LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Faculty of Technology Management
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TRAFFIC FLOW DEVELOPMENT AT NORTH EUROPEAN COMPANY LEVEL WITH RESPECT OF CHINA AND RUSSIA

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ABSTRACT

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The aim of the thesis is to analyze traffic flows and its development from North European companies` point of view to China and Russia using data from logistics questionnaire. Selected North European companies are large Finnish and Swedish companies. The questionnaire was sent via email to the target group. The study is based on the answers got from respondent companies from years 2006, 2009 and 2010. In the thesis Finnish Talouselämä newspaper and Swedish Affärsdata are used as a database to find the target companies for the survey. Respondents were most often logistics managers in companies.

In the beginning of the thesis concepts of transportation logistics is presented, including container types, trade terms, axel loads in roads and in railways. Also there is information about warehousing types and terminals. After that, general information of Chinese and Russian transportation logistics is presented. Chinese and Russian issues are discussed in two sections. In both of them it is analyzed economic development, freight transport and trade balance. Some practical examples of factory inaugurations in China and Russia are presented that Finnish and Swedish companies have completed. In freight transport section different transportation modes, logistics outsourcing and problems of transportation logistics is discussed.

The results of the thesis show that transportation flows between Europe and China is changing. Freight traffic from China to European countries will strengthen even more from the current base. When it comes to Russia and Europe, traffic flows seem to be changing from eastbound traffic to westbound traffic. It means that in the future it is expected more freight traffic from Russia to Europe. Some probable reasons for that are recent factory establishments in Russia and company interviews support also this observation. Effects of the economic recession are mainly seen in the lower transportation amounts in 2009.

TIIVISTELMÄ

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Työn tavoitteena on analysoida tavaraliikenteen kehittymistä Pohjois-Euroopan yrityksien osalta Kiinaan ja Venäjälle käyttämällä apuna verkkopohjaista kyselyä. Valittu kohderyhmä on suomalaiset ja ruotsalaiset yritykset, joille logistiikkakysely lähetettiin. Työ perustuu yrityksiltä saatuihin vastauksiin ja niiden analysointiin vuosilta 2006, 2009 ja 2010. Vastaajat ovat pääosin logistiikkapäälliköitä kohdeyrityksissä. Yrityksien tietojen etsimiseen on käytetty Talouselämä ja Affärsdata sanomalehtien antamia tietoja.

Työn alussa esitetään logistiikan peruskäsitteitä, joita ovat konttityypit, toimituslausekkeet, akselipainot maanteillä sekä rautateillä. Myös erilaisia varastoja ja terminaaleja analysoidaan. Kiinan ja Venäjän osalta tutkitaan talouden kehittymistä, rahtikuljetuksia, kuljetustasapainoja sekä tehtaiden perustamisia kohdemaissa. Eri kuljetusvaihtoehtoja, kuten maantie, rautatie, lento- ja merikuljetuksia tutkitaan myös. Lisäksi käsitellään ulkoistamiseen liittyviä tekijöitä sekä yritysten kohtaamia logistisia ongelmia ulkomailla.

Tutkimuksen tulokset osoittavat, että kuljetusvirrat Kiinasta Eurooppaan tulevat vahvistumaan tulevaisuudessa. Näin ollen yhä enemmän tuotteita kuljetetaan Kiinasta Suomeen ja Ruotsiin lähivuosina. Euroopan ja Venäjän osalta on odotettavissa jonkinlainen muutos tutkimuksen materiaalin mukaan. Aiemmin kuljetustasapaino osoitti kuljetusmäärien olevan suurempi Euroopasta Venäjälle, mutta tulevaisuudessa tilanne voi muuttua toiseen suuntaan tehtaiden perustamisten myötä Venäjällä. Myös yrityshaastattelut tukevat tätä havaintoa. Talouden taantuman vaikutukset näkyvät selvimmin kuljetusmäärien laskuna vuonna 2009.

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LIST OF ABBREVIATIONS

ASRS	Automated Storage and Retrieval Systems
BRIC	Brazil, Russia, India and China
CIA	Central Intelligence Agency
CNY	Chinese yuan
EUR	Euro
FEU	Forty-foot Equivalent Unit
GDP	Gross Domestic Product
ICC	International Chamber of Commerce
ISO	International Organization for Standardization
LCM	Logistics Costs Management
LPI	Logistics Performance Index
RUB	Russian ruble
SEK	Swedish krona
TEU	Twenty-foot Equivalent Unit
3PL	Third-Party Logistics

1 INTRODUCTION

1.1 Background

The global gross domestic product (GDP) increased annually with average rate of 3.5 percent between 1994 and 2008 (Review of Maritime Transport, 2009, 1). The year 2008 affected enormously to the trade worldwide and also to world economy. The world faced an economic crisis after year 2008 and this was seen in the slowdown in the world economy. One example is the cancellation of orders in manufacturing based companies. After that, companies have been trying to keep current orders and contracts. Another indicator is a decrease of trade in bulk freight at the end of year 2008 and this has continued also in year 2009. (Review of Maritime Transport, 2009, XIW) According to Verny & Grigentin (2009), North America, Europe and Asia are three main parties in global trade. In year 2006 these three counted 83 percent of exports and 80 percent of imports. (Verny & Grigentin, 2009, 109) When it comes to two of BRIC countries, especially China and Russia, transportation in China is convenient research area, because of its large container volumes in world scale. Based on information from EU bilateral trade and trade in the world, trade (goods) between EU-27 and China is unbalanced. The deficit of EU-27 between China was 133 billion euro in 2009. Transport and machinery equipment is the main product group that is transported to EU-27 area from China. (EU, 2010a) Russia is an important trade partner for Finland and trade relating issues between these two countries have a special importance. Trade between EU-27 and Russia is also unbalanced showing that deficit of EU-27 was 49 billion euro in 2009 and fuels count the largest share of transported products from Russia to EU-27 (EU, 2010b). Next in Figure 1 is presented the growth of GDP in the World, EU-27, China and in Russia.

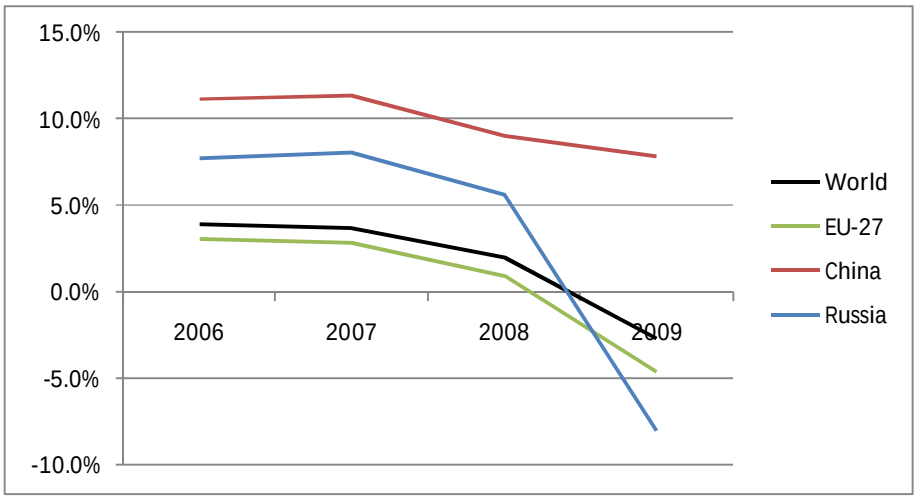

Figure 1. The GDP development between 2006 and 2009. (Review of Maritime Transport, 2009, 2)

World`s GDP growth seems to be positive from 2006 to 2008. In year 2009 the GDP decreased with 2.7 percent. Situation is quite same in EU-27 countries. In the first three years the growth was a bit smaller than compared to World total and in 2009 the GDP decreased 4.6 percent. Addition to this, in 2009 the GDP decreased with 4.1 percent in developed economies (EU-27, United States and Japan), but was positive in former years. Situation in China has been brilliant compared to other countries. The GDP growth was 11.1 percent in 2006 and still 7.8 percent in 2009. That is far better than in developed economies. Ivanova *et al*. (2006, 2), says that trade between Europe and China has been increasing. The GDP in Russia increased from year 2006 until year 2008, but decreased 7.9 percent in 2009. Variation in Russia is more probable than in other countries, because Russia is dependent of export prices of raw materials. (Review of Maritime Transport, 2009, 1-2)

Container traffic is also a convenient indicator of world trade. World container traffic has increased remarkably in recent years. Ebeling (2009) says that around 90 percent of transport traffic (general cargo - not fuels) is carried in containers (Saranen, 2010, 107). In 2008 traffic between Europe and Asia was 21.6 million TEUs, taking 30 percent share of world total long distance traffic (Global Insight, 2008). In 2004 world container throughput was 356.6 million TEUs and in 2008 throughput was 506.9 million TEUs. That means an increase of 42.0 percent

during the examined period. (Review of Maritime Transport, 2007, 2008 and 2009) The economic recession affected to world container trade and then freight amounts (TEUs) decreased 26.1 percent in 2009 (OECD, 2009, 2). China has a huge throughput when comparing to other container ports in the world. In 2008, China`s share was over 20.0 percent of all ports in the world (total of 114 million TEUs). In the list of twenty largest container ports, seven are located in China. Russian ports have smaller throughputs compared to China (total of 3 million TEUs). It can be seen that throughputs of Russian ports are far from the amounts of China`s ports.

Like it was mentioned, Chinese share of ports have a significant role. In Russia railway and road transportation are the most important transportation modes. That gives a reason to investigate which kind of transportation modes are used in a company level. Foreign companies face some difficulties when they have business abroad. Transportation issues play a key role when goods are transported from China to European countries or vice versa. In Russia there are some extra features when operating abroad. Northern companies have established factories to China and Russia and these changes in manufacturing will impact to transportation balances, in other words, to which direction goods are transported in the future. That`s why it will be investigated traffic flows in China and Russia from Northern companies point of view. Results will give interesting guidelines for companies operating in China and Russia and how the trend has been developed in recent years. It has been made research work at Kouvola research unit since 2006 from this subject, so survey data from several years gives perspective to the survey.

1.2 Objectives and scope

The aim of the thesis is to investigate traffic flow development between Europe and China, and between Europe and Russia from large Finnish and Swedish companies point of view. Survey data is from three different years. Both China and Russia have a great importance in world trade and this is one reason why these countries are selected in the thesis. The main focus is on freight transport

and passenger transportation issues are not analyzed in this thesis. It is investigated key concepts of transportation logistics and different transportation modes. It is also analyzed respondents` career issues and companies` main transportation units. The used transportation measure to indicate annual cargo flows between target countries is TEU (Twenty-foot equivalent unit). Also traffic balance and direction of traffic flows are investigated. Like it was mentioned earlier, more than 90 percent of transported items (general cargo) are carried in containers in the world (Ebeling, 2009). The study bases on the answers got by questionnaire format and it was sent to large Finnish and Swedish manufacturing companies in 2006, 2009 and 2010. In the questionnaire was asked also transportation issues in Japan, South-Korea and India, but these sections were not included into survey. Warehousing issues are presented in the section of concepts of transportation logistics.

1.3 Research problem and methodology

The research problem of the thesis is the development of transportation flows from Finnish and Swedish companies` point of view taking consideration China and Russia. Also the second issue is, how the economic crisis has affected to transportation flows in recent years. Then research questions of the thesis can be presented as follows:

1. *How transportation (freight) flows have changed in North European companies concerning China and Russia and what kind of development can be expected in the future?*
2. *How the economic recession has affected to transportation flows based on the newest survey data?*

In logistics area the traffic unbalance exist quite often and this gives a reason why it will be investigated. Also China is one of the market leaders in the world and its base is strengthening all the time. China`s share of transported goods in containers is very high. Russia is Finland`s neighbor country and Finland is one of the key

trade partners of Russia. Anyhow, it needs to be mentioned that there is few terminals in Russia and containerization is on the low level. Russian`s GDP has been growing in last years positively, except year 2009, but it seems to grow in the future based on estimations. That`s why it is reasonable to investigate Russian`s export and import trade to Northern companies.

A web-based questionnaire was used to gather data from the target group. The questionnaire consisted mainly of multiple choice questions and some of them were open questions. In the beginning of the answering sheet respondents were asked to write a valid answer code, so it was possible to make sure that respondent is a right person when analyzing answers. The questionnaire was sent in English, Swedish and Finnish to logistics managers of target companies. It was also needed to send reminders to get more answers. All in all, the same questionnaire was used the first time in year 2006 and second time in 2009.

Answers were analyzed in detail and this can be seen in empirical part of the thesis. Respondents` position and career were also asked and the most used container types in companies. Annual cargo volumes to China and from China were asked to estimate in TEUs. The same issues concerning traffic to Russia and from Russia were also inquired. Traffic balance was calculated based on given export and import amounts and this enabled to find out the direction of transported goods. Also two respondent companies were interviewed during the survey process.

1.4 Structure of the thesis

In Chapter 2 is told general issues of transportation. Differences between semi-trailer, 20` long and 40` long container are discussed. Trade terms meaning Incoterms 2000 are explained in detail and also axel loads in road and railway transport is discussed. Warehousing types and different kind of terminals are also presented.

Chapter 3 concentrates on transportation in China and typical characteristics of it, taking consideration four transportation modes. These are road, railway, sea and air transportation. Furthermore, it discusses briefly about transportation problems and logistics outsourcing in China. In Chapter 4 are examined similar transportation issues, but now corresponding in Russia. Road transport, railway, sea and air transport modes are presented in the same way. After these, problems and logistics outsourcing themes are discussed at the end. Also some practical examples of companies are presented who have inaugurated a new plant or factory recently to China or Russia to show that investments like these have been made.

Chapter 5 concentrates on background of the thesis and data gathering from three survey years. Characteristics of target companies are introduced as well as response rates. The following Chapter 6 is about empirical data analysis from three survey years. In this chapter it is analyzed all data in detail and these results give guidelines of traffic flow development. Also opinions of interviewed respondents from two Finnish originating case companies are analyzed and presented.

Discussion Chapter 7 follows the empirical data analysis and gives answers to research questions. Here it is also discussed the empty container problem and currency changes concerning Chinese yuan and Russian ruble against Finnish euro and Swedish krona. Conclusions are drawn in Chapter 8 and this chapter summarizes the main results of the thesis.

2 CONCEPTS OF TRANSPORTATION LOGISTICS

2.1 Container types

Containers are made for different purposes. Container types are, for example, usually dry (general purpose), ventilated, dry bulk, named cargo (automobiles), reefer, insulated, open top, platform and tank containers (Shipping Container Information, 2010). Based on information from Containerization International Yearbook, there are fifteen different container types as Table 1 shows.

Table 1. Fifteen different container types (Containerization International Yearbook, 2010, 379).

Number	Container type (ISO)
1	Dry freight
2	Dry freight (CPC)
3	Dry freight (ventilated)
4	Bulk
5	Silo
6	Open-top
7	Open-side
8	Flatrack
9	Platfrom
10	Reefer (integral)
11	Reefer (port-hole)
12	Insulated (non-reefer)
13	Tank
14	US domestic (Non-ISO)
15	Swapbodies (Non-ISO)

Usually containers are 20`, 40` and 45` long, but there can also be shorter, 10` long containers. These standard ISO containers can be transported by container ships, trains and trucks. (EconomicExpert, 2010). According to Maersk Line (2010), usually width of a standard 20` container is 8` and height is 8.6`. The width of standard 40` container is 8` and height 8.6`. High cube 40` container is same like the standard 40`, but the height is 9.6`. The longest, 45` container`s

width is 8` and height 9.6`. Maersk Line has also this 45` container made by aluminium with same dimensions like steel version. (Maersk Line, 2010)

Table 2. Container types measured in TEUs and FEUs (Container Handbook, 2010; EconomicExpert, 2010).

Container type	TEU	FEU
20`	1	0.5
40`	2	1
45`	2,25 (~2)	1,125 (~1)

One TEU means a 20` long container and one FEU means a 40` long container. One 40` container means two 20` containers and then one FEU is two TEUs. This can be seen in Table 2. (Container Handbook, 2010) 45` long container is usually rounded to two TEUs and to one FEU. Nowadays it is used more often 40` and 45` long containers. (Container Handbook, 2010; EconomicExpert, 2010) There are also other transportation units in logistics. In road transportation a semi-trailer is widely used. According to Statistics Finland, a semi-trailer is defined as follows:

"A semi-trailer is a towed vehicle, which is designed to be coupled to a semi-trailer towing vehicle or to a dolly. It imposes a substantial static vertical load on the towing vehicle or on the dolly." (Statistics Finland, 2010)

Semi-trailer`s length can be 13.6 m, the width 2.55 m and the height 2.7 m. Inside to the semi-trailer can be loaded carrying material maximum of 27 tonnes. (Kaukokiito, 2008) According to LKW Walter (2010), the length of semi-trailer is 13.6 m, the width between 2.45 m and 2.48 m and the height between 2.50 m and 2.70 m. (LKW Walter, 2010)

2.2 Trade terms

Incoterms 2000 means a list of thirteen different trade terms. Terms are specified and the main reason to use these terms is to avoid misunderstandings in trade

transactions. Using these rules made by International Chamber of Commerce (ICC) can be solved disagreements between two parties. A trade term consists of three letter codes that tell the rules of transportation between the seller and the buyer. It is a contract between these two parties. The first purpose of trade term is to define the time and the place, when the seller has rights to demand the payment of article, also in the case, where the article is disappeared or destroyed. The second reason is to define the responsibilities of the buyer and the seller. In this situation is defined the place and the way the seller sets transported articles available to the buyer and what the buyer needs to do to receive the articles. The third issue is the responsibility of costs. This means a way, how basic transportation costs are shared between participants. (If, 2000a) There are also other trade terms in logistics area than Incoterms 2000. These are, for example, Combiterms, Finnterms and Revised American Foreign Trade Definitions 1941 & Uniform Commercial Code (Räty, 2006, 23-25).

Trade terms consist of four groups. These groups are E, F, C and D. The group E means a situation, where the seller sets goods available in a way that the buyer can pick them up. In group F the seller distributes goods to the special carrier (the buyer nominates the carrier). In group C the seller makes a contract and gives the goods to the carrier. In the last group D, the seller takes care of transportation and gives the goods to the appointed place. (If, 2000a)

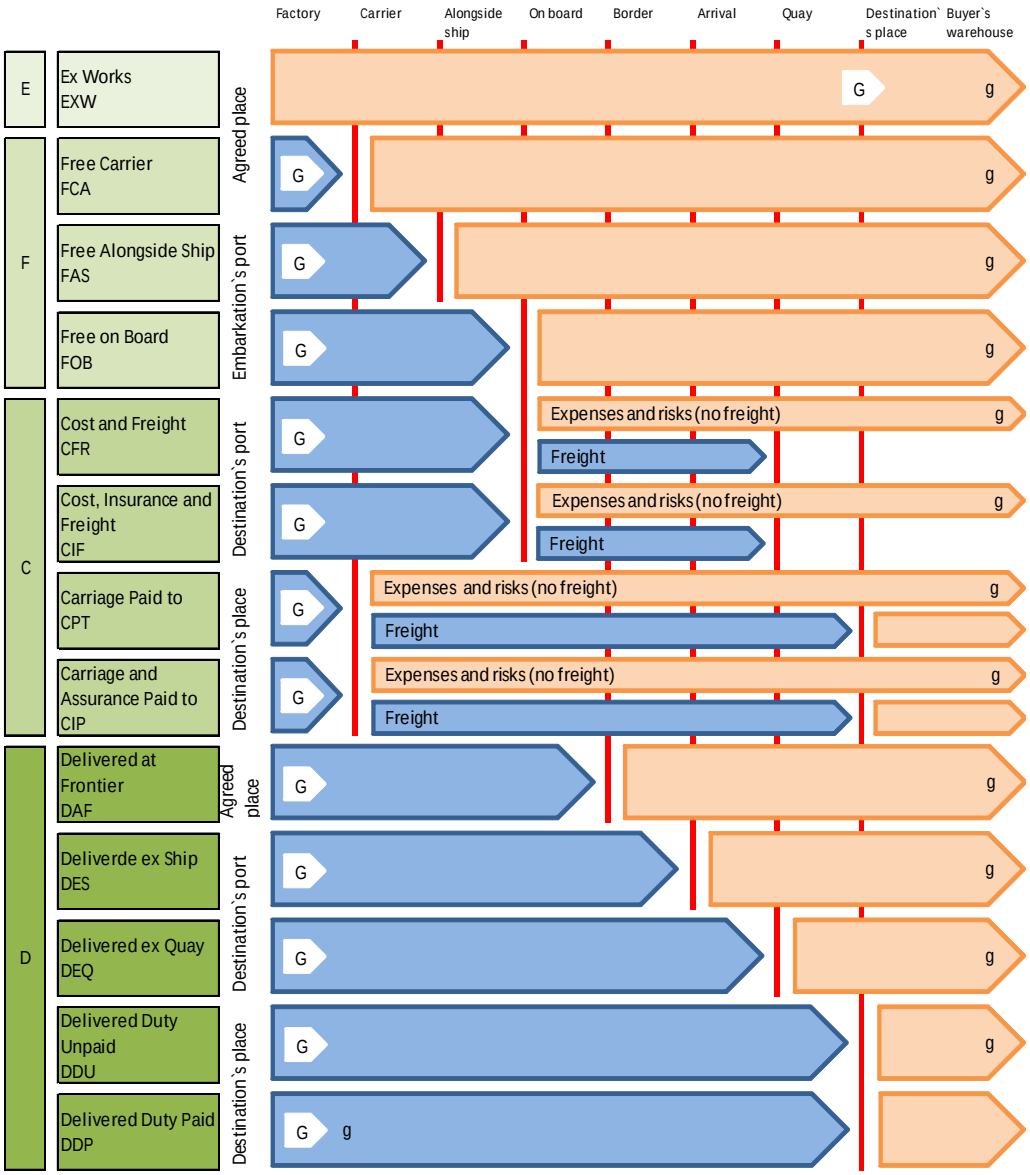

Figure 2. Incoterms 2000 (formatted from MedCargo, 2006).

Figure 2 exemplifies Incoterms 2000 trade terms and four different classes (on the left side). Blue color indicates the seller`s costs and risks and orange color indicates the buyer`s costs and risks. *G* indicates an export clearance and *g* means an import clearance. (MedCargo, 2006)

Ex Works

Goods are situated into an agreed place by the seller that the buyer can pick up the delivered items. When the buyer has received the goods, the responsibility and risks are on the buyer`s side. The seller takes care of marking of packages and

helps the buyer with transportation documents if needed. The main task of the buyer is to pick up goods and transport them to the target destination. Ex Works is convenient as a base for setting prices. The buyer needs to be able to take care of export formalities. (If, 2000a; Räty, 2006, 28)

Free Carrier

This term means that the seller place the goods to the named carrier and this carrier is nominated from the buyer`s side. The risk is on the buyer`s side when the carrier receives the goods. This trade term is suitable for all transportation modes and it can be used in container freight traffic and intermodal traffic also (If, 2000b; Räty, 2006, 33)

Free Alongside Ship

The seller carries the delivered items alongside the ship to the agreed place and takes care of the export procedures. The seller`s insurance is marked until the ship. The risk is on the buyer`s side right after when the buyer receives the goods. This term is only for sea transport modes. Problems exist when the buyer do not come to pick up the items, because of the risk sharing. (If, 2000b; Räty, 2006, 41)

Free on Board

The seller carries the goods to the ship in a certain seaport named by the buyer and export procedures are made. After that, the risk is on the buyer`s side and marks the insurance starting from this moment. This term is valid only for sea transport modes. (If, 2000b; Räty, 2006, 44)

Cost and Freight

The seller delivers the goods to the starting port and loads them also to the ship. Export procedures are also made. In this case the seller pays the sea freight to the target port. The risk is on the buyer`s side right after when goods are loaded to the ship first time. The seller is not responsible for the goods after the starting port. This trade term is suitable only for sea freights. (If, 2000b; Räty, 2006, 49, 55)

Cost, Insurance and Freight

The seller delivers the goods to the buyer by loading items to the ship and export procedures are made also. The seller pays the sea freight to the target port and takes an insurance on behalf of the buyer. The risk is on the buyer`s side when the goods are boarded to the ship in a starting port. This trade term is appropriate for sea transportation. (If, 2000b; Räty, 2006, 56, 61)

Carriage Paid To

This is a trade term, where the seller delivers the goods to the carrier at the starting point. The seller is also responsible of freight costs until a predetermined target destination. Risk is on the buyer`s side, when the seller delivers the goods to the named carrier. This trade term is suitable for all transportation modes, including container traffic and intermodal transportation. (If, 2000b; Räty, 2006, 62,)

Carriage and Insurance Paid To

The seller delivers the goods to the buyer by giving the items to the carrier at the starting point. Risk is on the buyer`s side when the named carrier receives the goods. The seller also pays the freight costs to the target destination and takes an insurance on behalf of the buyer. The insurance costs are anyhow paid by the buyer. (If, 2000b; Räty, 2006, 67)

Delivered at Frontier

The seller delivers the goods to the buyer on the named place on the border. All export procedures are also made by the seller. The risk will be after border on the buyer`s side. This trade term is usable for all transportation modes, when the goods are transported to the country border. Actually this is suitable only for road and rail transport modes. (If, 2000b; Räty, 2006, 70,74)

Delivered Ex Ship

The seller delivers the goods on the ship to the target port destination, where the buyer can unload the goods. At this time the goods are undeclared. Risk is on the

buyer`s side, when the goods are unloaded from the ship. This trade term is valid for sea transportation mode. (Räty, 2006, 75)

Delivered Ex Quay

The seller delivers the goods to the platform of the target port without import procedures. There the buyer can load the goods. Risk is on the buyer`s side when the seller sets the goods at the predetermined platform or quay. This trade term is only valid for sea transportation modes. (If, 2000b; Räty, 2006, 78)

Delivered Duty Unpaid

This means a delivery without customs clearance. The seller delivers the goods to the buyer in a vehicle to the named target destination. After that the goods can be unloaded, but the customs clearance is not made. This trade is suitable for all transportation modes, including container transportation and intermodal transportation. (Räty, 2006, 82)

Delivered Duty Paid

This differs a bit from the previous term. This trade term means a delivery with customs clearance and import procedures are made. The seller delivers the goods to the buyer in a vehicle in a named target destination. After that the goods can be unloaded and the customs clearance is made. This trade is suitable for all transportation modes, including container transportation and intermodal transportation. (Räty, 2006, 82)

In Table 3 are shown the outbound transport taking consideration ground and sea transport. These both are also divided into two categories, meaning cost and risk. For example, Ex Works trade term means that costs and risks do not belong to the seller in ground and sea transport. All trade terms are classified next.

Table 3. Trade terms in case of outbound transport from the seller`s point of view (If, 2000b).

