection.*

### **2.1. Research strategy**

When defining the research strategy for this thesis, we need to define the term research strategy. There are a few definitions to choose from, but (Bryman & Bell, 2011) has a straight forward definition of a research strategy. The authors explain research strategy on page 26 as a general orientation to the conduct of research. In other words, an orientation of how the researchers plan to conduct their research.

The first and probably main step when choosing a research strategy is to decide whether the research will be mainly qualitative or quantitative. These strategies have different distinguishing features, and the choice of strategy will in many ways shape the results of the study. The choice of type of research in this thesis is based on the nature of the

research problem and the research questions that is explained in chapter 2.2. But first, the two main research strategies according to (Bryman & Bell, 2011) are defined:

**Qualitative** research: *“A research strategy that usually emphasizes words rather than quantification in the collection and analysis of data”* Bryman and Bell (2011, 26).

The qualitative research has an inductive approach when considering the connection between theory and research. This means that the qualitative research studies are more worried with the interference of the real world, while the quantitative studies are more theoretical testing of a given model. The qualitative research is more focused on the statement that the social reality in the world is a *“constantly shifting emerging property of individuals` creation”* Bryman and Bell (2011, 27)

**Quantitative** research: *“A research strategy that emphasizes quantification in the collection and analysis of data”* Bryman and Bell (2011, 27)

Bryman and Bell further say that a quantitative research strategy means that the researchers have a deductive approach regarding the connection between research and the relevant theory on the given subject. Social reality is viewed as an external, objective reality. (Bryman and Bell, 2011)

### **2.1.1. Choice of research strategy**

In this master's thesis, we as authors have attacked the research problem in a detailed and thorough manner. The aim of the thesis has been to get a broad understanding of the New Silk Road-project, and the rail transportation solutions utilized between China and Europe/Scandinavia. The thesis aims to investigate the rail solution and compare it with the air and sea transport solutions. There are relatively few scientific studies which cover this, so an interesting aspect has been to see how well the rail solution compete with the other solutions. The research questions illustrate the objectives with the study, and they are mainly qualitative driven research questions. The research strategy is thereby a qualitative study. However, some quantitative data is utilized and analyzed to perform the comparative analysis of the transportation modes.



## **2.2. Research problem and research questions**

Being a qualitative study, as explained earlier, a good starting point is to formulate a research problem. When a research problem is defined, the research questions are formulated. These research questions are based on the literature review of the different aspects of our study, and they are important for the further research. The research questions are used as guidelines in the research process since the research design and data collection is dependent on the nature of the research questions. The analysis is based on the research questions and clear questions helps the author to be direct in the research, and not take the research in other directions than the ones that are relevant for the thesis. (Bryman and Bell, 2011)

This chapter firstly presents our research problem and thereby our formulated research questions.

### **2.2.1. Research problem**

Our research problem is based on the literature review. Sea transportation is the dominating mode in terms of volume capacity, and air transportation is the fastest in terms of lead-time. Based on this, our research problem is as earlier stated:

*“Which role do rail-based solutions play versus sea- and air-based routes along the New Silk Road between China and Europe/Scandinavia?”*

After developing the research problem, the research questions are developed. These are closely related to the research problem and forms the direction of the study while also broadening the study.

### **2.2.2. Research questions**

***RQ 1:***        *What is the New Silk Road, and what is the current state of its development?*

- RQ 1.1**      *What is the background for the development of the New Silk Road?*
- RQ 1.2:**      *How far have the plans been realized?*
- RQ 1.3**      *Which scenarios for future developments could be drafted within the next decade?*
- RQ 2:**        *How well does rail transport compete with sea and air transport between China and Europe/Scandinavia?*
- RQ 2.1:**      *How well do the current rail-based solution perform in terms of lead-times and costs?*
- RQ 2.2:**      *What type of goods is transported with rail along the New Silk Road today?*
- RQ 2.3:**      *What types of goods could possibly be moved from sea/air to rail?*
- RQ 2.4:**      *How far have the new rail-based links between China and Europe/Scandinavia been developed?*

These RQs divide the thesis into two main parts. The first one is about China and their enormous trade and infrastructure project: The New Silk Road. The supporting question to RQ 1 is meant to illustrate the possible future developments on the New Silk Road. The project is developing as we speak, and it would be relevant to look at possible future developments.

RQ 2 is linked directly to the research problem. This is where the analysis of the rail solution today is approached.

The questions form the structure of the thesis and they are listed in an order that gives the reader depth and understanding of the research problem. The questions give the reader a

knowledge “platform” of the situation today, and further gives, through analysis, an evaluation of the role the rail solution plays in the project.

## **2.3. Research design**

Research design is explained as “*a framework for the collection and analysis of data*”.

Bryman and Bell (2011, 40)

There are different types of research designs that can be utilized when doing a qualitative study. Some common ones are:

*Comparative design, Case study, Experimental design, Cross-sectional design and longitudinal design.* (Bryman & Bell, 2011)

This section describes these qualitative research designs and explains the choice of research design for this thesis based on these designs.

### **2.3.1. Longitudinal design**

Bryman and Bell describe longitudinal design as a method to illustrate or map changes in the research of business and management. When conducting interviews or questionnaires, you can further use longitudinal research to act as an extension of the interview. The data samples with the longitudinal design approach are collected more than one time to be able to map the mentioned changes. The consequences are that this type of research is time consuming and costly for the researcher. (Bryman and Bell 2011, 57-58)

Given the research time and nature of this research, this is not the optimal fit for this thesis. However, there are some links to our study in this design. The study aims to map changes over time, so it can be related to this in this manner.

### **2.3.2. Cross-sectional design**

Bryman and Bell define cross sectional design in the following way: “*A cross-sectional design entails the collection of data on more than one case and at a single point in time in*

*order to collect a body of quantitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association.*” Bryman and Bell (2011, 53)

We see four characteristics of this research design in the definition:

- The first one is that a cross sectional research utilize more than one case when trying to explain the nature of the situation. This is because of the interest of variations in the study. The researchers want to map variations related to their study to be able to make clearer distinction between the different cases studied.
- The second point in a cross-sectional study is that the study focuses on the cases at one single time, not over time.
- The third point is the usage of quantitative data to better create distinction between the different cases.
- The fourth point is to map the patterns of the association to establish relationships between the variables.

(Bryman and Bell 2011, 54)

This research design could be relevant in the comparative analysis of modes in this thesis. However, it points two points out that it should be looked at one single time, not over a period. This case study is an ongoing project which means the authors have to see more of a timeline to see the characteristics of the development of the project.

### **2.3.3. Case study design**

Bryman and Bell explain case study to be a detailed and intensive analysis of a single case. The case study aims to understand the single case and the complexity and nature of the single case. (Bryman and Bell, 2011).

This approach appeals to the topic of the thesis in the way that it is primarily one big project with many “subprojects”.

### **2.3.4. Comparative design**

A comparative research design is described by Bryman and Bell to be a study of two cases or more. The cases applied in the research are quite similar, and the logic of the comparison is key to the research. The objective of such a survey is to better understand a social phenomenon. The method for this is to compare multiple situations which are contrasting to each other. Cross-sectional examination of data from the cases should be applied in the research. Bryman and Bell (2011, 63)

This method could also be relevant given the nature of our research problem.

## **2.4. Choice of research design**

The reason for illustrating these research designs is to build a foundation and get a better understanding of the term research design. The choice of research design does not completely fit one of the above-mentioned strategies but is a combination of mainly the case study and comparative design. However, the other two others could also be relevant when defining the research design of this thesis.

The choice of research design is based on the nature of the case. The objective is to describe the New Silk Road and the rail solution as one case, but also analyze the sea and air freight solutions to build a foundation for the comparative analysis. The research is mainly based on relevant scientific articles and other scientific literature on the matter, as well as interviews and presentations are used to get further insight. Interviews are naturally our primary data, and the scientific literature our secondary data.

## **2.5. Research method and data collection**

Bryman and Bell describe research method as a method for gathering the necessary data for your research. The research method is based on the applied research design and collection of data will be done according to what chosen research design implies. Bryman and Bell (2011, 41)

As mentioned earlier, the research topic is divided in its nature. This thesis utilizes the case study approach combined with the comparative approach when considering research design.

The first part is dependent on secondary data like scientific articles etc. It is a descriptive study where the aim is to give an up-to-date description of the current situation.

In the “second part”, where comparative analysis between rail, sea and air transportation along the New Silk Road is conducted, the primary data is collected through interviews with the third-party logistics provider Greencarrier. Here, the conducted interview with the railway executive Johan Ignell is used gather information. In addition, we have been granted access and permission to use the information from a secondary interview that our supervisor Harald Hjelle did with Ignell in relation to another research project. Collection of specific information regarding goods characteristics, transportation costs, lead-time and distance is from the interviews and additional material provided by Greencarrier and supplemented with information from secondary sources.

### **3. Theory and literature review**

The literature and theory review focus on the theoretical foundation of this thesis. In this section, some of the theories behind the development of the New Silk Road are illustrated with further relevant literature. The literature review is based on the research questions. The theory covers international trade and transportation economy. These are relevant subjects that illustrate why countries trade, and the barriers of trade.

A lot of our literature is found on the search engine “Oria” and Google Scholar. Keywords are “The New Silk Road”, “transport costs”, “trade theory”, etc.

In the second part of the literature review the current situation of the rail system along the New Silk Road is illustrated, and the Greencarrier rail solution is mapped. Further, the two main alternatives routes to the rail solution are presented. These are the sea routes and the air routes. The air freight solutions are illustrated with freight statistics and infrastructure development. The futuristic project along the Northern Sea Route (NSR) will also be illustrated with general characteristics in addition to China’s policy for developing this route.

#### **3.1. International trade**

A possible main driver for developing the rail connection between China and Europe is the potential benefits from international trade. China seeks to increase their trade with Europe and is investing heavily in the development of the New Silk Road. (Arviem, 2017)

In this section, the theory of international trade is explained, and main trade theories are described to give the reader a better understanding of why countries trade and China's objectives for investing in this project.

##### **3.1.1. Introduction to international trade**

The concept of international trade has its origins all the way back to ancient times. Different flows of trade were linked through various transportation routes, connecting countries as well as entire continents together. The Silk Road was one of the major

contributors here, linking the world (especially Asia and Europe) together through trade both on land and on sea. In addition to the trade-aspect, having to do with the exchange of goods, the Silk Road also contributed to the development of political and economic relationship among countries, as well as civilizations. Here, some of the most important elements are the exchange of cultures, knowledge and skills. (Khaslavskaya, 2016)

Since the 1950s, the level of international trade has grown substantially faster than the world income. The share of manufacturing in world trade has at the same increased substantially. This trend and development is closely related to the aspect of globalization, which through industrialization and the rapid introduction of technology has connected the world closer together, and with that transformed many economies all around the world. (Behar & Venables, 2010)

However, the level of international trade is small compared to the level of domestic trade that occurs in the world today. Much of the reason for this can be explained through the different types of trade barriers that are more existent in international trade. Examples here can be distance, borders, tariffs, etc. (Behar & Venables, 2010)

There are many different theories related to international trade and the concept of trade in general. One of the main theories of international trade are the Heckscher-Ohlin theory. This theory will be described to get a theoretical platform regarding why countries trade and why trade between China and Europe/Scandinavia is occurring in the global trade market. Further, an explanation of why countries trade follows to illustrate the benefits gained from trade.

#### **3.1.1.1. Heckscher-Ohlin Model**

The Heckscher-Ohlin model was developed in 1919 by the Swedish economist Eli Heckscher. Heckscher's ideas were then developed further by one of his students Bertil Ohlin in 1924. Together they developed the trade model/theory "The Heckscher Ohlin model". (Giri, 2011)

Based on the assumption that countries differ in the amount and quality of resources they possess, the HO model outlines that the countries with rich capital resources are likely to



export capital-intensive products, and that the countries with rich labor resources are likely to export labor-intensive products. Further, this forms the principle and argument that the more similarities between countries there are in terms of resources, the less trade there is.

The HO model has two important characteristics:

*1: Production factor in form of capital. Gives a more realistic framework.*

*2: Comparative advantage in different production factor endowments in each country instead of only differences in technology.*

The HO model also considers capital when explaining the nature of trade between countries. This gives the model a more realistic theoretical framework than other theories. The result is that the clear specialization in production of one commodity per country is not very likely to happen.

The HO model focuses more on the fact that the qualities required for production in countries differs between countries. The producing country will according to the HO model export the goods that they have abundant capacity to produce. If for example Norway considers their resources, they would immediately see the feasibility for producing electricity by using the waterfalls found in Norway. The HO model implies that Norway therefore should produce and export more electricity demanding products like for example aluminum, given that the good use its abundant factor intensively. Another example of this theory could be how an undeveloped country with high population but low capital and therefore unskilled workers, could be forced to be exporting less sophisticated manufactured goods. (Giri, 2011)

This model gives, as described, a more realistic view on why countries trade, and on what premises. We understand more of why China would want to develop the trade between with Europe by looking into the HO model. It is of course an even more complex situation than the ones described over, but the basic principles are the same. The reason for trade is basically, from our point of view, the benefits gained from trade. Therefore, this model to some extent, explain why also China can benefit from trade with other countries. China has their factor endowments like other countries, and by exporting commodities and goods where they have a competitive advantage and importing goods that other countries have a

competitive advantage in producing, the benefits of trade will be visible. This is most likely a strong motivation behind the development of the New Silk Road; to increase trade and thereby collect the benefits gained from trade. (Giri, 2011)

### **3.1.2. Why countries trade**

This section investigates in why countries trade in general and thereby China`s theoretical incentives for trade.

Explaining why countries trade is complicated, but Martin Stopford highlights three main reasons for global sea trade. The authors of this thesis think that these incentives for trade also applies to international trade in general:

The first point is manufacturing costs. Difference in manufacturing costs will benefit the country with the lowest manufacturing costs. Trade will most likely happen if the price difference does not exceed tariffs and transport costs related to trade.

Second point is the natural resource differences from one country to another. The HO model explained this.

Third point is the temporary imbalances. Related to business cycles where a shortage of a material can occur, the need for more materials than produced inbound creates a demand for import. (Stopford, 2009)

These three points from Stopford along with the trade models help to get an understanding of why China will conduct trade, but of course we see that the main reason for trade is the price differences that result in the benefits from trade. The country will probably trade if the result is better than it would have been with domestic production and sale. (Stopford, 2009)

## **3.2. Transport economics**

Transportation economy is relevant to the study because of how it affects trade. High transportation costs would for instance maybe reduce the importers will to import goods.

The transportation costs could possibly represent a barrier for trade and are therefore relevant to our study since the New Silk Road is developed to increase trade flow between the countries and the continents. A factor like lead-time may also be crucial for the choice of transportation mode. Based on these and more arguments we find transport economics relevant for this study.

Transport economy can be described to be the usage of microeconomic theory to try to illustrate the transport sector from an economic perspective (Grøvdahl & Hjelle, 1998).

Transportation economy covers the following topics and more:

- *Prices for transport, expenditure, transportation costs and transportation-offers.*
- *Mode choice and user patterns.*
- *Deregulation and regulation of domestic and international transportation.*
- *Price discrimination and market analysis.*

Transportation economy covers a lot of the topics when evaluating transportation solutions in the world today. This thesis focuses on describing the theories related to transport costs, lead-times, and modes of transport. This is done to get better knowledge regarding transportation costs, lead-times and modes of transport influences the transport of goods, and how a transporter evaluates these factors when considering the available options for transportation of their goods. (Grøvdahl & Hjelle, 1998)

### **3.2.1. Transportation costs**

Transportation costs is the next step in the theory review. This is relevant in the way that transport costs are an important factor when choosing mode of transport. Further, with high transportation costs, the benefits from trade could be reduced. If the transportation costs are higher than the increased income from trade, the whole trade would most likely be non-beneficial for a country, and the whole reason for trade would disappear.

Therefore, one objective for developing the infrastructure along the New Silk Road is likely to be to decrease the transportation costs and therefore increase the benefits gained from trade. In this section transport cost theory is described and discussed.

There are still many countries in the world today that remain isolated and struggles to integrate into the world economy. One of the key factors that can explain this is transport

costs, as transport costs plays a major role in shaping the trade patterns all around the world (Li, et al., 2012).

With transport costs, we primarily refer to the freight charges related to the transport of a good. To explain transport costs, we can use the transport cost function from (Behar & Venables, 2010):

*Transport cost = f (distance, geography, infrastructure, trade facilitation, technology, fuel costs, .....)*

Transport costs are highly linked with so called non-pecuniary costs, examples here being factors like speed and reliability. In addition, transport costs are determined by many underlying variables as shown in the function:

*Distance, Features of geography, Infrastructure quality, Trade facilitation measures, Fuel costs, Transport technology.*

To what extent the distance affects the transportation costs is important when considering new transportation solutions. The first point one should consider is what transport mode that should be utilized in the given route.

(Limao & Venables, 2001) illustrates that the cost by increasing the distance transported with 1000 km gives a seven times higher cost by land than by sea. This is something to think about when considering the mode of transport.

This means that countries that are landlocked will have a quite big cost disadvantage compared to the countries with a coastline. Landlocked countries have according to (Limao & Venables, 2001) 50% higher transport costs than comparable countries.

Infrastructure quality is of course an important factor when measuring transport costs. Insufficient infrastructure will most likely decrease reliability, speed and safety in the transport chain. If roads/rails are in poor condition, we will most likely see a higher transportation time with more stops and failures. This will lead to higher transportation costs in total.

Fuel costs has a direct impact on the transport costs. The more fuel one mode burns, the higher transport costs. One should consider different technology solutions and routing alternatives to discover the most cost-efficient solution.

### **3.2.1.1. Containerization**

The introduction of containers in the transport and logistic sector has had a major impact on transport costs. Especially in shipping and maritime transportation, where the greater trade volumes flow today, the containerization has contributed greatly to the underlying principle related to economies of scale. With different types of goods all being packed in one container, the unit-costs for each good is minimized as a result. This again lowers the transport cost of that goods-unit. However, it is important to note that regardless of containerization there still are large variations in transport costs on the cross-country basis both in terms of time and money.

Containerization was established in the 1960s and was dependent on the development in information technology. Reduced handling costs and lead-time was results of the introduction of the container, along with safety of the goods inside one container unit. Containerization represented a whole new way of organizing transport, with end to end control of trade and large capital investments (Stopford, 2009).

## **3.3. Modes of transportation**

This part is meant to give the reader an overview of the different modes of transport, and the key characteristics of each one. This is relevant to the thesis in the sense that it gives a general understanding of each mode and what advantages/disadvantages that is related to each mode.

### **3.3.1. Maritime transportation**

Maritime transportation is the mode that handles most of the trade volumes in the world. This mode is typically utilized for long distance transportation of big volumes of low-valued cargo. The mode suffers disadvantages related to low speed and low flexibility, but the big advantage is that the mode has considerable lower costs compared to the other modes. The low costs originate from the principles related to economies of scale, with

low-unit costs for containers transported on big vessels with big capacities. Today, most of the modern container vessels can handle volumes of more than 13 000 TEU.

(Khaslavskaya, 2016)

### **3.3.2. Rail transportation**

Rail transportation of goods typically use block trains. These block trains have a capacity of around 90 TEU and compared with other modes the cost/time ratio is considered to be at a medium level. Like maritime transportation the mode is suitable for long distances, but the high dependency related to infrastructure is a big problem in comparison. To build rail tracks are very expensive, and equally demanding to maintain as well. However, the average speed of the block trains is much higher than maritime transportation, giving the mode an edge in terms of lead-time as a competitive advantage. Based on this, railway transportation has potential, and in recent years a number of fast block trains have been put into operation offering various railway solutions for customers. (Khaslavskaya, 2016)

### **3.3.3. Air transportation**

Air transportation is typically used for small volumes of high-valued and time-sensitive cargo. One of the characteristics of air transportation is that it is an expensive solution. However, the mode might save costs compared with others when it comes to the cost-elements of warehousing, inventory, and reordering. Further, an interesting statistic to note is the market share of transportation between China and Europe: Here, the air and sea-air transportation is above 80 % in terms of capital, and the sea transportation handles 96-98 % of total transportation in terms of volume. (Khaslavskaya, 2016)

### **3.3.4. Intermodal transportation**

A transportation that is executed by two or multiple modes is defined as an intermodal (multimodal) transportation, using typically a combination of truck, train, air and/or ships from its origin point to its destination point without transshipment. The most popular combinations of intermodal solutions are the rail-truck-combination, followed by the truck-water-combination. There is also a high demand for the truck-air-combination and the air-water-combination. The use of intermodal transportation solutions is made possible much due to the development related to containerization over the years, especially by the

introduction of standardized containers in the transport and logistics-sector.

