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DEVELOPMENT OF CARGO ROUTE: TROMSO – KIRUNA – ROVANIEMI – MURMANSK

Bachelor's Thesis 2014

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ABSTRACT

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DENIS, OSIEV	Development of cargo route Tromso – Kiruna – Rovaniemi – Murmansk
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Thesis: Development of cargo route Tromso – Kiruna – Rovaniemi – Murmansk was chosen based on the logistic forum meeting with the countries of Barents region countries. The main topic of this forum was improvement in co-operation in transportation methods of Barents region countries. Main participants were: Russian Federation, Norway, Sweden and Finland.

The objective of this study was to find particular ways for development of the route: Tromso – Kiruna – Rovaniemi – Murmansk, which will connect four countries in one logistic chain. In this thesis route was considered as a project and the goal was to prove that this route is economicaly feasible and should be necasserly built.

This research was carried out by comparing annual reports from the customs services concerning amounts of cargo passing through the borders. The project route in this thesis compared to current situation and all information was found from the official sources such as customs of Russia, Finland, Sweden and Norway and logistics companies as well.

The main problem is the missing link between the areas on the route or undeveloped railroad network, which is not able to carry the necessary capacity. In the case of missing links there arises a problem of unreasonable time losses. The development of this network and co-operation in this development could be a solution to this problem since the time for transportation as well as costs would be decreased.

1. INTRODUCTION

Under the growing influence of globalization, which term can be defined as a tendency of moving investment funds and businesses out from the boundaries of their domestic markets to other markets around the world, increasing in this case dependency of markets from each other's changing the whole production process (1), could be mentioned tendency of growing significance of international trade in countries' economies. This tendency makes countries dependable from each other and requires collaboration in solving problems of international trade and finding possible ways for development of the future collaboration, which would be beneficial for all of the parties. Moreover, globalization made countries a part of a global supply chain network, where every country plays her own unique role. Without collaboration in the development of international trade the whole giant supply chain network, which is composed of the countries all over the world, will struggle to perform sustainable, money-saving and environmentally friendly production as an answer for a currently growing demand situation.

Topic: Development of cargo route: Tromso- Kiruna – Rovaniemi – Murmansk was chosen after reading an article about the meeting on the governmental level heads of the Murmansk State and heads of the Regional Council of Lapland to discuss near-border collaboration within the limits of Kolarctik project **(2).** Kolarctic is a project of neighbor collaboration with countries neighbors of European Union (**3**). At this meeting problems concerning lack of transportation capacity, which is disturbing further development in the international trade in the Barents region, were discussed. This region includes North-West part of the Russian Federation and Northern parts of Finland, Sweden and Norway (**4**). More closely the possibilities for development of new route: Tromso – Kiruna – Rovaniemi – Murmansk were discussed.

An objective of this study was to find specific ways for developing the route: Tromso – Kiruna – Rovaniemi – Murmansk, which will connect four countries in one logistic chain. In this study route was considered as a project and the goal was to prove that this route is feasible and should be necessarily built. The project route in this study compared to the current situation and all information was found from the official sources such as customs and logistics companies' webpages.

The main problem is the missing link between the areas on the route or poor railroad network development, which is not able to carry the necessary capacity. In the case of missing links there arises a problem of unreasonable time losses. The development of this network and co-operation in this development could be a solution to this problem since the time for transportation as well as costs would be decreased.

During the research process current situation on existing routes and possible ways of development were examined. To give fair proof of the economic feasibility customs reports of all countries were studied. In addition to this, these reports were analyzed to find specific tendencies and dependability of trade processes. Rail transport was taken as the main transport mode, because of the cargo article description.

The project could be considered as actual because of the high loading of existing routes, and also existing documents and articles proving that this route is discussed on the governmental level. Moreover, subject could be meant as actual because of developing necessity of the Northern Sea Route, which makes projected route one of the main directions to reach one of the largest hubs-ports in the Northern part of the Russian Federation Transport port of Murmansk.

Project was interesting because studies in home university are closely related to the subject of forwarding and transportation logistics; furthermore, this subject will show my willingness to solve the problems connected with routing, which will give me a competitive advantage in job hunting.