Term		Ground		Sea	
		Cost	Risk	Cost	Risk
EXW	Ex Works	No	No	No	No
FCA	Free Carrier	Yes	Yes	No	No
FAS	Free Alongside ship	Yes	Yes	No	No
FOB	Free On Board	Yes	Yes	No	No
CFR	Cost and Freight	Yes	Yes	Yes	No
CIF	Cost, Insurance and Freight	Yes	Yes	Yes	No
CPT	Carriage Paid To	Yes	Yes	Yes	No
CIP	Carriage and Insurance Paid To	Yes	Yes	Yes	No
DAF	Delivered At Frontier	Yes	Yes	No	No
DES	Delivered Ex Ship	Yes	Yes	Yes	Yes
DEQ	Delivered Ex Quay	Yes	Yes	Yes	Yes
DDU	Delivered Duty Unpaid	Yes	Yes	No	No
DDP	Delivered Duty Paid	Yes	Yes	No	No

Based on a research made by Customs Finland concerning large Finnish companies (those companies who have a major role in import trade), the most used trade term is CIF, EXW, DDU or FOB (National Board of Customs Finland, 2008). According to Kuljetusopas (2010), it is said that the role of EXW, FAS and FOB will decrease in the future. It means that trade terms, where the seller will have more responsibility of transportation, will be used more often and this has already happened in recent years. (Kuljetusopas, 2010)

Hurme (2009) researched which trade terms are most used in a certain Finnish logistics and forwarding company. It was made a questionnaire to investigate this issue. The result was that the EXW and DDU were the most general trade terms. Practically Ex Works was more like Free Carrier, because the seller participated often to the loading process. In this case the seller made much more than it was required from the seller, so in accident situations there would be probably complicated issues, who will be charged of those extra costs. (Hurme, 2009, 20)

2.3 Road weight limits and railway axel loads

Like Table 4 depicts, in Finland and Sweden are the highest weight limits in Europe (maximum of 60 tonnes). In Russia maximum weight limits are 38 tonnes. When the weight of truck is taken off from these amounts, it shows that in Finland and Sweden it is allowed to transport much more than in other European countries. When it comes to trucks with two or three axels of all European countries, maximum weight is usually between 18 and 26 tonnes. Weights per bearing and driving axle are between (7)10 and 13 tonnes. (International transport forum, 2010)

Table 4. Maximum weights in Europe in tonnes. (Internation transport forum, 2010)

Country	Weight (per bearing axle)	Weight (per drive axle)	Truck (2 axles)	Truck (3 axles)	Road Train (4 axles)	Road Train (5 axles and +)	Articulated Vehicle (5 axles and +)
Austria	10	11.5	18	26	36	40	40
Azerbaijan	10	10	18	24	36	42	44
Belgium	10	12	19	26	39	44	44
Bosnia-Herzegovina	10	11.5	19	26	38	40	40
Bulgaria	10	11.5	18	26	36	40	40
Croatia	10	11.5	18	24	36	40	40
Czech Republic	10	11.5	18	26	36	44	42 / 48
Denmark	10	11.5	18	26	38	42 / 48	42 / 48
Estonia	10	11.5	18	26	36	40	40
Finland	10	11.5	18	26	36	44 / 60	42 / 48
France	13	13	19	26	38	40	40
FYROM	10	11.5	18	26	36	40	40
Georgia	10	11.5			44	44	44
Germany	10	11.5	18	26	36	40	40
Greece	7 / 10	13	19	26	33	40	40
Hungary	10	11.5	18	25	30	40	40 / 44
Iceland	10	11.5	18	26	36	40	44
Ireland	10	11.5	18	26	36	44	44
Italy	12	12	18	26	40	44	44
Latvia	10	11.5	18	26	40	40	40
Liechtenstein	10	11.5	18	26	36	40	40
Lithuania	10	11.5	18	26	36	40	40 / 44
Luxembourg	10	12	19	26	44	44	44
Malta	10	11.5	18	25	36	40	40 / 44
Moldova	10	10	18	24	36	40	40
Montenegro	10		16	24	36	40	40
Netherlands	10	11.5	21.5	33	40	50	50
Norway	10	11.5	19	26	37	42	44
Poland	10	11.5	18	26	36	40	40
Portugal	10	12	19	26	37	40	40
Russia	10	10	18	25	36	38	38
Slovakia	10	11.5	18	26	36	40	40
Slovenia	10	11.5	18	26	36	40	40
Spain	10	11.5	18	26	36	40	44 / 42
Sweden	10	11.5	18	26	38	48/60	48/60
Switzerland	10	11.5	18	26	36	40	40
Turkey	10	11.5	18	25/26	36	40	40/44
Ukraine	11	11	16	22	38	38	38
United Kingdom	10	11.5	18	26	36	40	40 / 44

In Table 5 are listed total road weight limits in Finland. A truck with two axels is allowed to transport maximum of 18 tonnes. In a truck with three axels, the limit is 25 tonnes and with five axels the limit is 38 tonnes. Maximum weight limit of truck and a semi-trailer is 48 tonnes. In full trailers the maximum limit is 60 tonnes. (Tiehallinto, 2010)

Table 5. Maximum weights of trucks in Finland (Tiehallinto, 2010)

Vehicle	Axels	Maximum total weight (ton)
Truck	2	18
Truck	3	25
Truck	5	38
Truck and semi-trailer	6	48
Truck and trailer	> 7	60
Truck, semi-trailer and small trailer (center axle)	> 7	60

If maximum weight of a full trailer in Finland is up to 60 tonnes on roads and the weight of truck is between 18 and 26 tonnes (Volvo trucks, 2010), it means that the maximum carrying load would be between 34 to 42 tonnes. In a semi-trailer can be transported in these cases between 22 to 30 tonnes. According to Ministry of Transport and Communications, Russia has planned to increase the road weight limits up to 40 tonnes from current 38 tonnes. If this rule will be accepted, these heavy weight trucks could transport goods without special permits. (Ministry of Transport and Communications, 2009)

When it comes to railways, in Finland track gauge is 1,524 mm (broad) and in Sweden a standard track gauge is 1,435 mm (Table 6). The difference is then 89 mm and because of this, dimensions vary on the track lines. (Joint Finnish-Swedish infrastructure, 2009, 38) In China track gauge is 1,434 mm and in Russia gauge is 1,520 mm (Central Intelligence Agency, 2010a; Central Intelligence Agency, 2010b). Railway weight limits in Finland are divided into three categories. That means axel loads of 20.0, 22.5 and 25.0 tonnes. (RHK, 2010) Watson and Timmis (2009, 4) defined axel load as follows:

"Axle load is the static weight of the vehicle on each axle."

The smallest axel load and the largest axel load have both a minor role, and most often the axel load is 22.5 tonnes in Finland. The axel load near Russian border and in South-East Finland is 22.5 tonnes. (RHK, 2010)

Table 6. Track gauges and axel loads in Finnish and Swedish railways (Banverket, 2007; Joint Finnish-Swedish infrastructure, 2009, 38; RHK, 2010)

	Finland	Sweden
Track gauge	1,524 mm	1,435 mm
Axel loads	20.0 t	22.5 t
	22.5 t	25.0 t
	25.0 t	30.0 t

In Sweden the axel load on railways is most often 22.5 tonnes and some upgrading work aims to 25.0 tonnes. In some special situations 30.0 tonnes is allowed to transport on 4-axel wagons, but this is only possible in certain track sections in Sweden. (Banverket, 2007)

According to VR Cargo (2010b), there are two types of wagons meaning two and four axel wagons. When the axel load is 22.5 tonnes, it means that in a wagon with two axels total weight is 45 tonnes. Total weight means in this case the weight of a wagon and the weight of carried goods summed together. If the weight of a wagon is 20.0 tonnes, maximum carrying load is then 25.0 tonnes. In wagons with four axels (axel load 22.5 tonnes), total weight can be 90 tonnes. Then the maximum carrying load can be 75 tonnes, when the weight of a wagon (tare weight 25.0 tonnes) is taken off. (VR Cargo, 2010b)

2.4 Types of warehouses and terminals

According to Rimiene & Grundey (2007), there is no simple definition for logistics centre and many different terms have been used. One reason for this is the development on logistics area in the last 30 years. Because of logistics outsourcing (3PL) concept, it has been started to use a term of logistics centre. Anyhow, it is not easy to define logistics centre and other terms due to the evolution of it. (Rimiene & Grundey, 2007, 88)

Warehouse is often kept as a place, where manufactured goods or products are stored. Warehouse is in the middle of manufacturer and end-customer in the supply chain. Often finished products are transported to warehouse and from warehouse products are headed into customer. (Rimiene & Grundey, 2007, 89-90)

Customs warehouse is a place where undeclared goods are stored. These customs warehouses can be divided into two categories, to private and public warehouses. Public warehouses mean groups of A, B and F. Group A is the general customs warehouse and anyone can store the goods or there can be many people to place the goods to the warehouse. Usually transportation companies near ports use the group B customs warehouse. The group F is quite a rare customs warehouse where workers are customs authorities. Private customs warehouses can be divided into three groups. These groups are C, D and E. The group C is the most general. The group D means customs clearance at home and the group E means that goods are stored in a valid place mentioned in the permission. (Langdonsystems, 2010; National Board of Customs, 2010c)

Terminal differs from a warehouse. In terminal it is transported goods with more than two different transportation modes. That means collection of items, storing and distributing. According to Rimiene & Grundey (2007) and Wiegmans *et al.* (1998), there are five different types of terminals. These are mainport, international, national, regional and local terminal. Mainport terminals have high volumes and low costs, information technology is used and large global companies use this. Generally mainport terminal is seaport or international airport and has network connections all over the world. When it comes to international terminals, those are made for transportation heading into European destinations. Railway, road, sea and flatboat connections are available. National terminals serve for a certain country and this has railway, barge and road connections. Regional terminal serves for only regional target groups. It typically includes railway and road connections. Information technology solutions and equipment are usually modest. Local terminal serves for local freight and includes small railway connection or barge. (Rimiene & Grundey, 2007, 90-91)

Distribution center differs from a warehouse in a way that in a distribution center it is stored only ordered and needed products. Also distribution centres add value usually meaning extra service. (Rimiene & Grundey, 2007, 90) Like in Figure 3 can be seen, distribution centre collects goods to the one place and then products are delivered to target customers. This is only one example of a distribution centre for production based factories that Garavelli has explored (Garavelli, 2001).

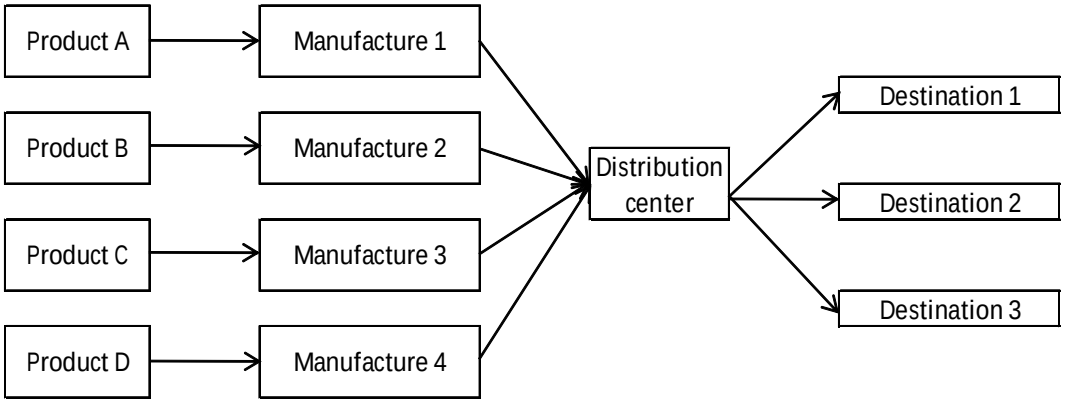

Figure 3. The idea of a production based distribution centre. (formatted from Hilmola & Szekely, 2006, 12; Garavelli, 2001)

It is said that distribution centre decreases inventory levels. Usually customers demand improvements to achieve these lower inventory levels and cost reductions. Effectiveness of workers in the distribution centre will improve and capital recovery will be faster. Economies of scale are reason for these advantages. (Hilmola & Szekely, 2006, 12-13)

According to Roodbergen & Vis (2009), automated storage and retrieval systems (ASRS) are developed to serve production and logistics distribution. It is possible to take raw material from storage and put them into production. Another way is to serve customer demand when system takes the finished product from the store and points it to the customer. Some problems that may exist in developing process and those are system combination, warehouse assignment, batching issues, order and dwell-point issues. (Roodbergen & Vis, 2009, 343, 346, 358)

3 CHINA

3.1 Economic development

In China an economic boom is continuing (Hasan *et al.*, 2009; Li & Oberheitmann, 2009; Shrivastava, 2006; Yao & Yueh, 2009). This positively affects to companies working in logistics area (Shintani *et al.*, 2005, 39-40). Gross domestic product in China was approximately 4.814 trillion US dollars in 2009 and 4.326 trillion US dollars in 2008 (Central Intelligence Agency, 2010a; WTO 2010). The growth of GDP has been 7.8 percent in 2009, 9.0 percent in 2008, 11.4 percent in 2007 and 11.1 percent in 2006 (Review of Maritime Transport, 2009, 2). Shrivastava (2006) says that economic development affects to transportation, meaning that transportation and an economic boom have a correlation. Sometimes a bad transportation network constraints the economic growth. Also a challenge is to meet the needs of sustainable transportation system. This is a big issue in China nowadays and finding a solution that takes consideration environmental factors, current needs of transportation and future generations is not an easy task. (Shrivastava, 2006, 54)

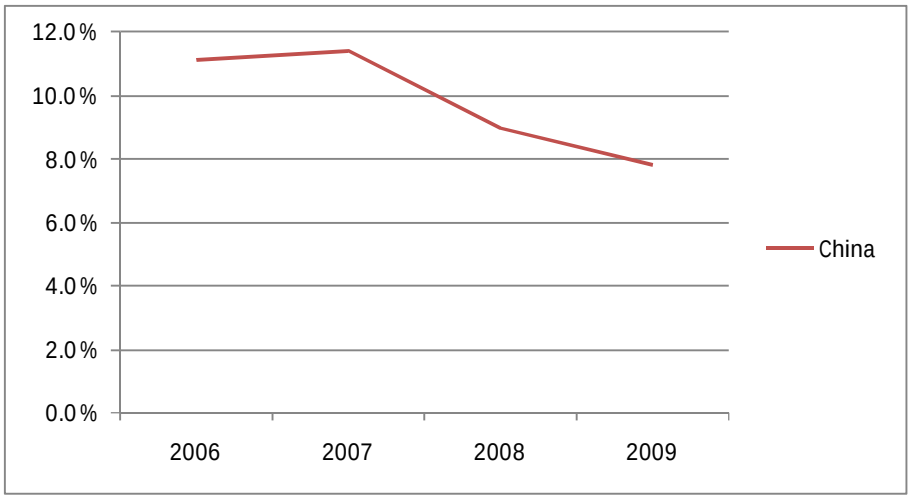

Figure 4. The growth of the gross domestic product in China between 2006 and 2009 (Review of maritime transport, 2009, 2)

The growth of GDP, also in year 2009 indicates that China has not suffered from the economic recession with same way like Russia is (Russian GDP decreased 7.9

percent in 2009, see Figure 1). This trend seems to continue, when GDP growth for year 2010 is estimated to be 9.5 percent (World Bank, 2010d, 15). Also GDP per capita has increased in China in recent years. Like Central Intelligence Agency (2010a) estimates, in 2009 the GDP per capita was 6,600 US dollars, in 2008 around 6,100 US dollars and 5,700 US dollars in year 2007.

According to Ivanova *et al.* (2006), trade between China and Europe has been growing. Some reasons for this are globalization, when China has become a manufacturing leader in the world. The largest share of freight transport is transported by sea and in year 2005 it was transported around 7 million TEUs between Europe and China. When container transport is rapidly increasing, infrastructure constraints the development of container transport. It is a problem to increase capacity, when there is a lack of land areas and investment caused delays makes capacity improvements more difficult. (Ivanova *et al.*, 2006, 2)

3.2 Freight transport

World economic forum`s the Global competitiveness report has ranked the infrastructure of China. The comparison consists of 134 different countries. The infrastructure in China was divided into seven parts. Concerning freight transportation, five of them are relevant to freight transport and the rest two relates to passenger transport. Five analyzed measures are overall quality of infrastructure, road quality, railroad quality, port infrastructure quality and quality of air transport infrastructure. Each of these was ranked as a disadvantage or an advantage. Only one of these five measures was ranked as an advantage and this was the quality of railroad infrastructure (28^{th} of 134). The rest were disadvantages in this category. (Global competitiveness report, 2008-2009)

World Bank`s Logistics performance index is also an useful measure to analyze logistics issues in China. The index consists of six separate measures and also an overall ranking of LPI is given. The first measure is customs following by

infrastructure, international shipments, competency in logistics, monitoring of deliveries and preciseness. (World Bank, 2010e)

Table 7. Logistics performance index in China. (World Bank, 2010e)

Overall LPI	from 0 to 5	3.49
	rank	27
Customs	from 0 to 5	3.16
	rank	32
Infrastructure	from 0 to 5	3.54
	rank	27
International shipments	from 0 to 5	3.31
	rank	27
Competency in logistics	from 0 to 5	3.49
	rank	29
Monitoring of deliveries	from 0 to 5	3.55
	rank	30
Preciseness	from 0 to 5	3.91
	rank	36

The best ranking value belongs to preciseness (3.91) in China (Table 7). The weakest ranking value (3.16) concerns customs. It can be recognized that all values are higher than three in this scale. Overall ranking of LPI (3.49) authorizes to the 27th place of all 155 different countries. (World Bank, 2010e)

Table 8. Turnover by transport mode in billion ton-kilometers in China (National Bureau of China, 2002-2003 and 2005-2009)

	2002	2003	2005	2006	2007	2008	2009
Railway	1,548	1,709	2,073	2,195	2,380	2,511	2,524
Road	670	701	857	965	1,126	1299	3,638
Waterways	2,648	3,228	4,806	5,390	6,218	6,522	5,744
Air	5	6	8	9	12	12	13
Pipelines	-	-	89	132	183	206	202
Total	4,866	5,638	7,825	8,682	9,907	10,538	12,108

Table 8 depicts turnover by transport mode in China. Amounts are gathered from National Bureau of China, but there were no information if these amounts are inland or international ton-kilometers. Sea transport has the largest role in China, when measuring in ton-kilometers. These amounts have increased from year 2002 up to 2008. In 2009 it is seen a small decrease compared to previous years. The

highest level was reached in 2008, when it was transported 6,522 billion ton-kilometers by sea. Second largest transportation mode is road transport and it has passed the railway transportation mode during year 2009. Earlier railway transportation was the second largest mode. The highest amount was reached in 2009, when it was carried 3,638 billion ton-kilometers goods on roads. Transported amounts on roads in 2009 were around six times larger than in year 2002. Third largest transportation mode is railway transport and the amounts of this mode has also been steadily growing during investigation period. Air and pipelines have both a minor role and especially air transport in billion ton-kilometers is much lower than compared to sea transport. When investigating total transportation kilometers, the amount has tripled. In 2009 the total amount of transported goods in China was 12,108 billion ton-kilometers and increased from the level of year 2008.

3.2.1 Road

China`s road network has increased from 2005 to 2007 and it is the second largest in the world. In 2005 the length of road network was 3,345,187 kilometers and in following year 2006 the length was 3,456,999 kilometers. The latest data is from year 2007 indicating the length of road network is 3,583,715 kilometers. According to World Bank data, a share of paved road network of all roads was around 70 percent in 2007. That means around 2,500,000 kilometers of paved road. (Central Intelligence Agency, 2010a; World Bank, 2010a)

When investigating road traffic between Finland and China, it shows that there is almost no road traffic at all. Statistics of Customs Finland say that in 2006 and 2007 it was transported 1 ton from China to Finland on roads. Traffic from Finland to China was 3 tons in 2006 and 2 tons in 2007. During years 2008 and 2009 there were no goods transport on roads from China to Finland, but it was carried 1 ton of goods in each year from Finland to China. All in all, these amounts are small compared to sea transport mode between Finland and China. Geographical issues are logical reasons for this and also distances are long

between these countries. It can be assumed that situation is quite same in Sweden than in Finland in road transport issues. (National board of Customs Finland, 2010a)

3.2.2 Railways

Railways are an important part of logistics network in China. From economic point of view, railways are cost-efficient and far less polluting than road transport. This transportation mode contributes a sustainable development, when rail transport uses less energy. (Hughes, 2009) The length of railway network in China is currently 77,834 kilometers (Central Intelligence Agency, 2010a). According to Chinese Government, it has been planned to construct more railway network up to 120,000 kilometers until 2020. (Hughes, 2009)

Like Table 8 shows, freight has been increasing from 1,548 billion ton-kilometers to 2,524 billion ton-kilometers. The growth between years 2002 and 2008 is 63 percent. According to Zoninsein (2010), state-owned railway company in China (China Railway Construction Corporation) will construct more rail lines to China. A lot of products will be transported from China and there is a huge need for effective railway network. One example is a planned railway from China to Europe, meaning railway via Russia to Germany. (Zoninsein, 2010, 1)

The other major issue is that Chinese railway companies will take bigger role in transportation. They will be leaders in the area of railways and railway freight transport has a big role among passenger and high-speed trains. This deserves especially the exportation from China. (Zoninsein, 2010, 1)

3.2.3 Sea transport

Sea transport is the major transportation mode between European countries and China. Huge amounts of goods are transported in containers and the amounts of carried containers worldwide are growing. According to Review of maritime

transport (2009), the share of Chinese ports counts more than 20 percent of container transported worldwide and China has the largest container throughput in the world. (Review of maritime transport, 2009, 109-110)

Container port traffic means containers` throughput measured in a standard unit of TEUs (World Bank, 2010b). In the list of twenty largest containers, seven are located in China. These seven ports are Shanghai, Hong Kong, Shenzhen, Ningbo, Guangzhou, Qingdao and Tianjin (Table 9). The biggest volume is in Shanghai, with port throughput of 27.9 million TEUs in 2008. The throughput has been growing in all of these seven Chinese terminals from 2004 to 2008. In 2008, the sum of throughput of all twenty container ports was 247.4 million TEUs, Chinese share is 114.9 million TEUs. (Review of Maritime Transport, 2009, 110-111, 113)

Table 9. Port throughputs measured in TEUs between 2004 and 2008 in China (Containerization International Yearbook, 2008 and 2006; Review of Maritime Transport, 2009, 113).

Port	2004	2005	2006	2007	2008	Change (%) 2004-2008
Shanghai	14,557,200	18,084,000	21,710,000	26,150,000	27,980,000	92.21%
Hong Kong	21,984,000	23,538,580	23,538,580	23,998,449	24,494,229	11.42%
Shenzhen	13,650,000	18,468,900	18,468,900	21,099,169	21,413,888	56.88%
Ningbo	4,005,500	7,068,000	7,068,000	9,360,000	11,226,000	180.26%
Guangzhou	3,308,200	241,300	6,600,000	9,200,000	11,001,300	232.55%
Qingdao	5,139,700	7,702,000	7,702,000	9,462,000	10,320,000	100.79%
Tianjin	3,814,000	5,950,000	5,950,000	7,103,000	8,500,000	122.86%
Total	66,458,600	81,052,780	91,037,480	106,372,618	114,935,417	72.94%

The percentage change indicates a growth during five years. Increase has been the most remarkable in Guangzhou and the lowest increase in Hong Kong. The increase of throughputs in Shanghai, Hong Kong and Shenzhen is probably lower because these ports are already major players with high throughputs and container throughputs are currently twice as much compared to Ningbo, Guangzhou, Qingdao and Tianjin. Probably these four last mentioned ports have a big rising potential in forthcoming years.

3.2.4 Air transport

Like earlier it was noticed, turnover of air transport have had a small part of total transports. There are 482 airports in China in total of which 57 are unpaved. Comparing these amounts of airports to the whole world, position in number of airports is 15th of all 235 different countries. (Central Intelligence Agency, 2010a) When dividing the amount of transported goods (million ton-kilometers) with the amount of paved airports (425), it can be given an index of air transport effectiveness (Figure 5).

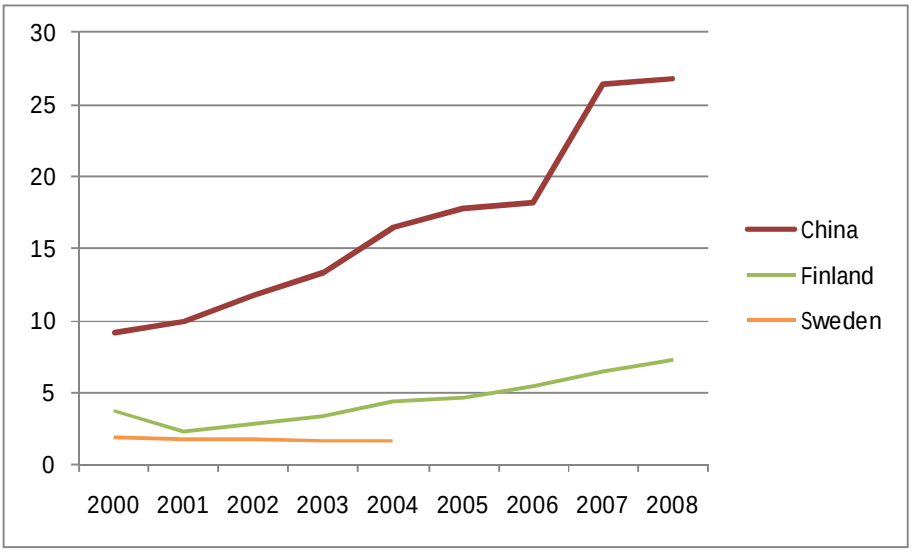

Figure 5. Index of airport effectiveness in China compared to Finaland and Sweden. (Central Intelligence Agency, 2010a; World Bank, 2010g; World Bank, 2010h; World Bank, 2010i)

The airport effectiveness index is much higher in China than in Finland and Sweden. A remarkable increase is seen after year 2006, when the Chinese index passed a value of 25. Also in Russia the index is far from China`s level and it is also behind Finland (see Figure 9). Information of Sweden was only available up to year 2004. In Finland the index is higher than in Sweden, because of freight traffic in Helsinki-Vantaa airport.

3.2.5 Transportation problems and outsourcing

China`s transportation network is wide and complicated with bottlenecks, slow customs handling and bureaucracy (Shrivastava, 2006, 54; Trading up, 2006, 5). One of the major problems when operating in mainland area concerns the export of manufactured goods. This started in Shanghai in the end of 1980s (Hilmola, 2010c). Foreign companies face the biggest problems when transporting items and goods from China in a case, where products are manufactured in this country. Due to that reason, like it is said in Trading up (2006) article, foreign companies want to operate on seaboard areas, but a disadvantage of this area are high and rising costs. There is a need for efficient logistics system, which is connected with ports and exporters are those who need more efficient system in China. (Trading up, 2006, 5) Different development and free trade zones affect to transportation. Those different development zones are high-tech, economic and technological, free trade and export processing zones (China development zones). Usually free trade and export processing zones locates on coastal areas.

China has been improving industry of logistics and also management skills concerning this area after late of 1990s. According to Song & Wang (2009), too high logistics costs affect to competence of companies. Also total logistics costs in every year have been rising concerning transportation. Chinese companies do not have a cost control system of logistics or do not see logistics cost management (LCM) issues in a great importance. The problem is that companies are unable to gather relevant cost information and can`t allocate correctly costs, because of traditional accounting system. That is one reason why it is impossible to make decisions to cut costs in that sector (Binshan *et al.*, 2001). That reduces the use of LCM. (Song & Wang, 2009, 658)

According to Song & Wang (2009) logistic management system and other reporting systems have anyhow been used in Chinese companies and the amount is although growing, while there are companies who do not use it all. It can be noted two main reasons for this trend. The first one is that the Chinese Government demands the development of cost control of logistics and the second

is competitive business environment. To succeed in this business environment, companies need to cut costs to achieve competence and improve performance using cost management systems. Still some problems exist in cost management systems like; which are real cost components that incur logistics costs, how to get valid data and how costs are calculated. (Song & Wang, 2009, 667-668)

Transportation is connected with degradation of environment. This means waste, pollution and use of natural resources. This connection between transportation and pollution of environment has been one of the main topics in policy. (Shrivastava, 2006, 54) Global competitiveness report listed some difficulties, when operating in China and five of those in the following order were financial issues, instable practices, bureaucracy, inflation and tax related issues. (Global competitiveness report, 2008-2009)

Competitive advantage and cost cutting in logistics can be gained by logistics outsourcing (Mitra, 2006, 159; Perrons & Platts, 2005). Higher customer demands assist more and more companies to outsource their logistics functions to so called third-party logistics (3PL). By outsourcing, companies can focus on areas what they know best. (Tian *et al.*, 2008, 346-347; Vaidyanathan, 2005)

Lau & Zhang (2006) have explored outsourcing in China and problems companies face. Factors that encourage companies to outsource in China are strategic and financial. Also environmental factors are mentioned as a reason. Strategic factors are benefits from re-engineering, getting more flexibility and to concentrate on what companies know best. From economic point of view, cost cutting and more wise use of capital investments are main reasons to outsource. Environmental reasons are development of IT and good suppliers` position to affect company`s decisions. Problems in outsourcing are poor logistics service providers, weaknesses in transportation, rules and information technology infrastructure. After these it can also be mentioned the lack of measurement concerning outsourcing after this process. (Lau & Zhang, 2006, 788)

3.3 Trade balance

Export value of China was 1.204 trillion US dollars in 2009 and in 2008 it was higher with 1.435 trillion US dollars. Compared to world scale, China keeps the second position (Russia in 13th position) of all 223 different countries. In Table 10 are shown main export countries.

Table 10. Main export countries of China. (Central Intelligence Agency, 2010a)

Export country	Share
United States	17.7 %
Japan	8.1 %
South Korea	5.2 %
Germany	4.1 %

United States has the largest share of exports (17.7 percent). Japan is the second on the list (8.1 percent) and South Korea third (5.2 percent). Germany`s share (4.1 percent) is one of the largest from European countries. Furthermore, it needs to remember that a lot of China`s production are transported to Hong Kong area.

Electronic devices are main export products. Clothes and textiles and metal products have also a main role in transportation from China. Main export products worldwide are listed below:

- electronic devices
- data processing products
- clothes and textiles
- steel and iron
- medical and optical equipments. (Central Intelligence Agency, 2010a)

Import value of China was 954.3 billion US dollars in 2009 and 1.074 trillion US dollars in 2008. Comparison in world scale justifies to 4th position of all 220 in 2009. Table 11 shows the main import countries.

Table 11. Main import countries of China. (Central Intelligence Agency, 2010a)

Import country	Share
Japan	13.3 %
South Korea	9.9 %
Taiwan	9.2 %
United States	7.2 %
Germany	4.9 %

Japan keeps the largest share (13.3 percent) of import. South Korea has the second largest share (9.9 percent) and Taiwan is third (9.2 percent). United States keeps the fourth largest share (7.2 percent) and Germany has the fifth largest share (4.9 percent).