(Khaslavskaya, 2016)

### **3.3.5. Mode choice**

In addition to shaping the volume of trade, transport costs also shape the modal choice for transportation. Still today most goods travel by ship, but upon the years there has been a striking development of growing volumes of goods shipped by air.

A study by (Hummels, 2007) states that over the period from 1975 to 2004, the manufactured goods traded by air grew by 7,4% per year while the goods traded across the sea grew by 4,4% per year. The same study also describes that planes tend to carry more valuable goods over longer distances. Here, the study illustrates an interesting volume-perspective in terms of goods imported by the US: less than 1% of the goods now travel by air, but more than a third of the value of the imported goods now arrives on planes. Finally, the study describes the growth of air transport as being higher compared to other modes in terms of ton-miles. (Hummels, 2007).

The choice of mode of the transportation of goods is considered to be a trade-off, primarily between the higher monetary transport costs and the faster transport time. Further, there are also other important elements to consider. Here, the aspects of reliability and delivery uncertainty are particularly important, especially for trade in intermediates or in products where the demand may be transient. (Behar & Venables, 2010)

Companies use different methods for their handling of transportation and logistics-services. Some companies use a single logistics provider's own fleet, and some use forwarders and consolidators who again make use of third-party transport suppliers. From an economic standpoint, mode choices in the transportation and logistics sector are made based upon opportunity costs. The decision-making process includes several different factors and attributes to consider and balance. Speed, cost, capacity, security and safety are some of the most important elements here. The idea for a company or provider is to select the mode that comes closest to their requirements, based upon their financial and other constraints. This type of approach is described in the article '*An inventory theoretic model of freight transport demand*' by (Baumol & Vinod, 1970):

“Considering a situation where speed and economy of service are important; adding more factors complicates the mathematics but not the logic.” (Baumol & Vinod, 1970)

Elaborating on the speed-element, a key word here is lead-time. This is particularly important in the supply chain, both in transportation as well as in production. The issue of safety stock is a relevant example here, as the possibility of delays necessitate that a company must keep a larger safety stock (Baumol & Vinod, 1970).

Summing up, the approach and analysis of Baumol and Vinod covers important elements when it comes to warehousing and inventory management. However, it does not fully include the consolidation and transshipments-aspects, which is a critical and integral part of many supply chains. Here, intermodal activities and solutions are commonly used, meaning the use of various modes of transportation along the trip for a delivery. The question becomes of whether to use the same mode of transport for the entire trip, use the intermodal alternative, or consolidate at some point in the system.

Figure 1 describes an example of a situation where there is the option of moving freight from A to B using either truck or the rail/truck (intermodal) combination.

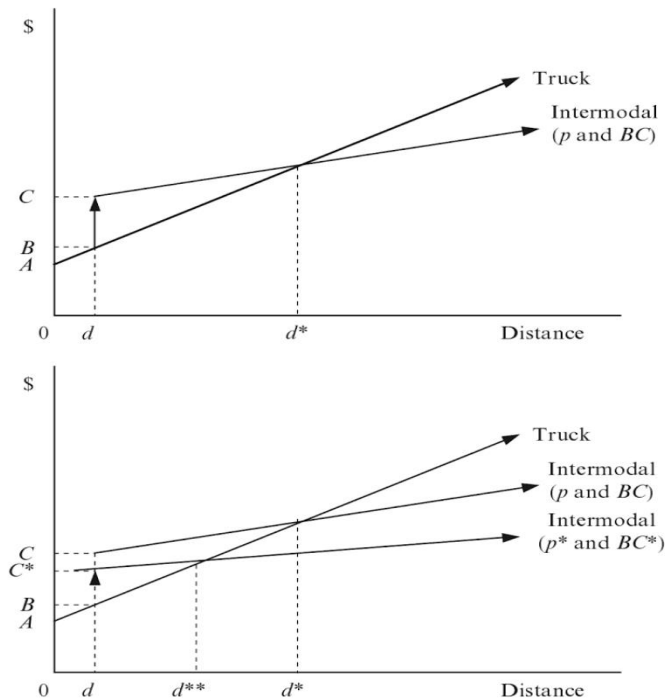


Figure 1: Costs per ton of direct and intermodal transport Source: (Button, 2010)



A different aspect to consider when it comes to mode choice is the extent of which third-party logistics and/or other outside parties/operators should be engaged, and the degree of which a company should operate its own logistics and transport-operations.

Table 1 shows an example of a survey conducted in the UK, ranking the different factors that matters for a company when deciding to use their own truck fleet. Here, factors like reliability and control are important, while the simple cost of carriage does not dominate the decision having to do with third-party carriage use compared to the broader notion of costs and service quality.

It should be noted that the weights placed on the different factors vary between different industrial sectors. However, when it comes to the size of the companies and the change over time the factors listed remain very similar to the example in the table.

**Table 1: Reasons for electing to use a company’s own truck fleet. Source: Button (2010)**

<i>Factor</i>	<i>Score</i>
Reliability	14.9
Control	13.0
Customer relations	9.4
Speed of delivery	9.2
Flexibility	7.8
Cost versus price	7.4
Ability of ‘own account’ to meet timing constraints	6.6
Price is subordinate to service considerations	6.5
Specialized capacity	5.5
Speed of response	5.1
Adaptability	3.6
Consistency	3.5
Avoidance of damage of consignment	3.4
Security	2.6
Other (non-financial)	1.1
Other (financial)	0.5

In this section, the theory of transport costs has been illustrated. The connection between transport costs and mode choice has also been discussed, and transportation costs as a factor has been evaluated when considering mode choice. Transportation costs are important, but it must be considered along with other factors like for example reliability of service and speed of delivery. (Button, 2010)

## **4. The New Silk Road-project**

In this section, the New Silk Road-project is explained and the objectives for developing this route is discussed. The perspectives of China, Europe and Scandinavia are discussed in addition to future expectations. This section also focuses on the trends related to investments and trade between China and the Scandinavian countries.

### **4.1. The New Silk Road**

The New Silk Road is a gigantic transport and infrastructure-project introduced by the Chinese President Xi Jinping in 2013. The idea is to revive the Silk Road that dominated world trade 2000 years ago through both maritime and land routes. China's plan is to invest huge amount of capital in the project by developing and reviving ports, railroads, airports and all related infrastructure. So far, China has made deals and agreements with over 60 countries through the project. (Lockhart, 2017)

#### **4.1.1. China's perspective**

To fully understand the New Silk Road-project, it is important to elaborate on China's perspective, role and underlying reasons for investing in the project. Based on China's rapid economic and industrial development over the recent years, the country has experienced a vast industrial overcapacity as a result. This has affected especially the segments having to do with steel manufacturing and heavy equipment. The New Silk Road-project could serve as an outlet, slowing the domestic market down and open up new markets for trade with other countries. Further, the project could be a key in keeping the national economy buoyant.

For China, the project is very much strategic in nature as the country strikes new economic and cultural relationships and partnerships along the way. In addition to be an economical project, it is also very much a geopolitical project in an effort to improve relationships with Asian and European countries. In many ways it seems that China through the New Silk Road-project wishes to establish itself as a dominant and permanent superpower in the world. (Lockhart, 2016)

Further, when President Xi of China introduced the New Silk Road-project in 2013, it was not just considered to be a transportation and infrastructure-project. It was based on the following five pillars:

- *Enhancing monetary circulation*
- *Improving road connectivity*
- *Promoting unimpeded trade*
- *Stepping up policy communication*
- *Increasing understanding between people and nations*

For China, it is important to boost the western part of the country, as much of the overall economic activity is based in the eastern coastal cities and areas like Shanghai. An investment-boost in the western part of the country could help to ease the social tension between the coast and the developing inland provinces. Further, the New Silk Road-project could serve as a transit corridor, connecting western China with the EU. This is an important element given the fact that the EU is China's biggest trading partner.

(Chakhoyan, 2015)

In addition to investing in their own country, China also has and is making huge investment in infrastructure in other countries through the New Silk Road-project. Two countries of importance here are Pakistan and Kazakhstan. In Pakistan, China has already pledged to invest tens of billions of US-dollars in infrastructure-projects like the Port of Gwadar. Further, in Kazakhstan, huge investments in railway-infrastructure development is ongoing. China sees these infrastructure-investments as having a stimulating effect on the wider economy and important for connectivity and access towards the West.

(Chakhoyan, 2015)

An important element that China has to consider when doing these investments in infrastructure is the strategy of how to balance its competitive edge to arise as an integral part of the global trade patterns and value chains rather than a simply a transit point. Each investment has to serve as a piece of a puzzle in an overall transportation network, and not as a tool for solving logistical problems and issues just in a short term or on a temporary-basis. (Chakhoyan, 2015)

Although the Chinese economy has experienced rapid and steady growth over many years, it still has a way to go to reach the level of the EU's economy. For China it is therefore very important that Europe participate and sees opportunities in the New Silk Road-project for it to be a successful investment and initiative in the long term. (Chakhoyan, 2015)

#### **4.1.2. Europe's perspective**

For Europe, there are many different elements to consider when it comes to the relationship with China following the New Silk Road-project. Generally, there seems to be an underlying understanding that China is ready to take a more dominant role in terms of regional and global governance as a result of the New Silk Road-project. Further, the New Silk Road-project seems to be the strategic tool for China, symbolizing a strategic shift towards more inclusiveness and economic prosperity in the world. (Loesenkrug-Pietri, 2015)

Following China's investments and initiatives, there are major interests at stake for Europe and the EU that must be safeguarded and secured along the way. Here, particularly the elements having to do with regional stability, economic development, and the diversification of energy supply are essential in this regard. (Loesenkrug-Pietri, 2015)

Further, an interesting opportunity that the New Silk Road-project can offer is new markets to European firms. To engage in a competitive market with Chinese and local companies in countries along the New Silk Road should be seen as a major business opportunity, introducing European solutions into new marketplaces and countries with millions and billions of new customers. The New Silk Road could be used as a door-opener to the Chinese market, the most populated country in the world, as China will need allies when engaging overseas. (Loesenkrug-Pietri, 2015)

Given the fact that the EU is China's largest trading partner, it has a unique opportunity to communicate its own respective interests and intentions directly to China. It is important for Europe to realize that the New Silk Road-project is a "moving concept", being developed as it matures along the way. Therefore, by offering concrete proposals of collaboration through the New Silk Road-project, the EU should have good prerequisites in making the project beneficial for both sides. (Loesenkrug-Pietri, 2015)

### **4.1.3. Challenges for the New Silk Road-project**

Although the New Silk Road-project has great potential, it also faces great and difficult challenges. These challenges are primarily linked to the speed and cost-elements having to do with the shipping of goods. A good example to illustrate this can be to do a mode-comparison between the air transport-solution and the rail transport-solution: When companies choose the air-solution, the customs- and inspections-related issues are only dealt with at the beginning and at the end of the journey. Although the rail-solution is less expensive, there is always the risk of stalling each time the train crosses a border. In addition to the speed-element, there is also the issue of increased costs when one may have to move from one train to another. Further, there are also tariffs and the risks of arbitrary delays and possible system manipulation along the way.

In the future, it would be interesting if the rail transport along the New Silk Road could be organized and operated under a single unified customs system with effective methods of tracking the products onboard. This could be a positive development for making the rail-solution more effective and more interesting for new customers as shipments could move more smoothly across boundaries as a result. This type of development may result in that some customers would prefer the rail-alternative instead of the air-alternative when shipping goods from China to Europe, or from Europe to China. (Lehmacher, et al., 2017)

## **4.2. Scandinavia and China**

The following paragraphs describe the trends related to China's Foreign Direct Investments (FDIs) in Scandinavia. In addition, the trends related to trade are discussed, both from the Scandinavian and the Chinese perspective.

The bulk of the information is obtained from a newly released report from July 2017 by Jone Kalendiene, Violeta Pukelienė and Mundaugas Dapkus from Vytautas Magnus University in Lithuania, which outlines trends in trade and investment between the Scandinavian countries and China from a business perspective.

### 4.2.1. Background

In recent years, China has made big foreign direct investments (FDI) in many countries and areas throughout the world, making the country at the end of 2014 the third largest global investor. However, most of the investments have been concentrated in the Asia-region. Only 8% of the investments have been concentrated in the European Union, further making the global share of the investments in Scandinavian countries even smaller. Still, Scandinavia is an area where the potential for more investments and development could be utilized and further discovered in the future, especially in relation to the New Silk Road-project. (Kalendine & Dapkus, 2017)

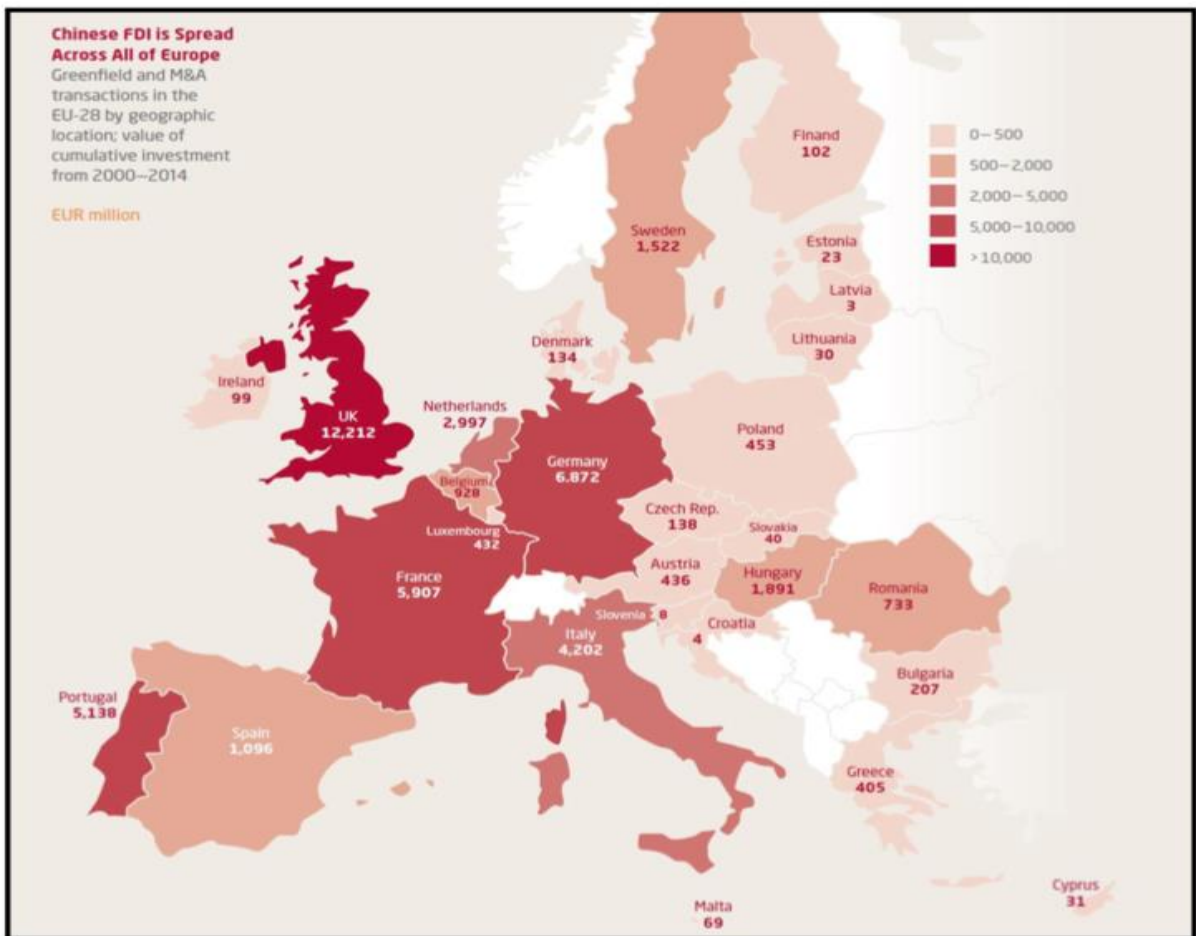


Figure 2: Chinese FDIs in the EU-28. Source: (Kalendine & Dapkus, 2017)

### 4.2.2. China’s FDIs in the Scandinavian countries

China’s FDIs in Scandinavia increased steadily from 0,2% of their total FDIs in 2005, to 0,5% in 2010. This market share has remained quite stable since 2010. From the

Scandinavian perspective, the Chinese FDIs in Scandinavia today makes up 8% of the total FDIs in the region. (Kalendine & Dapkus, 2017)

#### **4.2.2.1. Sweden**

As of now, most of China's FDIs in Scandinavia are concentrated in Sweden. In total, the investments in Sweden covers almost 90% of the overall Chinese investments in Scandinavia, representing a value of approximately \$2.4 billion. The underlying reason for this is mainly rooted in the few big mergers and acquisitions that have occurred in the Swedish automotive industry. In 2010, the Swedish car manufacturer Volvo was bought by the Chinese Zhejiang Geely Holding Group for \$1.5 billion. This represented the biggest Chinese investment in the European car industry. Further in 2012, the Hong Kong-operated National Modern Energy Holdings Ltd. established the National Electric Vehicle Sweden AB (Nevs) in Sweden. This transaction represented an aim to buy the main assets of the other car producer in Sweden, Saab.

In addition to the monetary investments into the Swedish economy, the Chinese investments has also played a major role in research and development-promoting, as well as advancement of technology in the country. Many Swedish firms have gained substantial capabilities as a result, exemplified by Nevs transformation of Saab as a company ready for development and manufacturing of electric cars. (Kalendine & Dapkus, 2017)

#### **4.2.2.2. Denmark**

One of the first Scandinavian countries benefiting from China's FDIs was Denmark. Back in 2005, Denmark represented the leader of Chinese investments in Scandinavia, covering 80% of the market with a value of \$97 million. The situation changed however in 2007, and China's investments in the country is now valued to be \$53 million, covering 1% of the total foreign investments. The investments are mostly related to the high-tech and knowledge-intensive sectors in Denmark, as well as the energy sector, with renewable energy being an area of particular interest. (Kalendine & Dapkus, 2017)

#### **4.2.2.3. Finland**

The Chinese FDIs in Finland are increasing, tripling from 2009 to 2010, and still continues to grow as of this day. It should however be noted that the investments are not as big in

total terms, standing today at \$34 million, which accounts for only 1% of Chinese investments in Scandinavia. In 2013, Finland and China made an agreement to enhance the existing relationship and expand bilateral cooperation on areas like technology, clean energy, urbanization and sustainable energy. Based on this, the trade and investments between the two countries are expected to continue to increase in the future. (Kalendine & Dapkus, 2017)

#### **4.2.2.4. Norway**

The relationship between China and Norway is interesting to study as there have been many significant happenings and events in recent years. Up until 2010, there were good progressions in both political and cultural exchanges, as well as to further trade agreements between the two countries. However, a significant setback occurred in terms of cooperation when the Nobel Peace Prize was given to Liu Xiaobo, a man considered to be a terrorist by China. As Norway provides the origin of the Nobel Peace Prize Committee, the country was frozen out of several agreements by China for more than 6 years following the Nobel Ceremony, while Xiaobo was imprisoned in China. The cold front between the two countries affected especially the fishing industry, with the exports of Norwegian salmon to China being completely stopped as a result, causing Norway to lose major monetary profits. Finally, in December 2016, the relationship between the two countries were restored, as Norway's foreign affairs minister Børge Brende stated together with the Chinese foreign minister that China and Norway had normalized the diplomatic and political ties. This was marked in April 2017, when a big Norwegian delegation visited Beijing, led by the Norwegian Prime Minister Erna Solberg.