Major import products are electronic devices. Mineral fuels and oils are imported huge amounts, and China is the fourth largest oil importer in the world. The list of main import products of China are below:

- electronic devices
- mineral fuels and oil
- medical and optical equipments
- ores
- plastic products
- chemical products. (Central Intelligence Agency, 2010a)

Ivanova *et al.* (2006) have explored trade between China and EU. Based on this information the trade unbalance has been growing in this period from 2001 up to 2005 (Table 12). EU countries have transported more and more from China to EU region. Exports from EU region to China have also been increasing.

Table 12. Trade balance between EU and China in billion euros. (Eurostat; Ivanova *et al.*, 2006, 22)

	2001	2002	2003	2004	2005
Import	81.62	89.61	105.39	127.44	158.04
Export	30.55	34.87	41.17	48.19	51.75
Balance	-51.07	-54.74	-64.22	-79.26	-106.29

Table 13 depicts trade turnover in China. Finland has higher overall turnover compared to Sweden (million US dollars). From China it is transported to Finland more than it is carried from Finland to China. In Sweden the situation has been opposite than in Finland. Export amounts from Sweden are higher than import amounts from China to Sweden, but amounts have worsened after these years.

Table 13. Trade turnover in China (million US dollars) with respect of Finland and Sweden in 2005. (Eurostat; Ivanova *et al.*, 2006, 23)

	Export	Import	Turnover
Finland	2,628	3,626	6,254
Sweden	3,122	2,577	5,699

In Tables 14 and 15 are presented trade balance based on information from OECD, National Board of Customs Finland and from Statistics Sweden, because it would be reasonable to analyze these issues in US dollars, euros and in Swedish kronas. Based on OECD Statistics (2010a), it is possible to do some conclusions about trade balance between Finland, Sweden and China (Table 14). Trade from China to Finland has been growing until 2008, but in 2009 amounts decreased due to the economic recession. Trade from Finland to China has been quite constant and the highest point was in 2008. Also this amount lowered in year 2009 and overall balance is westbound oriented.

Table 14. Trade balance (US dollars) of Finland and Sweden concerning China. (OECD Statistics, 2010a)

	2004	2005	2006	2007	2008	2009
From China to Finland	2,445,417,849	3,491,941,234	5,146,041,217	6,080,914,715	6,412,777,247	4,762,489,739
From Finland to China	2,430,007,888	1,927,224,376	2,469,238,922	2,944,193,332	3,020,968,860	2,533,573,357
Balance	-15,409,961	-1,564,716,858	-2,676,802,295	-3,136,721,383	-3,391,808,387	-2,228,916,382
From China to Sweden	2,396,615,061	3,012,098,861	3,938,724,654	5,296,175,458	5,664,156,576	4,558,648,777
From Sweden to China	2,593,143,264	2,525,338,704	2,821,443,617	3,291,192,166	3,991,823,779	4,114,584,653
Balance	196,528,203	-486,760,157	-1,117,281,037	-2,004,983,292	-1,672,332,797	-444,064,124

Between Sweden and China trade has been more balanced compared to situation in Finland. It has been transported a bit more from China to Sweden than vice versa. Traffic from China to Sweden has increased from year 2004 until 2008, but a decrease can be recognized in 2009 like it was also between Chinese and

Finnish trade. Quite surprisingly traffic from Sweden to China has been growing during all investigation period, also in 2009. Overall trade balance is westbound oriented.

Table 15 shows trade balance between respective countries in euros and kronas. This indicates that it is carried more from China to these two North European countries when valued in countries own currencies. Trade imbalance exists every year and trade is again westbound oriented.

Table 15. Trade balance (1000e and 1000 SEK) of Finland and Sweden concerning China (National Board of Customs Finland, 2010d; SCB, 2010)

	2005	2006	2007	2008	2009
From China to Finland	2,820,126	4,127,484	4,457,681	4,364,914	3,434,460
From Finland to China	1,556,111	1,971,360	2,159,775	2,058,677	1,854,057
Balance (1000 e)	-1,264,015	-2,156,124	-2,297,905	-2,306,237	-1,580,403
From China to Sweden	22,490,906	28,996,245	35,734,658	36,935,199	34,606,550
From Sweden to China	18,844,378	20,712,194	22,190,256	25,916,415	31,301,535
Balance (1000 SEK)	-3,646,528	-8,284,051	-13,544,402	-11,018,784	-3,305,015

The most significant change can be seen in the situation between Sweden and China in 2009. Compared to previous years, traffic imbalance was lower in 2009, when value of transported goods was much higher from Sweden to China than earlier. Concerning Finland and Sweden, in 2009 the value of transported goods decreased from China to Finland and Sweden.

3.4 Finnish and Swedish companies` factories in China

Finnish and Swedish companies have founded factories and plants to China, so it would be useful to present practical examples. Also trend to establish new manufacturing units abroad have an impact on transportation flows between Finland and China, and between Sweden and China.

Metso Corporation

Metso offers technology and services in mining, automation, pulp and paper, construction and energy industries. It employs 27,000 people in 50 different

countries. Metso has opened a new technology center on 28th of May 2010 in China. This technology center is located in Shanghai on Free trade zone area (China development zones) and this center concentrates on automation solutions. The aim is to improve the position in the growing Chinese markets and main customers would be in China and in Asia Pacific. Metso already have some factories and service units in Shanghai region, so this investment is not the first one. This new technology center produces also parts and components to other factories of Metso. It is estimated that over 600 people will work in the new factory in forthcoming years. (Metso, 2010)

Trelleborg Group

Trelleborg AB was founded in 1905 offering rubber products. Nowadays Trelleborg is a global company concentrating on polymer technology and it has 100 hundred factories in 40 different countries. (Trelleborg, 2010a) Trelleborg strengthened its position in China by opening its fifth factory in 2009. This factory in China locates in Qingdao area of China, near from the main hub employing 100 people. Also this area is close to international sea port. Airport is also close to factory with good services. Infrastructure of the city Qingdao is kept superior. Chinese markets is kept to be growing and Trelleborg`s investments to China has been successful. Earlier there was one plant in China, but now there are five of them. (Trelleborg, 2010b)

Sandvik

Sandvik was founded in 1862 and it is a Swedish based company. It operates in 130 different countries and employs 44,000 people. Sales were SEK 72 billion in 2009. Main products are metal cutting tools, equipments for mining and construction and special metal products. (Sandvik, 2010a). Sandvik has production units in eastern parts of China. In 2008 Sandvik opened three plants to China Wuxi area. Also investments were made in Langfang and new factory in Shanghai was opened (Kanthal production). In 2009 plant investment were made in Jianding and a new factory was opened in Zhenjiang. (Sandvik, 2010b)

4 RUSSIA

4.1 Economic development

According to World Bank (2010d), Russian`s economy is strengthening after the economic crisis with small steps, but the recovery will be difficult. Transportation infrastructure is a big issue and it might constraint the economic growth (World Bank, 2010e, 1). Gross domestic product in Russia was approximately 1.232 trillion US dollars in 2009. The real GDP decreased almost 7.9 percent in 2009, when it was increasing 5.6 percent in 2008 and 8.1 percent in 2007. The increase of gross domestic product was 7.7 percent in 2006 (Figure 6). (Central Intelligence Agency, 2010b) World Bank (2010) estimated that increase of GDP in the first quarter of 2010 was around 2.9 percent. (World Bank, 2010d, 3)

Figure 6. The growth of the gross domestic product in Russia between 2006 and 2009 (Review of maritime transport, 2009, 2)

GDP per capita in Russia was 15,100 US dollars in 2009 indicating 75th place of worldwide ranking (227 countries in total). Comparison to this, China is ranked to 128th place (6,600 US dollars per capita), Finland to 36th place (34,900 US dollars per capita) and Sweden to 28th place (36,800 US dollars per capita). In the previous year 2008 the GDP per capita was 16,300 US dollars and 15,400 in 2007. (Central Intelligence Agency, 2010b) The consequences of economic

recession can be seen in the development of gross domestic product per capita in Russia. In 2009, the amount decreased lower level than it was in year 2007.

4.2 Freight transport

Infrastructure in Russia is not the best possible and reasons for that are lack of investments and lack of maintenance. Lately published trade index by World economic forum has ranked Russia to the 48th place concerning transportation infrastructure taking consideration all transportation modes. (World Bank, 2010d, 13)

World economic forum`s the Global competitiveness report is made to rank countries of specific areas. One of these is an infrastructure evaluation of a country where all countries are taken into consideration. Infrastructure of Russia is ranked and this comparison consists total of 134 different countries. In the report were ranked eight measures, but five of them concerns freight transport. Investigated factors were ranked as an advantage or a disadvantage. Only one part was an advantage, meaning the condition of railroad infrastructure (32^{nd} of 134). The rest factors were disadvantages consisting of overall infrastructure`s condition, road quality, port infrastructure and air transport quality. (Global competitiveness report, 2008-2009)

Another useful measure is World Bank`s Logistics performance index (Table 16). This indicator consists of six measures like customs, infrastructure, international shipments, competency in logistics, skill to monitor deliveries and preciseness. Also an overall ranking is given. Each part is ranked in a scale of zero to five. (World Bank, 2010f)

Table 16. Logistics performance index in Russia (World Bank, 2010f)

Overall LPI	from 0 to 5	2.61
	rank	94
Customs	from 0 to 5	2.15
	rank	115
Infrastructure	from 0 to 5	2.38
	rank	83
International shipments	from 0 to 5	2.72
	rank	96
Competency in logistics	from 0 to 5	2.51
	rank	88
Monitoring of deliveries	from 0 to 5	2.60
	rank	97
Preciseness	from 0 to 5	3.23
	rank	88

From these six measures the best ranking belongs to preciseness (3.23). The worst index (2.15) concerns about customs. Overall logistics performance index (2.61) is in the halfway of the scale between from zero to five. When comparing to other world, Russia keeps the 94th position of all 155 different countries. (World Bank, 2010f)

In Table 17 is presented six different transport modes and their turnover in billion ton-kilometers. Amounts differ greatly from situation compared to China. Investigation period is from 2000 to year 2008. Pipelines have the biggest share of all and the second is railway transport. Third largest is road transport following by sea transport. Air transport has the smallest share of all.

Table 17. Turnover by transport mode in billion ton-kilometers in Russia (Federal Statistics, 2010a)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Road	153	160	167	173	182	194	199	206	216
Railway	1,373	1,434	1,510	1,669	1,802	1,858	1,951	2,090	2,116
Pipelines	1,916	1,962	2,100	2,273	2,413	2,474	2,499	2,465	2,464
Marine	122	113	112	85	66	60	62	65	84
Inland waterways	71	83	84	81	92	87	87	86	64
Air	2.5	2.6	2.7	2.7	3.0	2.8	2.9	3.4	3.7
Total	3,638	3,755	3,976	4,284	4,558	4,676	4,801	4,915	4,948

According to Laisi (2010), if the share of pipelines is taken off, the biggest share belongs to railway transportation in Russia. Then railway transportation counts 85

percent of all transportation modes. When excluding pipelines, comparison to other BRIC countries shows that railway freight transport in Russia has larger role than in China (21 percent), India (32 percent) and Brazil (33 percent). (Globaltrans, 2010; Laisi, 2010, 26)

4.2.1 Road

Based on Federal Statistics (2010b), the length of road network was 940,000 kilometers in 2008. The amount of paved network is around 80 percent according to World Bank. When it comes to transported goods on the roads, it was carried 153 billion ton-kilometers of goods in 2000. The amount was 216 billion ton-kilometers in 2008 (Federal Statistics, 2010a; World Bank, 2010c). Like Table 16 shows, the road freight turnover has been growing from 2000 until year 2008. The increase has been 41 percent during this period. When comparing the share of road to the total freight turnover (all transportation modes including pipelines), the share of road is only 4.4 percent. When excluding the pipelines, the share of road is 8.7 percent.

Road transportation is generally used, because it best serves customers` needs. It can be said that fast deliveries are preferable on highways than in rail transportation. Road transportation mode better fits for short transports (Saranen *et al.*, 2010, 168, 174)

Table 18. Road traffic between Finland and Russia (1000t). (National Board of Customs 2010a; Posti *et al*., 2009, 47, 52; Statistics Finland, 2006)

(1000t)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Export to Russia	0	0	0	0	0	1,554	1,648	1,749	1,813	1,432
Import from Russia	0	0	0	0	0	4,256	4,095	3,511	3,317	2,292
Transit traffic	1,239	1,532	1,791	2,243	2,591	2,866	3,102	3,888	4,002	1,836
Eastbound	1,182	1,402	1,664	2,127	2,490	2,780	2,947	3,694	3,802	1,744
Westbound	57	130	127	116	101	86	155	194	200	92
Balance						-8	345	1,738	2,098	792

Road transit traffic is eastbound oriented. Around 95 percent of transit traffic comes from Finland to Russia (Table 18). Westbound transit traffic from years

2006 to 2009 are estimations, because data is not available from these years. Only data of eastbound transit traffic can be collected. According to National Board of Customs, in 2006 were transported almost 2,947 tonnes via Finland to Russia and 3,694 tonnes in 2007. The highest point was reached in 2008, when transit traffic was 3,802 tonnes. In 2009 the amount lowered significantly, being 1,744 tonnes. (National Board of Customs, 2009) When investigating only road traffic between Finland and Russia, more goods are transported from Russia. Transit traffic is not included in export and import amounts (National Board of Customs, 2010a). Overall balance shows that more goods are transported from Finland to Russia, but in 2009 is seen a remarkable decrease compared to year 2008.

Table 19. Eastbound road traffic from Finland to Russia. (National Board of Customs, 2010b)

	2002	2003	2004	2005	2006	2007	2008	2009	2009 (I-III)	2010 (I-III)
million tons	1.5	2.0	2.3	2.6	2.9	3.7	3.8	1.7	(0.47)	(0.4)
billion euros	12.0	17.7	19.4	22.0	24.7	30.7	30.9	14.4	(3.9)	(3.4)

Like Table 19 shows, eastbound road traffic has increased except in year 2009 measured in tonnes and euros. The first three months in 2009 and 2010 were also investigated and amounts are almost same, a bit decrease is detected in 2010.

Table 20. Amount of trucks at the four main border crossing points in Finland. (National Board of Customs, 2010b)

	2005	2006	2007	2008	2009	2009 (I-III)	2010 (I-III)
Imatra	52,900	64,700	101,300	110,200	42,500	11,000	9,400
Nuijamaa	118,000	118,600	137,500	153,500	68,200	14,800	16,500
Vaalimaa	177,200	238,000	221,700	230,200	175,500	40,000	35,100
Niirala	32,900	30,700	24,500	26,400	23,000	3,100	5,900
Total	381,000	452,000	485,000	520,300	309,200	68,900	66,900

Vaalimaa is the most significant border crossing point measured in the amount of trucks following by Nuijamaa (Table 20). Total amount of trucks decreased remarkably in 2009. Situation in the three months in 2010 is almost same than in 2009.

4.2.2 Railways

Railways keep the largest share of transportation in Russia, when excluding pipelines (see Table 17). Then the share of railways is 85 percent and when taking consideration pipelines, the share of railway freight is 43 percent (Globaltrans, 2010; Laisi, 2010, 26). According to Global competitiveness report, condition of railway infrastructure was ranked as an advantage in Russia. Saranen *et al.* (2010) says that rail is the most used mode (Saranen *et al.*, 2010, 174) According to Federal Statistics (2010b), the average railway length has been around 85,000 and 87,000 kilometers during the 21st century. Saranen *et al.* (2010) says that rail transportation is kept steady and reasonable in long journeys. Rail transportation`s benefit is punctuality, but a drawback is rather slow delivery times. (Saranen *et al.*, 2010, 168, 180)

Table 21. Railway traffic between Finland and Russia (1000t). (National Board of Customs 2010a; Posti *et al*., 2009, 47, 52; Statistics Finland, 2006; VR Cargo, 2004, 65; VR Cargo, 2009, 85)

(1000t)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Export to Russia	0	0	0	0	0	372	521	610	630	398
Import from Russia	0	0	0	0	0	10,685	10,717	7,853	7,918	4,992
Transit traffic	2673	4,008	3,461	3,194	3,201	3,389	4,250	3,550	4,800	4,426
Eastbound	223	237	211	202	234	197	120	120	400	200
Westbound	2,450	3,771	3,250	2,992	2,967	3,192	4,130	3,430	4,400	2,200
Balance	0	0	0	0	0	-13,308	-14,206	-10,553	-11,288	-6,594

Table 21 shows that railway transit traffic is westbound oriented (93 percent). Only small share of all is transported to east. According to Posti *et al.* (2009, 47, 52), in 2008 transit traffic on railways was 4,400 tonnes to west and 400 tonnes to east. Amounts of year 2009 are estimations. Between Finland and Russia, more traffic comes from Russia on railways and transit traffic is excluded from export and import amounts (National Board of Customs, 2010a). Overall balance indicates westbound oriented railway transportation between Finland and Russia.

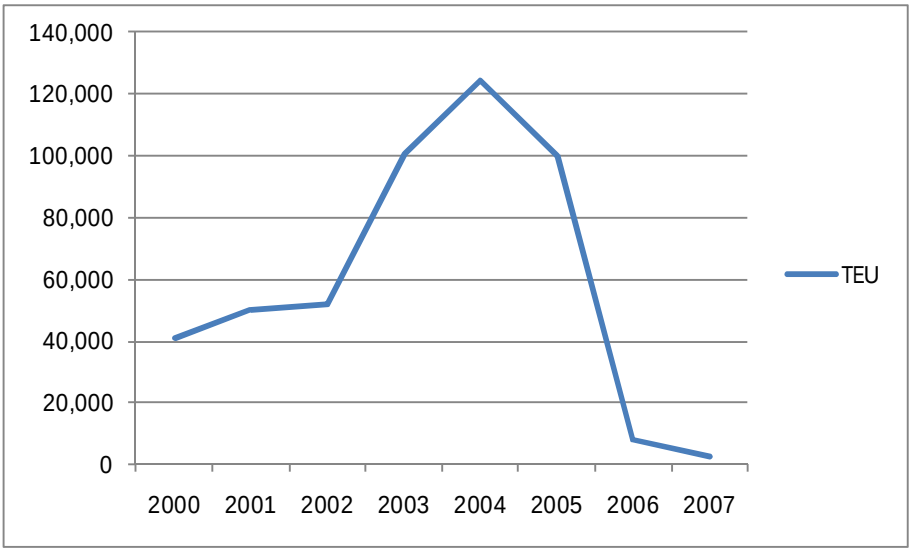

Figure 7. Transported TEU amounts in Trans-Siberian railway. (VR Cargo, 2010a)

According to VR Cargo Finland, freight transport in Trans-Siberian railway has increased from year 2000 until 2004, but has lowered remarkably after the year 2004 (see Figure 7). Reason for that was increase of prices on Russian track section (VR Cargo, 2006, 18). However, based on information by Nurminen Logistics (2010), after many years started a block train (in April 18, 2010) using Trans-Siberian railway from Finland to South-East Asia containing Finnish export products (Nurminen Logistics, 2010).

4.2.3 Sea transport

There are five major ports in Russia. Those ports are Kaliningrad, Novorossiysk, St. Petersburg, Vladivostok and Vostochniy (Table 22). Amounts are measured in TEUs and it is seen that in all five ports the amounts have significantly grown during this examination period from 2004 to 2008. St. Petersburg has the largest throughput of all and then has a key role in Russian`s transportation.

Table 22. Ports and container throughputs (TEU) in Russia between 2004 and 2008 (Containerization International Yearbook, 2006, 2008, 2009 and 2010)

Port	2004	2005	2006	2007	2008	Change (%) 2004-2008
St. Petersburg	773,431	1,121,111	1,449,958	1,697,720	1,983,110	156.40%
Novorossiysk	135,119	161,756	226,570	342,183	428,378	217.04%
Vostochniy	272,529	272,004	291,423	370,992	401,000	47.14%
Vladivostok	102,169	124,721	146,837	223,496	267,228	161.55%
Kaliningrad	72,489	112,528	151,047	252,146	213,210	194.13%
Total	1,355,737	1,792,120	2,265,835	2,886,537	3,292,926	142.89%

Total throughput has more than doubled from year 2004 until 2008. The increase has been smallest in Vostochniy and biggest in Novorossiysk. The throughput of St. Petersburg is five times larger than in Novorossiysk and in Vostochniy. Comparing to Vladivostok, the throughput is eight times larger and almost ten times larger than in Kaliningrad.

Table 23. Sea transport between Finland and Russia (National Board of Customs, 2010a)

(1000 t)	2005	2006	2007	2008	2009
Import	13,635	13,602	16,449	15,710	15,952
Export	115	142	291	265	137
Balance	-13,520	-13,460	-16,158	-15,446	-15,815

Table 23 depicts transportation flows from Russia to Finland and vice versa. It can be noticed that transportation flows have been westbound oriented and export from Finland to Russia has small role compared to total traffic flows. Traffic is unbalanced and in sea transportation the imbalance has strengthened. These amounts do not include transit traffic (National Board of Customs, 2010a).

4.2.4 Air transport

Air freight has been varied in 2004 and 2008 (Figure 8). After 2005, the freight in million ton-kilometers grew in 2006 to the level of 1,926. Anyhow, in 2007 the air freight amount decreased to the level of 1,224. In 2008 the air freight transport grew to the highest level of 2,399. (World Bank, 2010c)

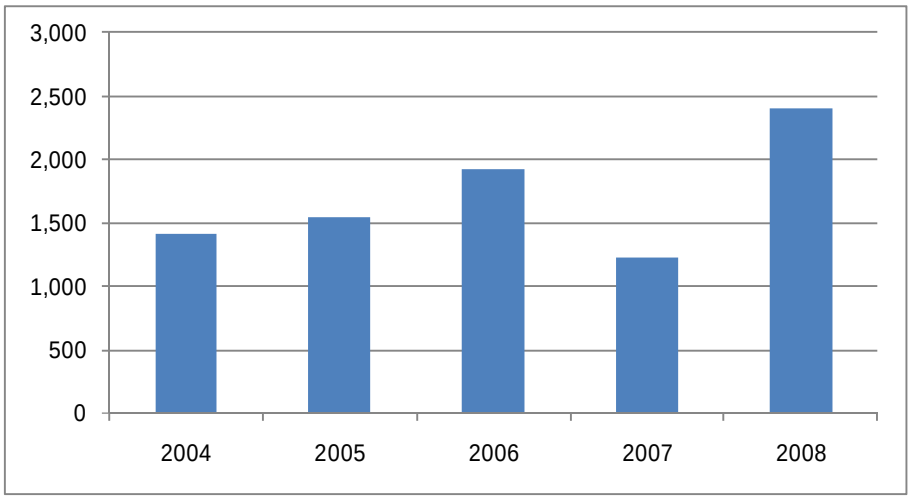

Figure 8. Air freight transport in million ton-kilometers in Russia between 2004 and 2008 (World Bank, 2010c).

There are 1,216 airports in Russia and the amount of paved ones are 595. This justifies to 5th position of all 235 different countries (Central Intelligence Agency, 2010b). When dividing transported goods (million ton-kilometers) with the amount of paved airports, it can be given a measure of airport effectiveness. The amount of paved airports in calculation is kept constant (595). Figure 9 describes the situation below and shows a comparison to Finland and Sweden.

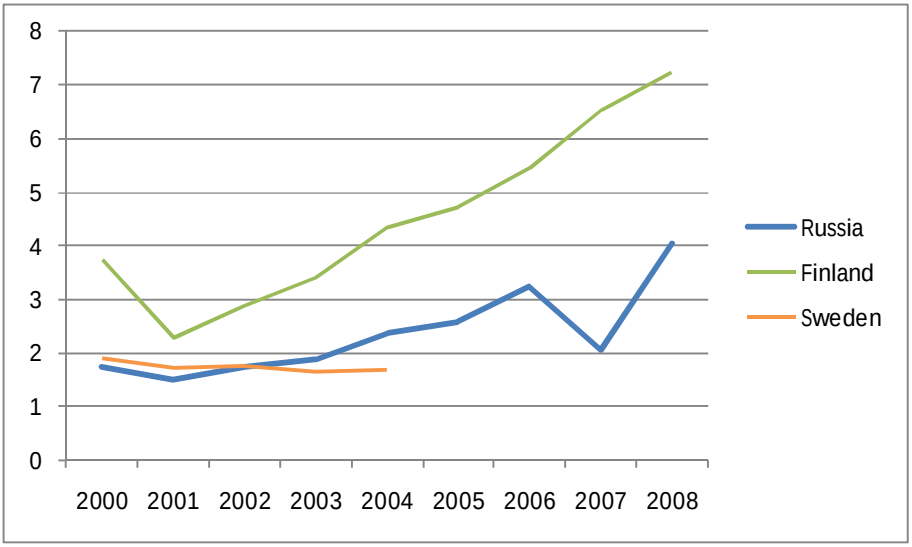

Figure 9. Index of airport effectiveness in Russia. (Central Intelligence Agency, 2010b; World Bank, 2010c; World Bank, 2010h; World Bank, 2010i)

The airport efficiency index in Russia has increased up to year 2006. A remarkable decrease is seen in 2007, but the index has grown from that situation until 2008. In Finland the same index is much higher than in Russia and Sweden. A probable reason for this is that in Finland is transported much more goods via the same airport, like Helsinki-Vantaa as an example.

4.2.5 Transportation problems and outsourcing

Finnish companies meet some problems with Russian trade. Some of these are custom issues, bureaucracy and unpredictability (Finnish-Russian Chamber of Commerce, 2004). Also long truck queues near the Russian border in Finland have been a big issue to solve (Lorentz, 2008, 247). Infrastructure in Russia is one of the main concerns among others (Central Intelligence Agency, 2010b). When it comes to road transportation, some disadvantages of road transportation are customs handling and large carrying loads. It might take time in customs and large transportation loads require unique permits. That logically incur extra logistics costs and makes difficult fast deliveries. (Saranen *et al.*, 2010, 168) Based on the Global Competitiveness Report 2008-2009, five main disadvantages of doing business in Russia are:

- corruption
- regulation of taxes
- financing issues
- bureaucracy (government)
- rate of taxes. (Global Competitiveness report, 2008-2009)

According to Ahola (2008, 38) corruption and bureaucracy are the biggest problems in Russia. Although, many actions to prevent corruption has been planned to implement. It is estimated that the costs of corruption is around one billion rubles in a year. Actual costs are estimated to be still 2000 times higher than previously mentioned. (Ahola, 2008, 38)

During the time of Soviet Union, it was not concentrated on would an investment be profitable or how long time it takes that profits cover the costs. Factories` main performance measure was how much they can produce a certain product. (Johanson *et al.*, 2000; Tiusanen & Jumpponen, 2001) Nowadays companies increasingly concentrate on their core competitiveness and this increases the willingness to outsource. Finding a proper subcontractor is a challenge when operating in Russia. (Dudarev *et al.*, 2004; Johanson *et al.*, 2000) The amount of small companies has been increasing in Russia. Usually these small companies are not proper candidates to be subcontractors. It is needed a lot of licenses and permissions to fulfill the needed requirements. This application time for these permissions takes around two months. Also banks in Russia operate in a different way compared to western banks. When it is assigned a loan to a small enterprise, often interest rates are high. (Helanterä & Ollus, 2004, 118; Tiusanen & Jumpponen, 2005, 20)

It can be said that many companies have outsourced their logistics functions. In the article of Saranen *et al.*, (2010) there were five companies and only one of them had own transportation equipment in use. That concerns road transportation and this can be kept as a usual situation in Russia. (Saranen *et al.*, 2010, 180)

4.3 Trade balance

Russian`s estimated export value was 303.4 billion US dollars in 2009. When comparing to other countries, Russia keeps the 13th position of all 233 countries. One year earlier, in 2008, the export value was 471.6 billion US dollars. The main export countries are seen in Table 24.

Table 24. The main export countries of Russia. (Central Intelligence Agency, 2010b)

Export country	Share
Netherlands	12.2 %
Italy	9.0 %
Germany	6.9 %
Turkey	5.9 %
Ukraine	5.0 %
China	4.5%
Poland	4.3%

Netherlands has the largest share (12.2 percent) and reason for that is probably huge export of natural gas and petroleum products to this country. The second is Italy (9.0 percent) and third Germany (6.9 percent). In the list below are the main export products that are transported from Russia:

- natural gas
- crude oil and crude oil products
- metal and chemicals
- wood
- military and civilian manufactures. (Central Intelligence Agency, 2010b)

When it comes to export issues in Russia, this country has had a key role compared to other countries. In 2009, Russia exported most natural gas in the world scale. Concerning oil exports, Russia was the second in the world scale and had also a key role exporting steel and aluminum. If the natural gas and petroleum products are excluded from the list, the order of main export countries would change. The economic crisis affected remarkably Russian economy in 2008 and 2009, because of low oil prices. The Central Bank of Russia has done some rescue actions to help the situation and to prevent the devaluation of the currency. Russian`s agriculture has also changed in recent years. Earlier Russia was mainly importer of grain, but nowadays country is exporter on that area. (Central Intelligence Agency, 2010b)

Import value of Russia (estimated) was 191.8 billion US dollars in 2009. That corresponds to 19th place worldwide of 220 countries. In 2008 the import value was 291.9 billion. The main import countries are seen in Table 25.