In meeting the New Silk Road-project and take advantage of the opportunities it brings, there may be areas where Norway must adjust to, customize to and develop along the way. An example here is the 16+1 initiative. This Chinese initiative, which is aimed to intensify and expand cooperation between China and 16 EU Member States and Balkan countries, is something that Norway could get closer to in terms of cooperation. The initiative was created to strengthen the competitiveness of the New Silk Road land routes in Europe. For Norway, cooperating with the 16+1 could be strategically important to get access to the areas related to the New Silk Road-project and maybe create new business opportunities as a result.



However, the area that perhaps should be of most of interest for Norway is the Chinese government's decision in June 2017 to expand the New Silk Road to include an Arctic sea route, The Polar Silk Road. This route links the New Silk Road to Norway, Scandinavia and Northern Europe, highlighting the growing economic and strategic importance of the Arctic region. Here, the Port of Kirkenes is worth mentioning, with its important strategic location in the North of Norway, close to the Russian border and the Arctic Sea. (Arvesen, et al., 2017)

#### **4.2.2.5. Summary and conclusions**

When summarizing China's FDI in Scandinavia, it should be noted that they are not as big in monetary terms as in other regions and countries. China is not one of the leading investors in the Scandinavia and does not consider Scandinavia to be one of their key markets as of today. However, this may change in the future as China seeks to expand the New Silk Road to include an Arctic sea route, as mentioned earlier. However, it is worth to point out that China's investments in all of the Scandinavian countries are following a similar pattern of cooperation related to research, development, and advancement in technology. This form of partnership is favoring both China and all of the Scandinavian countries in the long run. (Kalendine & Dapkus, 2017)

#### **4.2.3. Trade - trends between China and the Scandinavian countries**

On the global scale, the trade of goods and services between China and the Scandinavian countries is considered to be at a moderate level, with aggregate statistics on bilateral export and import indicating small but increasing flows. The major reason for this can be explained by the relatively small scale of the economies in the Scandinavian countries, with small domestic markets included. The value of the share of the Scandinavian countries in China's export as well the value of the share of China's import from the Scandinavian countries is presented in the tables below. Here, we can for example that the Scandinavian countries together received 1,2% of Chinese export on average from 2011 to 2015 (table 2). Further, we can calculate from table 2, that Norway is China's biggest export partner in the region, receiving 31% of China's export to the Scandinavian region. Finally, we can calculate from table 4 that Sweden is China's main import partner in the region, contributing for 39% of China's imports from the Scandinavian region.

**Table 2: Value of the share of the Scandinavian countries in China's export (%). Source: (Kalendine & Dapkus, 2017)**

<b>Year</b>	<b>Denmark</b>	<b>Sweden</b>	<b>Finland</b>	<b>Norway</b>	<b>Nordic</b>
<b>2011</b>	0.354	0.361	0.160	0.437	1.311
<b>2012</b>	0,313	0.323	0.287	0.394	1.317
<b>2013</b>	0,298	0.304	0.220	0.374	1.196
<b>2014</b>	0,304	0.311	0.211	0.361	1.187
<b>2015</b>	0,279	0.306	0.191	0.351	1.128
<b>average</b>	0.309	0.321	0.214	0.383	1.228

**Table 3: Value of China's export market shares in the Scandinavian countries (%). Source: (Kalendine & Dapkus, 2017)**

	<b>Denmark</b>	<b>Sweden</b>	<b>Finland</b>	<b>Norway</b>	<b>Nordic</b>
<b>2011</b>	6.97	3.87	3.62	9.13	5.56
<b>2012</b>	7.01	4.02	7.73	9.25	6.44
<b>2013</b>	6.78	4.18	6.26	9.20	6.22
<b>2014</b>	7.14	4.49	6.45	9.48	6.50
<b>2015</b>	7.48	5.06	7.26	10.42	7.14

**Table 4: Value of the Scandinavian countries' export market share in China (%). Source: (Kalendine & Dapkus, 2017)**

	<b>Denmark</b>	<b>Sweden</b>	<b>Finland</b>	<b>Norway</b>	<b>Nordic</b>
<b>2011</b>	0.136	0.325	0.195	0.157	0.812
<b>2012</b>	0.130	0.280	0.167	0.122	0.699
<b>2013</b>	0.139	0.285	0.170	0.131	0.725
<b>2014</b>	0.149	0.274	0.158	0.156	0.738
<b>2015</b>	0,178	0.291	0.153	0.164	0.787
<b>average</b>	0.146	0.291	0.169	0.146	0.752

Looking on the statistics from the tables, it is clear that there is a big trade imbalance between the Scandinavian countries and China. This is a big threat to the Scandinavian countries, meaning that the imports from China to the Scandinavian region is much higher than the exports to China from the Scandinavian region. The Scandinavian countries seem not be able to sell in China's domestic market to a proper extent, while they import much goods from there. However, given the current development in the Chinese market today with increasing income levels, the situation may balance itself more out in the future, meaning that the Scandinavian countries' export to China will grow faster as a result. (Kalendine & Dapkus, 2017)

#### **4.2.3.1. China's export to the Scandinavian countries**

As China's promotion towards an export-led expansion of the economy was developed, a need for new markets emerged. As a result, a trade boom between the Scandinavian countries and China started in 2002. However, as indicated in the tables, the trade flows were not the biggest, and China's export share to the region remains quite moderate to this day.

As mentioned earlier, Norway is China's biggest export market in the Scandinavian region, with 31% of the total Chinese exports (table 2). Norway also account for the biggest export market share of China in the region, reaching its highest level in 2015 with 10,4% (table 3). Further, Sweden is the second biggest export market of China in the region, with 5% in 2015 (table 3). This is much lower than in Norway and might indicate that China has a growth potential here for increasing its exports to the region even more. Breaking down the different industry-sectors contributing to China's exports to the Scandinavian countries, the textile industry particularly stands out. In Norway, half of the export market from China is apparel and clothing. Further, the textile industry contributes for one third of the export market from China in Denmark and Finland, and about 25% in Sweden.

The greatest share of China's exports to the Scandinavian countries is in electrical and non-electrical machinery and equipment. In total, these types of goods contribute to about 1/3 of China's exports to the region, most of it going to Norway and Finland. Even though the demand has had a slightly decreasing trend in recent years, Chinese producers have

been able to maintain or even increase their market share, indicating their high competitiveness. (Kalendine & Dapkus, 2017)

#### **4.2.3.2. China's import from the Scandinavian countries**

When examining China's import from the Scandinavia, it is worth to point out that the total share is minor in China's market, seen from the global scale. In total, the Scandinavian countries altogether account for approximately 0,75% of China's import (table 4). As mentioned earlier, Sweden is the biggest exporter from the region to China, accounting for almost 39% of the total Scandinavian imports. Further, Finland is the second biggest exporter, accounting for 22% of the Scandinavian imports. (Kalendine & Dapkus, 2017)

Of all Scandinavian exports to China, approximately 1/3 are electrical and non-electrical machinery and equipment. However, the exports share of these goods has decreased slightly due to the decreasing nominal value for each year and the changes related to manufacturing in the exporting countries. Further, there has been some compensation following the fast growth of the nominal value of exported fur skins and artificial fur and manufacturers as a result, almost doubling the import from 2010 to 2015. In addition, the export of pharmaceutical products has increased significantly (57% increase in export since 2010). In total, these two sectors account for approximately 10% of the total Chinese imports from the Scandinavian countries. (Kalendine & Dapkus, 2017)

Being the leader of Scandinavian exports to China, Sweden represents an interesting ongoing development as its export market share has decreased by an average of 3% annually in recent years. The underlying reason for this is mainly because of the decreasing trend of exports from the electrical and non-electrical machinery and equipment as described in the previous paragraph. However, in Sweden's automobile-sector, following the acquisition of Saab by a Chinese company, the exports of vehicles from Sweden to China has increased rapidly. The annual growth export rates were almost doubled from -19% in 2012 to 19% in 2015 as a result, indicating the importance of the vehicles sector in the Swedish exports as it increased from 7,9% in 2011 to 14,3% in 2015 of the total Swedish exports to China. This development is a good example of how a

national economy can take advantage of a foreign investment, and how it further can help to reach distant locations as a result. (Kalendine & Dapkus, 2017)

Despite the decrease in exports of electrical and non-electrical machinery and equipment, Denmark experienced the fastest growth of exports to China of all the countries in the Scandinavian region from 2011 to 2015. Actually, the total exports went up 29% during this period. Here, the areas which have contributed are the exports of food products like meat and fish (16%), fur skins and artificial fur (14%), pharmaceutical products (10,4%) and optical industry (8,7%). (Kalendine & Dapkus, 2017)

When it comes to Norway's exports to China, it has experienced a slowly increasing trend following the growing exports from the industry of electrical and non-electrical machinery and equipment, accounting for about 25% of the Norwegian goods flow to China. Further, the fishing exporting industry and its products experienced a severe decline since the Nobel Peace Prize award in 2010 and the lack of cooperation between China and Norway that followed as a result. This has however somewhat recovered and increased following the restoration of the relationship in December 2016 as we have mentioned earlier. (Kalendine & Dapkus, 2017)

#### **4.2.3.3. Summary and conclusions**

Given that Scandinavia is a fairly small region, both in terms of its economics size and population, China does not consider it to be the most important one having to do with bilateral relationship. This is also reflected historically when it comes to the moderate scope of the monetary and goods flows between the Scandinavian countries and China that have occurred upon the years. While being closely integrated with the European Union's market, there still should be more potential for a tighter integration towards the Chinese market, given the rapid growth and opportunities that has emerged in China following the country's economic development. The New Silk Road-project represents maybe the greatest of opportunities, as it through its ongoing development and rapid expansion helps to intensify communication and cooperation between the regions. (Kalendine & Dapkus, 2017)

The gains and opportunities from the New Silk Road-project are already beginning to emerge, as reflected in the Chinese investments in Scandinavia region, which in 2015 increased. Further, a shift in the investment flows from the Chinese government from manufacturing to services is ongoing, which probably also will affect the orientation of foreign trade. In the future, it is expected that the importance of the low-tech manufacturing industries in foreign trade between Scandinavia and China will decrease and will be compensated with the growth of trade in services. This will most likely bring the cooperation between the Scandinavia and China to a new level as a result. (Kalendine & Dapkus, 2017)

## 5. The New Silk Road-railway alternative

This section describes the overall New Silk Road-railway alternative between China and Europe. Here, the currently used railway routes and corridors between China and Europe are examined, as well as the potential alternative routes and corridors in the future. In addition, the status, the importance and the development of the railway alternative is discussed by noting different elements and challenges along the way.

### 5.1. Describing the development of the overall New Silk Road-railway alternative

The steady and rapid development of the New Silk Road-railway in recent years offers an alternative to the air- and ocean trade-routes between China and Europe/Scandinavia. Although the overall volumes that are transported by rail today are small in absolute size compared to the overall containerized ocean freight, the rail volumes between China and Europe have grown significantly in recent years, while ocean freight has been stagnant. Figure 3 illustrates this fact clearly, with the numbers from the top-5 rail shippers serving as examples as well. (Seabury Consulting, 2017)

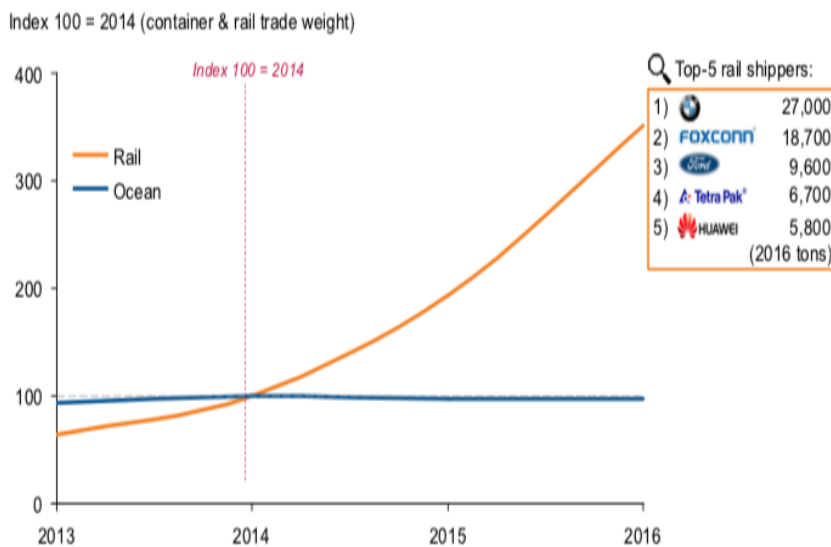
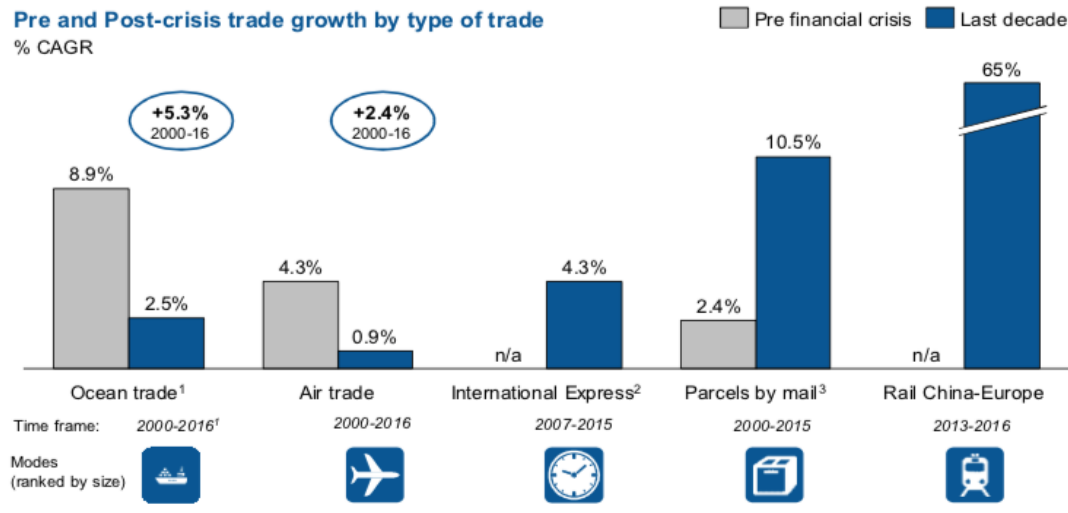


Figure 3: China-Europe rail freight vs. ocean freight, 2013-2016. Source: (Seabury Consulting, 2017)

There are also additional numbers and statistics that describe a significant growth for the New Silk Road-railway between China and Europe (65% increase), and a simultaneous small growth for both air and ocean freight in the last decade. This is illustrated in figure 4.



**Figure 4: Trade growth by type of trade - pre-financial crisis and the last decade. Source: (Seabury Consulting, 2017)**

### 5.1.1. Describing the rail transport routes and corridors between China and Europe

In total, there are 4 different transport routes and corridors between China and Europe:

1. *The trans-Siberian corridors (via Russia)*
2. *The trans-Caspian corridors*
3. *The southern corridors (via Turkey)*
4. *A separate sea-land route – the Balkan corridors*

The interesting aspect here is that when it comes to the regular rail connections between China and Europe so far, all of them have been carried out via the trans-Siberian corridors that run through Russia. With the introduction of the New Silk Road-project, there are attempts ongoing to develop alternative connections in the long-term to redirect some of the trade flows to other routes.

The following two tables show a comparison of the transport corridors between Eastern/Central China and Europe (Shanghai-Łódź and Chengdu-Łódź). Here we can see



the potential for the alternative routes as many of them are shorter in terms of distance compared to the trans-Siberian corridors, etc. (Jakóbowski et. al, 2018)

**Table 5: Comparison – Eastern China-Europe – Shanghai-Lódź. Source: (Jakóbowski et. al, 2018)**

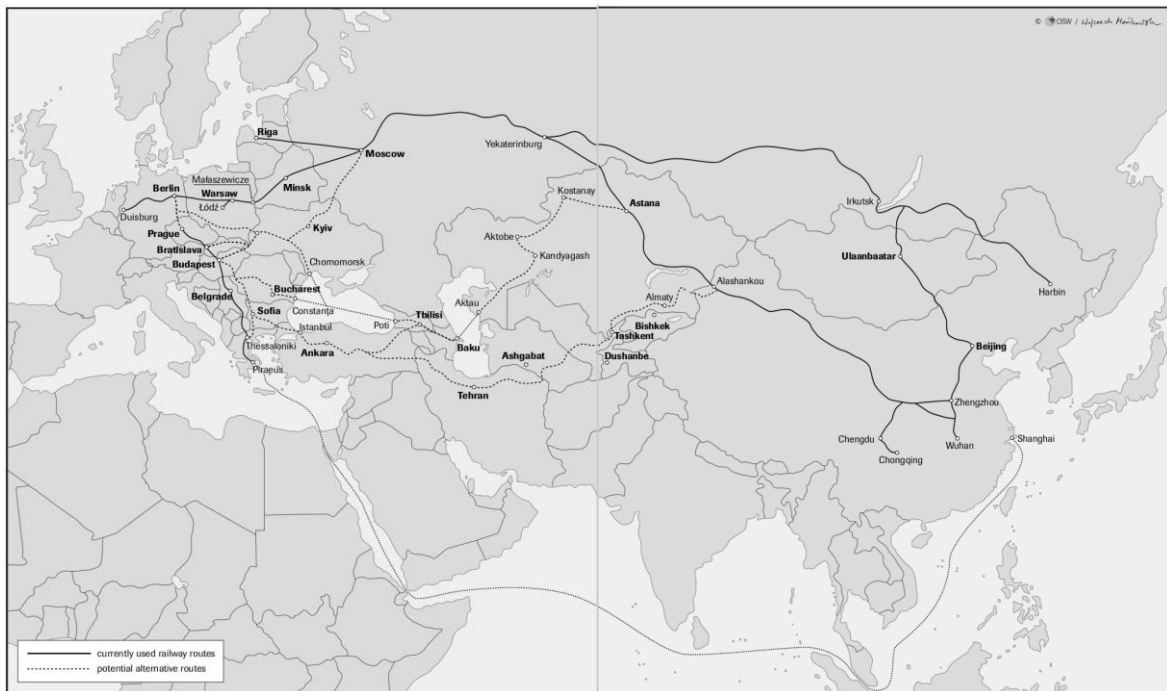
Corridor	Trans-Siberian (A) (Manzhouli-Brest)	Trans-Kazakh (B) (Dostyk-Brest)	Trans-Caspian (Dostyk-Aktau-Baku-Poti-Charno-morsk)	Southern (Dostyk-Tehran-Ankara)	Maritime route (Gdańsk)
<b>Distance (km)</b>	11,430	9,910	12,120	12,430	20,810
<b>No of border clearances</b>	2	2	5	6	1
<b>No of trans-shipment operations</b>	2	2	6	2	2

**Table 6: Comparison – Central China-Europe – Chengdu-Lódź. Source: (Jakóbowski et. al, 2018)**

Corridor	Trans-Siberian (Manzhouli-Brest)	Trans-Kazakh (Dostyk-Brest)	Trans-Caspian (Dostyk-Aktau-Baku-Poti-Charnomorsk)	Southern (Dostyk-Tehran-Istanbul)	Maritime route (Shanghai-Gdańsk)
<b>Distance (km)</b>	12,350	8,870	11,070	11,390	22,770
<b>No of border clearances</b>	2	2	5	6	1
<b>No of trans-shipment operations</b>	2	2	6	2	2

Following the development of the New Silk Road and the newly opened connections between China and Europe that are being introduced as a result, all trade flows are executed using the easiest solutions possible. This essentially means that one takes use of the transport corridors that already have the biggest capacity and infrastructure, as well as the most favorable legislative conditions. So far, as mentioned earlier, the focus and basis has been to use three trans-Siberian routes that run through Russia. Today, the biggest number of containers is transported using the corridor through Kazakhstan, starting on the Chinese-Kazakh border crossing of Alashankou/Dostyk (see figure 5). All the three corridors meet in the Urals near Yekaterinburg (see map). From there, the goods are transported to Europe via the Belarus-Polish border crossing named Malaszewicze (see

figure 5) where it gets unloaded onto standard European gauge flatcars (Jakóbowski et. al, 2018).



**Figure 5: China-Europe rail corridors. Source: (Jakóbowski et. al, 2018)**

#### **5.1.1.1. The trans-Siberian corridors (via Russia)**

Of all the existing rail transport routes between China and Europe today, the trans-Siberian corridors have the best infrastructure. The use of the corridors is facilitated through the cooperation between the states that belong to the Eurasian Economic Union, meaning Russia, Kazakhstan and Belarus. At this time, the trans-Siberian corridors are the cheapest, the fastest and the safest option from the point of view of the Chinese provinces that provide subsidies for the rail connections with Europe. In addition, these corridors also offer the most favorable relation of costs to desired effect. As a result of this, the routes have received the biggest support from the Chinese central government and been established as a key element related to China’s strategies. The contribution from important stakeholders along the routes include Russian Railways (RZD), Kazakh Railways (KTZ) and Belarusian Railways (BZD). This is very important as they cooperate closely with China along the way. (Jakóbowski et. al, 2018)

### **5.1.1.2. The trans-Caspian corridors**

One potential alternative to the currently used trans-Siberian corridors could be the trans-Caspian land and sea corridors which run through the Caspian Sea, the Caucasus and the Black Sea. However, this route has challenges as it requires several complex intermodal solutions along the way like ferry crossings, etc. Up until today, the use of trans-Caspian corridors in terms of rail has been quite insignificant and quite limited to the non-EU states which are located along the corridor.

The main stakeholders Kazakhstan and Azerbaijan see economic benefits in developing the trans-Caspian corridors, as they seek to develop the logistics sector and the transit of containers from China to Turkey as a way to expand their own trade channels with Europe and China.

Given the relatively poor transport infrastructure along the route, formal limitations when it comes to border clearance, unified regulations and technical standards, as well as varying transport costs, the future potential of this route is quite uncertain at this point in time. As of today, these corridors have not received any significant support from the Chinese central government and provinces yet, which prevents the development on a larger scale. (Jakóbowski et. al, 2018)

### **5.1.1.3. The southern corridors (via Turkey)**

Another potential rail-alternative between China and Europe is the southern corridors which run through Turkey. Here, the trains run partly along trans-Caspian corridors (China-Georgia section), and further use the rail connection between Baku-Tbilisi-Kars (see figure 5) towards the European part of Turkey.

The main problem along this route is the state of the rail infrastructure in Turkey. Therefore, from China's perspective, the work along the southern corridors is mainly intended to build permanent connections with Turkey. As of today, this route is not considered to be favorable by China in terms of the connection with Europe. However, this route is possibly a potential alternative in the future. (Jakóbowski et. al, 2018)

#### **5.1.1.4. A separate sea-land route – the Balkan corridors**

The China-Europe Land-Sea Express Line, the so-called Balkan corridors, is a route that China is also interested to develop further. This is a maritime route that connects the Chinese ports with the port in Piraeus in Greece (see figure 5). From Piraeus, the goods are further delivered by rail to central and western Europe running through Macedonia, Serbia and Hungary.

Overall, the Balkan corridors is not a simple alternative to the land-based rail connections. The purpose now serves as a means of reducing the duration of maritime transport between China and Europe. So far, because of limitations in infrastructure, the rail transport via the western Balkans has not reached its full potential. In addition, there are limitations when it comes to the lack of simplified waybill formats and customs procedures. In the context of potential competition between western Balkan ports and ports in northern Europe this is especially important. (Jakóbowski et. al, 2018)

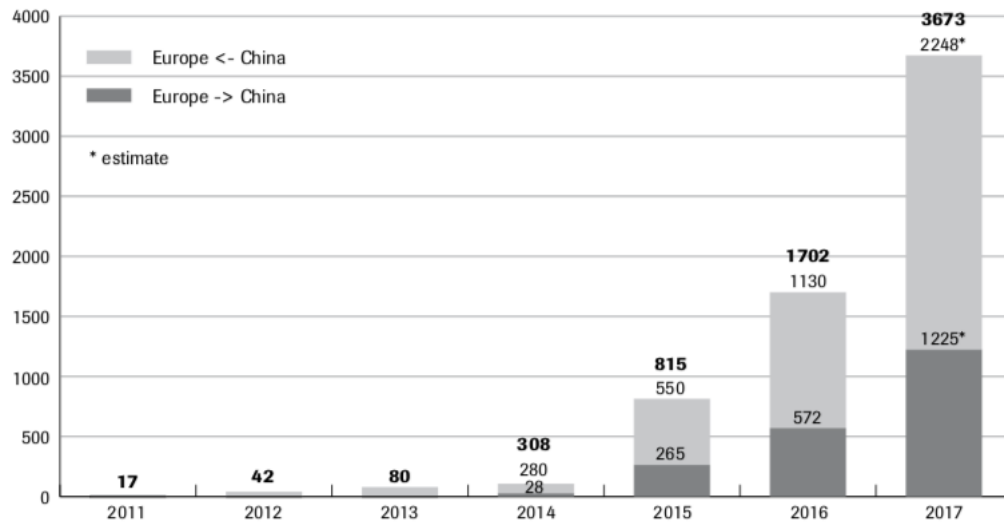
#### **5.1.2. Examining the status of the rail connections between China and Europe**

Data from China Railway Express (CRE) (see figure 6) show an increasing trend in the number of rail carriages between China and Europe in recent years. From 2011 to 2016, the annual number of rail carriages rose from 17 to 1702. In 2017, a record-number of 3673 rail carriages travelled between China and Europe. During the whole period from 2011 to 2017, the annual increase in the number of rail carriages has been from 100 to 150%. (Jakóbowski et. al, 2018)

This data from the Chinese side coincide with the data from by the Russian side. Here, according to data published by RZD, which use TEU as unit for estimating the volume, the number of containers transported between China and Europe rose gradually and reached 44 200 TEU in 2014, 81 100 TEU in 2015, and 153 000 TEU in 2016. (Jakóbowski et. al, 2018)

As we can see in figure 6, there is a clear imbalance in the number of carriages from China to Europe and those from Europe to China. As this further could impact the trade balance

between China and Europe, the EU has given high political priority to deal with this issue. (Jakóbowski et. al, 2018)



**Figure 6: Number of rail carriages between China and Europe, 2011-2017. Source: (Jakóbowski et. al, 2018)**

### 5.1.3. Key bottleneck – the trans-shipment terminal of Malaszewicze

The border crossings between Belarus and Poland are very important when it comes to the China-Europe rail connections as the trans-Siberian corridors dominate the rail transport today, combined with the blockade of transit via Ukraine because of the ongoing Russian-Ukrainian conflict. At the Belarusian-Polish border, the trans-shipment terminal of Malaszewicze serves an essential purpose. Today, the border crossing’s capacity is already strained due to the current big traffic intensity which causes congestion and create a bottleneck as a result. Often, trains have to wait for up to several days for the cargo to be transloaded at the terminal. For this reason, there is a clear need for investments to modernize portions of the railway in this area and the terminal as a whole. This is of key importance not just for Poland and Belarus, but also for the future development of the whole rail system of the China-Europe rail connections. The consequences of not providing the necessary investment could lead to a temporary drop in the rail traffic between China and Europe. In addition, there is the potential risk that future trade flows will be redirected to other corridors and border crossing in the long term as a result. (Jakóbowski et. al, 2018)

#### **5.1.4. The importance of rail connections for the automotive industry**

Many European automotive companies use rail transport to dispatch their car components to their factories in China. German automotive companies, such as Audi, BMW and Volkswagen are here the dominant users. As an example, BMW sends 3-7 trains to China every week. For a long time, European automotive companies have sent disassembled vehicles to Russia by rail, where they later were assembled. This was done to bypass the Russian laws as the production only could be carried out in Russia. As an example, Volkswagen has been sending disassembled cars from its factories in the Czech Republic and Slovakia to its plant in Kaluga (Russia) since 2002. Only in 2008, 1250 trains transported 50000 containers from the Czech Republic and Slovakia to Kaluga. So, from the point of view of the automotive industry, to further transport the disassembled cars to China would only mean an extension of the present transportation route. (Jakóbowski et. al, 2018)

#### **5.1.5. The importance of rail connections for the electronics industry**

One of the first companies to transport its goods from China to Europe by rail was Hewlett-Packard (HP). Today, HP is sending 2-3 trains to China every week. The transportation of the goods moves through the door-to-door system taking approximately 16-18 days. The background of why HP is using rail to a such large extent is rooted in a decision by the governments of China, Kazakhstan and Russia where the HP's manufacturing plants were included in a special customs zone as a consequence of a decline and instability in the maritime freight sector at which the duration of goods from China to Europe increased from 26 days to 34-36 days. As a result of this special customs zone, the duration of transportation has shortened as the trains do not have to stop for customs clearance along the way, making rail a favorable and profitable transport solution for HP to use overall. (Jakóbowski et. al, 2018)

## **5.2. The New Silk Road and Greencarrier - describing the railway alternative between China and Europe/Scandinavia**

In this section, the railway-alternative of freight transport from China to Europe/Scandinavia is described and mapped using Greencarrier's railway-solution as an example. The primary information is collected in close correspondence with Greencarrier, through two telephone interviews with Johan Ignell (Rail Freight Manager in Greencarrier), in addition to a presentation-document that he provided us with (see appendices).

The first telephone interview with Ignell was conducted by our supervisor Harald M. Hjelle in December 2017. The second telephone interview with Ignell was conducted by us in January 2018.

### **5.2.1. Mapping Greencarrier's various railway-routes along the New Silk Road**

Greencarrier's various railway-routes of goods going Westbound (WB) as well as Eastbound (EB) on the New Silk Road between China and Europe/Scandinavia are illustrated in the figures that follow. Taking the example of WB-goods, there are two different routes going out from China:

- One route from the city of Zhengzhou, transporting goods with FCL-trains (Full Container Load).
- One route from the areas and cities located in the eastern part of China, transporting goods with both FCL- and LCL-trains (Less than Container Load).

These two routes meet at a point in Russia, following the same route towards Europe with Warsaw and Hamburg serving as the two main consolidation points for further transfers towards various parts of Europe, such as Scandinavia.

From the consolidation points in Warsaw and Hamburg, there are typically four different solutions for transporting the goods further to their final destination points:

1. Train-truck intermodal solution: The containers that are loaded on the trains can be transferred to trucks. However, there is a disadvantage here as the containers have to be

returned to Warsaw/Hamburg afterwards. Overall, this solution is considered to be very expensive.

2. Greencarrier's solution: The containers are taken to Greencarrier's stocking area in Warsaw/Hamburg and get further transported by Greencarrier's own trucks from there to its destination-points.

3. Reloading on an own train.

4. Train-sea intermodal solution: Transferring the containers from the trains to the container ships.

(Ignell, 2018a)

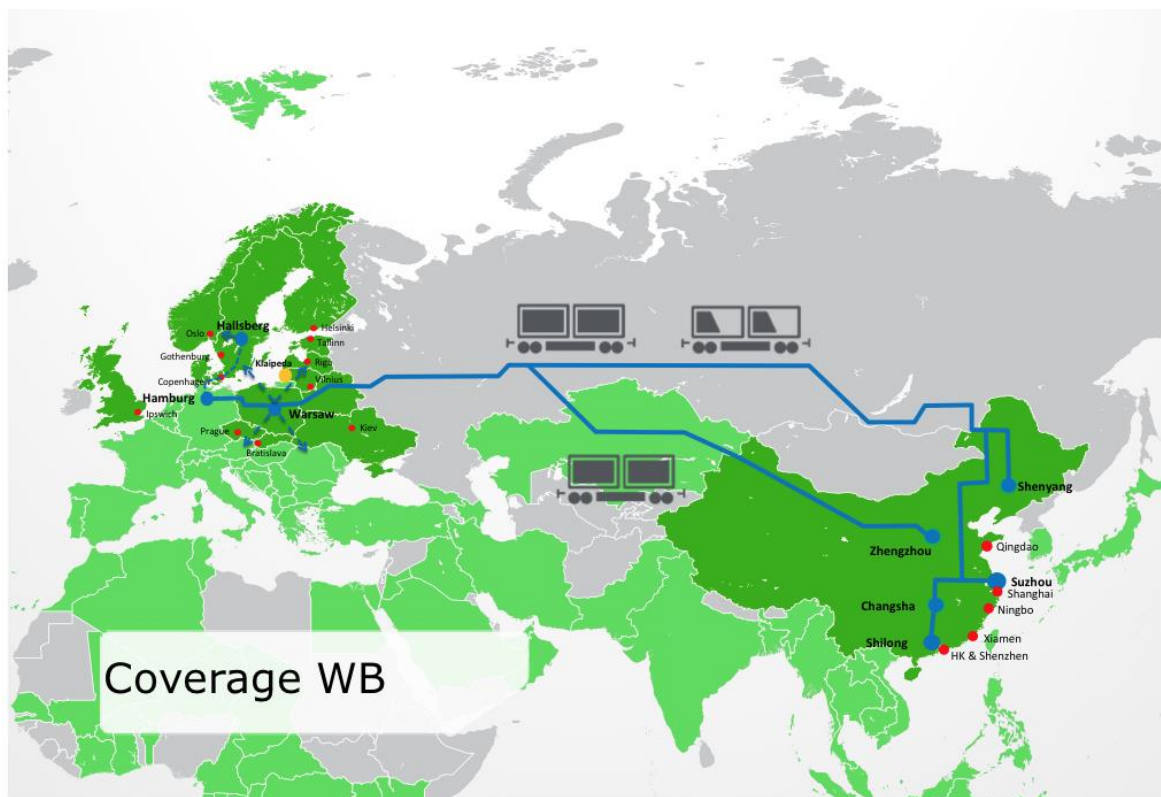
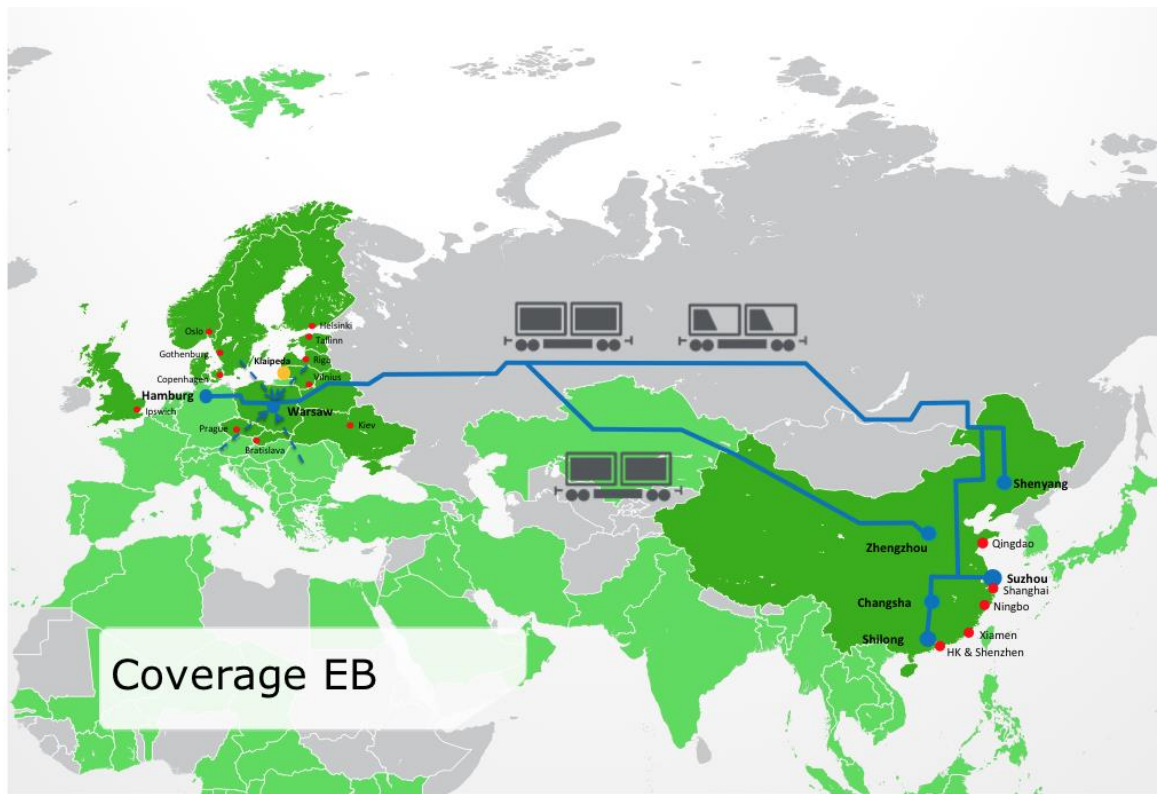


Figure 7: Greencarrier - Coverage WB-goods. Source: PowerPoint, Ignell (2018b)





**Figure 8: Greencarrier - Coverage EB-goods. Source: PowerPoint, Ignell (2018b)**

### **5.2.2. Greencarrier’s cargo flows and handling**

Greencarrier’s focus of business is mainly with the transport of goods between China and Scandinavia. In recent years, there has been an area of focus for Greencarrier to promote the railway as an alternative for the transport goods between China and Scandinavia. This has newly paid off in terms of actual results, as the company throughout 2017 succeeded to a large extent to convert a lot of air cargo to trains. Typically, there are situations where customers plan to have large cargo volumes shipped at sea and experience delays along the way. Here, they tend to load the sea container, sometimes without the last shipment. If there is a delay of 1-2 weeks, many customers think that they have to use air transport to Scandinavia. In situations like this, Greencarrier provides a train-solution to the customers for the goods that are delayed, serving as a cheaper alternative than air transport. The goods for transport by train are consolidated in Suzhou, just outside of Shanghai. Here, Greencarrier has its own CFS (Container Freight Station) for trains.

When the cargo from China reaches Greencarrier’s main hub in Warsaw, there is a warehouse outside the city which Greencarrier provides. All the containers, both FCL and

LCL, go to this hub. Here, the cargo gets loaded into trailers and further transported with road to the final destinations. All containers get stripped in the warehouse. This is due to the fact that if a container is transported directly to Oslo for example, the container must be returned back to Warsaw or Hamburg afterwards which is very costly.

As Greencarrier provides over a natural flow of trailer services especially from Poland to Scandinavia, it makes sense to use this network from Warsaw to Scandinavia. Overall it is a matter of costs and lead-time, as it is cheaper and faster to cross dock in Warsaw rather than using rail all the way from China to Scandinavia as of now. (Ignell, 2017)

### 5.2.3. Greencarrier's setup

The setup of Greencarrier's railway-solution between China and Europe/Scandinavia, both FCL and LCL, as well as WB and EB, originates through 5 Greencarrier offices (Qingdao, Shanghai, Ningbo, Xiamen and HK & Shenzhen) and 6 FCL- and LCL-hubs (Shilong, Changsha, Zhengzhou, Suzhou, Shenyang and Manzhouli) in China in particular.

#### 5.2.3.1. FCL WB Setup

Greencarrier organizes their FCL WB setup of goods to Europe/Scandinavia through 6 different hubs in China (Shilong, Changsha, Zhengzhou, Suzhou, Shenyang and Manzhouli). The lead-time is estimated to be between 17 and 20 days, with 1 departure every day, using normal container equipment.