Table 25. The main import countries of Russia. (Central Intelligence Agency, 2010b)

Import country	Share
China	12.9 %
Germany	12.6 %
Japan	6.9 %
Ukraine	6.0 %
United States	5.1 %
Italy	4.1 %

From China is imported the largest share (12.9 percent) and the second is the Germany (12.6 percent). Japan keeps the third position (6.9 percent). The main import products that are transported to Russia are:

- cars
- machines and equipment
- pharmaceutical products
- plastic
- steel, iron and semi-finished metal products
- consumables
- food. (Central Intelligence Agency, 2010b)

Still, in recent years the import of cars has a bit decreased affected probably by the economic recession. Machines and equipment indicates conceivably the construction of factories to Russia. Pharmaceutical products are one of the main import products to Russia. (Central Intelligence Agency, 2010b)

One issue that is worth mentioning on trade balance is transit traffic. It means traffic via another country to the destination country. These amounts are not counted to the export amounts of transit country. For example, if goods are transported via Finland to Russia, transported goods are not included to Finnish export trade. (Märkälä & Jumpponen, 2007, 4) Russian`s economic crisis has

affected transit traffic via Finland to Russia. In 1999 transit traffic to Russia was on the lowest level, but after that traffic has increased. Road transit traffic has increased significantly and amount of railway transit traffic has decreased slowly. (Märkälä & Jumpponen, 2007, 20) Reasons why Finland is kept a convenient transit traffic country are safety and warehousing possibilities. Furthermore, fast deliveries from Southern Finland to St. Petersburg and Moscow are other benefits. Also value added services and predictability advocates Finland to be a competitive transit traffic country. (Märkälä & Jumpponen, 2007, 84) In Table 26 are seen import and export flows of Finland and Sweden between Russia measured in US dollars. It needs to be noticed that transit traffic is not included in export traffic from Finland to Russia. Imports (from Russia to Finland or to Sweden) are valued by CIF (Cost Insurance and Freight) and exports (From Finland or from Sweden to Russia) are valued by FOB (Free on Board). (OECD Statistics 2010a) To give some picture about transit traffic, via Kokkola Finland sea port it is transported 2.49 million tonnes to east in 2009 (all ports of Finland counts 4.5 million tons). As an opposite to that, transit traffic from east via Kokkola is 0.127 million tons of total 1.6 million tonnes. (Finnish Port Association, 2010)

Trade from Russia to Finland has been increasing from year 2004 until 2008 (Table 26). In 2009 can be seen a collapse of trade from Russia to Finland. Trade from Finland to Russia has also been growing on the same period and a remarkable decrease can be noticed in 2009. Still, trade between Russia and Finland is more westbound oriented (traffic from Russia to Finland).

Table 26. Trade balance (US dollars) of Finland and Sweden concerning Russia. Transit traffic excluded. (OECD Statistics, 2010a)

	2004	2005	2006	2007	2008	2009
From Russia to Finland	6,595,983,791	8,124,898,493	9,750,790,245	11,519,582,169	15,007,362,083	9,781,922,739
From Finland to Russia	5,321,784,054	7,070,632,394	7,718,849,115	9,090,182,341	11,088,506,626	5,546,452,945
	-1,274,199,737	-1,054,266,099	-2,031,941,130	-2,429,399,828	-3,918,855,457	-4,235,469,794
From Russia to Sweden	2,197,725,982	3,296,410,271	4,365,916,196	4,428,460,467	6,913,962,971	4,114,408,938
From Sweden to Russia	1,855,033,955	2,133,566,751	2,423,883,039	3,367,266,366	4,446,251,376	1,845,720,330
	-342,692,027	-1,162,843,520	-1,942,033,157	-1,061,194,101	-2,467,711,595	-2,268,688,608

Between Sweden and Russia, trade is more modest compared to situation between Finland and Russia. Trade from Russia to Sweden has increased after 2004 until

2008, like in Finland`s situation and a slowdown in 2009 is seen also. The development is same in trade from Sweden to Russia. All in all, it is exported from Russia to Sweden much more than from Sweden to Russia. Trade imbalance exists between Finland and Russia, and also between Sweden and Russia. In spite of the economic recession that is seen year 2009 results, a deficit grew in Finland compared to earlier years. In Sweden the deficit lowered a bit.

Analysis of different currencies gives same kind of results. In case of Finland, trade imbalance has been growing from 2005 up to 2009 (Table 27). Like earlier it was noticed, also the value of transported goods (1000e) decreased significantly in 2009.

Table 27. Trade balance (1000e and 1000 SEK) of Finland and Sweden concerning Russia. (National Board of Customs Finland, 2010d; SCB, 2010)

	2005	2006	2007	2008	2009
From Russia to Finland	6,556,892	7,754,364	8,407,504	10,140,373	7,026,213
From Finland to Russia	5,744,044	6,215,058	6,711,151	7,611,584	4,044,122
Balance (1000 e)	-812,848	-1,539,305	-1,696,352	-2,528,789	-2,982,091
From Russia to Sweden	24,820,120	33,093,113	29,198,710	44,422,303	31,240,338
From Sweden to Russia	15,987,381	17,864,663	22,702,474	28,883,413	14,042,127
Balance (1000 SEK)	-8,832,739	-15,228,450	-6,496,236	-15,538,890	-17,198,211

When it comes to value of transported goods (1000 SEK) between Sweden and Russia, also imbalance has been growing. In 2009 value of transported goods decreased remarkably like in case of Finland and Russia due to the economic recession.

4.4 Finnish and Swedish companies` factories in Russia

Next it is presented latest practical examples of factory establishments in Russia. Below it is also handled Finnish and Swedish companies` factory inaugurations to give recent real examples.

Atria

Atria Group is a Finnish food company and it has major role in Finland, Scandinavia, Russia and in the Baltic region. Atria started in 1903 and its business area is divided into Atria Finland, Atria Scandinavia, Atria Russia and Atria Baltic. (Atria, 2010) Atria has recently opened a new factory to Russia. This new meat processing unit is located in Gorelovo, near St. Petersburg and it consist of two parts. The first part, the logistics centre opened already in 2008 and the second part started to operate recently and is the actual meat processing unit. On St. Petersburg there is also another Atria`s factory and Atria operates also in Moscow region. The new factory employs around 200 people and the production is fully automated with the area of 17,000 square meters. Atria`s market share on St. Petersburg region is 20 percent and is the market leader on that area. In Moscow region the market share is 4 percent. The Finnish Atria Group mainly uses a name of Atria Russia when operating in Russian markets. (Atria, 2010)

SKF

SKF is a Swedish company that is specialized in rolling bearings, gaskets, mechatronics, lubrication and service. Service consists of maintenance, support and instructions. SKF started in 1907 and nowadays it operates in 130 different countries. Company has more than 100 factories with 15,000 distributor places. (SKF, 2010a) In June 2010, SKF has opened a new factory to Russia. The place of the factory is located in Tver and its main products are CTBUs (Compact tapered bearing units). The main customer target group is railway operators in Russia, but international ones. This factory investment makes possible to offer bearing products to the growing railway market in Russia. Also, the new factory is one of the first that has LEED certification meaning that environmental factors are taken into consideration during the factory construction process. The costs of investment are about SEK 235 million and it employs around 100 people. Furthermore, SKF inaugurated also Solution factory to Moscow to enable special solutions, for example, to railway customers. (SKF, 2010b)

SCA

SCA started to operate in 1929 in the area of forest industry. During decades, SCA has widened its product groups. Nowadays these main product groups are hygiene, forest, tissue and packaging products. Company exports its products to over 100 different countries. (SCA, 2010a) According to press release of SCA, a new plant was opened recently in Russia. The new mill locates in Sovetsk, in Tula area. Factory`s main raw material is recycled paper and annual capacity is 30,000 tonnes. This is one of a kind factory in Russia, when it is used recycled paper as a raw material. Currently SCA has two mills in Russia to produce hygiene products, in Leningrad and Tula region. (SCA, 2010b)

5 RESEARCH ENVIRONMENT

5.1 Background of research

This research aims to concentrate on Finnish and Swedish companies and their logistics functions. It investigates traffic flows from these companies point of view between Europe and China, and also between Europe and Russia. Same kind of research has been made in 2006 (Hilmola & Szekely, 2006) and 2009 (Hilmola, 2010a; Hilmola & Lorentz, 2010b) and this research in 2010 is a continuation of these two former research works. Anyway, all transportation data will be investigated from three years.

Chosen companies are the largest ones in Finland and Sweden. During all these three research years, it is used Finnish Talouselämä newspaper and Swedish Affärsdata as a database for a research. From these newspapers were found 500 largest companies from both countries and those large companies were the target group in the research. After that it was searched contact information of these companies and also people who are responsible of logistics issues. Target was to find email addresses of these managers and after that it was possible to send the questionnaire to these people. This kind of research strategy has been used in logistics surveys earlier like Häkkinen *et al*. (2004) have done (Hilmola & Szekely, 2006, 16). Totally one thousand companies were not reached and a real target group was around five hundred companies in year 2009 and 2010. In 2006 target group consisted of around seven hundred companies. Because in the list were also companies that have no logistic functions at all, these companies are undoubtedly out of the list. (Hilmola & Szekely, 2006, 16)

5.2 Data gathering in 2006, 2009 and 2010

Surveys completed in 2006, 2009 and 2010 consist of web-based surveys that include an investigation of logistic functions concerning Finnish and Swedish companies at North Europe. The logistics and supply chain questionnaire was sent

via email to target companies (see Appendix 1). Emails were allocated to the logistic managers or to the general info address in a particular company. When it was not found the right addresses, also the general info email address reached the respondent in a company quite well. The questionnaire format was available in English, Swedish and in Finnish, and all of these formats were identical. (Hilmola & Szekely, 2006, 16)

When this research had been done earlier in 2006 and 2009, in this year it was not needed to do so much work for finding addresses than earlier. During the very first time, when finding addresses, it was used a web search engine to find contact addresses and it needed a huge amount of work. During all of these years it has been used Aptual`s Jalusta program to send questionnaires to target companies. By using this program it could be sent many questionnaires at the same time and see how many reaches the questionnaire and how fast respondents will click the link of questionnaire format.

Year 2010

The very first questionnaire round in this year was sent on 26th of February. The questionnaire was aimed to 352 Finnish companies and also to 218 Swedish companies. The first reminder to these companies was sent on 12th of March and it reached 343 Finnish companies and 215 Swedish companies. The second reminder on 23rd of March reached 338 Finnish companies and 212 Swedish companies. The third reminder was sent on 9th of April and it reached 325 Finnish companies and 209 Swedish companies. After that, no more questionnaires were sent because the research closes at the end of April 2010. Reasons for lower amounts of sent emails between the first inquiry and the last reminder is that we needed to remove or change some addresses based on email feedback. Most often it was responded from company side that they do not want to take part in to this questionnaire and in some cases they answered that they are not the actual target group.

After sending the first questionnaire we got seven answers from Finnish companies and two answers from Swedish companies. After the first reminder

five Finnish companies and two Swedish companies answered. After the second reminder we got seven answers from Finnish companies and two answers from Swedish companies. After the third reminder we got four answers from Finnish companies and two from Swedish. Totally we got 31 answers and 25 are valid answers (Table 28). Duplicate and empty answers reduce the amount of answers. Response rate in year 2010 is 4.4 percent. When calculating the response rate, it has been divided valid answers with number of sent emails.

Year 2009

The first questionnaire was sent between 21st and 23rd of January. On that time the questionnaire reached 303 Finnish companies and 230 Swedish companies. After the first reminder on 12th of February 266 companies from Finland and 211 companies from Sweden got the questionnaire format. The second reminder was sent on 25th of February and it reached 261 Finnish companies and 186 Swedish companies. The last and the third reminder in year 2009 was sent on 13th of March. That reached 240 Finnish companies and 180 Swedish companies.

Between the first inquiry and before the first reminder twelve Finnish respondents and seven Swedish companies answered. After the first reminder two Finnish companies answered and six Swedish companies. After the second reminder seven Finnish and six Swedish sent the answer sheet to us. After the third reminder four Finnish respondents answered and no Swedish at all. Totally we got 44 answers and 35 of them are valid answers (Table 28). Response rate is then 6.5 percent.

Year 2006

In research 2006 questionnaire`s target group was about 750 companies (Hilmola, 2010a, 7; Hilmola & Lorentz, 2010b, 8). In year 2006 the logistics questionnaire was sent three times and the target group was these earlier mentioned large Finnish and Swedish companies. The first initial call for answers was sent on 2nd of March and it reached 414 Finnish and 354 Swedish companies. The first reminder was sent on 14th of March. That reached 386 Finnish and 322 Swedish companies. The second reminder was sent on 3rd of April.

After the first inquiry we got twenty-one answers from Finnish companies and nine from Swedish. When sending the first reminder we got 18 answers from Finland and 11 from Sweden. After the last inquiry we got ten answers from Finnish companies and five from Swedish companies. Totally we got 74 answers and 64 of them are valid answers (Table 28). Response rate is 8.3 percent according to database. When calculating the rate of answers from 2006, 768 companies were the total target group.

Table 28. All and valid answers, number of sent emails and response rates of Finnish and Swedish companies.

Year	All answers	Valid answers	Number of sent emails	Rate of answers
2010	31	25	570	4,4 %
2009	44	35	533	6,5 %
2006	74	64	768	8,3 %
Total	149	124	1,871	

In the research process in 2010, it can be noticed that Finnish companies are more willing to response to the questionnaire than Swedish companies according to data we have gathered. In 2010 we got 18 valid answers from Finnish companies and seven from Swedish companies. It means that 72 percent of all answers (25) are from Finnish companies. According to earlier research made in 2009 about 60 percent of answers were from Finland and in 2006 the situation was quite a same with response rate around 70 percent of Finnish companies (Hilmola, 2010a, 8).

When it comes to amount of answers, in some cases we have got two answers from the same respondent. An explanation for this could be a situation where respondent double clicks the sending button. In these cases the respondent do not get a confirmation that questionnaire format is sent without problems. That is somehow a feature of web-survey program than an actual problem. Before analyzing the data those double answers has been removed. Also, some answers are empty. Some people answer only to the first questions, maybe because the questionnaire format is quite long (Hilmola, 2010a, 8). It is also usual that some respondents answer only to the questions of annual cargo volume with given alternatives, but not to the question about weight of cargo. Questionnaire format

with answers of annual cargo volume and estimation of cargo weight are useful when calculating a weighted TEU amount. Because of different quality level of answers, those previously mentioned full answers with annual cargo volume and also with weight of cargo from the same respondent are quite rare. This reduces the valid sample size for investigating traffic balance, weighted TEU and distribution of cargo volumes. During year 2010, also an economic recession might have an impact to the lower level of answers compared to previous years. Companies` probably see other facts more important than telling information about their logistics issues to others.

6 EMPIRICAL DATA ANALYSIS OF THREE SURVEYS

In this section has been used all answers that we have got from surveys 2006, 2009 and 2010. In all of these surveys, it has been asked to estimate the past, the current and future estimations about annual cargo volumes and traffic balance. In this survey is also asked some background information about respondents. Warehousing issues were also asked in the questionnaire format, but those facts were not reported in this empirical part.

If the respondent has estimated the annual cargo volume, but not the weight of cargo volume, we have still used that annual cargo volume information when analyzing only the traffic amounts. Because of that reason, sample sizes concerning annual cargo volumes are larger compared to sample sizes of traffic balance, weighted TEU and distribution of cargo volumes later on this survey.

6.1 Structure of the empirical data analysis

Based on the research data it is going to be investigated transportation development between Europe and China and between Europe and Russia. Before that it is analyzed respondents career and position in a company, container types that companies use, modal split of transportation and share of transportation costs.

Annual cargo volume is one of those issues investigated in the survey and the TEU (Twenty-foot equivalent unit) is the actual measurement unit. The second analysis includes the traffic balance between Europe and China and also between Europe and Russia. The measurement unit in this case is a percent. After that will be analyzed weighted TEU and distribution of cargo volumes.

In the very first research made in 2006 the respondents were asked to answer about the past, the current and the future trends how the traffic flow had been developed and how it will develop in a certain area. In survey 2006 the examined

years were 2001, 2005 and 2010. In the second survey made in 2009, the examined years were 2005, 2010 and 2015. In the newest survey this year, respondents were asked to estimate traffic flow in 2008, 2011 and 2016 with given alternatives. The alternatives in the questionnaire format were like below in the case of annual cargo volumes concerning China and Russia. According to all data, it can be done some assumptions of the current development trend. Five different options to evaluate annual cargo volumes are mentioned below:

- 0–1 000 TEU
- 1 001–5 000 TEU
- 5 001–10 000 TEU
- 10 001–50 000 TEU
- 50 000 TEU or larger TEU.

Also it was asked to estimate weight of cargo volume. The answer sheet in this section was formulated like below. It included year and estimation of weight of cargo from Europe to China and vice versa altogether with 100 percent. In every survey during these three years, this section contained three different years, the past, the current and the future estimation. In the newest questionnaire it means years 2008, 2011 and 2016. Later on the questionnaire format were asked the same questions concerning situation between Europe and Russia.

- Year
- Europe to China
- China to Europe
- Altogether 100 percent

- Year
- Europe to Russia
- Russia to Europe
- Altogether 100 percent

One example of answer is that 30 percent of transport comes from Europe to China and 70 percent from China to Europe. That equals 100 percent in total. Only these valid answers were used to analyze the traffic balance, the weighted TEU amounts and distribution of cargo volumes. To get that weighted TEU amount, it is needed to multiply annual cargo volumes (TEU) and weight of cargos (percent). This issue is investigated more accurately later in this study. When analyzing the traffic balance, the non-valid answers were not taken into consideration. This rejected the valid sample size from the level of 25 to the level of 12 in year 2010.

6.2 Career of respondents and position in a company

Respondents` career in target companies indicates that they have been working most often more than eight years (Figure 10). The following data is from three survey years.

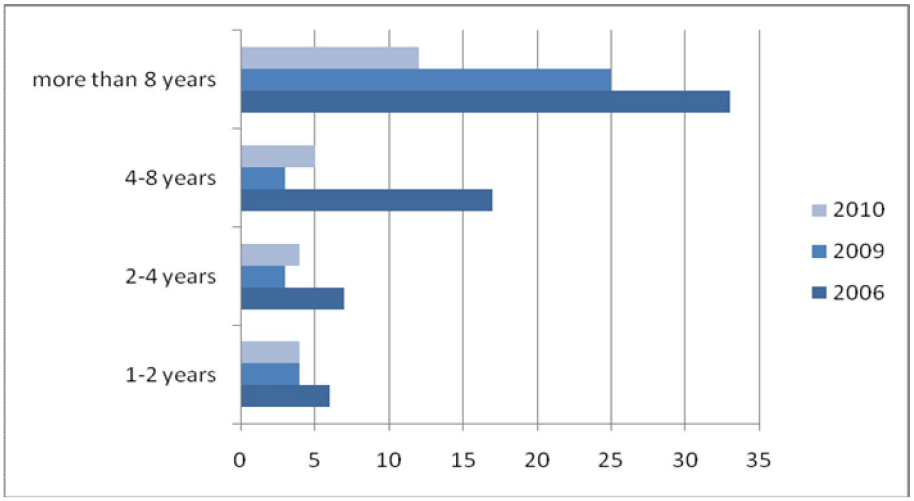

Figure 10. Respondents` career in a company based on survey results from 2006 (n=63), 2009 (n=35) and 2010 (n=25).

In 2010, twelve of all respondents belonged to the first category, working more than eight years. Five had been working between four to eight years. There were total eight answers in two last categories, meaning four answers in category of between two to four years and also four answers between one to two years. Total

amount of responses were 25 in 2010. When it comes to answers from 2009, it can be noted that twenty-five of all respondents had been working more than eight years. Three had been working between four to eight years, and also three between two to four years. To the last category belong four respondents of all. Totally we got 35 answers from year 2009. According to answers from 2006, there were thirty-three respondents who had been working more than eight years. In the second category, between four to eight years, were totally seventeen answers. Seven of all belonged to the category between two to four years and six to the last category. In 2006, totally we had 63 responses according to this working time issue.

Also respondents have been also working in current logistics function many years (Figure 11). It seems that most often respondents have been working more than eight years based on survey.

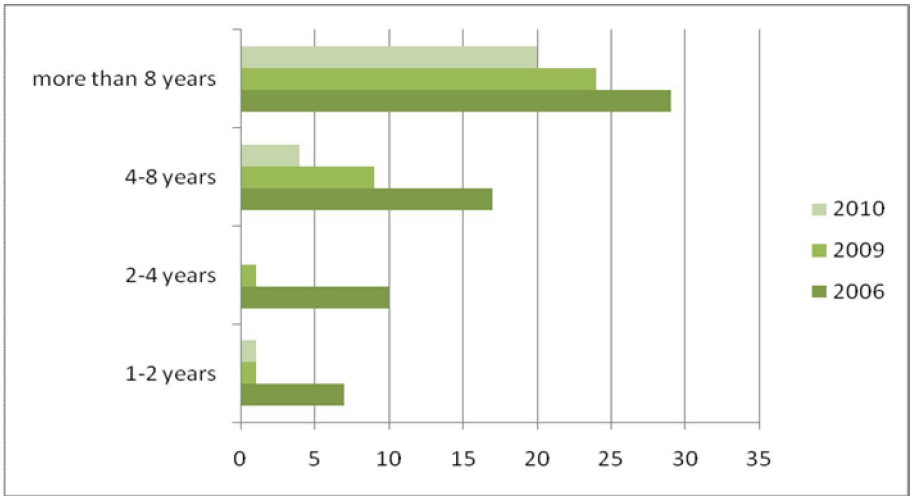

Figure 11. Respondents`working experience in current logistics function in 2006 (n=63), 2009 (n=35) and 2010 (n=25).

In 2010, most often respondents had been working more than eight years in this logistics function, meaning twenty people. Between four to eight years had been working four people and one in the last class between one to two years. Total amount of answers were 25 in 2010. In 2009 were twenty-four people who had been working in current logistics function more than eight years. Between four to eight years had been working nine people. To the last two classes belonged in

total two respondents, one of each. Total amount of answers were 35 in 2009. When it comes to year 2006, twenty-nine had been working more than eight years in the current logistics function. Seventeen had been working between four to eight years and ten people between two to four years. Seven belonged to the last category. Total amount of answers were 63 in 2006.

When it comes to respondents` position in a company, most often managers have answered to the questionnaire (Figure 12). In 2006 and 2009 white-collar workers answered more often than directors.

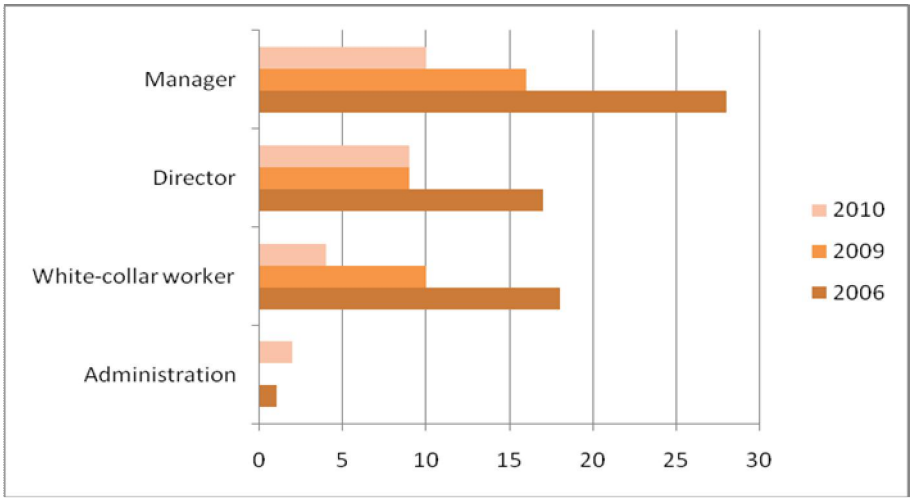

Figure 12. Respondents`position in a company from survey years 2006 (n=64), 2009 (n=35) and 2010 (n=25).

In 2010, about 40 percent of all were managers and 36 percent were directors. White-collar workers were 16 percent of all and the rest 8 percent were working in administration tasks. Total amount of answers were 25 in 2010. In 2009 managers were 46 percent of all. Directors were 26 percent and 28 percent white-collar workers. There were no respondents working in administration area. Total amount of answers are 35 in 2009. According to answers from 2006, managers were 44 percent of all. Directors are 27 percent and 28 percent are white-collar workers. Only one percent of all respondents work in administration. Total amount answers were 64 in 2006.

Respondents have many years experience in logistics area. According to previously mentioned, it can be kept responses valid and reliable, because of many years working experience within the company itself but also in logistics function. Also respondents have been working more than eight years in current logistics functions. Managers most often answered to the questionnaire. According to Hilmola and Lorentz (2010b), most often respondents in 2006 and 2009 were managers (44 percent), white-collar workers (29 percent), directors (26 percent) and working in administration (1 percent) (Hilmola and Lorentz, 2010b, 9).

6.3 Container types of respondent companies

Alternatives in the questionnaire format concerning transportation units were a bit changed in 2010 compared to year 2009. In 2010 it was asked which one of the following transportation units were used in the target company; 20` long container, semi-trailer (truck), 40`(45`) long container or something else. In 2010 the semi-trailer option was added. The distribution of results is shown in Figure 13. The most used transportation unit is a semi-trailer with percentage of 60. The second used transportation unit is 40`(45`) long container and with same percentage of something else option. The least used transportation unit is 20` long container with eight percent.

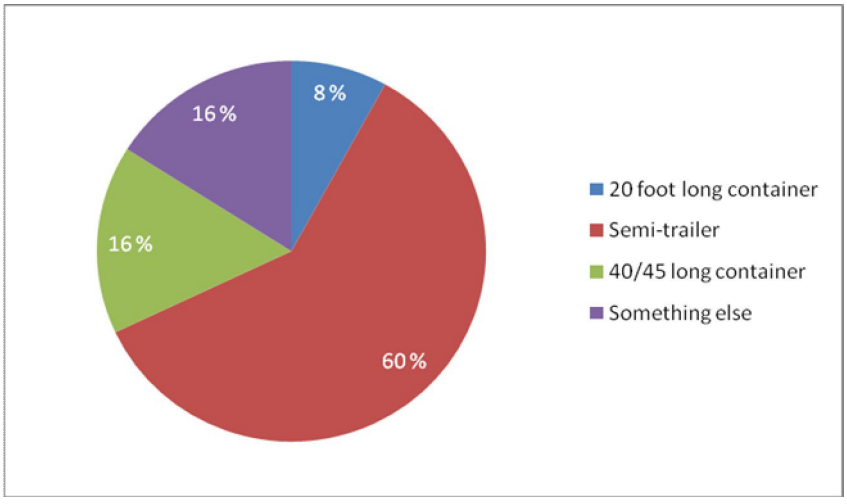

Figure 13. Container types in 2010 questionnaire (n=25).

Semi-trailers and 40`(45`) containers share three quarters of all transportation units. Then 20` long container have a minor role. From all answers (n=25) seven responses are from Swedish companies and the rest eighteen are from Finnish companies. Those respondents who answered a semi-trailer as their transportation unit, fifteen in total, consisted of thirteen Finnish and two Swedish responses.

In 2009 the alternatives of transportation units were 20` long container, 40` long container and the last option was something else in the logistics questionnaire (see Figure 14). The option of something else counted the major amount with percentage of 70. The second used transportation unit was 40` long container with percentage of 18 and 20` long container was third with percentage of 12. Something else alternative probably includes the semi-trailer option which was not an alternative in 2009.

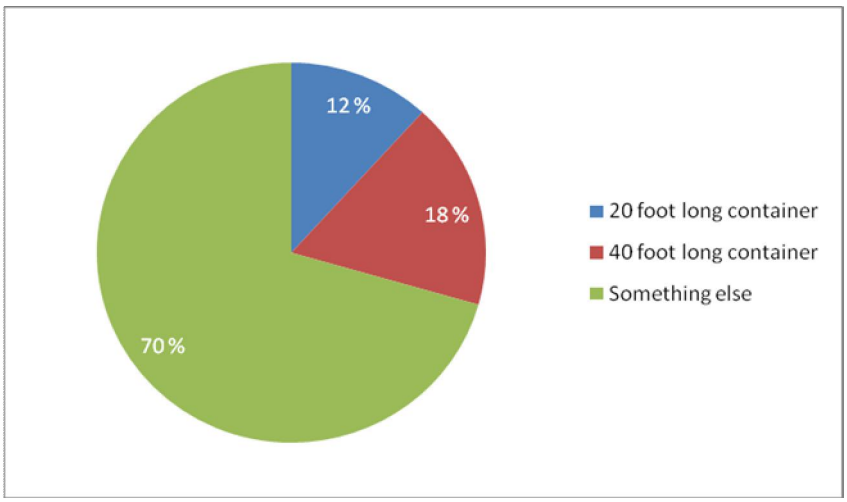

Figure 14. Container types in 2009 questionnaire (n=34)

In 2009 the share of 20` long container is the smallest again. Something else and 40` long container summed together counts 88 percent. Assuming that something else includes also the semi-trailers, it can be said that these transportation units play a key role in transportation in Finnish and Swedish companies. Total amount of answers were 34 in 2009. Those who answered something else as their option, in total twenty-three, fifteen of those are Finnish companies and the rest eight are Swedish companies. In 2006 questionnaire were not asked the transportation unit.

Based on answers from 2010, a semi-trailer is the most used transportation unit. This is a clear characteristic in Finnish companies. Nevertheless the semi-trailer is the most used transportation unit, it does not differ greatly from standard 40` long container (2 TEUs). That is the most probable reason for general use of TEU measurement unit in logistics. The semi-trailer with dimensions of 13.6 m (length), 2.55 m (width) and 2.70 m (height) is almost same like a standard 40` long container with dimensions of 12.0 m (length), 2.35 m (width) and 2.39 m (height) (Kaukokiito, 2008; Maersk Line, 2010). This means that one semi-trailer equals almost a one FEU and two TEUs (Table 2). The payload in a semi-trailer is around 27 tonnes and it is same, around 28 tonnes, in 20` and 40` long containers (Kaukokiito, 2008; Maersk Line, 2010). In 2009 were not this semi-trailer option in the questionnaire and then most answers were from alternative of something else. In both examined years, 20` container have a minor role according to answers. Anyhow, in companies and in this thesis it is widely used the TEU to measure freight flows.

6.4 Modal split of transportation

According to results from 2010 (n=15), it can be said that road transportation is evaluated to be most used transportation mode. Each respondent has estimated the share of each transportation mode which equals 100 percent in total. Only answers meeting this requirement have been taken into consideration. The second mostly used transportation mode is sea transport followed by air and rail transport. In the following Figures between 15 and 18 is seen all 15 answers and how much each transportation unit counts of 100 percent in 2010 survey.

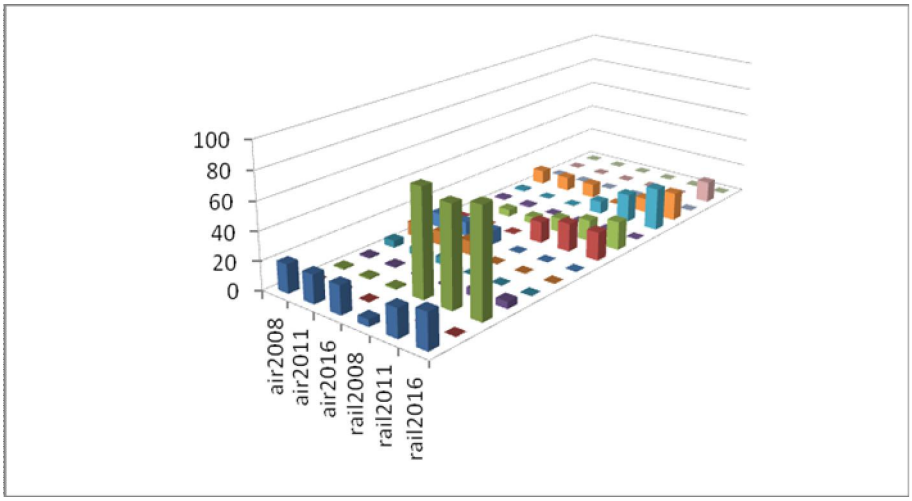

Figure 15. Answers of air and rail transportation in 2010 survey (n=15).

Air transportation has not a significant role (Figure 15). Eight keeps the development constant and two thinks that amount decreases. There were no answers that indicate any kind of growth and five put zero percent to that air transportation mode. When it comes to rail transportation, seven estimated a growth in the future. One estimated constant situation, but no one said that rail transportation will decrease. A bit surprisingly seven answered that they have no rail transportation in their use at all.

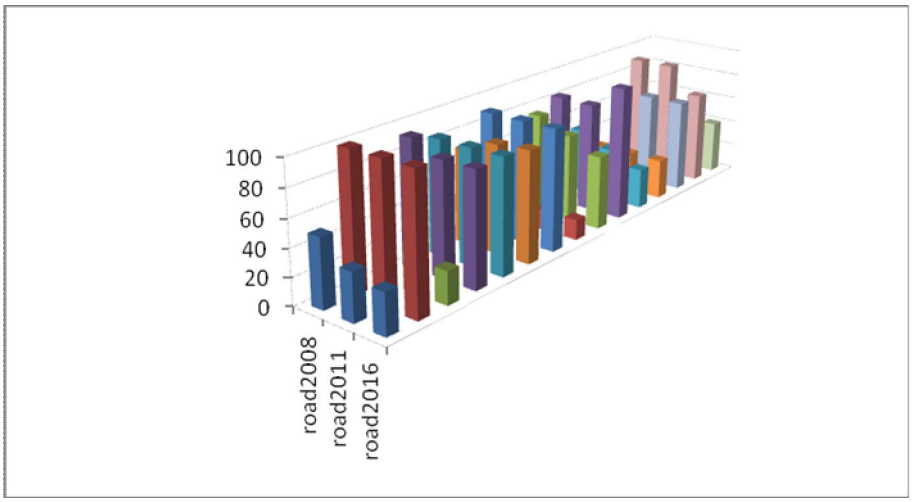

Figure 16. Answers of road transportation in 2010 survey (n=15).

When analyzing results of road tranportation and its development in the future, it can be said that amounts are estimated to be constant or they are a bit decreasing (Figure 16). Eight of all estimated that amount stays constant and five estimated a

decrease until 2016. Only two of respondents estimated that road mode would increase in forthcoming years.

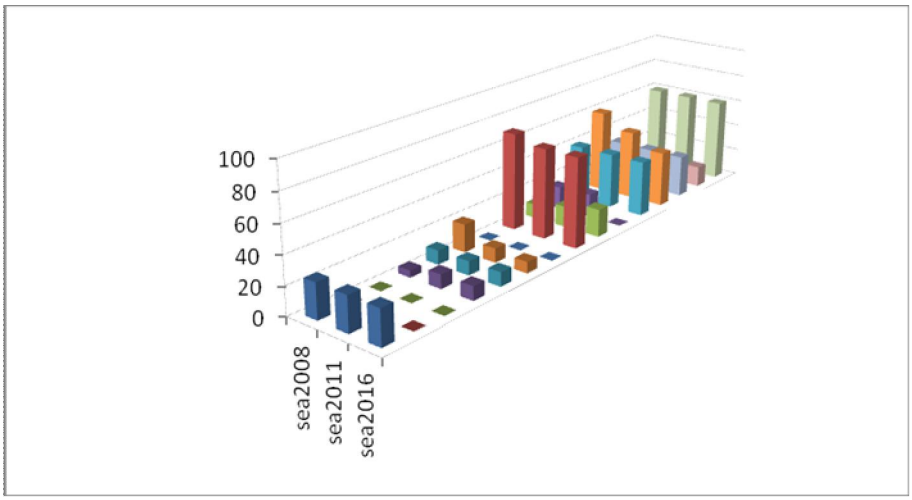

Figure 17. Answers of sea transportation in 2010 (n=15).

Development of sea transport shows that five estimated it to be constant (Figure 17). Four says that sea transportation is decreasing and three says that this mode is increasing. Three of all said that they have no sea transport at all putting zero amounts to the answer sheet.

Most often respondents answered that road transportation is the most used transportation unit with percentage around 60. Sea transportation is a bit more than 20 percent and rail is crossing the 10 percent share in the future. Air transportation mode seems to be around 5 percent of all. The following Figure 18 shows the overal picture of transportation modes in 2010 and future development trends.

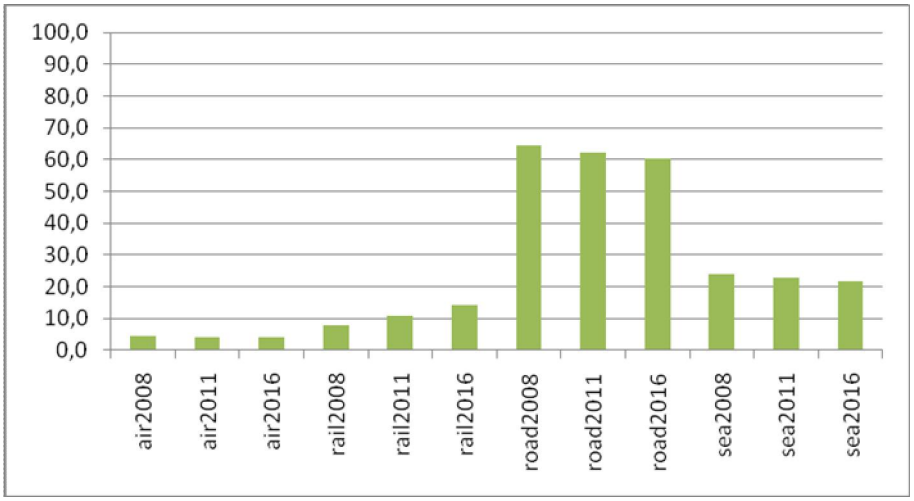

Figure 18. Modal split of transportation in 2010 (n=15).

Road transportation mode is decreasing and slightly sea transportation also. Rail mode is growing and the air transportation is staying stable. There is no doubt that road mode has the major role.

Like in year 2010, also in 2009 road is mostly used transportation mode. The second most used is sea transport, followed by air and rail transportation.

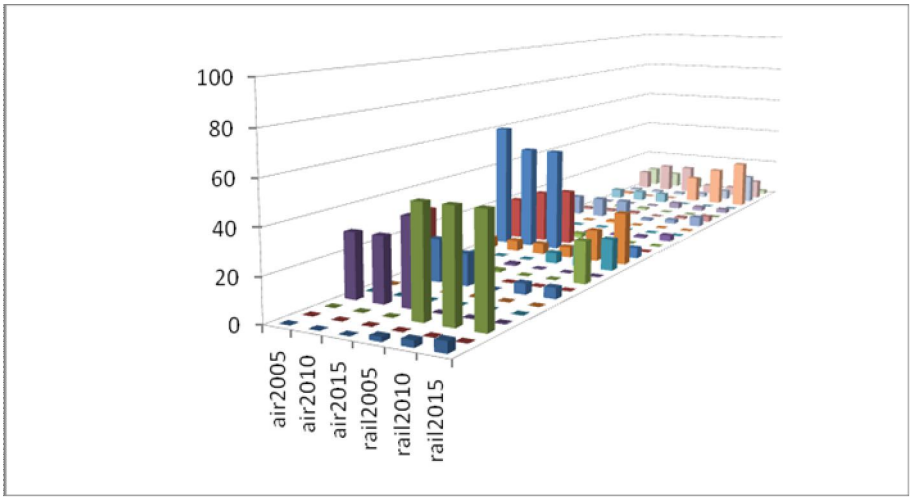

Figure 19. Answers of air and rail transportation in 2009 (n=27).

In air transportation mode, five of respondents estimate a growth, seven think a constant situation and five believe a decrease (Figure 19). Ten had no air transport at all. When it comes to rail transportation, thirteen believes an increase, two says

that mode stays constant and one thinks that this mode decreases. Eleven said that rail transportation is not their option.

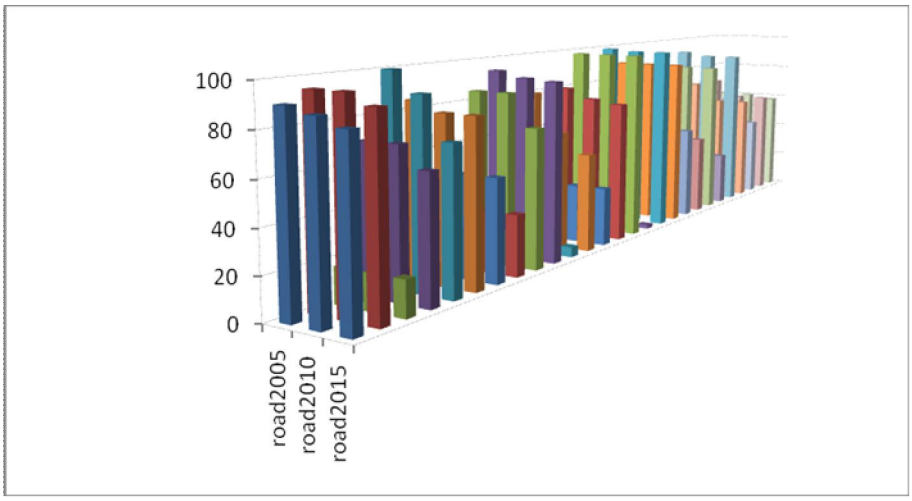

Figure 20. Answers of road transportation in 2009 (n=27)

The development of road transportation seems to be stable or a bit decreasing according to results from 2009 (Figure 20). Eight of all answered that amount stays constant. Seventeen of answers indicated a decrease, this might look large amount because to this group have taken consideration also one percent change. Two of all estimated that road transport will increase in the future.

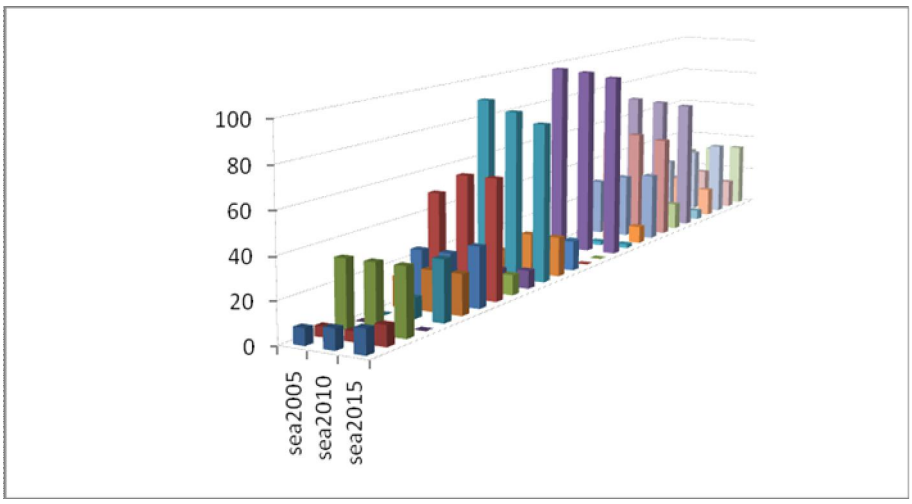

Figure 21. Answers of sea transportation in 2009 (n=27).

Development of sea transportation is believed to grow (Figure 21). Fourteen said that this mode will increase. Five answered that sea mode stays constant and five

said that this mode will decrease. Three had no logistics functions in sea transport mode.

The share of road transportation is between 60 to 65 percent (Figure 22). Sea transportation`s share is around 25 percent. Air transportation`s share is less than 10 percent and rail around 5 percent.

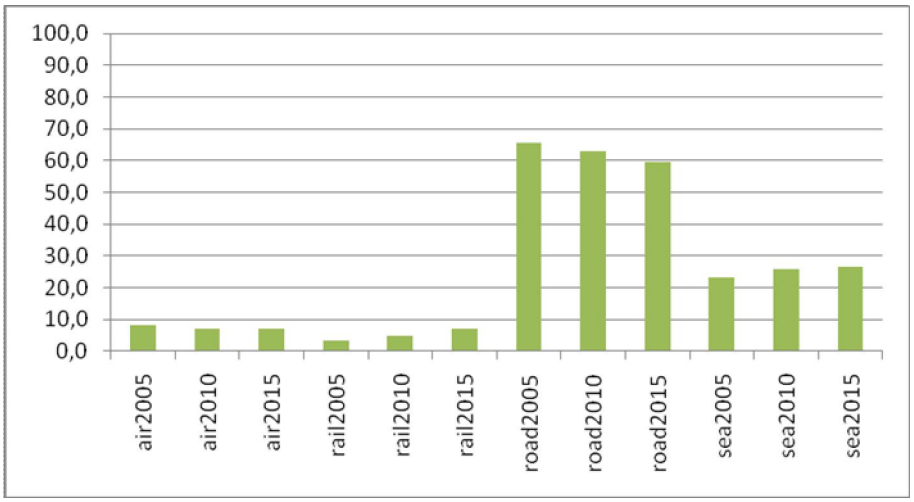

Figure 22. Modal split of transportation in 2009 (n=27).

In 2009 the road transportation is the most used mode like in 2010 and this amount is estimated to decrease. The second used modal split of transportation is sea and this mode is growing. Air freight is less than 10 percent and stays constant. The last mode is rail, just with around 5 percent, but it is seen that railway transportation is achieving more interest.

Survey results from 2006 show also that road transportation is the most used transportation mode. Then comes sea, air and rail transport modes. Sample size is the largest (n=54) compared to years 2009 and 2010.

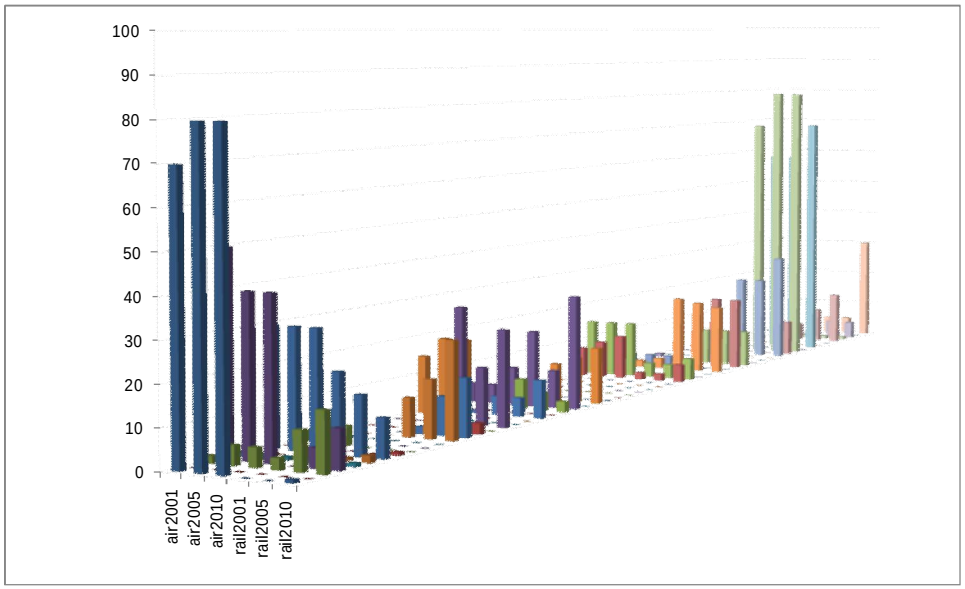

Figure 23. Answers of air and rail transportation in 2006 (n=54).

When it comes to air transportation mode, seven think that it will grow (Figure 23). Seven estimate that it stays constant and three estimated a decrease. Most of answers indicated that companies do not use air transport mode at all. That concerns thirty-seven answers. In rail transport twenty said an increase and three estimated a constant situation. Five estimated a decrease and the largest part, twenty-six do not have rail transport mode in their operations.

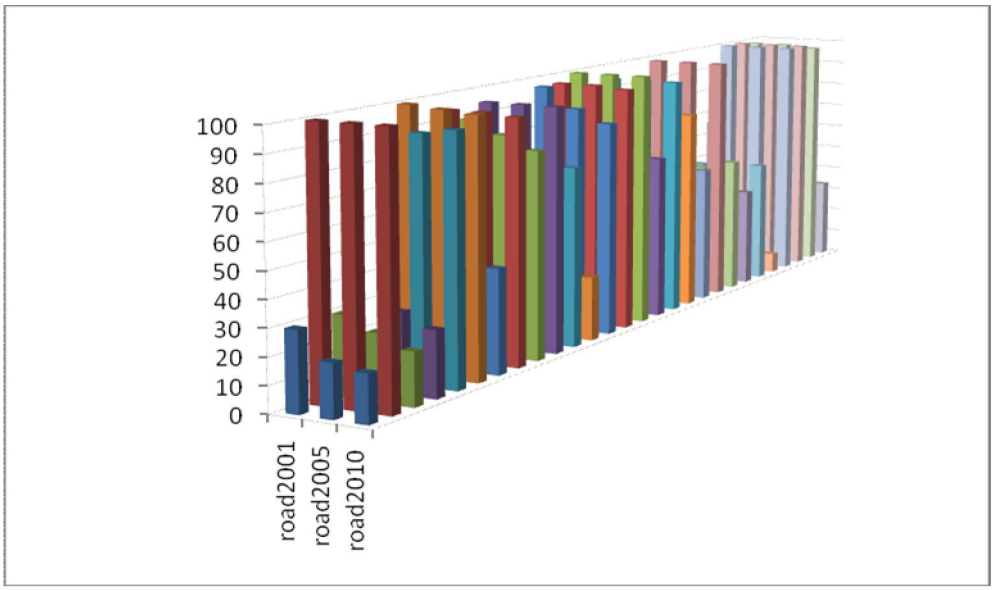

Figure 24. Answers of road transportation in 2006 (n=28 of all 54).

In Figures 24 and 25 answers are dived into two parts concerning road transportation, because of large amount of answers. Total amount of answers were then 54.

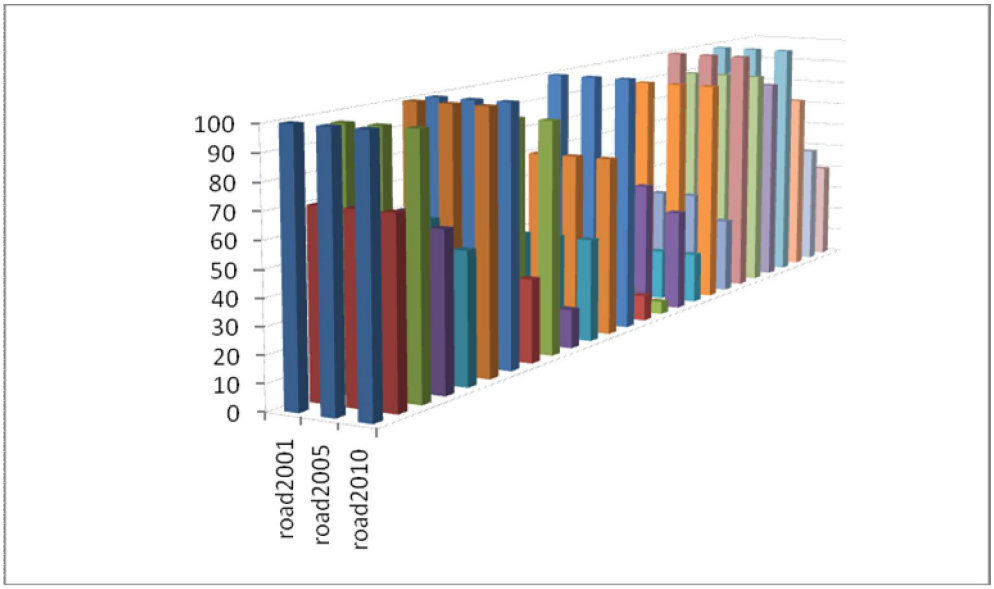

Figure 25. Answers of road transportation in 2006 (n=26 of all 54).

Data of road transportation shows that nine estimated growth and twenty-one estimated road transport keeps its position being constant. Twenty-four thought that amount decreases. To the last category has been taken consideration one percent decreases from 2001 to 2010.

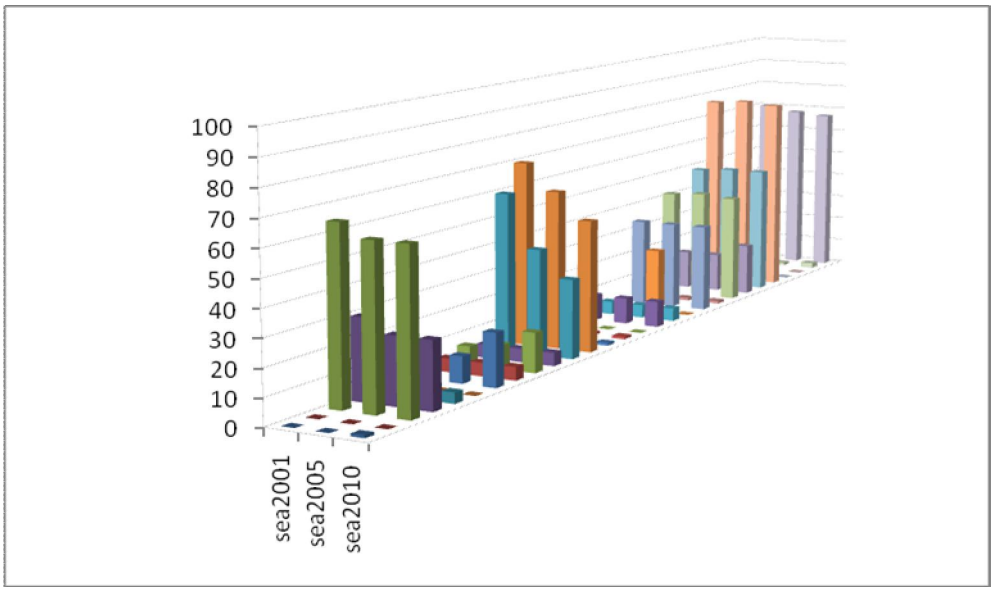

Figure 26. Answers of sea transportation in 2006 (n=28 of all 54).

Sea transportation mode estimations are presented in Figures 26 and 27. It was also needed to divide answers into two parts.

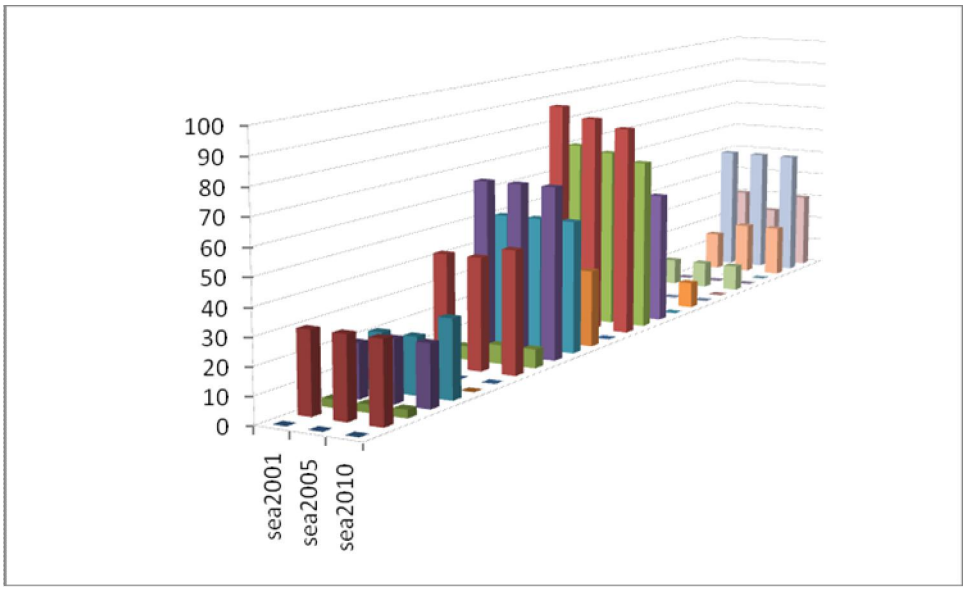

Figure 27. Answers of sea transportation in 2006 (n=26 of all 54).

Sea transportation mode seems to grow based on eleven respondents. Twenty-one think that it stays constant and nine estimates a decrease. Thirteen of all do not use sea transportation at all.

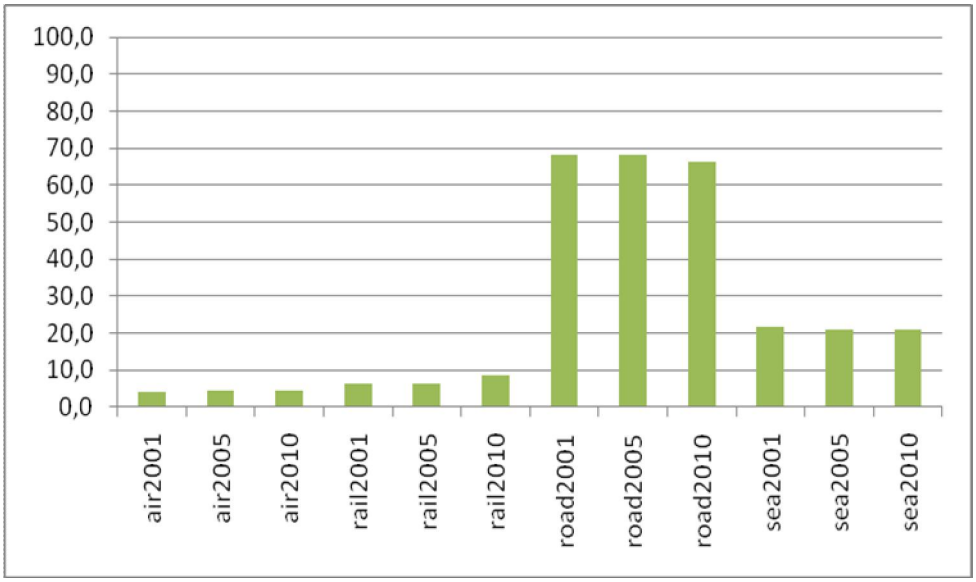

Figure 28. Modal split of transportation in 2006 (n=54).