Figure 9: Greencarrier – FCL WB Setup. Source: PowerPoint, Ignell (2018b)

### 5.2.3.2. LCL WB Setup

Greencarrier organizes their LCL WB setup of goods to Europe/Scandinavia through 3 different hubs in China (Zhengzhou, Suzhou and Manzhouli). The lead-time is estimated to be between 17 and 19 days with departures on every Sunday. Further, Greencarrier provides their own consolidation to Warsaw, transporting between 2 and 5 HC-containers per week.



Figure 10: Greencarrier – LCL WB Setup. Source: PowerPoint, Ignell (2018b)

### 5.2.3.3. FCL EB Setup

Greencarrier organizes their FCL EB setup of goods to China through the Zhengzhou-hub in China. The lead-time is estimated to be between 17 and 20 days, with departures every day, using normal container equipment, transporting via the consolidation points in Hamburg and Warsaw.



Figure 11: Greencarrier – FCL EB Setup. Source: PowerPoint, Ignell (2018b)

#### 5.2.3.4. LCL EB Setup

Greencarrier organizes their LCL EB setup of goods to China through the Zhengzhou-hub in China. The lead-time is estimated to be between 18 and 21 days, with departures 3 times per week, transporting via the main consolidation point in Warsaw.



Figure 12: Greencarrier – LCL EB Setup. Source: PowerPoint, Ignell (2018b)

#### **5.2.4. Rail services and operations**

Greencarrier's rail services and operations are organized based on buying services from suppliers. There are several suppliers available on the market, with Greencarrier usually using two suppliers in particular. As the rail-volumes are very limited compared to sea-volumes, it is important for Greencarrier to offer big enough volume to obtain a good bargaining position towards a supplier. The alternative is to distribute the business over many different suppliers, which can be very costly overall. The idea is to find the most cost-efficient solution, and a supplier that keeps its promises related to few delays and precise information flow. This is important both for Greencarrier and its customers.

When it comes to the rail operators, they are to a large extent located close to Shanghai and Ningbo. Most of them are Chinese in some form, as it is not allowed to operate in the business without a Chinese partner. This is based on the fact and foundation that it was the Chinese government who started the New Silk Road-project. This means that you cannot enter as a Norwegian or Swedish company and just set up a hub in China. As an example, one of Greencarrier's main suppliers has their main office in Austria, but they also have a Chinese partner.

Most of the freight transport between China and Europe/Scandinavia is based on FOB-terms (Free-On-Board-terms). This means that it is the Europeans who typically buy the freight services, choose LSP (Logistics Service Provider) and further decides whether to use sea or rail as the mode of transportation. Generally, this means that there is no difference between sea and rail. However, it is worth to point out that for rail the technical solution is Chinese, but the transport is bought by European actors. This is typically exemplified by big European actors like Maersk, Damco, DHL and Hellmann, who runs their own block trains from China to Europe. (Ignell, 2017)

#### **5.2.5. Types of goods - rail**

Today, there are many different types of goods that get transported by rail on the New Silk Road between China and Europe/Scandinavia. One of the most dominant types is automotive cargo, which typically gets transported between Germany and China. Here, both fully assembled cars are transported in containers, in addition to car parts. In the

beginning when rail freight was first introduced between China and Europe, it was mostly used for transporting IT-related equipment like printers and computers from China to Germany. As the service has evolved over the years, all kinds of things are being transported, both high-value and low-value cargo. Some examples here are clothes, shoes, machine parts, carpets, electronics, etc.

Although many different types of goods today are transported by rail, there are still many types of goods that still get transported by air. The considerations towards lead-time regarding high-value and popular electronic goods like a new iPhone from Apple is an example of a type of goods in this category. Here, a 20 days lead-time by rail represents a significant loss in market value for Apple. (Ignell, 2017)

### **5.2.6. Costs and the environmental perspective**

As mentioned earlier, there are significant costs to save using rail instead of air transport. There is also the environmental perspective, with rail transport being much more environmentally friendly than air transport when it comes to the level of emissions. Both these elements are particularly important to Greencarrier in their focus of promoting the railway-solution to their customers.

It is interesting to compare the costs of rail transport to the costs of air- and sea transport. Here, it is important to keep in mind that often when it comes to air transport, the airlines charge quite high prices because customers panic. To take an example, transporting 7-8 CBM (Cubic Meters) by rail would be 40-50% cheaper than by air. To summarize, rail is much more expensive than sea, but still significantly cheaper than air. (Ignell, 2017)

### **5.2.7. Lead-time**

For Greencarrier, the lead-time-aspect between China and Europe/Scandinavia is the most important element to maintain for the railway-solution to continue to be competitive in the future. Since Greencarrier started its railway-solution between China and Europe/Scandinavia in 2014, there have been important developments related to lead-time along the way. In the beginning, the lead-time was on a stable level of 14 days from China to Warsaw, with no major problems or bottlenecks causing delays along the route. As a result, the rail solution was established and gradually built out through 2015 and 2016.

However, during 2017, an enormous acceleration of volumes occurred as more and more customers started to use and were interested in the railway solution. These increasing volumes has created a bottleneck of congestion - mainly on the border crossing from Belarus to Poland named Malaszewicze. Together with some of the congestion on the Chinese side, from China into Russia, the lead-time is now estimated to be between 17 and 19 days.

The bottlenecks of congestion in Malaszewicze and on the China-Russia-border are mainly results of capacity restraints at the terminals. One has to change trains on the border between China and Russia, having to lift the containers from one trains to another. The same is the issue in Malaszewicze, in addition to the swapping of trains. Further, there is the issue about the capacity related to handling of these activities and the directional balance of the railway wagons, as they need to transport cargo on the return trip as well. There also can arise issues having to do with the shortage and availability of locomotive drivers, etc. (Ignell, 2017)

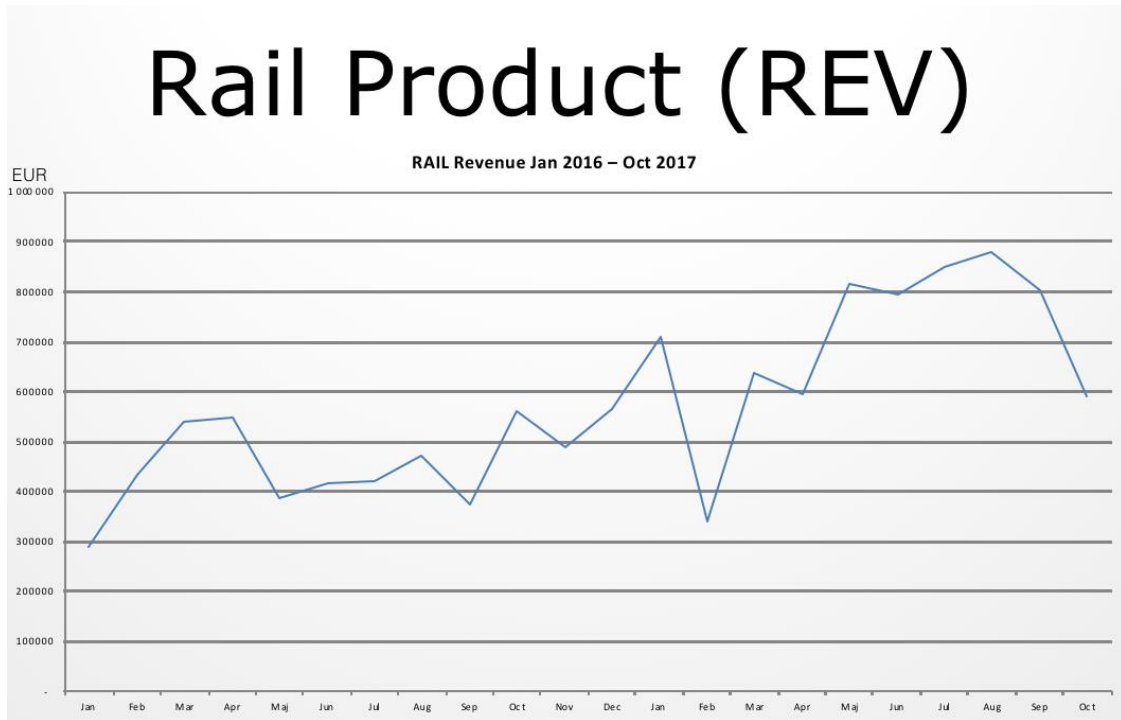
### **5.2.8. Competition**

Greencarrier faces fierce competition in the rail freight market along the New Silk Road. Examples of some big competitors here are Damco, Kühne-Nagel, Schenker, DSB, etc. Being only 800 employees, Greencarrier focuses mainly on Northern Europe and Asia-Europe trades, and does not offer many solutions in other destinations like most of the big carriers do. The area where Greencarrier differs from the other actors is on the environmental side, symbolized through their name. For example, there is more focus on the usage of short sea solution instead of trucking, in addition to rail instead of air. Further, Greencarrier offers more activity in the Northern Europe than many of the other big carriers, which mainly focuses on Central and Southern Europe. (Ignell, 2017)

### **5.2.9. Examining the results of Greencarrier's rail product between China and Europe/Scandinavia**

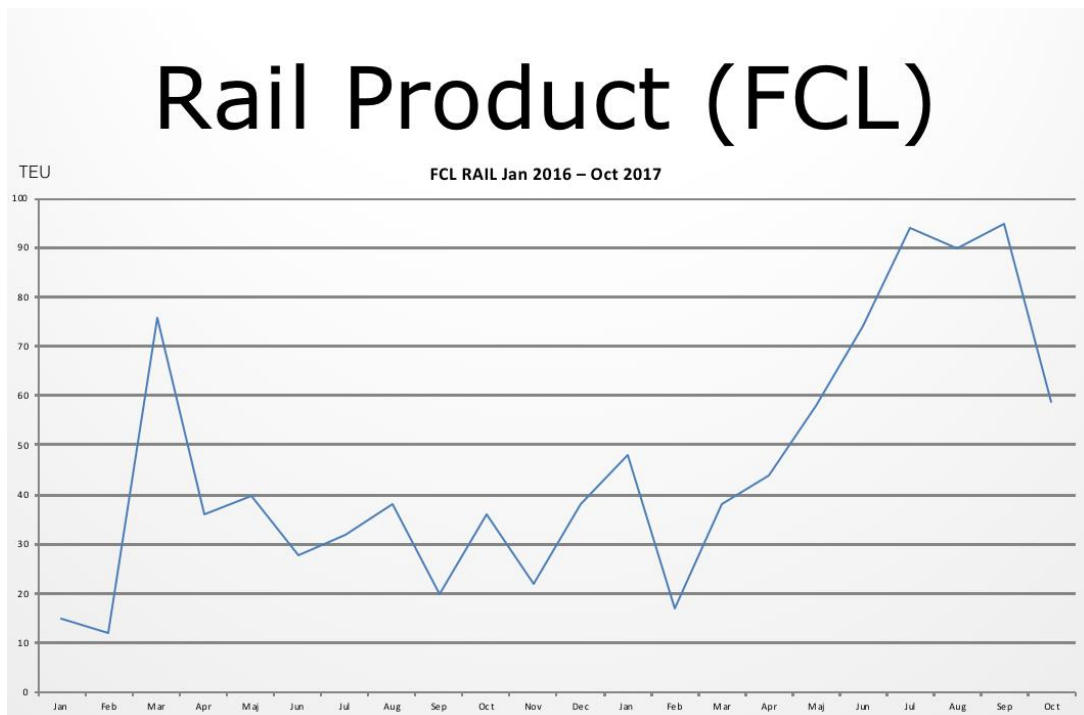
Figure 13, 14 and 15 illustrate the results having to do with the revenues, numbers, developments, and trends of Greencarrier's rail product between China and Europe/Scandinavia from January 2016 to October 2017.

All these 3 figures show an overall growth for Greencarrier's rail product during this period:



**Figure 13: Greencarrier - China-Europe/Scandinavia - Rail Product – Revenue. Source: Ignell (2018b)**

Figure 13 indicates that the revenues from Greencarrier's rail product increased by 55% in the period from January 2016 to October 2017.



**Figure 14: Greencarrier - China-Europe/Scandinavia - Rail Product – FCL. Source: Ignell (2018b)**



Figure 14 indicates that the FCL volume from Greencarrier's rail product increased by 85% in the period from January 2016 to October 2017.



**Figure 15: Greencarrier - China-Europe/Scandinavia - Rail Product – LCL. Source: Ignell (2018b)**

Figure 15 indicates that the LCL volume from Greencarrier's rail product increased by 162% in the period from January 2016 to October 2017.

### 5.2.10. Future perspective

In the future, Greencarrier expects that the transport network along the New Silk Road will continue to develop. Recently, Greencarrier has compiled a service from China to Hallsberg (south in Örebro, Sweden). A train service of FCLs is run through Hamburg, and cross-docked to a regular railway wagon. From there, the train is driven to Hallsberg, with the last mile being on a truck. This takes 2 extra days compared to the truck service from Poland and saves 17% in terms of CO<sub>2</sub>-emissions. How this will develop going further is uncertain, as changes take time to fully implement in the business.

Like mentioned earlier, investments in the bottleneck on the Belarus-Poland border (Malaszewicze) are much needed in the future. As of now, Greencarrier like other carriers loses momentum when lead-times have increased as a result of this bottleneck. (Ignell, 2017)

## 6. New Silk Road – Maritime transportation

### 6.1. Introduction

This section explains general characteristics of maritime transportation, and the current “state of affairs” in the container shipping market.

### 6.2. Container shipping

Even though the many economic crisis the world has seen in the past we see that the container shipping industry has been experiencing a steady growth through the years. The only dip in global container traffic was in the global financial crisis in 2008. This is a strong indicator of the market power the container shipping market has on the other modes of transportation. The global container traffic measured in TEU or Twenty Foot Equivalent Unit (Container) shows a growth from approximately 23 million TEUs shipped by sea in 1990 to approximately 160 million TEUs in 2016. What this illustrates is that the container shipping industry is a resilient and solid industry that can cope with global market changes. (Seabury Consulting, 2017)

An illustration of this is shown in figure 16:

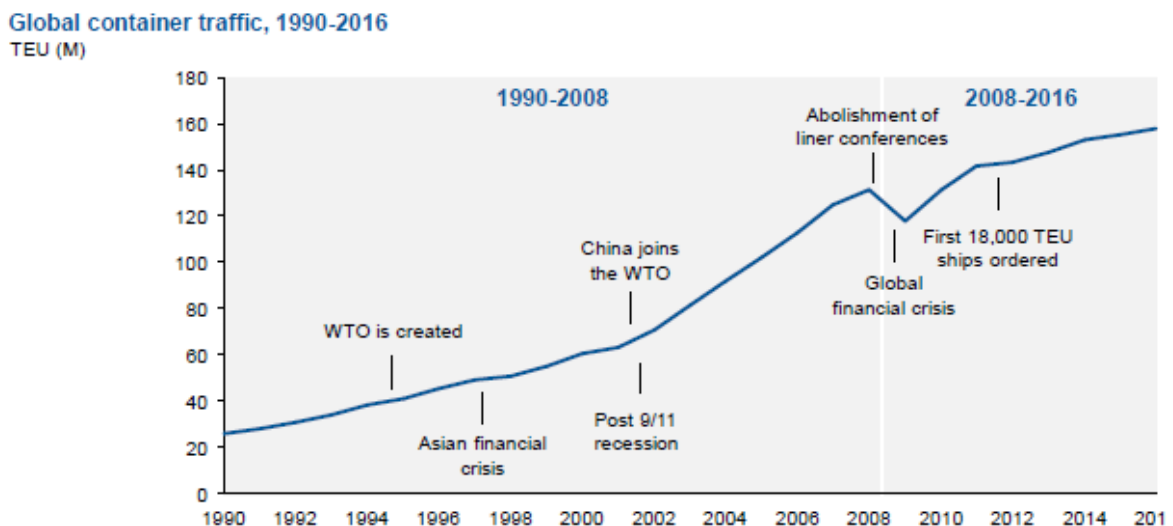


Figure 16: Global container traffic. 1990-2016. Source: (Seabury Consulting, 2017)

As figure 16 illustrates, the large volume of shipped TEUs and the steady strong growth in the market, one could quite easily conclude that the container shipping is the leading container transportation mode in the market. Just to illustrate the market power of maritime transportation in the container market it can be compared to the airfreight market. Air trade share has declined in the container transport industry. In 2016 airfreight only transported 1,5% of the total trade volumes in the world. This means that container shipping transported 65 times more than airfreight in terms of metric tons transported. The authors of this thesis mean that this illustrates the main competitive advantage of the maritime container shipping industry: volume capacity.

In other words, the shipping has the capacity to transport more volume than the other modes of transportation. (Seabury Consulting, 2017)

Figure 17 is a comparison between air and sea freight that illustrate this clear difference in transported goods between the modes from the year 2000 to 2016:

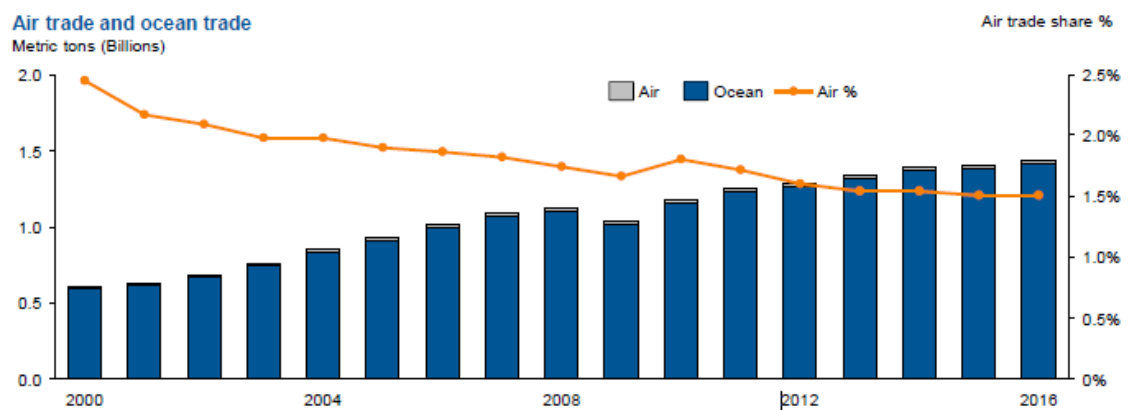


Figure 17: Air trade and ocean trade. Source: (Seabury Consulting, 2017)

The difference in trade volumes are mostly due to capacity, but one should also consider the cost per TEU. It is much costlier to transport one TEU by than by sea. (Ignell, 2018a)

When comparing the modes, one should also consider lead-time, urgency etc., but when comparing volumes and capacity, shipping is the market winner. (Seabury Consulting, 2017).

One other aspect worth mentioning is the economics of scale gained from building large vessels. This means that with ships with larger capacity, the unit costs per TEU will decrease. The shipping industry here has more possibilities than both rail and air due to different factors. With the ongoing development due to the Maritime Silk Road-project (MRS), the capacity size of the ships is also likely to increase. Better port infrastructure allows more trade volume, which again favorites larger vessels. We see that the largest container vessels have a cost per TEU that is 10% lower than smaller vessels. (Seabury Consulting, 2017)

A comparison between vessel types and airplanes is illustrated in figure 18:



Figure 18: Large vessels provide economies of scale. Source: (Seabury Consulting, 2017)

Now that we have illustrated the market power of maritime shipping, the way forward is to investigate the container shipping from China to Europe.

56% of all container shipping in 2016 comes from Asia with China as the clearly biggest exporter of the Asian countries. China had a market share of 32% percent in 2016. One third of all container shipping export in the world, and the biggest ships are naturally also usually utilized from China to Europe. It is also worth mentioning that intra-Asia had the world's biggest container trade. (Seabury Consulting, 2017)

Figure 19 shows us the top 5 Asian export markets in 2016, and the percentage of the global export market.

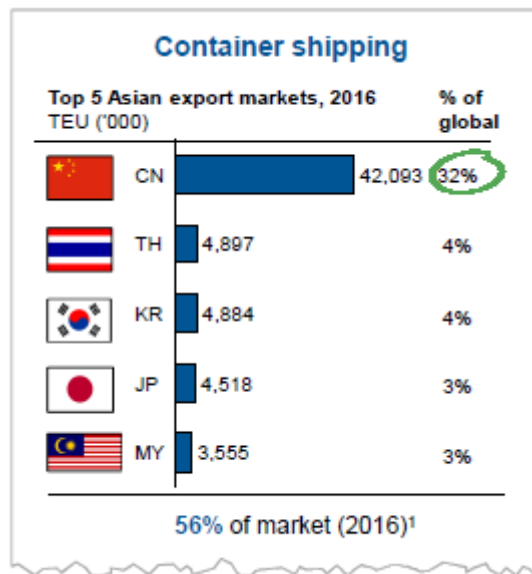


Figure 19: Container shipping. Source: (Seabury Consulting, 2017)

### 6.3. Types of goods transported with container shipping

Sea freight is characterized by having a competitive advantage in terms of volume. The lead-time is most likely the major “drawback” for container shipping. The result is that commodities like Norwegian salmon that needs to be transported fast to maintain quality is transported with air. But most commodities are sent by sea freight per today as described over. This thesis wants to investigate into witch commodities that can be transferred from sea to rail on our route. A collaboration between modes will maybe be the best solution for all transportation modes. (Seabury Consulting, 2017)

### 6.4. The New Maritime Silk Road (MSR)

Having illustrated the container shipping industry and the vast scale of the container shipping between China and Europe, the next step is to explain the ongoing development of the maritime routes between China and Europe. This includes the New Maritime Silk Road (MSR), the Suez Canal and the potential future alternative along the Northern Sea Route (NSR).

The New MSR is basically the maritime part of the New Silk Road project. It involves development of infrastructure along the Maritime route from China through Asia and ultimately into Europe.

Belt and Road Center defines the project as follows:

*“The aim of this mega project is to revolutionize deep-sea trade from Southeast Asia through Africa to Europe, and to put the participating countries on the track of economic development with the help of the infrastructural developments along the coastline. “*

(Klemensits, 2017)

Further, quoting Professor Yang Baoyun: *“Just like the historical route hundreds of years ago, the new Maritime Silk Road will bring tangible benefits to neighbors along the route, and will be a driving force for the prosperity of the entire East Asian region”*

Klemensits (2017, 3)

The New MSR is funded by the Asian Infrastructure Investment Bank (AIIB), and the Maritime Silk Road Bank, with total investments of 50-100 billion US dollars. This indicates the enormous scale of this project and china's ambitions for this development.

#### **6.4.1. Involved countries in the MSR**

The new MRS is an international concept where many countries are involved in terms of port and infrastructure developments. China is of course the most important region for the MRS. Secondly comes Southeast Asia with Singapore and Malacca Straits. China has little influence in these areas, and they have therefore been trying to engage these two countries (Malaysia and Indonesia) in the investments.

Further, the south-east Asian countries Sri Lanka, the Maldives and Pakistan are the main partners of the MSR. Investments are being made in ports in all of the countries to develop the route. (Klemensits, 2017)

India is naturally one important part of this development. At least that is what we would expect. Unfortunately, the Indian prime minister Narendra Modi is making it clear that India is not supporting the idea. Their view is that the Chinese investments and expansions is

violating their geostrategic interests. Indian government are claiming that China will gain competitive advantage due to their expansion in the involved countries. The rivalry between China and India is well known, and India means that China is decreasing India's influence in the regions of Sri Lanka, Bangladesh and the Maldives. (Klemensits, 2017)

Figure 20 shows an illustration of the maritime routes (blue) and land routes (red) between China and Europe including China, southeast Asia, and south Asia.

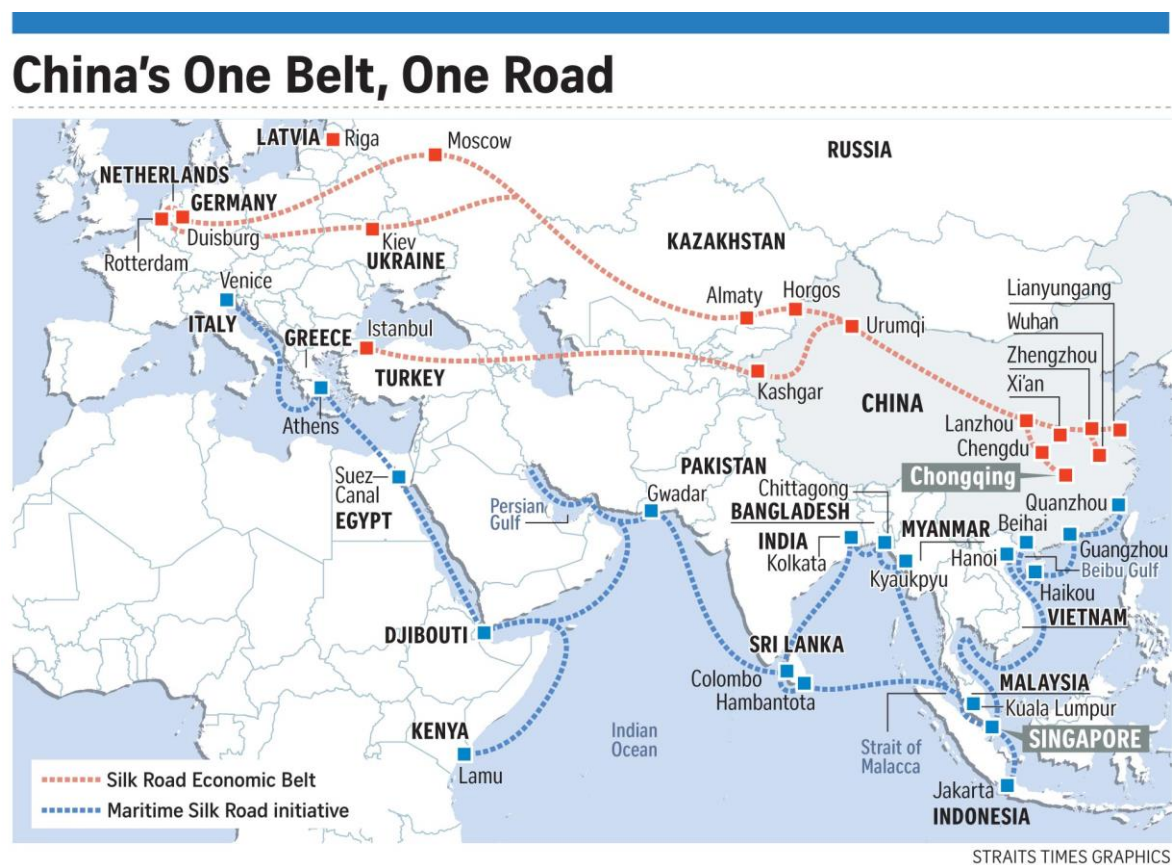


Figure 20: China's One Belt, One Road. Source: (Noi, 2017)

## 6.5. Suez Canal

With its 190 km, the Suez Canal is the maritime link between the Mediterranean Sea and the Red Sea. On a larger scale, it could be considered the main maritime link between Europe and Asia. It opened in 1869 and is today one of the biggest maritime routes in the world, in terms traffic volume. The Suez Canal allows shippers to send their vessels

through the canal instead of going around the south of Africa. This route is much shorter, and the vessels saves both time and operational costs sailing through this route. (Kaushik, 2018)

## 6.6. The Northern Sea Route (NSR)

The Northern Sea Route (NSR) is the maritime alternative to the southern route via the Suez Canal. The route takes the northern path from China towards Europe. It is a connection between the Atlantic Ocean and Pacific Ocean, just like the southern routes, but that is where the similarities stop. The route runs alongside the Russian Coast of Siberia and Far East, and crosses five Arctic Seas. The main challenge for this route is the climate, and ice conditions in the Arctic. The route has not reached its full potential for international shipping, but with the ongoing climate changes in the world today we see that it is a possibility for the NSR to gain its “market power” in the shipping market.

This brings us into the advantages of utilizing this route. Having mentioned the ice conditions as the main challenge, it is only natural to think that the NSR must have a competitive advantage in distance to even be considered as a shipping alternative. The NSR offers indeed a lower distance from China to Europe, than the route via the Suez Canal. This is illustrated in figure 21:

	Via Suez Canal			Through Northern Sea Route			Days saved
	Distance Nm.	Speed Knts	Days	Distance Nm.	Speed Knts*	Days	
Shanghai, China	12050	14	37	6500	14	19	18
Busan, Korea	12400	14	38	6050	14	18	20
Yokohama, Japan	12730	14	39	5750	14	17	22

**Figure 21: Distance and speed comparison of Suez and the Northern Sea route. Source: (Articbulk.com, 2017)**

This illustration shows a significantly lower distance from Shanghai in China to Kirkenes in Norway. The difference would of course be shorter when using the main European ports



like for example Rotterdam as starting/ending point, but it gives us an impression/forecast of the advantages that can be gained from utilizing this route in the future. (Kiiski, 2017)

The main reason we think this is a possible substitute for the existing maritime routes, is the reduction in distance and lead-time between the continents. The main challenge for this route is possibly environmental. Where ice conditions in this arctic route is likely to be the biggest challenge to the knowledge of the authors.

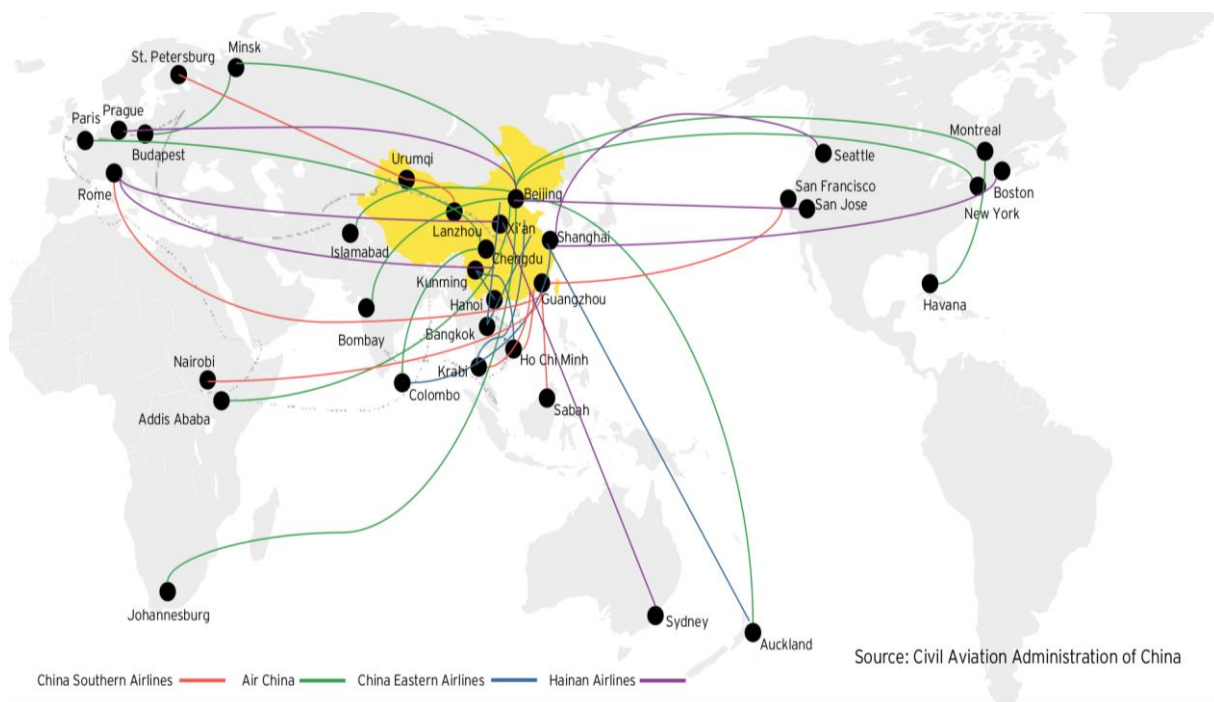
China hope to be able to build a “Polar Silk Road”. China want to do this by developing the arctic routes and construct good infrastructure along the route and calls for international cooperation in the development of infrastructure. China has a strong focus on the navigational safety and security regarding shipping in this route. China want to improve logistical capacity and navigational security in the arctic and they support the International Maritime Organization (IMO) when formulating navigational rules. To develop the Polar Silk Road China is dependent on participation of all involved parties. China is one these stakeholders. The development is as mentioned also partly dependent on climate changes in the Artic, but China plans to develop a Polar Silk Road. (Scrafton, 2018), (The State Council The Peoples Republic Of China, 2018).

## 7. New Silk Road – Air transport

### 7.1. Introduction

As the New Silk Road-project has continued to develop over the years, the expansion of air routes and airports have also been important areas of priority along the way. This has given a significant boost to the Chinese aviation industry with significant demand growth and increasing internationalization as a result. In this section, statistics regarding aviation along the New Silk Road is described along with characteristics of the air freight.

There is much information in addition to several numbers and statistics from previous years (2015 and 2016) that illustrates an increasing trend in aviation along the New Silk Road.



**Figure 22: International routes – top four Chinese air companies – 2015. Source: (EY, 2016)**

## 7.2. Statistics 2015

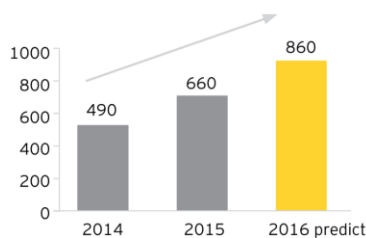
- There were 51 strategic aviation projects directly serving the New Silk Road-project.
  - China opened 170 new international routes. This was an increase of 35% for the year.
  - Air China, China Eastern Airlines, China Southern Airlines and Hainan Airlines experienced their revenue growth rates of international routes surpassing that of domestic routes.
  - The passenger turnover of countries along the New Silk Road increased by more than 70%.
- (EY, 2016)

## 7.3. Statistics 2016

- The Civil Aviation Administration of China (CAAC) issued Opinions on further deepening the reform of civil aviation. Here, they proposed to open up airspace and optimize the allocation of international traffic rights. In addition, they encouraged the enterprises in civil aviation to expand and compete in the international aviation market through the use of capital.
  - China was expected to open more than 200 new international routes this year, a 76% increase from 2014.
- (EY, 2016)

In 2016, China is predicted to open more than 200 new international routes, and the total number is

**76%** up from that of 2014



Data source: Civil Aviation Administration of China, 2015 annual report of each airline company

In 2015, the top four airlines' revenue growth rates of their international routes surpassed that of domestic routes

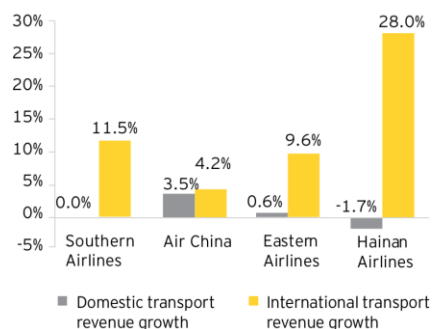


Figure 23: China – aviation statistics. Source: (EY, 2016)

Furthermore, China has upon the recent years signed several bilateral intergovernmental air transport agreements with 61 countries along the New Silk Road. Here, 43 of the countries have air links with China.

In addition to the growth in international routes and transport capacity, there are also major investments overseas ongoing from Chinese enterprises when it comes to areas like aviation infrastructure, aircraft manufacturing and air services. Mainly, this has its background from the global financial crisis in 2008, in addition to the financial strain that has existed in some regional governments. This have made many local airports desperate for new investors. Chinese enterprises have seized upon this opportunity from the market downturn, and continually expanded their business internationally as a result. A number of foreign airports have been acquired or invested in. Here, Parchim International Airport in Germany, Heathrow Airport in the UK, and Parma Airport in Italy serve as some examples.

Further, by investing in overseas airport facilities, Chinese enterprises have established several express channels along the way. These channels have facilitated the logistics convenience between domestic and international markets, shortened transportation time, lowered transport costs, as well as boosting the cross-border e-commerce business. (EY, 2016)

#### **7.4. Air freight - less dependent on Asia than ocean freight**

As a continent, Asia is an important export market for air freight. Overall, Asia accounted for 40% of the global export market in 2016. Further, China stands out as the most dominant market, alone accounting for 20% of the global export market in 2016.

However, it is worth to point out that air freight is less dependent on Asia than ocean freight. This can be explained through the high levels of exports in container shipping, with 56% of all exports originating in Asia in 2016. Here, China alone accounted for 32% of all export volumes in container shipping. (Seabury Consulting, 2017)

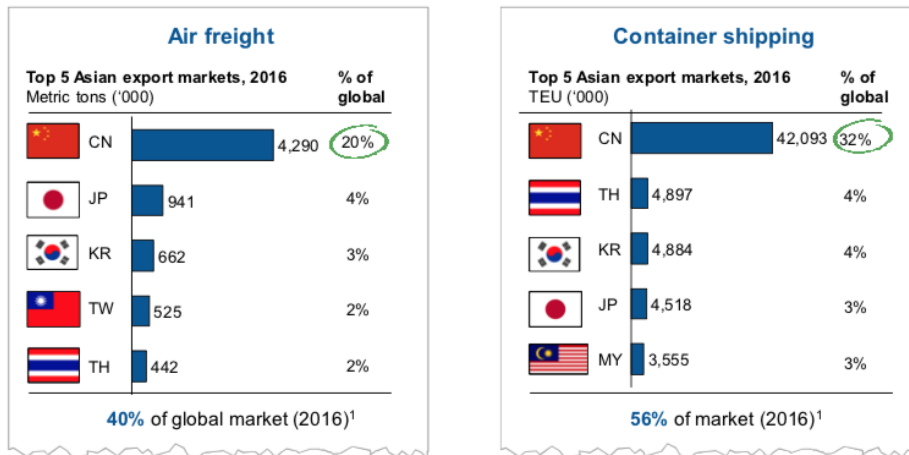


Figure 24: Top 5 Asian export markets - air freight and container shipping - 2016. Source: (Seabury Consulting, 2017)

## 7.5. A changing air freight market driven by new high-tech products

As the continual development of new high-tech products emerge, the air freight market plays an important role with providing short lead-times compared to other modes of transport. Here, the supply of new cellphones (iPhone, Huawei, Samsung) serve as an example. In terms of air weight, these volumes have steadily increased and overtaken laptops upon recent years. Following a similar trend in semiconductor products, this has all led to an overall lower tonnage shipped by air, which is illustrated in the figure below. Overall, all this provides us with information that air freight is changing driven by new high-tech products along the way. (Seabury Consulting, 2017)

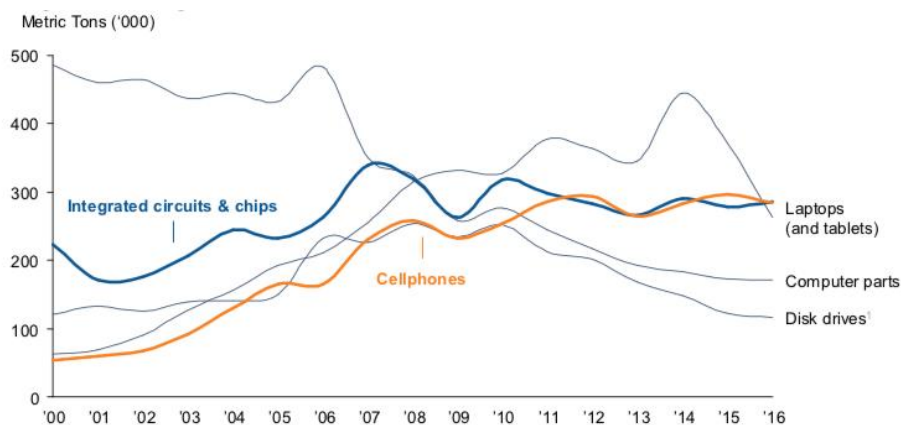


Figure 25: High tech air freight, 2000-2016. Source: (Seabury Consulting, 2017)

## **8. Discussion**

### **8.1. Introduction**

As we throughout this thesis have written extensively about the New Silk Road-project and the relevant elements that connects to the project, this section will have a specifically and particularly focus of summing up and reflect upon the most important issues and answers we have found based on our main and underlying research questions.