In 2006 road transport holds the biggest share following by sea. The last two, air and rail have both a minor role. Rail mode seems to increase with two percent, but air transport seems to be constant (see Figure 28).

In all survey years, road transportation mode keeps the first position of all transportation modes. According to questionnaire format, it was not asked more precisely to which direction they use a certain transportation mode. The second used is sea and the last ones are air and rail transport.

6.5 Share of transportation costs

Table 29 depicts the share of transportation costs and each class average. The last and the biggest option, more than 8 percent was rejected maximum up to 10 percent to enable comparable calculation with other classes meaning a class average of 9 percent.

Table 29. Share of transportation costs and class averages.

Share of transportation costs	Class average
1-2 %	1.50%
2-4 %	3.00%
4-6 %	5.00%
6-8 %	7.00%
8-10 %	9.00%

It has been multiplyed class averages with frequencies to get the weighted transportation costs. This amount is then divided with all answers like equation 1 shows. The results of this calculation is seen later in Figure 32.

$$\frac{\sum (\text{Class average [\%]} \times \text{frequencies [n]} = \text{Weighted transportation costs})}{\text{Total amount of answers [N]}} \quad [1]$$

Transportation costs are divided as follows in Figure 29 (n=24-25) according to survey 2010. It is seen that the development of these costs starts from 2008 until 2016 estimate.

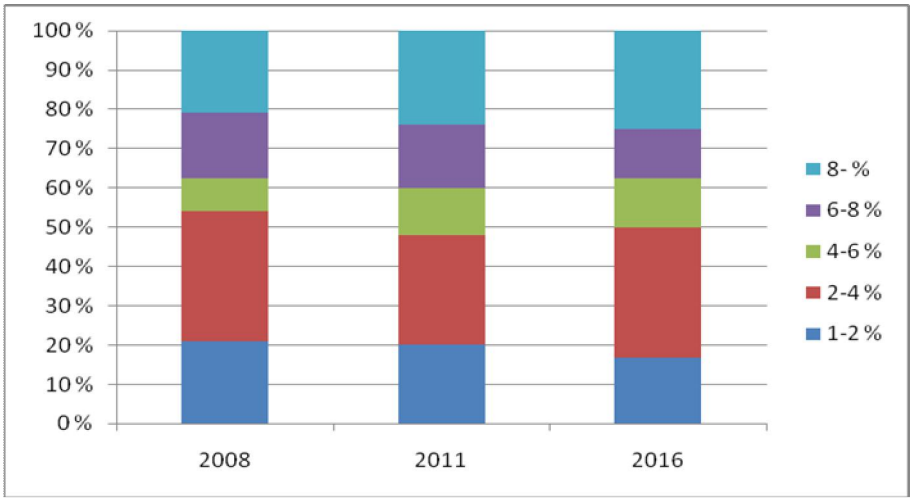

Figure 29. Share of transportation costs from 2010 survey data (n=24-25).

The largest group seems to be 2-4 percent from sales. The second largest groups is more than 8 percent and it grows until 2016. Third largest groups is 1-2 percent following by the group 6-8 percent. The smallest group is 4-6 percent of sales.

The share of transportation costs is seen in the following Figure 30 in 2009. The examined years are 2005, 2010 and 2015. Sample size (n=34) is larger than in 2010.

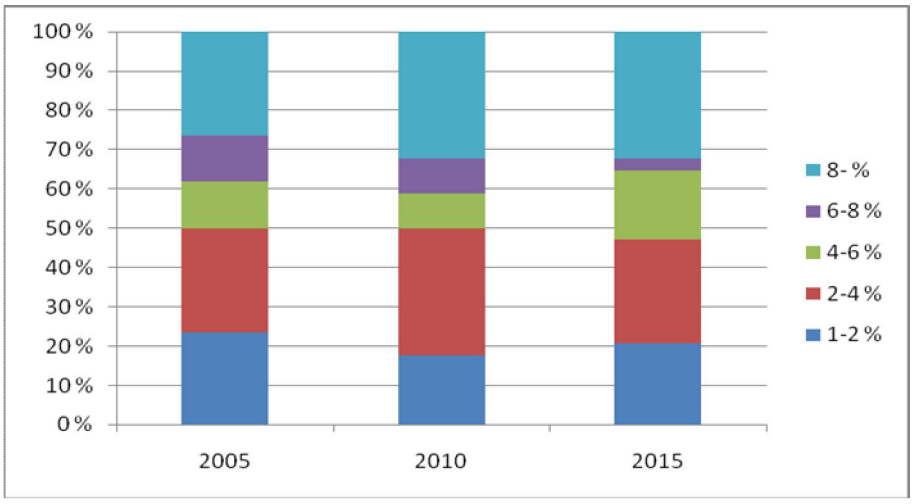

Figure 30. Share of transportation costs from 2009 survey data (n=34).

According to data from survey 2009, most often transportation costs of sales are more than 8 percent. Almost same share has the group of 2-4 percent. Third largest group is 1-2 percent following by the group of 6-8 percent and 4-6 percent. The last mentioned group seems to be twice as much in 2015 than in year 2010. A clear increase can be seen.

The share of transportation in 2006 can be seen in the following Figure 31. The examined years are 2001, 2005 and 2010. Sample size (n=61-62) is the largest from these three survey years.

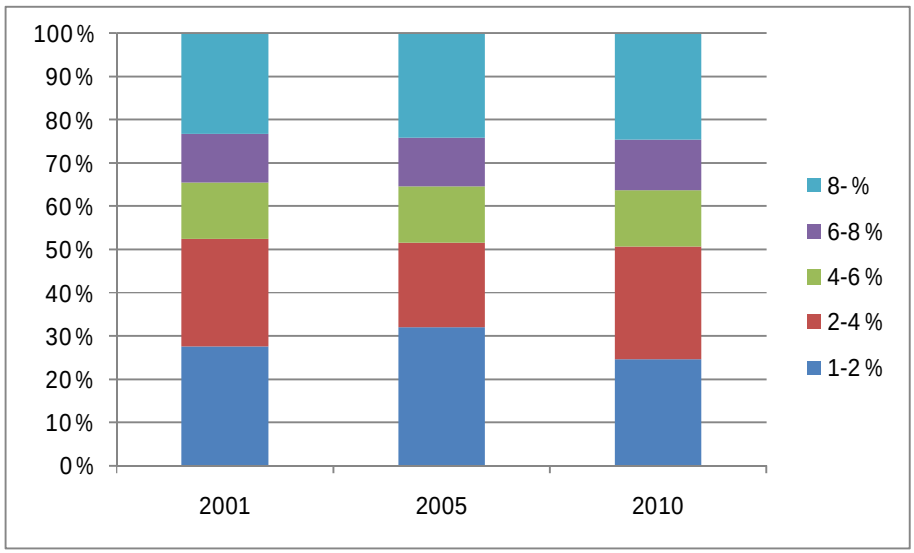

Figure 31. Share of transportation costs from 2006 survey data (n=61-62).

Based on the data from 2006 questionnaire, companies have estimated most often that transportation costs are more than 8 percent or between 1-2 percent. Third largest group is 2-4 percent and the fourth is the group of 4-6 percent. The smallest group is 6-8 percent.

Nevertheless the sample sizes differ in these surveys, the results seem to be quite same. The transportation costs of companies are most often more than 8 percent of sales (weighted amount calculated as 9 percent). This might also indicate that costs of transportation are much more than informed amounts. The reality might be different and companies` transportation costs shares are probably much higher than analyzed in this survey. The Figure 32 below describes how companies have

estimated the future development of transportation costs. All three survey data results can be seen.

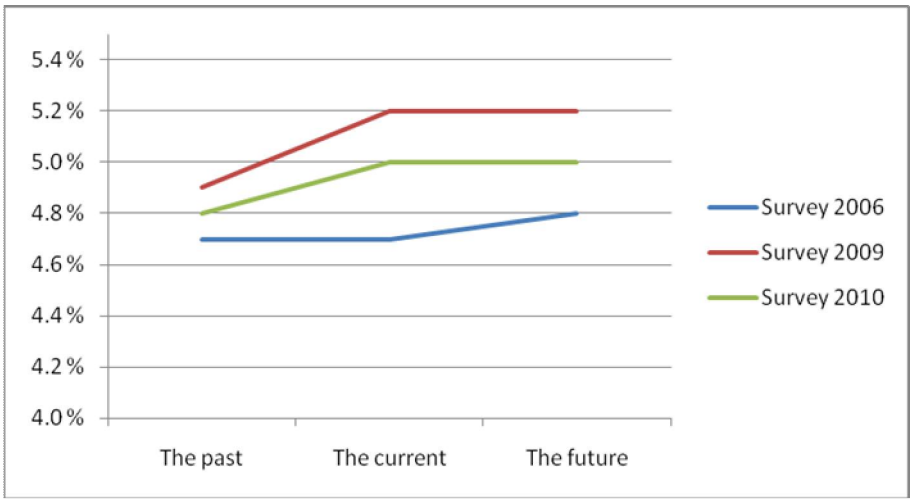

Figure 32. Average transportation costs of three survey years.

The newest data shows that average transportation costs are around 5 percent. It is estimated to be same also in the future. Data from 2009 shows that in the past costs have been lower and costs will increase after that. However, it is estimated that in the future costs will stay at the same level. Results from year 2006 differ a bit, the past and the current has been estimated to be at the same level, but it has been estimated some growth in the future. The future estimation of year 2006 has been quite realistic with 4.8 percent, because in surveys 2009 and 2010, the average transportation cost in the past was estimated to be 4.9 percent and 4.8 percent.

6.6 Annual cargo volumes between Europe and China

Figure 33 depicts frequencies of answers about different container classes between Europe and China based on the survey results 2010. When analyzing the frequencies, it could be said that the first container class has been the most general according to answers. One of respondents has answered that company`s annual cargo volume is between 10 001 to 50 000 TEU in 2011 and 2016. In all classes, blue column indicates answers concerning year 2008, red column shows the

situation on the next year 2011 and the green column depicts the estimation in year 2016. Sample size (n=20-22) of annual cargo volumes is the lowest.

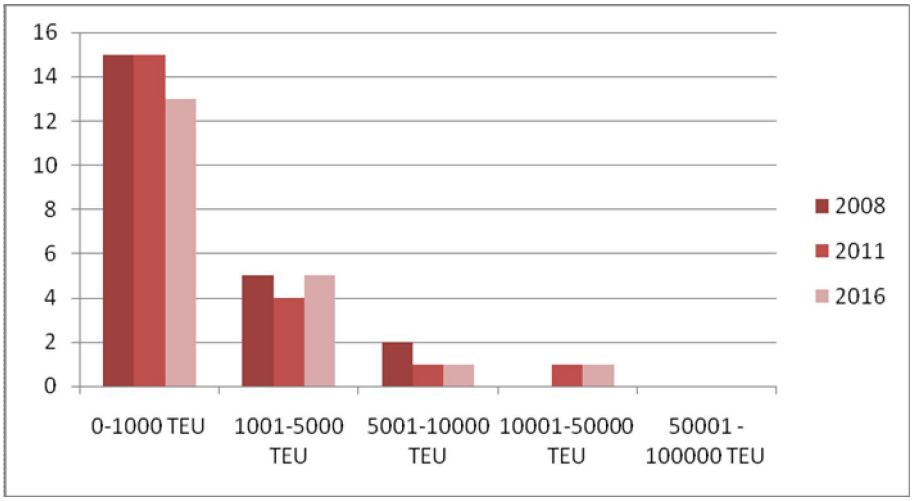

Figure 33. Annual cargo volumes between Europe and China – survey 2010 (n=20-22).

It could be noticed that one response on the second biggest container class means roughly the same amount like all first container classes together. In the biggest container class there were no answers. There were some answers in the second and the third largest container group.

Last year in 2009 (Figure 34) the amount of answers were higher (n=28-29). According to the results, the distribution of answers are same kind like in 2009. When analyzing the three biggest container classes, it could be said that a few companies have chosen these alternatives when answering to the questionnaire.

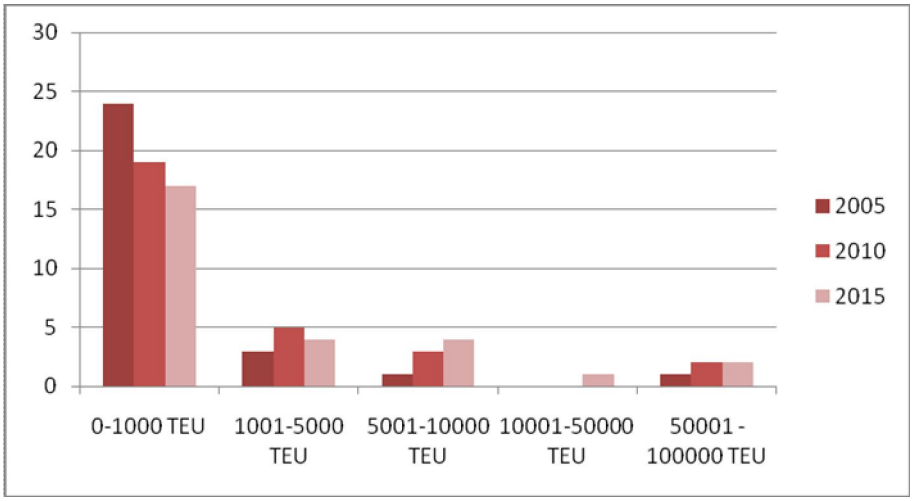

Figure 34. Annual cargo volumes between Europe and China – survey 2009 (n=28-29).

When multiplying the biggest container class with the frequencies, it means much more than all first container class amounts together. That means the same decision made earlier. Also it could be noticed that in 2015, there might be some increase in the three biggest container classes. Because these three groups are so large, change in frequencies have a real impact to the transport.

There is a same trend in Figure 35 like in two previous Figures. In the survey made in 2006, the response amount was the highest (n=54-55). Also in the very first questionnaire there seems to be some increasing of frequencies in the three largest container classes. According to results from 2006, there would be some companies with annual cargo volume between 5 001 to 10 000 TEU, between 10 000 to 50 000 TEU and between 50 001 to 100 000 TEU.

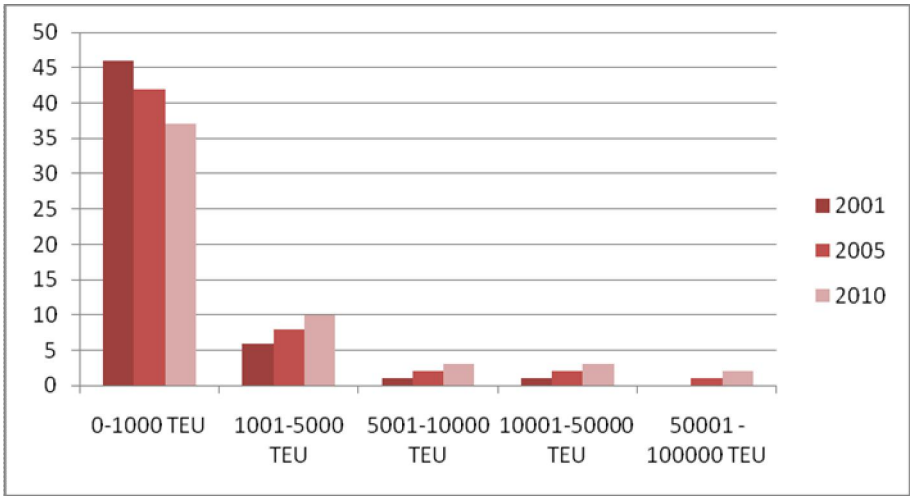

Figure 35. Annual cargo volumes between Europe and China – survey 2006 (n=54-55).

When analyzing the data of all these three years, it could be said that three largest container classes might be increasing. This could indicate some kind of change of annual cargo volumes between Europe and China. Larger container groups play a key role in the future. All these answers were got from three different research years, so these results and indicators can`t be a coincidence.

It can be noticed that in every year it has been estimated some kind of growth in the three largest container groups in forthcoming years between Europe and China. When seeing results from 2006, it is believed that traffic volumes would

increase from level of 2001 until 2010 in the three biggest classes. Same conclusion can be made also according to results from 2009. It is also estimated that annual cargo volume increases from 2005 level until 2015. When investigating results from the newest survey 2010, it can be noticed that the second largest container group is growing again in the future, meaning years 2011 and 2016. All in all, respondents might think that China is a great promise in the future and this is a message of all these three surveys made and this promise has sustainability. Large container amounts will have a significant meaning to cargo flows between investigated countries and the direction of transport affects widely to traffic balance.

6.7 Annual cargo volumes between Europe and Russia

In Figure 36 can be seen that one respondent has estimated annual cargo volume to be over 50 000 TEU in 2016. Also in the second biggest container class, between 10 001 to 50 000 TEU, the frequency is one in years 2008, 2011 and 2016. Most of the respondents have estimated that the smallest container class between 0 to 1 000 TEU best describes company`s situation of annual cargo volumes. In the newest survey response amounts (n=20) were almost the same like in the case of China and Europe (n=20-22).

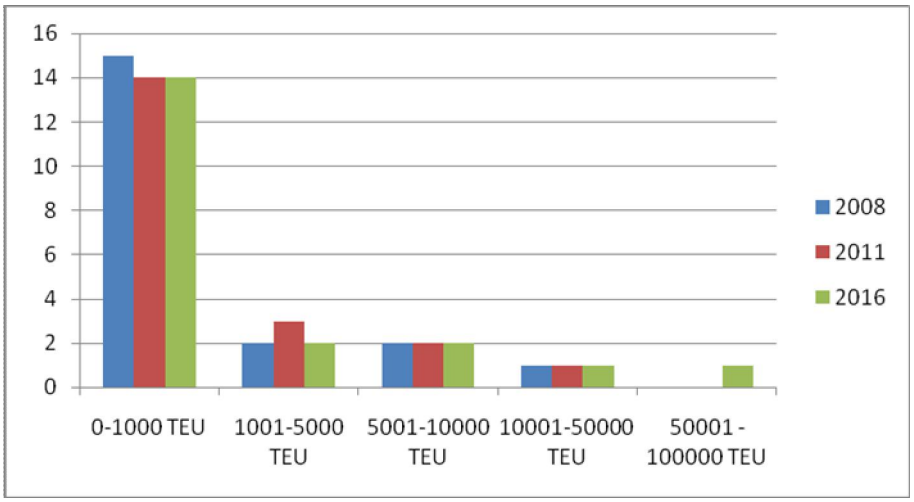

Figure 36. Annual cargo volumes between Europe and Russia – 2010 (n=20)

Like mentioned earlier, one large container class means actually much more than small the smallest container class together. The second largest container class indicates also a major role. Furthermore, large TEU amounts might dominate traffic in the future like the green column in the largest container class in 2016.

In Figure 37 can be seen the estimation of annual cargo volume from year 2009 research. The second largest container group is estimated to grow in a near future. Also the largest container groups have a significant meaning in 2010 and 2015 according to the answers of respondents. Sample size (n=27-29) in 2009 concerning annual cargo volumes is higher than in 2010.

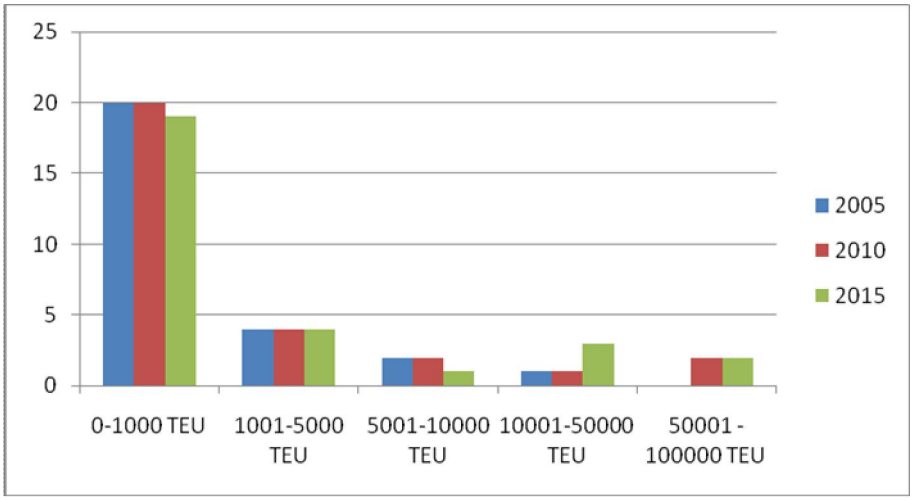

Figure 37. Annual cargo volumes between Europe and Russia – 2009 (n=27-29)

Anyhow, answers concerning this issue do not differ greatly from distribution point of view in five container groups, when compared to results from research year 2010. According to results from 2009, it can be said that more respondents believe stronger to the increase of the largest container groups meaning much more transport concerning the same company.

Concerning year 2006, it was some kind of indication that the biggest container group would increase. Based on the survey results from year 2006 (Figure 38), it was estimated that this would happen until 2010. When seeing the results from year 2009, it shows that some respondents have estimated annual cargo volume between Europe and Russia to be over 50 000 TEU in 2010 and 2015. Also

sample size (n=52-53) in year 2006 shows that companies have been more willing to answer to the questionnaire.

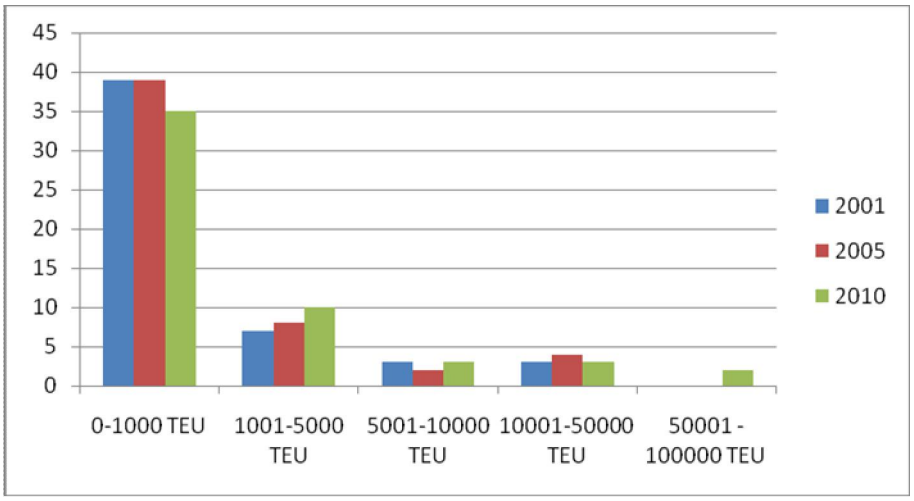

Figure 38. Annual cargo volumes between Europe and Russia – 2006 (n=52-53)

Anyhow, the distribution of container classes is same during all these three years. It needs to remember that possible increase in the biggest or in the second biggest container class would change direction of transport between Europe and Russia.

When it comes to results from these three years, respondents believe to the increase of annual cargo volume between Europe and Russia. This can be seen in every three surveys made concerning the three largest container groups. When it comes to results from 2006, respondents believe to the increase in the largest container group in year 2010. When analyzing results from year 2009, it can be noticed an increase of annual cargo volume in 2010 and 2015 concerning two largest container groups, indicating an overall traffic growth from respondents point of view. According to results from 2010, it is believed traffic increase in the largest container group until 2016. When comparing these results to situation in China, it can be said that between Europe and Russia is same kind of trend, but this trend is a bit lighter in Russia`s situation. Again, the large annual container amounts affect widely to transportation flows and traffic balance.

6.8 Traffic balance between Europe and China

The newest trend shows that traffic from China to Europe is strengthening (Figure 39). The decision is based on the following calculation; traffic from Europe minus traffic from China. An average traffic balance is just an average of all separate traffic balances. If the amount is a negative, it means traffic from China to Europe. Sample size (n=12) is lower than in previous years.

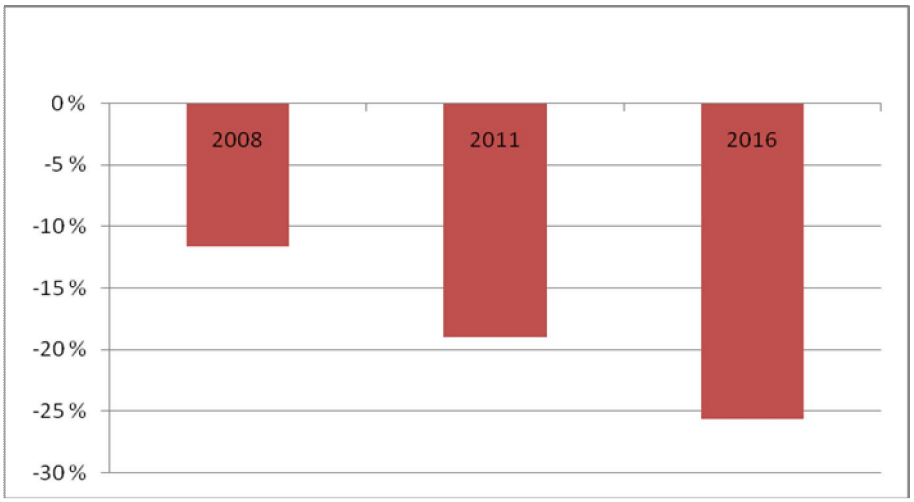

Figure 39. Average traffic balance between Europe and China – 2010 (n=12)

Results show that 12 percent of traffic balance comes from China to Europe in 2008 as an average traffic balance. When analyzing more precisely about the situation of year 2008, three of respondents answered that in their situation traffic comes only from China to Europe. As an opposite of that, three other respondents estimated that traffic comes only from Europe to China. Actually this means that rest of the answers decides the average traffic balance of 12 percent from China. As a result of year 2011, an average traffic balance is 19 percent from China to Europe. When analyzing the results of year 2011, one has answered that traffic comes only from China to Europe. Three of answers indicate that all traffic comes from Europe. Although many have estimated, that between 60 to 80 percent of traffic comes from China to Europe. This explains the average traffic balance from China. When it comes to the future estimations, it shows that traffic from China to Europe would increase to the level of 26 percent. Three of respondents estimated that traffic comes only from Europe to China. Only one of respondents

answered that all traffic comes from China, but there are still plenty of answers, where traffic is estimated to be between 60 to 98 percent from China.

According to the results from 2009, it seems that traffic mainly comes from Europe to China (Figure 40). Results are calculated like previously mentioned. Sample size in this case is almost twice as much (n=20) than in 2010. The average traffic balance is although decreasing from Europe and results from year 2009 differ greatly compared to the results from years 2006 and 2010.

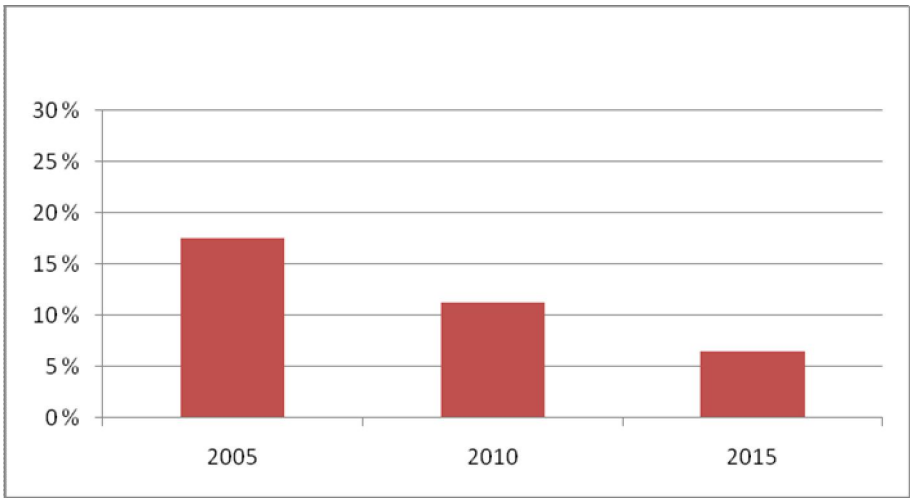

Figure 40. Average traffic balance between Europe and China – 2009 (n=20)

Traffic balance is 18 percent from Europe to China in 2005. When investigating answers concerning year 2005, it could be said that six respondents estimated that all traffic comes from Europe. Five said that all traffic comes from China as an opposite to that. An average traffic balance from Europe to China is 11 percent in 2010. When it comes to estimations of year 2010, six also answered that traffic comes only from Europe. Also there were answers indicating that between 60 to 90 percent comes from Europe. Three answers indicated that traffic comes absolutely from China to Europe. Average traffic balance estimation in 2015 is 7 percent. Based on estimation of year 2015, five said that traffic comes only from Europe. Also there were some estimations between 60 to 90 percent of traffic comes from Europe. As an opposite of that, three of respondents answered that traffic comes only from China to Europe.