### **8.2. Part 1**

This part will discuss the topic of main research question 1: *“What is the New Silk Road, and what is the current state of its development?”* In addition, the underlying research questions are discussed.

#### ***RQ 1: What is the New Silk Road, and what is the current state of its development?***

The New Silk Road is a gigantic transport and infrastructure-project. The project was introduced by the Chinese President Xi Jinping in 2013, drafted around the idea of reviving the Silk Road which in ancient times dominated much of the world trade both through land and maritime routes. For all related purposes, the project is very strategic and ambitious as China plans to invest huge amount of capital in the project. This includes developing and reviving ports, railroads, and all related infrastructure in China, as well as in other countries along the route. So far, China has made deals and agreements with over 60 countries as the project has unfolded, and the development is rapidly developing and continually moving forward as we sit here today. (Lockhart, 2017)

#### ***RQ 1.1: What is the background for the development of the New Silk Road?***

The background for developing the New Silk Road is closely related to China’s current role, status and future perspectives based upon economic as well as geopolitical considerations.

In terms of economics, China has gone through a rapid economic and industrial development over many years. In this process, China now has begun to experience a vast overcapacity, especially in the industrial segments related to steel manufacturing and heavy equipment. The New Silk Road could serve as an outlet for China in dealing with this overcapacity by expanding and open new export-markets for trade with other countries, with also slowing down the domestic markets in the process. In sum, this will probably help China to keep its national economy buoyant going forward. (Lockhart, 2016). This relates closely to the theory of international trade. We see the need for export in this case and benefits from trade will probably come as a consequence of the development of the New Silk Road.

In terms of geopolitics, it could be interpreted that China through its huge capital investments in the New Silk Road-project is a part of an ongoing and strategic effort by China to improve and create new relationships with Asian as well as European countries. Many also believe that China's potential "endgame" with the New Silk Road-project is to finally establish itself as a dominant and permanent global superpower, challenging the position that many see United States is holding today. (Lockhart, 2016)

***RQ 1.2: How far have the plans been realized?***

As the New Silk Road clearly is an ongoing project, continually developing, we have tried to the best of our ability to provide an overview of the project throughout our thesis. There are interesting developments ongoing especially when it comes to rail- and sea-alternatives along the route.

When it comes to the rail-alternative, we have described 4 different transport routes and corridors between China and Europe: The trans-Siberian corridors (via Russia), the trans-Caspian corridors, the southern corridors (via Turkey) and a separate sea-land route – the Balkan corridors. At this time, the trans-Siberian corridors is the route that is being utilized the most. Compared to the 3 other routes, this route overall provides the best infrastructure, and is also the cheapest, fastest and safest option. However, with the introduction of the New Silk Road-project, there are attempts ongoing to develop the alternative corridors to redirect more of the trade flows to these routes in the future. (Jakóbowski et. al, 2018)

From our communication and correspondence with Greencarrier, it is clear that there are many interesting things happening along the New Silk Road's rail alternative today. This is clearly illustrated by the figures and statistics that Greencarrier has provided us with, which show increases in both revenue and volumes when it comes to their railway-product between China and Europe/Scandinavia from January 2016 to October 2017, (figure 13, 14 and 15). This represents an overall increasing trend for the rail-alternative as a transport solution, collaborated by statistics we have obtained from Seabury Consulting.

When it comes to the maritime alternative between China and Europe/Scandinavia, it is still the alternative that transports the largest volumes of goods in total. The benefits related to economies of scale, low unit costs, volume capacity and containerization are strong factors that explains this.

Today, much of the maritime traffic along the route goes through the Suez Canal, a canal that works as a link between the Atlantic Ocean and the Indian Ocean, allowing the maritime transportation vessels to go between the Mediterranean and the Red Sea along the route between Europe and Asia. (Kaushik, 2018)

The Maritime Silk Road (MSR) is one of the key elements in China's New Silk Road-project, funded with investments of \$50-100 billion to both Chinese and other involved countries port and infrastructure developments. (Klemensits, 2017)

The New Silk Road-air transport alternative has also experienced interesting developments in recent years. China has through its New Silk Road-project made huge investments in airport infrastructure in several areas and cities around its country, causing increased internationalization as a result (figure 23). In 2015 and 2016, China opened respectively 170 and 200 new international air routes. As a result of this, Chinese airlines (Air China, Hainan Airlines, etc.) have experienced their revenue growth rates of international routes surpassing that of domestic routes. (EY, 2016)



***RQ 1.3: Which scenarios for future developments could be drafted within the next decade?***

There seems now to be a more stricter and clearer focus on environmental solutions in the transport and logistics-industry. This is exemplified by Greencarrier, which recently has complied a transport service from China to Hallsberg (south in Örebro, Sweden). This route contains a train-service of FCLs, which runs through Hamburg where it gets cross-docked to a regular railway wagon. From Hamburg, the train drives to Hallsberg, with the last mile being on a truck. Compared to the truck service from Poland, this takes 2 extra days. However, it saves 17% in terms of CO<sub>2</sub>-emissions, underscoring that it is a more environmentally friendly transport-solution. (Ignell, 2017)

It is expected that the transport network along the New Silk Road will continue to further develop in the future as new rail, sea and air-routes are being introduced along the route. When it comes to the sea-alternative, the rapid melting of ice in the Arctic Sea may pose new opportunities and alternatives for future shipping between China and Europe/Scandinavia using the Northern Sea Route (NSR). This route will offer a smaller distance between China and Europe/Scandinavia than the route via the Suez Canal. China sees great opportunity in the NSR as described in their newly released white paper in January 2018 titled “China’s Arctic Policy”. (The State Council The Peoples Republic Of China, 2018), (Kiiski, 2017)

### 8.3. Part 2

This part will discuss the topic of main research question 2: “*How well does rail transport compete with sea and air transport between China and Europe/Scandinavia?*”

To get a discussion with more depth and precise topics, the underlying research questions form the basis of the discussion throughout this part.

#### ***RQ 2.1: How well do the current rail-based solution perform in terms of lead-times and costs?***

According to (Ignell, 2017), the lead-time for rail is estimated to be between 17 and 19 days between China and Europe/Scandinavia. However, according to (Ignell, 2017), the lead-time used to be on a stable level of 14 days in the beginning between China and Warsaw. The reason for this increase in lead-time is due to the increase in volumes that have happened since 2017. As a result, bottlenecks have occurred along the route. One main bottleneck is on the border between Belarus and Poland, Malaszewicze. (Ignell, 2017)

According to (Articbulk, 2017), the sailing time from Shanghai to Kirkenes is 37 days. If the vessels were to sail to Rotterdam for example, the lead-time would be a couple of days shorter. However, the illustration from (Articbulk, 2017) does not include handling times etc. either, which is an example of a factor that also will increase the lead-time for sea transport. Based on this, there seems to be no doubt that the lead-time for rail outperforms the lead-time for sea transport.

However, in terms of sea transport, it is worth mentioning that if the future development of the NSR does occur, and the route is being utilized, the sailing time from Shanghai to Kirkenes would be 18 days given the statistics from (Articbulk, 2017). This means that the lead-time by sea would quite possibly be shorter than the lead-time by rail. Also, with the capacity advantage that sea transport has, the shipping sector would have another major competitive advantage on rail.

When talking about how well the rail solution compares with the air transportation in terms of lead-time, the result is not surprisingly in the air transports favor. One would here have to consider the costs of air transport to see how well the rail solution competes with air. According to (Ignell, 2017), transporting 7-8 CBM would be 40-50% cheaper with rail than with air transport.

To draw a conclusion regarding how well rail freight competes with sea and air in terms of lead-time and costs, the customer or freight forwarder would have to consider which factors are the most important related to their mode choice. For example, if transportation costs are the focus area, the mode choice would be sea transport. Transportation costs and lead-time are here trade barriers which are minimized with sea and air transportation. The rail solution will likely be the option for the customers who demands a relatively low lead-time, but to a reasonable price. The rail solution acts as an alternative to the customers who usually would send their delivery with air due to the lead-time, but when considering the rail solution, they could very well be using this, and save money. Airlines are often charging high prices for their services because of the urgent need the customers have. Greencarrier's rail solution aim to be an alternative for these customers. (Ignell, 2017)

***RQ 2.2: What type of goods is transported with rail along the New Silk Road today?***

A large variety of goods is transported with rail today. One example is automotive cargo. This is one of the dominant commodities going by rail between Europe and China today. Automotive goods include both fully assembled cars from manufacturer, and car parts.

Earlier, rail was mostly used to transport IT related equipment, but as the service has evolved over time, both high and low value cargo is now being transported along the route.

It is worth mentioning that even though a large variety of goods are transported by rail today, the lead-time factor sets boundaries for many manufacturers. This especially relate to products which are either high value and/or popular and needs to hit the market fast. Here, a 20 days lead-time would quite possibly decrease the value of the product, and therefore the costlier solution that is air-freight is often booked even though it represents

higher costs for the manufacturers. One example is the highly popular products from Apple. (Ignell, 2017).

***RQ 2.3: What types of goods could possibly be moved from sea/air to rail?***

The backbone of this underlying research question relates to the theory of mode choice. To answer this question, one would have to consider both the lead-time and transportation costs. If for example one “popular” good is demanded in the market in about 20 days, it would be possible to consider the rail solution instead of air. However, this is easier said than done, as it would require great market knowledge through analysis and/or prognoses about the market. If the prognoses show that the lead-time is too long, the transporter would use air transport, and if the opposite where demand peak will be in for example 30-40 days, the shipping alternative would likely be preferred.

The goods that are mainly the ones that Greencarrier aims to transport by rail rather than air are the goods where the manufacturers have sent a large shipment with sea, but some goods were not included. The manufacturers then “panic” and send the rest with air even though this is not necessary. Rail would be a valid option for the manufacturers as the lead-time still is shorter than sea, and the goods would arrive at the destination before the rest of the shipment. The consequences related to this are much lower transportation costs for the suppliers and no delay in delivery. (Ignell, 2017)

***RQ 2.4: How far have the new rail-based links between China and Europe/Scandinavia developed?***

The rail-based links are today well developed between China and Europe. Greencarrier’s rail solution is an example of one of the many alternatives when transporting goods between China and Europe/Scandinavia. The recent developments in the market indicate that the volumes of goods going by rail are increasing. This has resulted in some bottlenecks as earlier mentioned. The development moving forward would therefore be dependent on the demand for this transport solution. (Ignell, 2017)

## **9. Conclusion**

### **9.1. Introduction**

The conclusion is based on the research problem for this thesis: *“Which role do rail-based solutions play versus sea- and air-based routes along the New Silk Road between China and Europe/Scandinavia?”*

The underlying conclusions are based on the main and underlying research questions, as well as the discussion section. Overall, this section aims to summarize the findings of our research and answer the research problem.

### **9.2. Conclusions**

When describing the New Silk Road-project, it is important to remember that it is an ongoing strategic project, continually developing as we speak. Being a Chinese initiative, China’s role and ambitions are essential in the development of the project. This is highly reflected by the huge investments in transportation and infrastructure that China has made domestically as well as internationally since the project was introduced in 2013.

We have found that the investments made through the New Silk Road-project are reflected in all modes of transportation, but one of the most interesting developments in recent years have happened along the New Silk Road’s rail alternative. Here, there have been notable increases both in terms of revenues and volumes along the route between China and Europe/Scandinavia, which we have exemplified through Greencarrier’s results and related statistics throughout our thesis.

However, the maritime alternative is still the dominant mode of transportation today, transporting the largest total volumes of goods between China and Europe/Scandinavia through the Suez Canal. Further, there is also the potential possibility of utilizing the Northern Sea Route (NSR) in the future, following the rapid melting of ice in the Arctic Sea. This issue is especially highlighted in China’s newly released white paper “China’s

Arctic Policy”. Overall, this makes the maritime alternative one of the key elements in the New Silk Road-project.

One of the key areas of focus in our thesis has been to compare the rail alternative’s performance level to the other modes of transport along the New Silk Road. The two key factors here are lead-time and cost. We have figured that obtaining and maintaining the right balance between these two factors are essential to make rail a compatible and profitable transport alternative moving forward.

In this perspective, we have found out through our work that the lead-time between China and Europe/Scandinavia by rail is estimated to be 17-19 days. In comparison, the lead-time by sea is estimated to be short of 37 days. These numbers indicate that rail outperforms sea when it comes to lead-time. However, the lead-time by rail actually used to be on a stable level of 14 days before the sudden increases in volumes happening around 2017, which has created various bottlenecks along the route as a result. In addition, it is projected that utilizing the potential NSR in the future may shorten the lead-time between Shanghai and Kirkenes down to 18 days. Based on this information, in addition to the capacity and cost-advantages shipping has compared to rail, shipping could nullify the competitive advantage rail has in terms of lead-time. As a result, rail must strive to get back to a stable level of a lead-time of 14 days or lower to remain competitive in the future. The focus should therefore be to deal with the various bottlenecks along the route by investing to increase the volume capacities at these places moving forward. One important example here is the bottleneck on the border between Belarus and Poland, Malaszewicze.

Further, we have figured the comparison between the rail and the air-alternative to be interesting. Here, air has a competitive advantage in terms of lead-time, while rail has a competitive advantage in terms of cost. In the competition for potential customers, rail should therefore identify the customers who demands a relatively low lead-time, but to a reasonable price. Here, the overall idea is to be an alternative for customers who usually send their deliveries by air due to lead-time, but when considering the rail-solution they could potentially make use of it to save some money.

When it comes to the type of goods which is transported by rail along the New Silk Road today, goods from the automotive industry is dominant. These types of goods include fully assembled cars from manufacturers, car parts, and spare parts. In addition, a large variety of other types of goods is transported, both high and low value.

There may be multiple types of goods that possibly could be moved from sea/air to rail. However, lead-time sets boundaries in many cases. An example here is an Apple-product like an iPhone which is high value, popular and needs to hit the market fast. A lead-time by rail of 20 days would possibly decrease the value of the product, and therefore the air-solution is used instead of the rail-solution even though the transport costs are higher.

Summing up, it seems clear that many things are happening and are predicted to happen along the New Silk Road as the project moves along. This relates to especially to the rail alternative, as well as to the sea alternative. New routes as well as new technologies are being introduced, creating new opportunities and challenges along the way. This, in combination with what seems to be a more environmentally-related focus throughout the transportation and logistics industry will be interesting developments to follow moving forward.

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# Appendices

## Appendix I: Interview 1: Johan Ignell

*(Ignell, 2017)*

**REMOVED IN THE PUBLIC VERSION OF THE THESIS**

## Appendix II: Interview 2: Johan Ignell

*(Ignell, 2018a)*

<i>Date of interview:</i>	<i>19 January 2018</i>
<i>Duration of the interview:</i>	<i>26 minutes</i>
<i>Interviewer:</i>	<i>Eirik Haugland and Ole Harald Toppe</i>
<i>Interviewer affiliation:</i>	<i>Molde University College</i>
<i>Transcriber:</i>	<i>Eirik Haugland</i>
<i>Transcriber affiliation:</i>	<i>Molde University College</i>
<i>Interview type:</i>	<i>By phone with audio recording</i>
<i>Respondent type:</i>	<i>Johan Ignell, Greencarrier - LSP – providing upstream consolidation activities in China with cargo-flows destined for Northern Europe</i>
<i>Language of the original interview:</i>	<i>Norwegian/Swedish</i>
<i>Language(s) of this transcript:</i>	<i>English</i>
<i>Transcript reviewed and accepted by respondent, date: 5 February 2018</i>	

*The transcript is based on an audio-recording of the interview. This audio-recording will be deleted when the wording of the written transcript is reviewed and accepted by the respondent. The transcript is not an accurate word-for-word representation of the oral interview and does not contain any comments on the way the respondent behaved under the interview. The transcript should, on the other hand, convey the meaning of the statements given in proper written language with full sentences.*

*The letters “I:” and “R:” are used to indicate statements made by the interviewer and the respondent respectively.*

**English language version:**

I: How does the New Silk Road-railway contribute to European/Scandinavian products entering the Chinese marketplace?

R: The railway is a good alternative for transporting goods from China to Europe/Scandinavia and from Europe/Scandinavia to China. The sea route is still and will probably continue to be the greater contributor as it handles most of the greater volumes going back and forth. If a European exporter has Chinese customers and has a shipment that cannot be sent by sea because of lead-time, the most common solution has been to use air transport. The railway solution that now exists gives a new alternative. If for example there is a situation where the production is delayed with one or two weeks in Europe/Scandinavia, the railway solution can be a more beneficial solution than air. Railway has lower transport costs compared to air and serves in many ways as a backup-plan for producers. Still today there are customers that regularly use air transport either way and will continued to do so going further. However, there are customers that have chosen to transfer some of their volumes to rail to minimize their transport costs in addition to the environmental-aspect.

I: What can you tell us about Greencarrier's return logistics? Goods flow going back from Europe/Scandinavia to China? Goods-balance?

R: I would say that there is an unbalance related to the goods-flows. More goods are transported from China to Europe/Scandinavia than from Europe/Scandinavia to China. At least we experience this in Greencarrier. The train operators work actively to increase the volumes from Europe/Scandinavia to China. One should get back both containers and

wagons from China. It is very important for the train operators to find a balance between eastbound and westbound transport.

I: What would you say the challenges are when developing the New Silk Road-railway? Infrastructure? Track widths? Bottlenecks?

R: There are absolutely challenges when it comes to track width and different types of tracks along the route. There are different track widths in China and in Russia. Must therefore lift containers from train to train on the border between China and Russia. We in Greencarrier have worked with the New Silk Road since 2014. When we started in 2014 and further in 2015, 2016 the route was very efficient. There were no big problems along the route, and we had lead-times from China to Warsaw as short as 14 days. Something happened between 2016 and 2017 as more customers stated to use and were interested to use the route. More and more forwarders started therefore to sell the rail-solution. Now the big bottleneck is the border crossing into Poland from Belarus: Malaszewicze.

I: Are there any challenges that big parts of the railway-alternative go through Russia? Political?

R: China and Russia have a good relation when it comes to this area. There are no big problems in general. However, some type of goods cannot be transported through Russia, milk powder being an example here.

I: Is the infrastructure today feasible with future increase in volume of goods/trade along this route? Is the railway capacity good, or would it require further investments to deal with increased rail freight?

R: There has been an increase in Chinese train operators. Many deals between train operators have to be made. There has to be investments in Malaszewicze as mentioned earlier. Much of the New Silk Road-railway is financed by the Chinese state. In 2013, China took an initiative through the One-Belt-One Road initiative (OBOR). As for now, there will be continual investments from the Chinese state all the way forward to 2020.

I: Competitive advantages for the New Silk Road-railway compared to other modes of transport?

R: - Rail vs. sea: lead-time.

- Rail vs. air: half as expensive, more environmental friendly.

I: How are the logistics organized from the hubs in Warsaw and Hamburg?

R: 1. Intermodal solution. The containers are transferred to trucks. The disadvantages here is that you have to return the containers to Warsaw/Hamburg, and that it is an expensive solution.

2. We in Greencarrier take the containers in stock and use our own trucks from there.

3. Reloading on their own train.

4. Some competitors transfer the containers to ships.

I: How do you handle cargo in terminals?

R: The containers go to the stock and get emptied. Goods get transferred to a new wagon. Transit-documents are created.

I: What type of goods get transferred through the New Silk Road-railway?

R: It started with the transport IT-equipment. Now parts for the car industry contribute greatly to the overall volume from Germany to China. We in Greencarrier also transports much apparels and machine parts, etc.

I: Could new technology allow more goods to be transported by rail instead of sea/air? Do you in Greencarrier provide any solutions that could allow such a “transfer”?