In Figure 41 can be seen a change in average traffic balance between Europe and China based on the results from year 2006. Sample size is the largest (n=25) than in surveys made in 2009 and 2010.

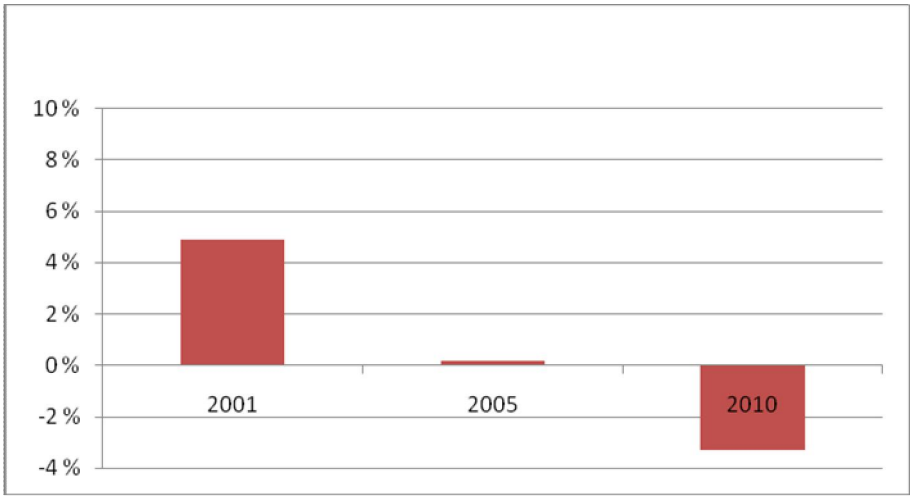

Figure 41. Average traffic balance between Europe and China 2006 (n=25).

Estimation of year 2001 shows that traffic comes from Europe to China with a percentage of five. Nine of respondents estimated that traffic comes only from Europe to China. Furthermore a few of respondents answered that traffic balance is around 90 percent from Europe. As an opposite of these answers ten of respondents had an estimation that traffic comes only from China. Answers concerning year 2005 show that balance is almost exist. Most of respondents have estimated that traffic comes with 100 percent from Europe to China or with 100 percent from China to Europe. Estimation concerning year 2010 shows that traffic balance has changed compared to years 2001 and 2005. Traffic balance is three percent from China. Seven estimated that traffic comes with 100 percent from Europe. Eight of respondents answered that traffic comes with 100 percent from China and two estimated that amount is around 90 percent from China.

After an analysis of these three survey years, a clear trend of traffic balance development can be seen. In all years the trend is decreasing starting from the past estimation until to the future estimation concerning traffic balance between Europe and China. There is a great variation between survey results concerning amounts in all three years, but in all of them is the same decreasing trend. It can

be said that freight traffic with more than 50 000 TEUs have a significant role to traffic balance.

6.9 Traffic balance between Europe and Russia

According to the data from year 2010, traffic from Europe to Russia seems to be decreasing (Figure 42). Traffic balance has been calculated in same way like in a previous sub-chapter.

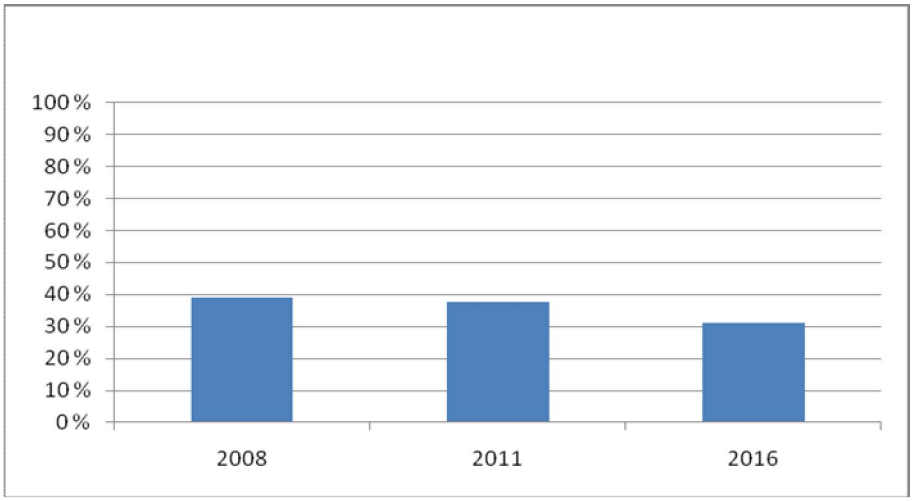

Figure 42. Average traffic balance between Europe and Russia – 2010 (n=12)

An average traffic balance from Europe to Russia is 39 percent in year 2008. When analyzing data of this year, it could be noticed that four of respondents estimated that traffic comes with 100 percent from Europe. Two of respondents answered that situation is an opposite to that. When it comes to other answers, again two of respondents estimated that traffic is equally distributed. In 2011 results show that traffic comes from Europe with 38 percent. According to that year, it shows that three think that traffic comes only from Europe to Russia. Five of respondents think that balance is between 40 to 90 percent to Russia. Only two estimated that traffic is 100 percent from Russia to Europe. An average traffic balance from Europe is estimated to be 31 percent in 2016. According to estimations of year 2016, three answered that traffic comes with 100 percent from

Europe and one answered that traffic comes only from Russia. Five said that traffic is between 60 to 90 percent from Europe.

Based on the results from survey 2009, traffic from Europe to Russia was estimated to be around 50 percent in all years (Figure 43). According to the results, the balance is a bit changing from 2005 to 2015. Answers from 2009 shows slightly a decrease and results from 2010 strenghten the same trend.

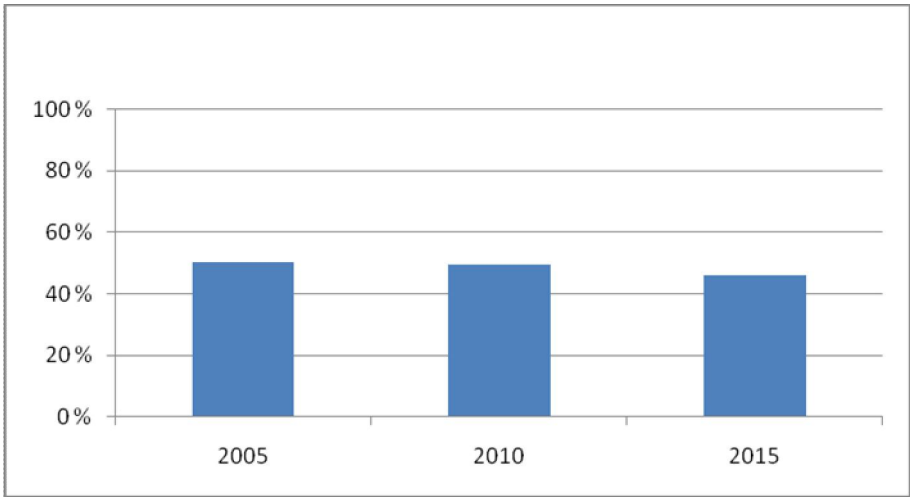

Figure 43. Average traffic balance between Europe and Russia – 2009 (n=23)

It is estimated that traffic balance is 50 percent in 2005 from Europe. Twelve of respondents answered that in their companies traffic comes only from Europe to Russia in year 2005. Five of respondents answered that all traffic comes from Russia. Traffic balance in 2010 is almost the same like in 2005, with percentage of 49. Eleven of respondents estimated that in year 2010 all traffic comes from Europe. As an opposite of that, four of respondents answered that all traffic comes from Russia. When it comes to traffic balance to year 2015, it is calculated to be 46 percent from Europe. When analyzing the answers regarding 2015, ten estimated that all traffic comes from Europe and there were also many respondents that estimated this amount to be around 90 percent. Only four answered that traffic comes only from Russia.

Based on survey results from year 2006, it can be said that traffic from Europe to Russia has been more active when comparing to the results from years 2009 and

2010. Figure 44 shows the estimation from survey 2006. In that year the sample size (n=31) was the highest.

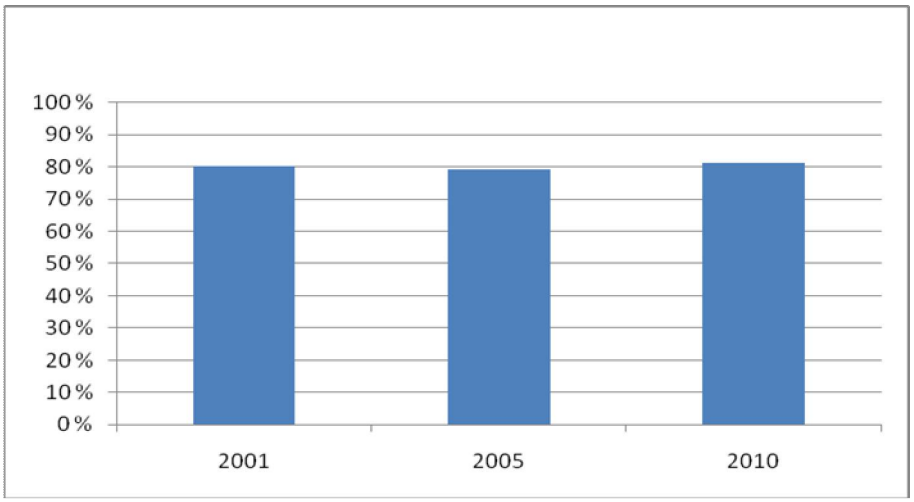

Figure 44. Average traffic balance between Europe and Russia – 2006 (n=31)

Based on the first survey 2006, the traffic from Europe to Russia was high. The balance percent was around 80 percent from Europe to Russia in all three examined years. Concerning year 2001, twenty-two of respondents answered that traffic comes with 100 percent from Europe. Also there were six answers with estimation of between 80 to 90 percent of traffic comes from Europe and two said that 100 percent of traffic comes from Russia. In 2005 twenty-one answered that all traffic comes from Europe to Russia and only had opposite answer. Answers regarding year 2010, show that eighteen of respondents estimated that traffic comes only from Europe and no one said that all traffic comes only from Russia.

When investigating results from all three years, it can be said that no great variation is seen concerning the past, the current and the future estimation. The most recognizable fact is that the level of traffic balance is significantly different in all years. In 2006 the traffic balance is around 80 percent from Europe to Russia. In 2009 the traffic balance is 50 percent from Europe and in this year 2010, amounts are around 30 to 40 percent from Europe to Russia. All in all, the level of traffic balance does not change remarkably meaning that the past, the current and the future estimation stays somehow constant. Anyhow there is decreasing trend, when comparing survey results from three years.

6.10 Weighted TEU

When multiplying class averages (TEU) with traffic balance (percent), the weighted TEU can be calculated (equation 2). In the largest container class the maximum amount was estimated to be 100 000 TEU. That is because in the questionnaire format was an option more than 50 000 TEU without maximum limits and it needed to define that maximum limit.

Class average [TEU]× traffic balance [%] = Weighted TEU *[2]*

In Table 30 is defined all averages of five different container classes. When calculating the weighted TEU amounts, the traffic balance define the direction of transport. In our calculations, if the amount has a negative number, it means that traffic comes from China or from Russia.

Table 30. Five different container classes and their class averages.

Container class	Class average
0-1 000 TEU	500 TEU
1 001-5 000 TEU	3 000 TEU
5 001-10 000 TEU	7 500 TEU
10 001-50 000 TEU	30 000 TEU
50 001-100 000 TEU	75 000 TEU

For example, if someone has estimated that annual cargo volume between Europe and China is between 0 - 1 000 TEU in a certain year, the average of container class is then 500 TEU (Table 30). Furthermore, if respondent has answered that traffic is 20 percent from Europe to China and 80 percent from China to Europe, traffic balance is then -60 percent meaning that traffic comes from China to Europe. When multiplying this 500 TEU with -60 percent, weighted TEU amount is -300 TEU.

6.10.1 Weighted TEU between Europe and China

It can be noticed that weighted TEU amounts are increasing from China to Europe (Figure 45). Red column is an average of weighted TEU. Blue column indicates traffic from Europe and green indicates traffic from China. Estimation about the past situation from year 2008 is -800 TEU, concerning year 2011, it is quite a near to -2 500 TEU and based on the answers of respondents in year 2016, weighted TEU will be almost -3 000 TEU meaning traffic from China to Europe. Sample size (n=12) of this category is lower than in 2006 and 2009.

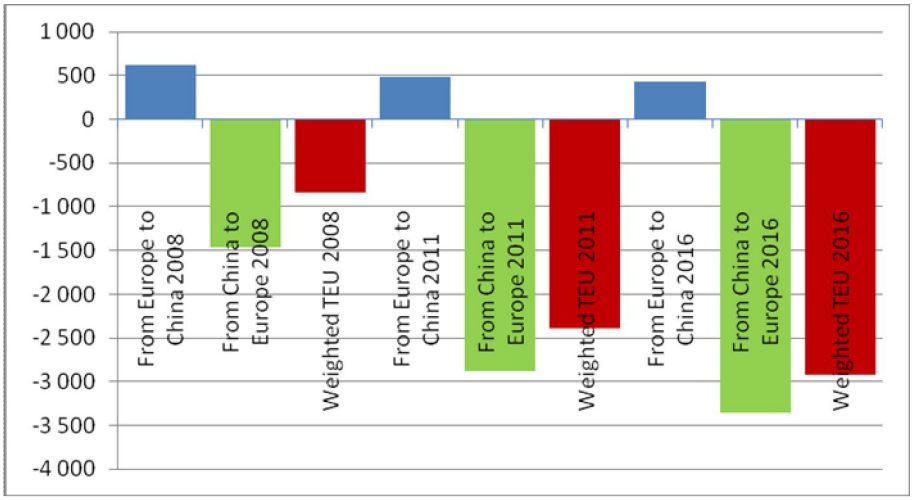

Figure 45. Weighted TEU between Europe and China – 2010 (n=12)

When it comes to weighted TEU in years 2008, 2011 and 2016, about half of all answers were around 500 TEU from Europe to China or vice versa. Four of all in 2008 are more than one thousand TEU and three of them are negative amounts. Weighted TEU amounts are more than one thousand in year 2011 three times meaning two -2 400 TEU and one -24 000 TEU. In year 2016 most recognizable amounts are three -2 400 TEUs and one -27 000 TEU. It could be said that an average of container class has most impact to the amount of weighted TEU. Reason for massive weighted TEU amount is mainly a huge amount of annual cargo volume. Percentages decide then to which direction traffic goes.

Because the weighted TEU is a negative in all examined years 2005, 2010 and 2015, the traffic comes from China to Europe according to the results from survey

2009 (Figure 46). In 2005 weighted TEU is -1 500, in 2010 -5 900 and in 2015 -5 600 TEU. Those TEU amounts are higher compared to results from 2010. If respondent has estimated annual cargo volume to be in large container group class, it logically highlights the weighted TEU in a certain year. Also the sample size (n=20) is larger than in 2010.

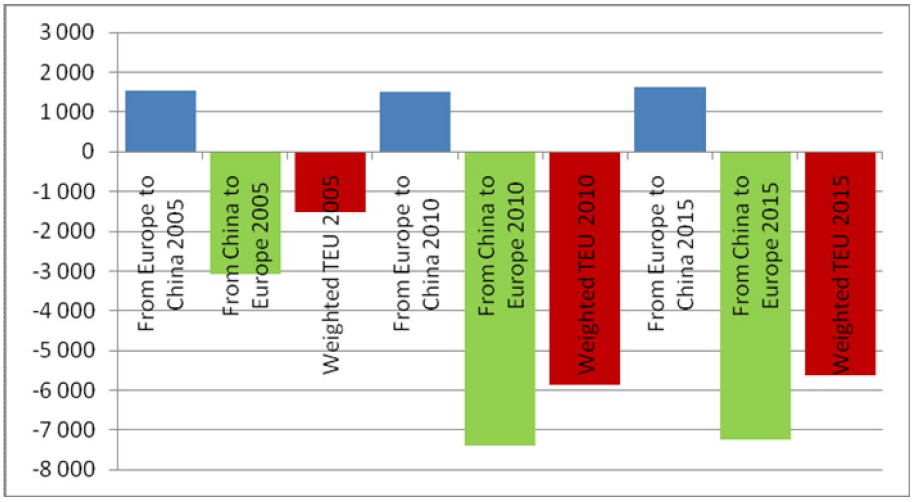

Figure 46. Weighted TEU between Europe and China – 2009 (n=20)

In year 2005 separate amounts of weighted TEU are more than one thousand four times and three of them are negative amounts. One of them is -30 000 TEU. It could be said that this have a massive impact to the average amount of -1 500 TEU in year 2005. When it comes to amounts in year 2010, two of them are over -45 000 TEU and one -7 500 TEU and also one 7500 TEU. These are the most probable reason to the average TEU of -5 900 in 2010 from China to Europe. Results from year 2015 are almost same kind like in 2010. Average amount is only a bit smaller and when examining unique answers, there is one amount of -37 000 TEU and one -75 000 TEU.

When analyzing the results from 2006 (Figure 47), the traffic has increased from China to Europe. Many separate weighted TEU amounts are around 500 from Europe or from China in all examined years. In 2001 weighted TEU is -1 400 TEU, -2 300 TEU in 2005 and -2 600 TEU in 2010. Sample size (n=25) is largest in these three different surveys.

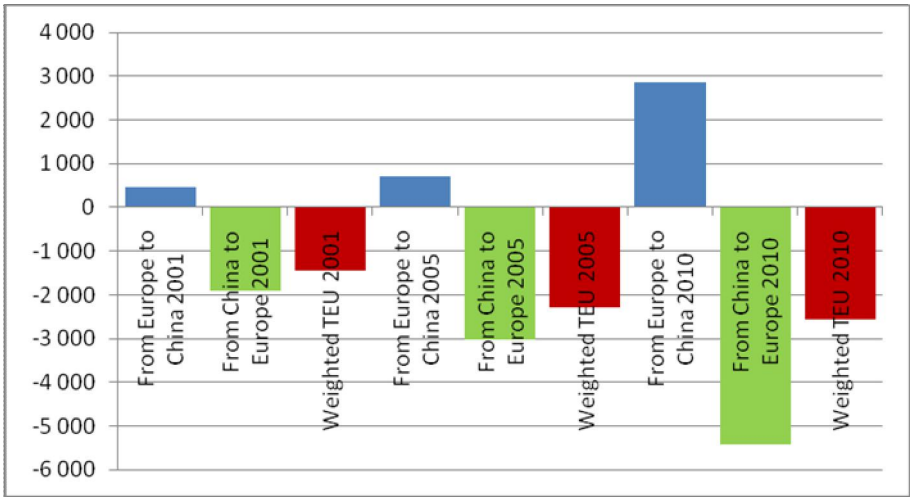

Figure 47. Weighted TEU between Europe and China – 2006 (n=25)

According to year 2001, there are six answers more than one thousand TEU and one of them is -30 000 TEU. The rest are 3 000 TEUs two times, -3 000 TEU also twice and one with -7 500 TEU. When it comes to year 2005, nine of all are more than one thousand TEU to both directions. Two of these are -30 000 TEU. Rest are around 3 000 to China or to Europe. Results from 2010 show that twelve answers are over one thousand TEU. Three of them are -30 000 TEU and one is 30 000 TEU. These large amounts logically explain the average weighted TEU -2 600 in year 2010.

Based on all three surveys, weighted TEU amount from China to Europe is increasing in forthcoming years. In every year we have got different amounts, but all these three Figures indicate the same trend. Also large annual cargo volumes affect to the overall results, how much traffic comes from China to Europe and traffic balance decides to which direction traffic goes.

6.10.2 Weighted TEU between Europe and Russia

Like Figure 48 shows, weighted TEU between Europe and Russia has been changed from a positive amount to a negative. It might be an indication of traffic flow change where traffic mainly comes from Russia to Europe in the future. The red column indicates the average weighted TEU. Blue column indicates traffic

from Europe to Russia and yellow indicates traffic from Russia to Europe in examined years. Weighted TEU in 2008 is 700 TEU, in 2011 it is 125 TEU and in 2016 estimated to be -2700 TEU. Sample size (n=12) in 2010 is lower than in 2006 and 2009.

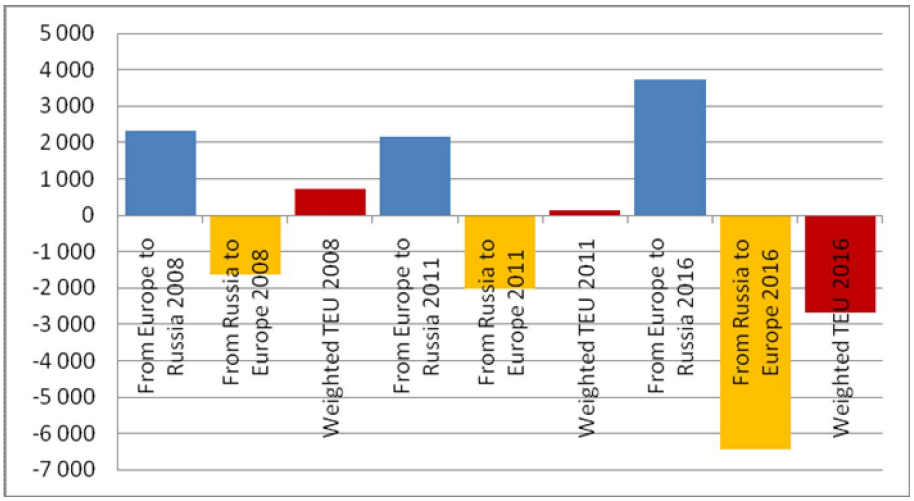

Figure 48. Weighted TEU between Europe and Russia – 2010 (n=12)

When it comes to separate results of weighted TEU from 2008, three of them are more than one thousand TEU. Two of these are positive ones, 3 000 and 6 700 and one is -3 000 TEU. When analyzing results from 2011, four of total are more than one thousand. Three of them are positive; 1 800, 3 000 and 2 700 and one is negative one -7 500. These four amounts summed together is around zero, so it might be an explanation for a balanced traffic. There are five results where amounts are more than one thousand in year 2016 estimations. Two of these are negative amounts -15 000 and -30 000 and the rest three are 1 800, 3 000 and 6 700. These two negative amounts have a significant effect to the results of year 2016.

In Figure 49 can be seen weighted TEU development from 2005 to 2015. Those results show that traffic increase from Europe to Russia according to survey results from year 2009. Results differ greatly from data of year 2010. Weighted TEU is 1 500 in 2005, 6100 in 2010 and 7 100 in 2015. Sample size (n=23) is larger than in 2010.

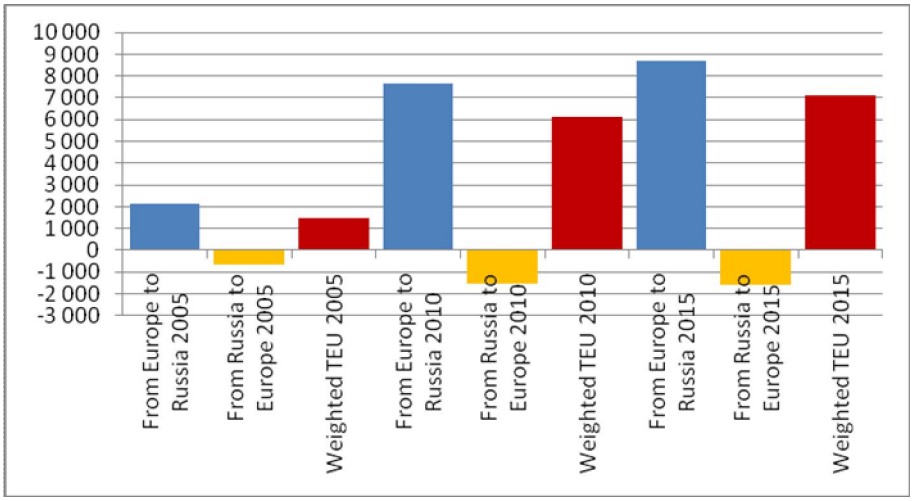

Figure 49. Weighted TEU between Europe and Russia – 2009 (n=23)

Results from year 2005 show that seven of all are between 2 700 to 7 500 TEU, meaning traffic from Europe to Russia. All of them are positive amounts. When it comes to results from 2010, eight of all are between 2 400 to 75 000 TEU. This scale is very large and it includes three large amounts like 18 000, 22 500 and 75 000 TEU. This has a significant effect of weighted TEU in 2010. According to estimation from 2015, nine of all answers are more than one thousand. Four large amounts are 18 000, 22 500, 30 000 and 75 000 TEU.

Figure 50 shows same kind of results than in Figure 49 can be seen. In these cases weighted TEU increases in all examined years from Europe to Russia. According to results from 2006, traffic comes mainly from Europe. Weighted TEU is 1 800 in 2001 and 2005, in 2010 it is 3 400 TEU. Sample size (n=32) is the largest compared to years 2009 and 2010.

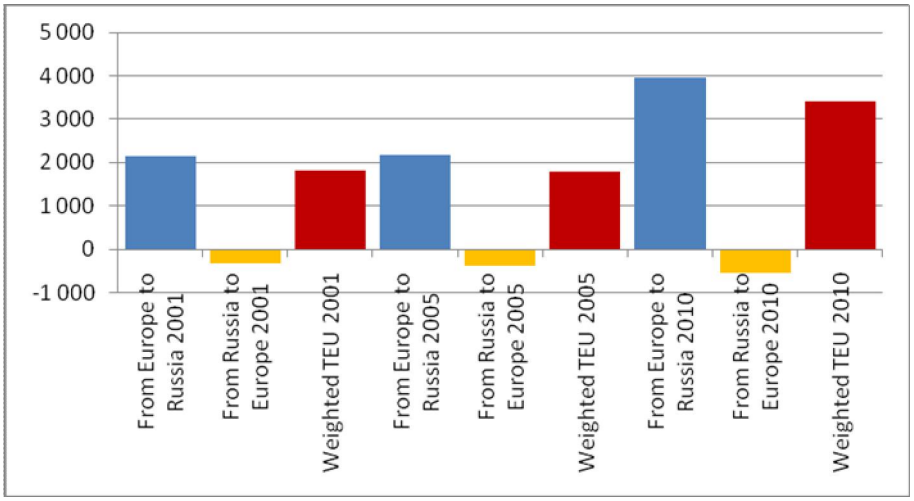

Figure 50. Weighted TEU between Europe and Russia – 2006 (n=32)

Separate weighted amounts from 2001 are mainly around 500 TEU. Seven of them are between 3 000 and 27 000 TEU. In year 2005 eight are between 3 000 and 24 000 TEU. This scale includes mainly amounts around 3 000 TEU and the maximum amount is the 24 000 TEU. When it comes to results from 2010, thirteen of them are between 1 800 and 48 000 TEU. It need to be mentioned that only one reached the amount of 48 000 and the second largest amount is 18 000. The rest eleven amounts are mainly between 3 000 to 7 500 TEU.

Based on the newest results from 2010, weighted TEU amounts seem to change. In that case traffic would come from Russia to Europe. When it comes to results from 2009, weighted TEU was estimated to grow from Europe to Russia and the same trend was recognized from results in 2006. It can be said that the newest findings might be an indication of a change. This might also be an explanation, where companies build factories to Russia because of cheaper energy and raw materials meaning more active transportation from Russia to European countries. Furthermore, based on information from RIA Novosti (2010), the customs union between Russia, Belarus and Kazakhstan will positively impact to the economies of these countries. It is expected that gross domestic product will increase significantly until year 2015. The planned union is estimated to be reality in 2012. These three countries will gain extra revenues by founding this customs union. Concrete changes are same tariffs between these three countries enabled by the integration. (RIA Novosti, 2010)

6.11 Cargo volume distribution

In cargo volume distribution all answers have been divided into three different sections. During this classification has been used information about traffic balance from the data of questionnaire survey from three years. Valid data means only answers where sum of from and to estimations is altogether 100 percent and also when we have information of annual cargo volumes from the same respondent. When percentage is altogether 100 percent, it can be sure that respondent has understood the question of traffic balance and has answered correctly.