R: A customer can typically install a GPS in the container. However, this is very expensive (24/7-tracking). Greencarrier gets daily updates from their operators about the status of various shipments.

I: Do you have any predictions towards the potential of the New Silk Road-railway in the future?

R: Sea transport will in the future still be the biggest, handling the greatest goods-volumes. Today, train operators search for alternative solutions to the bottleneck in Malaszewicze, Poland. One alternative may be the route from Xiang in China to Kovach in Finland. This route has existed in a few months now. Further, some operators have tried



out a route through Riga (Latvia). From there, the shipment is transferred with ship to Rotterdam (Holland). The development happens quickly.

The main focus should be to reduce the bottleneck in Malaszewicze. Have to decrease the loss in lead-time that is particularly caused by this bottleneck.

To have and maintain lead-time as the competitive advantage is an absolute key for the New Silk Road-railway to be successful in the future and for us in Greencarrier to operate and offer the rail-solution to customers.

End of interview.

### Appendix III: Presentation: Greencarrier

(Ignell, 2018b)

Lead time 17-20 days

1 departure every day

Normal Container equipment

FCL WB Setup

Manzhouli

Shenyang

Zhengzhou

Qingdao

Suzhou

Shanghai

Ningbo

Changsha

Xiamen

Shilong

HK & Shenzhen

Greencarrier office

FCL Hub

Rail China

GREENCARRIER

Lead time 17-19 days

Departures every Sunday

Own Consolidation to Warsaw

2-5 x 40 HQ/week

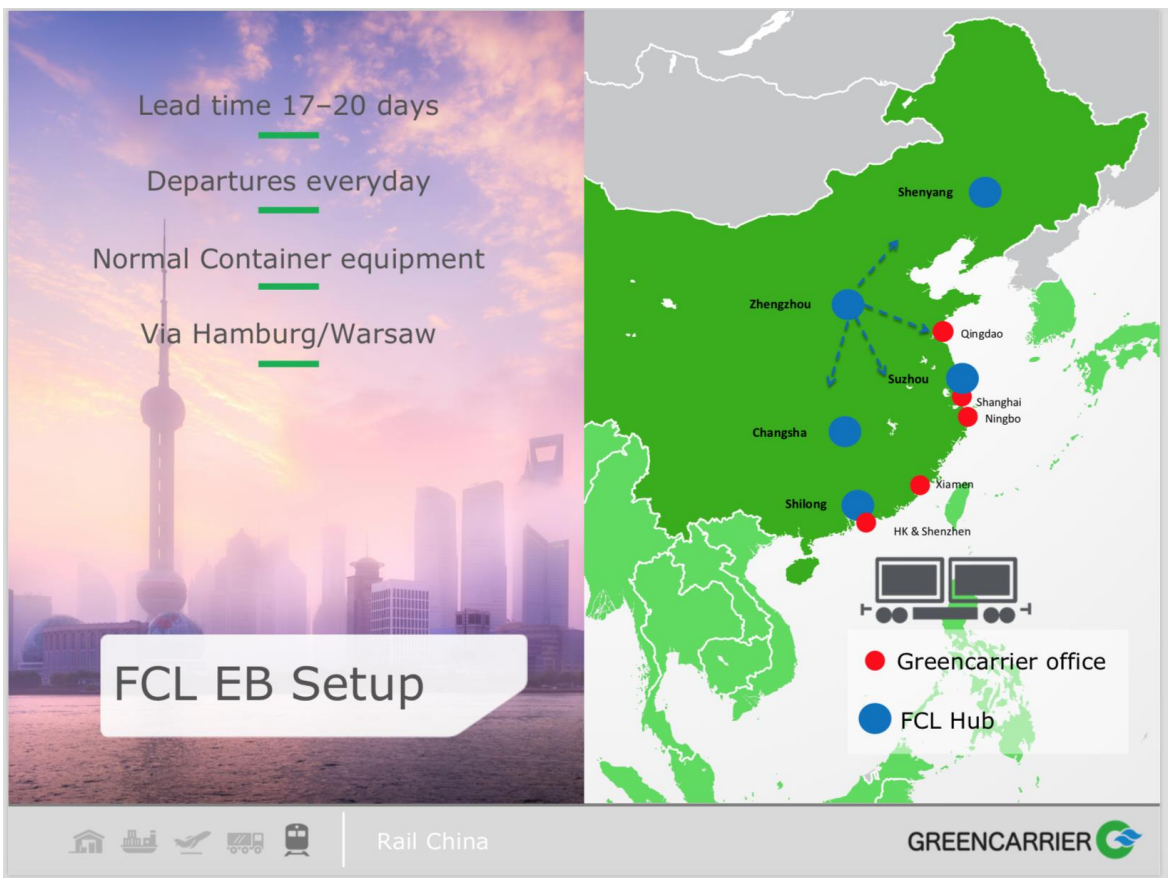
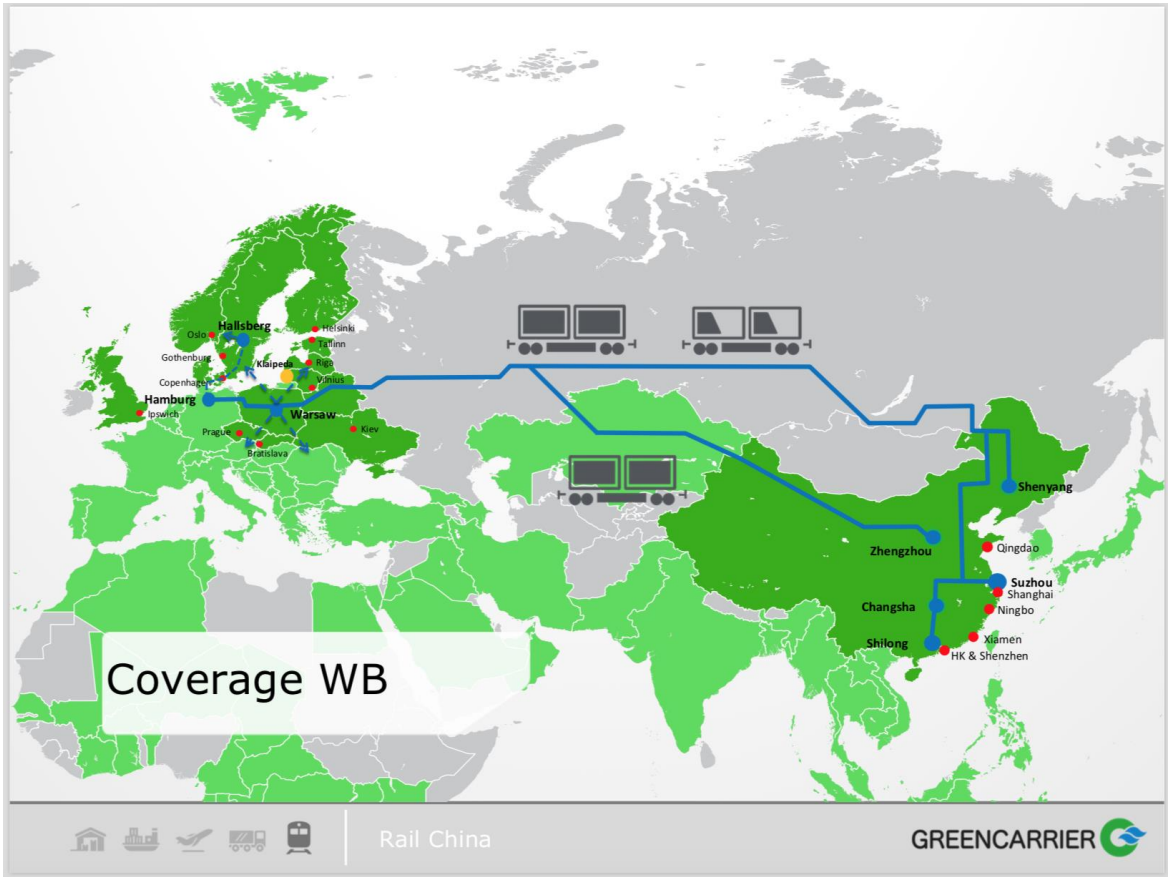
Rail China
GREENCARRIER

Lead time 20-24 days

Weekly departures

By boat to Dalian

Rail China
GREENCARRIER



Lead time 18–21 days

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Departures 3 times per week

---

Main consolidation point is Warsaw

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LCL EB Setup

● Greencarrier office  
● LCL Hub

Rail China

Coverage EB

Rail China

Low emission

Less effected by extreme weather

Economic solution for heavy bulk

Shorter lead time compared to sea

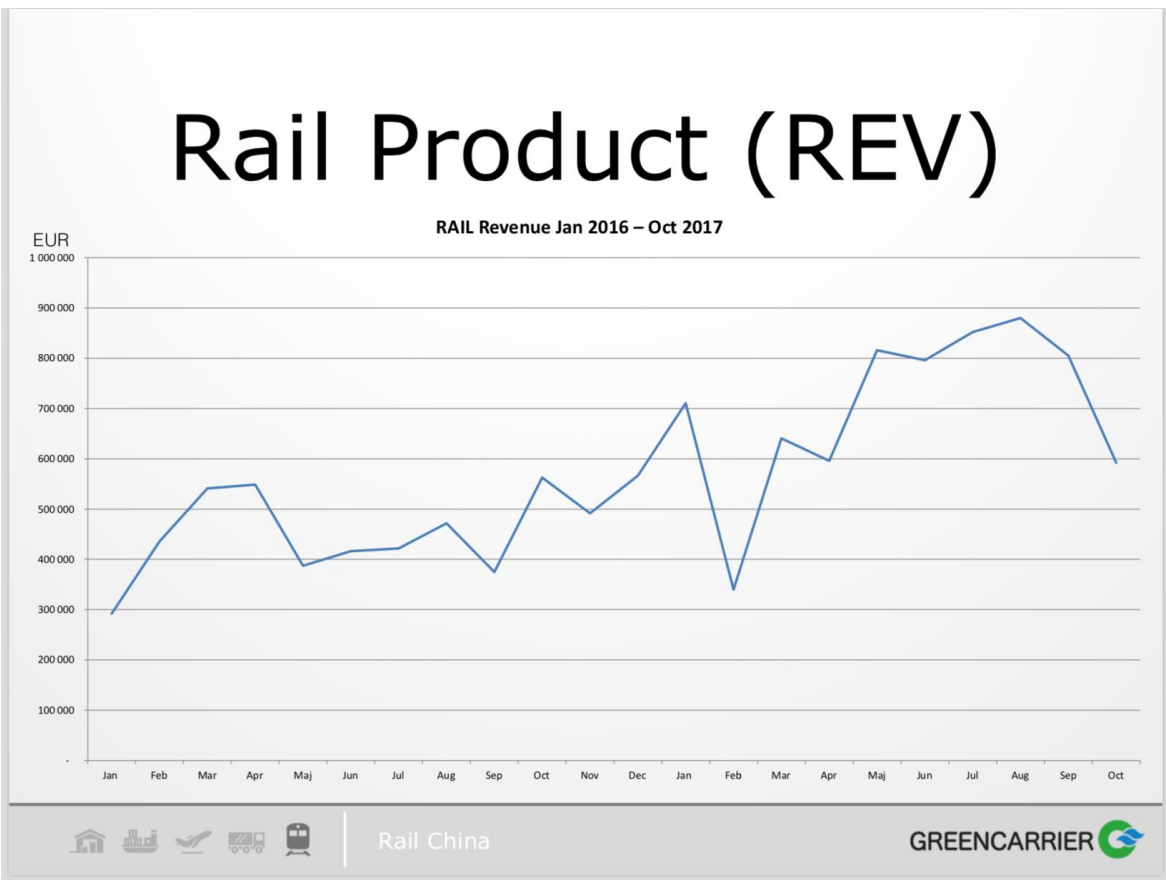
Stable rate levels

Cost savings compared to regular air freight

Your Benefit

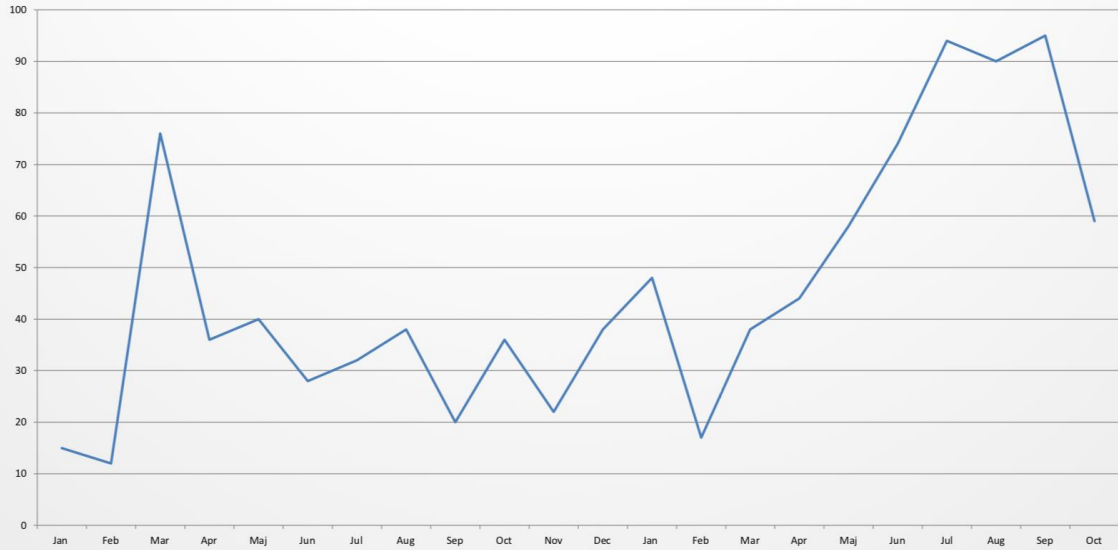
Rail China

GREENCARRIER



# Rail Product (FCL)

FCL RAIL Jan 2016 – Oct 2017

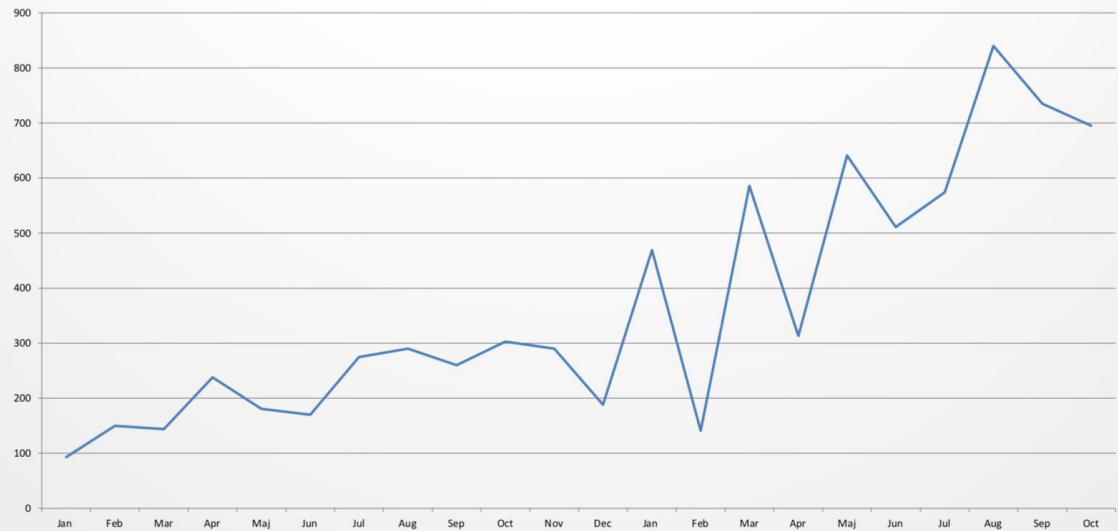


Rail China

GREENCARRIER

# Rail Product (LCL)

LCL RAIL Jan 2016 – Oct 2017



Rail China

GREENCARRIER

# Numbers Rail Jan – Oct 2017

- ✓ Revenue increase by 55%
- ✓ FCL volume increase by 85%
- ✓ LCL volume increase by 162%
- ✓ More than 200 customers (2017)



Rail China

GREENCARRIER

ALIMAK HEK

aanonsen®

HAFA BATHROOM GROUP | Itarä nord westerbergs

INTERSTIL  
A SCANDINAVIAN COMPANY

Purcell  
SYSTEMS  
an EnerSys company

Klimabolaget

Elektroskandia  
Sverige

PRODUKTIDE

ABB

Nissens  
DELIVERING THE DIFFERENCE

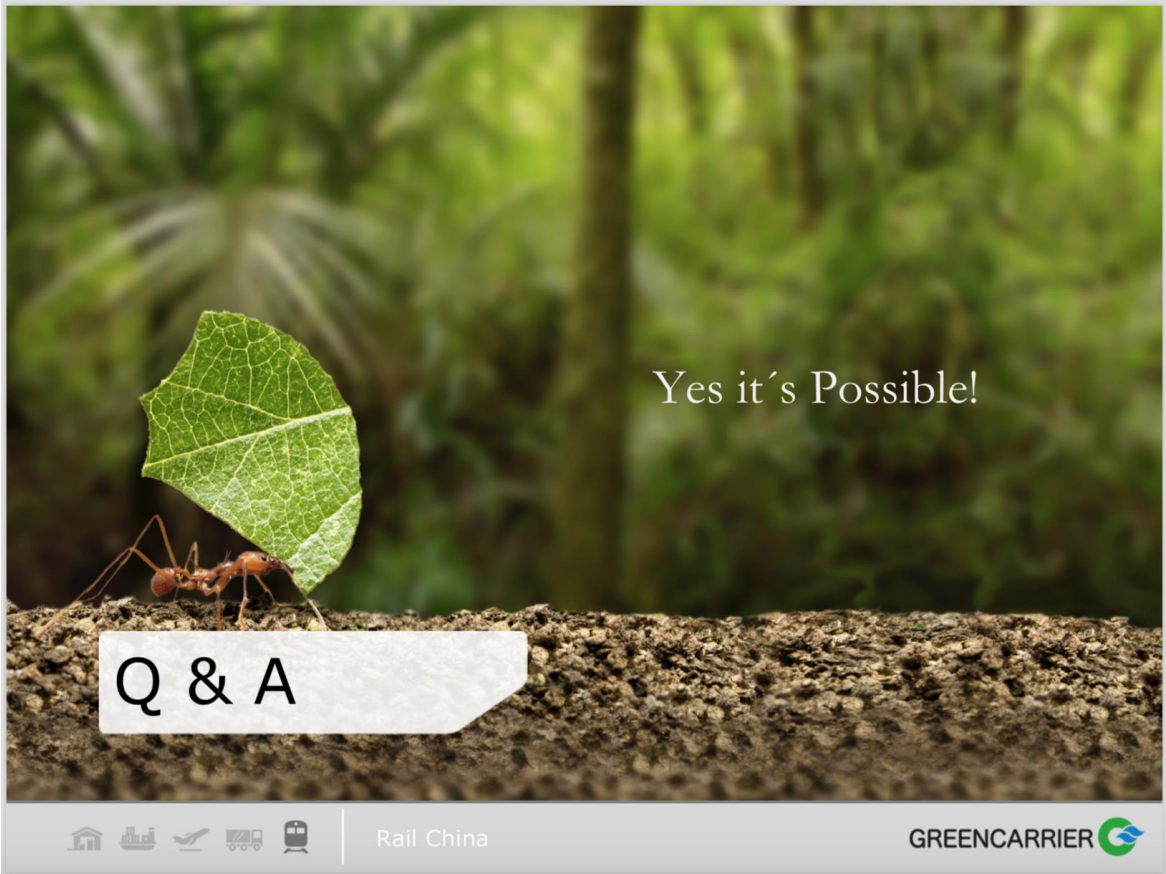
nordic light

Clients



Rail China

GREENCARRIER



Yes it's Possible!

Q & A



Rail China

GREENCARRIER 