When analyzing cargo volume distributions, three different classes were defined. In the first class traffic balance is more than 80 percent or less than 20 percent. In the third class distribution is more than 35 percent in both cases. In the middle (second) class are all values that do not belong to the first or to the third class. According to the data, often answers belong to the first class where distribution is, for example, 80 percent from China or 20 percent from Europe. That`s why it is investigated only this class. Because classification does not tell from which direction traffic comes, it was needed to make a list that best describes the situation. Earlier it was mentioned five different container classes. Because of great meaning of these largest container classes, this was also recognized also earlier in the section of annual cargo volumes, thus container classes are rejected taking off two smallest classes. That means investigation of three biggest classes only.

6.11.1 Cargo volume distribution between Europe and China

According to year 2010, results show that traffic comes from China to Europe (Table 31). These answers include annual cargo volume classes 5 001 - 10 000 TEU and 10 001 - 50 000 TEU with total answers of four. There were two answers in each of these two classes indicating traffic from China.

Table 31. Cargo volume distribution frequencies between Europe and China in surveys of 2006, 2009 and 2010.

Years	**2006**		**2009**		**2010**	
TEU	From Europe	To Europe	From Europe	To Europe	From Europe	To Europe
5 001-10 000	1	3	2	2	0	2
10 001-50 000	1	5	0	0	0	2
50 001-100 000	0	0	0	3	0	0
Total	**2**	**8**	**2**	**5**	**0**	**4**

Results from year 2009 indicate that traffic comes from China taking consideration all answers. Two of respondents answered that traffic comes from Europe and also two answered that traffic comes from China in container class of 5 001 - 10 000 TEU. In the second largest container class were no answers at all. Still, there are three answers in the largest container class. In this case are three answers indicating that traffic comes from China to Europe, resulting on a significant traffic flow.

According to the results from year 2006, it can be said that traffic comes from China to Europe. Three answered that more than 80 percent of traffic comes from China in class of annual cargo volume 5 001 - 10 000 TEU. Five respondents answered that annual cargo volume is between 10 001 - 50 000 TEU. There were no answers in the largest container class. In container classes of 5 001 - 10 000 TEU and 10 001 - 50 000 TEU were one answer in each indicating traffic from Europe to China.

According to Review of Maritime Transport (2009, 26) cargo flows from Europe to Asia was 10 million TEU and from Asia to Europe 17 million TEU in year 2007. The situation concerning cargo flows in 2008 was 10.5 million TEU from Europe to Asia and 16.7 million TEU from Asia to Europe. (Review of Maritime Transport, 2009, 26; Containerisation International, 2009) This shows same result like in this thesis, which includes data from three surveys.

6.11.2 Cargo volume distribution between Europe and Russia

In Table 32 can be seen cargo volume distribution from research years 2006, 2009 and 2010 between Europe and Russia. All these answers are also from the first class, meaning traffic balance more than 80 percent.

Table 32. Cargo volume distribution frequencies between Europe and Russia in surveys of 2006, 2009 and 2010.

Years	**2006**		**2009**		**2010**	
TEU	From Europe	To Europe	From Europe	To Europe	From Europe	To Europe
5 001-10 000	4	0	5	0	2	1
10 001-50 000	3	0	3	0	0	1
50 001-100 000	0	0	2	0	0	0
Total	**7**	**0**	**10**	**0**	**2**	**2**

According to results from 2010, in container class of 5 001 - 10 000 TEU two has answered that traffic comes from Europe. As an opposite of that, one has responded that traffic comes from Russia in the same container class. Also one estimation shows that traffic comes from Russia to Europe in container class of 10 001 - 50 000 TEU. When seeing total amounts, traffic shows to be balanced.

When it comes to results from year 2009 in all container classes, traffic comes from Europe to Russia. Five responses belong to the container class of 5 001 - 10 000 TEU, three answers to the class of 10 001 - 50 000 TEU and also three responses to the largest container class. It need to be noticed that in year 2009 were no answers saying that traffic balance is from Russia to Europe.

Answers from 2006 indicate that traffic also comes from Europe to Russia. Four of respondents have answered that annual cargo volume is between 5 001 - 10 000 TEU from Europe. In the second largest container group frequency is three. In the largest group were no answers. Also, there were no answers saying that balance is more than 80 percent from Russia to Europe. All in all, the distribution seems to change. Earlier the distribution was like that traffic comes from Europe to Russia, but in the future it seems to be an opposite situation.

6.12 Interviews with respondent companies

It was interviewed two companies (company A and B) who answered to the logistics questionnaire in 2010. Semi-structured questionnaire format was used in the interviews (see Appendix 2). The company A operates on chemical industry and the company B on electronic industry. Interviews were made in June 2010.

Company A

When it comes to consequences of this economic downturn concerning company A, the economic recession improves turnover of the company instead of this time has negative effects. It can be said that company A benefits more of these times than suffer. Companies on other industry sectors face more challenging times. Transportation costs have also decreased and it is a benefit for this company. For example, cargo flows to Poland are cheap, but infrastructure is not at the same level like in Finland.

Logistics rules are based on Incoterms 2000. The most used trade term is Ex Works and rarely it is used something else than that. The main benefit is simple use and responsibilities are easy to define. Another benefit of this is cost issues. When using Ex Works, it can be seen total transportation costs and this advocates the use of this term. Partial optimizing in supply chain is not a key and it is more important to get the big picture and manage it well. Logistics functions are outsourced. Almost all goods are transported by trucks, but some marginal materials are transported by plane. Environmental factors will have a more important role in the future, but this has not yet been the number one issue in this company. Environmental factors have been considered on factories, but not yet in transportation.

This company A has recently started a project to construct a factory to Russia and it is evaluated to take around four years. The aim of the factory is to head goods to the Russian market. Currently, goods are transported to Russia and no goods are transported from there. When transporting to Russia, customs procedures and many weeks waiting times are drawbacks. When the new factory is on the Russian

side, transportation to the target groups is much easier and this advocates this construction project. After this period, it affects to the traffic flows from Europe to Russia in a decreasing meaning. A big share of production will move to the Russia and this will cut down production in European factories. Still these European factories will run in the future, but production will be at lower level. Traffic unbalance is more like a feature than the main problem from respondent point of view. There seem not to be a solution for this and empty truck problem will exist in the future.

Company B

It was interviewed one electronic company and logistics manager of it concerning the logistics issues. Production plant locates in Southern Finland and another factory is in China. In Bulgaria is also some production. Company has currently two main products. The first one is produced in Finland and its main export regions are Russia, India and other Far East locations. The other product is manufactured in China and Finland and it will meet new regulations of energy consumption in the future. Target region will be European countries.

Based on interview, the economic recession affected to the company the first six months of year 2009. During this half a year time, production and orders decreased a bit. Anyhow, the situation returned to normal base in summer 2009 and after that production runs like earlier. Still some characteristics can be noticed after this time. A consequence of this time is lower price of raw materials (metal) and this decreases end-prices of products a bit. The main reason is customers` demand for lower product prices, because of lower raw material price. Some problems exist on liquidity issues with some customers. That causes extra work to make sure, is it permitted (unpaid invoices, credit limits) to load goods to the truck or not. On the factory side, the cost of labor is stayed constant like in previous times, so there is no change on that area.

Incoterms 2000 trade terms are used and the most used term is Delivery Duty Unpaid. In some situations it is used Ex Works. All workers and customers know the rules of used trade terms and responsibilities of them. Still it can be said that

DDU trade term demand a lot of work from manufacturer`s side, when it is needed to make sure all scheduling issues are on time and products are ready for transportation.

The most used transportation mode is road transport. When transporting goods, for example to Germany, weight restrictions need to be considered. In Finland it can be transported more heavy loads (30,000-40,000 kilograms with full-trailers) than in Germany (only 24,000 kilograms). Transport to Italy, Austria and Switzerland from Germany is organized by trains. Trucks are loaded to the train and it is heading to the target destination. This solution is used on Sundays, because of driving limitations. DHL is main partner on logistics on the European side.

Environmental issues are nowadays a big issue. To reduce emissions and energy, it will be concentrated on empty and half-loaded containers. In these situations, it is asked from the customer side to order large amounts at the same time and not small amounts meaning a lot of extra work to the manufacturer. Earlier when goods were transported from China to Finland via the Baltic Sea, some delays slowed transportation mainly because of sea ice and heavy wind. Currently these items (goods produced in China) are transported to the warehouse located in Germany, so there are no more problems on that side. There is also a warehouse in Finland.

A few years ago, it has been also planned to build a factory to Russia, but the future is still open. Raw materials (metal) are transported from Russia. When it comes to transportation to Russia, unpredictability, changing rules and terms cause extra work. In these situations the goods do not cross the border to target destination unless someone from manufacturer`s side will go to the border and solve the situation. Safety issues are not the main concern in Russia, but annually between one to two death-causing accidents happen on the roads. From costs point of view, it can be said that transportation costs will increase. This situation is anyhow manageable, when improving the whole logistics network keeping total logistics cost constant like earlier.

7 DISCUSSION

Nowadays China`s economic growth seems to continue and gross domestic product verifies this development. There is also a need for more efficient transportation system in China and more railway network will be constructed in a near future. China has also a major role concerning container ports in world scale compared to other countries. Although there exist some difficulties and problems in transportation system and foreign companies face some problems compared to local Chinese companies. Russian`s gross domestic product decreased in 2009 and the impact of the economic crisis can be seen. In previous years, starting from 2006, the GDP increased annually in Russia.

World Bank estimates the GDP development of world total to increase 3.3 percent both in 2010 and 2011. Estimation of year 2012 shows 3.6 percent annual growth. China`s GDP growth in 2010 is evaluated to be 9.5 percent, in 2011 amount is a bit lower with 8.5 percent and in 2012 around 8.7 percent. In Russia the GDP is evaluated to be positive with 4.5 percent in 2010. Increase is estimated to be almost at the same level in 2011 with 4.8 percent annual GDP growth and 4.7 percent annual growth in 2012. The modest amounts concern the Euro area. World Bank says that annual growth is estimated to be 0.7 percent in 2010, 1.3 percent 2011 and 1.8 percent in 2012. A slight increase can be noticed. (World Bank, 2010d, 15)

Imbalance between continents, countries and large companies is quite obvious nowadays. Shintani *et al.* (2005) says that in freight transport it always exists imbalance between two parties nevertheless which transportation mode is used. (Shintani *et al.*, 2005, 40) OECD Transport Outlook 2010 says that unbalances exist and this trend is increasing (OECD, 2010b, 11). It can be said that many companies face the empty container problem on freight traffic. That means the imbalance of transported goods in a certain company between two destination points. Traffic of Finnish and Swedish companies between China is not balanced. It is more evident that transported goods originate more and more from China and

this development trend is strengthening. When it comes to Russia, traffic from Europe to Russia might be decreasing, based on data of three years (2006, 2009 and 2010). It needs to remember that some companies with large container amounts annually will have a significant impact to this. Based on interviews with respondent companies, it was recognized that plans of factory constructions and openings to Russia are reality. One company has just started many years factory construction project due to benefits operating on the Russian side. The other company has been planning to make some strategic movements to Russia. One main advantage is easiness in transportation. The second is that there are no many weeks waiting times on the borders and uncertainty issues can be avoided.

To investigate traffic flows between countries, new factory inaugurations affect to the traffic balance. Earlier it was transported companies` products mainly from Finland or from Sweden to Russian market according to our survey data, but companies` new factories would change this trend. It would be reasonable to believe that in these situations more products are also headed into Russian markets, when a new plant locates in Russia. When comparing to earlier situation, this affects to transportation flows between Europe and Russia. When it comes to situation between Europe and China, it seems that more and more products will be transported from China. Research results indicate this kind of development. According to Ivanova *et al.* (2006, 22), it is transported more from China to EU area than vice versa and based on information from OECD. Between Sweden and China, situation is closer to balanced situation, but still it is carried a bit more from China to Sweden.

OECD statistics (2010a) show, that from Russia is transported more to Finland than vice versa. These amounts do not include transit traffic from Finland to Russia. Same kind of imbalance exists in trade between Russia and Sweden. Anyhow, unbalance is lower in case of Sweden than in Finland. When analyzing transit traffic between Finland and Russia, it can be said that in road transportation transit traffic is eastbound oriented. Anyway, overall balance according to literature shows that road traffic is also eastbound oriented, when export and

import amounts are taken into consideration. In railway transportation transit traffic is westbound oriented and overall balance is also westbound.

The economic crisis has also affected to currencies between investigated countries. Both Finnish euro and Swedish krona have weakened against Chinese yuan. It means that operating in China will be more expensive for Finnish and Swedish companies.

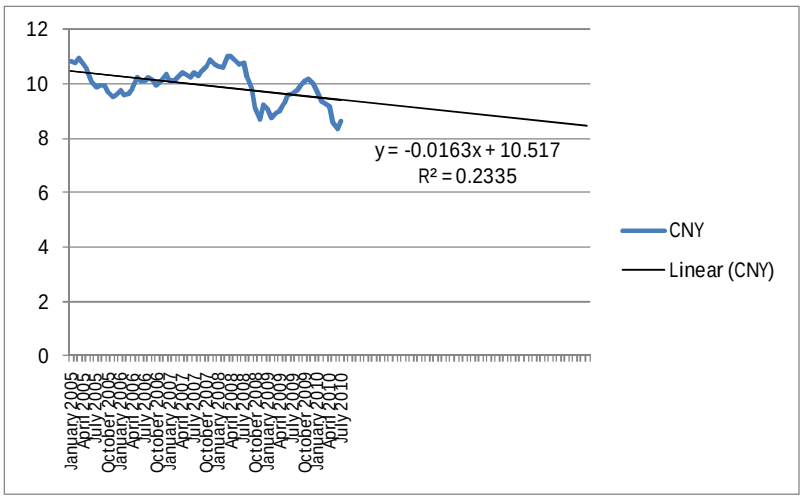

Figure 51. One euro in Chinese yuan - development from 2005 to 2010 (European Central Bank, 2010a).

Like Figure 51 shows, one euro has been around 10 yuan, but currently one euro equates 8.6 yuans in July 2010 (European Central Bank, 2010a). Like linear line show, this trend is estimated to continue in the future. It needs to be noticed that regression R^2 seem to be very low 0.23, but is statistically significant (see Appendix 3).

Like following Figure 52 also shows, Swedish krona has been weakening against yuan. One krona has been around 1.20 yuans and now it is 0.91 yuans in July 2010. This indicates a decrease in the future. Reliability of estimation is higher than in previous situation, when R^2 is 0.41, but dot not reach the level of 0.50.

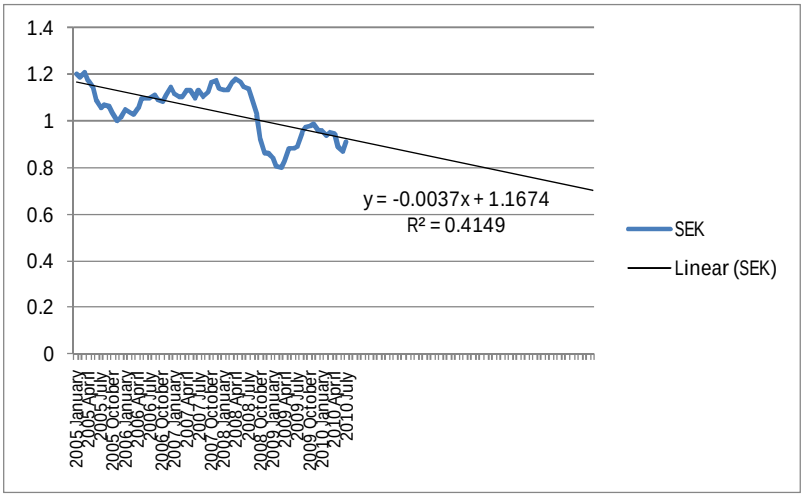

Figure 52. One Swedish krona in yuan - development from 2005 to 2010. (Riksbank, 2010)

When both euro and krona are weakening, it means that building a factory to China is becoming more expensive. Also salaries in China are increasing meaning that location issues become more significant. Also location on coastal areas is more preferred from foreign companies` point of view, but those areas are more expensive.

When examining currency issues to Russian ruble, it can be said that both Finnish euro and Swedish krona have been strengthening against ruble. That probably advocates factory planning and construction to Russia. Like in the following Figure 53 can be seen, five years estimate shows that this trend will continue (linear line).

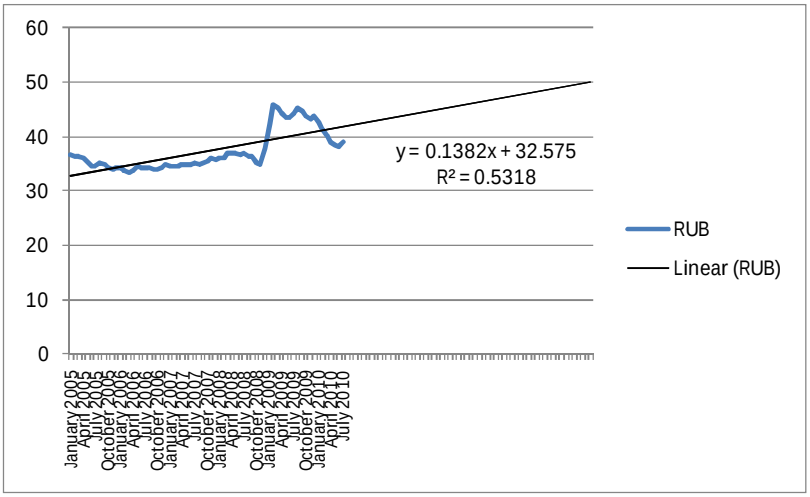

Figure 53. One euro in Russian ruble - development from 2005 to 2010 (European Central Bank, 2010b).

The regression R^2 seems to be over 0.50, so reliability is higher compared to previous analysis concerning China. When estimation indicates that euro strengthen even more against ruble in the future, it need to be noticed that the last months shows a decreasing trend. One euro has been around 36.6 rubles in January 2005 and 39.1 rubles in July 2010.

The following Figure 54 also shows that Swedish krona has been strengthening with small steps. One krona has been 4.05 rubles in January 2005. Currently one krona equates 4.11 rubles. R^2 is quite a low with level of 0.35. Estimation indicates an increasing trend (linear line).

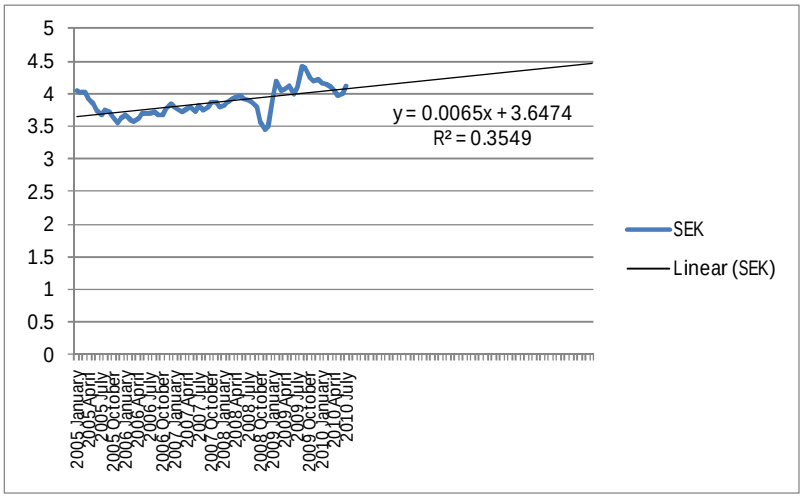

Figure 54. One Swedish krona in Russian rubles. (Riksbank, 2010)

When both euro and krona are strengthening against Russian ruble, it advocates investment to Russia. It need to remember that these indications are guidelines, so these conclusions can`t be kept as absolute truths.

When it comes to this survey research, response rate levels are low in every survey data. In all three years, response rates are less than 10 percent. Because of this, survey results give just guidelines of traffic flow development of companies. It was sent many reminders to target companies, but somehow it was not gathered more answers than we got. Especially after year 2006 response rates decreased significantly. Maybe the economic recession has affected to this and this is seen especially in response rates in year 2010.

8 CONCLUSIONS

In China container transport has a great importance. In Russia rail transport is number one transportation mode following by road transport. From Finnish and Swedish companies` point of view, the road transportation is the most used transportation mode according to survey results. Literature review indicates that it is transported more goods from China and from Russia to North European countries. Mineral fuels and mining equipment products explain this trade unbalance especially in case of Russia. GDP development is estimated to grow annually in China and in Russia in forthcoming years, but in the EU area is expected very modest growth. When it comes to effects of the economic recession, it can be seen that freight amounts have lowered in year 2009 compared to previous years. Currency changes and estimations show that factory inaugurations in China will be more expensive from Finnish and Swedish companies` point of view. Finnish euro and Swedish krona have strengthened against Russian ruble and this advocates factory planning to Russia.

When summarizing results of the questionnaire, respondents of logistics questionnaire have been logistics managers, directors and white-collar workers. They have been working in logistics area and in a company most often more than eight years. Finnish companies` share of responses was around 60 to 70 percent in all three years. Main container type of companies is a semi-trailer and the most used trade term seems to be Ex Works or Delivery Duty Unpaid. Modal split of transportation shows that road transportation is the most used transportation mode according to respondent companies, but the average amount is decreasing. Road transportation is followed by sea, rail and air transportation. There is a slight increase in the amounts of railway transportation mode. Share of transportation costs indicate that transportation costs in companies are also a bit growing.

Annual cargo volumes between Europe and China are quite interesting. Usually respondents have answered that most often cargo volumes are up 1 000 TEUs annually. There are anyhow some companies whose estimation show that annual

cargo volumes are more than 50 000 TEUs annually can be reality in the future and the amount of these kind companies might be increasing. The situation is almost same between Europe and Russia. It is also estimated that in forthcoming years large container amounts will grow. There seem to be a strong confidence of the future from companies` point of view and this is seen in all survey years. When summarizing this development, it could be said that logistics managers believe to the increase of large container amounts in the future. This also have a major impact on traffic flows.

Traffic balance between Europe and China shows that more and more of freight transport comes from China. Data from three surveys show this development. Between Europe and Russia can be seen a different kind of development. Earlier it was transported more from Europe to Russia, but currently traffic balance from Europe to Russia is decreasing. These results differ from data of OECD. Calculations of weighted traffic balance indicate that in the future freight comes from Russia to North European countries. Analysis of distribution gives same results like weighted TEU amounts.

When it comes to further research, traffic flows between other European countries and Asia would be also an interesting topic. Those European countries could be Germany, the Netherlands, Belgium and Poland to name just a few to make same kind of survey like the in case of Finland and Sweden. Also environmental factors will have a more important role in the future, so these kind of issues could investigated also in a survey and how those factors would affect to transportation flows with respective countries.

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APPENDIX 1: Logistics questionnaire 1/2

Innorail Kouvola

Logistics/Supply Chain Questionnaire Concerning Traffic Flows and Warehousing

Answering code: _____ (can be found in the e-mail)

Your position in the company:

○ Director ○ Manager ○ White-collar worker ○ Administration

Years worked in the company:

○ 1-2 years ○ 2-4 years ○ 4-8 years ○ more than 8 years

Years worked in a logistics function:

○ 1-2 years ○ 2-4 years ○ 4-8 years ○ more than 8 years

What is your company's most important transportation unit:

○ 20 foot long container
○ Semi-trailer (truck)
○ 40 / 45 foot long container
○ Something else

Please estimate how much your company spent (year 2008) and is planning to spend in years 2011 and 2016 for simply transportation of goods (excluding warehousing):

2008	2011	2016
○ 1-2 % from sales	○ 1-2 % from sales	○ 1-2 % from sales
○ 2-4 %	○ 2-4 %	○ 2-4 %
○ 4-6 %	○ 4-6 %	○ 4-6 %
○ 6-8 %	○ 6-8 %	○ 6-8 %
○ 8- %	○ 8- %	○ 8- %

Please estimate realized, and planned modal split in transportation:

	2008	2011	2016
Air	_____ %	_____ %	_____ %
Rail	_____ %	_____ %	_____ %
Road	_____ %	_____ %	_____ %
Sea/Water	_____ %	_____ %	_____ %
Altogether	100 %	100 %	100 %

Estimate annual cargo volume between Europe and China (TEU = Twenty Feet Equivalent Units):

2008	2011	2016
○ 0-1 000 TEU	○ 0-1 000 TEU	○ 0-1 000 TEU
○ 1 001-5 000 TEU	○ 1 001-5 000 TEU	○ 1 001-5 000 TEU
○ 5 001-10 000 TEU	○ 5 001-10 000 TEU	○ 5 001-10 000 TEU
○ 10 001-50 000 TEU	○ 10 001-50 000 TEU	○ 10 001-50 000 TEU
○ > 50 000 TEU	○ > 50 000 TEU	○ > 50 000 TEU

APPENDIX 1: Logistics questionnaire 2/2

Weight of cargo volume between Europe and China:

From	2008	2011	2016
Europe to China	%	%	%
China to Europe	%	%	%
Altogether	100 %	100 %	100 %

Estimate annual cargo volume between Europe and Russia:

2008	2011	2016
0-1 000 TEU	0-1 000 TEU	0-1 000 TEU
1 001-5 000 TEU	1 001-5 000 TEU	1 001-5 000 TEU
5 001-10 000 TEU	5 001-10 000 TEU	5 001-10 000 TEU
10 001-50 000 TEU	10 001-50 000 TEU	10 001-50 000 TEU
> 50 000 TEU	> 50 000 TEU	> 50 000 TEU

Weight of cargo volume between Europe and Russia:

From	2008	2011	2016
Europe to Russia	%	%	%
Russia to Europe	%	%	%
Altogether	100 %	100 %	100 %

Please indicate, if your company would like to receive a research report from the survey:

Yes No

Email address where PDF-file will be sent

Is your company interested to be involved in the future research works concerning this topic (e.g. interview or providing data)?

Yes No

Contact information (e.g. email)

Send answers

APPENDIX 2: Structured questionnaire format for respondent companies (Company A and B)

1. *How has the economic recession affected to transportation (import and export) after year 2008?*

2. *Is it used Incoterms 2000 trade terms in your company?*
   If yes, what is the most used trade term?
   If yes, how well employees and customers know them?

3. *Which transportation mode is the most convenient after road transportation?*

4. *What kind of actions has been made to cut CO_2 emissions of transportation?*

5. *Transport modes between Europe and China?*

6. *Transport modes between Europe and Russia?*

7. *The development of transportation costs?*

8. *Traffic imbalance issues in your company?*

9. *Location of factories (in Finland and abroad)?*

10. *Logistics management (warehousing and outsourcing)?*

APPENDIX 3: Regression analysis of currencies 1/2

SUMMARY OUTPUT EURO AND YUAN

Regression Statistics	
Multiple R	0.483193158
R Square	0.233475628
Adjusted R Square	0.221682946
Standard Error	0.579663722
Observations	67

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.652443328	6.652443328	19.79834745	3.44813E-05
Residual	65	21.84065198	0.33601003		
Total	66	28.49309531			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	10.51706524	0.143234829	73.42533455	2.93009E-64	10.23100554	10.80312494	10.23100554	10.80312494
	-0.016293613	0.00366187	-4.449533397	3.44813E-05	-0.023606872	-0.008980353	-0.023606872	-0.008980353

SUMMARY OUTPUT SEK AND YUAN

Regression Statistics	
Multiple R	0.644134127
R Square	0.414908774
Adjusted R Square	0.40590737
Standard Error	0.085773626
Observations	67

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.339117286	0.339117286	46.09378686	4.08213E-09
Residual	65	0.478212468	0.007357115		
Total	66	0.817329754			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.167399303	0.021194652	55.07990058	2.84572E-56	1.125070661	1.209727945	1.125070661	1.209727945
	-0.003678763	0.000541852	-6.789240522	4.08213E-09	-0.004760915	-0.00259661	-0.004760915	-0.00259661

APPENDIX 3: Regression analysis of currencies 2/2

SUMMARY OUTPUT EURO AND RUBLE

Regression Statistics	
Multiple R	0.729245946
R Square	0.531799649
Adjusted R Square	0.524596567
Standard Error	2.546349969
Observations	67

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	478.7026747	478.7026747	73.82945607	2.59678E-12
Residual	65	421.4533807	6.483898164		
Total	66	900.1560554			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	32.5751567	0.629202741	51.7721151	1.45918E-54	31.31855207	33.83176133	31.31855207	33.83176133
	0.138216447	0.016085882	8.592406885	2.59678E-12	0.106090722	0.170342172	0.106090722	0.170342172

SUMMARY OUTPUT SEK AND RUBLE

Regression Statistics	
Multiple R	0.595695797
R Square	0.354853483
Adjusted R Square	0.344928152
Standard Error	0.17206339
Observations	67

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.058476012	1.058476012	35.75230711	1.05097E-07
Residual	65	1.924377651	0.02960581		
Total	66	2.982853662			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.647402022	0.042516841	85.78723051	1.3145E-68	3.562490028	3.732314015	3.562490028	3.732314015
	0.006499311	0.001086964	5.979323299	1.05097E-07	0.004328493	0.008670128	0.004328493	0.008670128