Thesis includes information about countries and regions which are included in the projected route, as well as information about trade between those countries which will be analyzed. The baseline option includes a description of the route, existing problems and a slight comparison with existing routes. Also, this thesis gives possible ways of development and description – why this route is considered to be preferred. Moreover, this written work describes existing environmental problems and risks associated with the development of the projected route.

2. MARKET RESEARCH

First of all, the definition of meaning marketing research should be presented. Under this definition measurements and valuation of all risks and opportunities, which could appear in the process of the cargo delivery route's development, were intended. As the main criteria of this research the potential cargoes for this route were taken. Moreover, possible benefits of development this route were discussed (**4**). Generally market research should present the needs and preferences of customers (**5**). For making such an analysis, the information concerning railway connection was given in particular, the condition of the railroads on the parts of the route. In addition to this, the information about road transport and roads was added, because in some points of missing railways it is easier and cheaper to use trucks for transportation instead of building railroads. Moreover, this report includes information about the current cargo flows and the possible growth of this traffic (**6**).

Barents region and countries, which are included in this region, are mainly concentrated on working with wood production, metal ore production, fishing industry and development of energy sources (**7**). In consideration of the route "Tromso – Kiruna – Rovaniemi- Murmansk" every point has their own production.

Fish and oil goods are produced in **Murmansk**, which should not be enough for developing such a large route, but one should not forget the fact that Murmansk is the gates to the Northern Sea Route, should not be forgotten. In the recent years, it has been one of the most important and largest ports (**8**). Moreover, railroad is going through the city Apatity, the largest mining point in the Barents region, which makes an extraction of asparagus stone and chemical ore mining (**9**). Furthermore, near to Apatity Kirovsk is located. Kirovsk is also known as a mining city. Apatity has a connection with Murmansk by means of road network, which is continuing its development, and by means of railroad. Railroad in Apatity has been electrified since 1935 (**10**). The length of the route Apatity – Murmansk is 137 kilometers by railroad, which is used in most cases and has great capacity. Further to the industrial sector wood production should be added, which is also dominant in Murmansk State (**11**).

Secondly, the **Northern part of Finland** is also known for ore mining, but in comparison to Russia, Finland performs metal working operations. Furthermore, in this region paper, chemical production and electronic goods are produced. Rovaniemi in this case can become a great hub point, which will unite cargo-flow and tourists flow (**12**).

Thirdly, the **Northern part of Sweden** is also known ore mining and metal mining manufacturer. At this point Kiruna is known as a leading mining city, with developed railroad connection, possibility to handle cargo flows, which are incoming and outgoing from the city (**7**). Moreover, this part of Sweden is operating with mechanical, paper and wood handling productions. These productions can be the ways to develop future cargo flows (**13**).

Last, but not least point is **Tromso and Northern Norway**, which is mainly known for a fishing industry and is showing the growth of the fish transportation to Russia. In this region exploration of Oil and Gas has been provider. In this case the port of Tromso, which is handling general, bulk, oil and fish cargoes can become a hub port, for further transportation to the North-East of United States, for example (**14**)(**15**).

- Analysis of markets

For getting a clear view of the future possibilities of development, road and railroad network were described with the main advantages, risks and problems. The description includes current stage of development and alternatives.

The port city by the definition should have vast, well-developed infrastructure. **Tromso** is not an exception to the rules, it has a great connection by road with European route E8 (**16**) and by means of this road it has a connection to other European routes. Among the benefits of Tromso free of ice water area and rise and fall situation can be mentioned. The port is open 365 days annually and 24/7 daily (**15**).

However, Tromso has some problems in terms of development. Tromso does not have a railway connection to other parts of Norway. The closest point with a

railway connection is Narvik, which is 250 kilometers away from Tromso (**7**). In that case transportation from the port should be reasonably organized by the means of road transport to Narvik. In Narvik cargoes should change the mode of transport to rail transport and continue with delivery. However, it makes transportation longer, because of the reloading process, more damage-risk for cargo: handling operations should be performed twice with the same batch and become more expensive. It can be easily explained because of repeated using of reloading operations and using of the road transport which is the second most expensive mode after air transport. These factors make the solution of using road transport not an economic advantage in a long-term basis.

One of the most prominent mining productions in Sweden is concentrated in the region of **Kiruna**, that is why cargo delivery network should be built unconditionally (**13**).

Kiruna is situated on the main railroad of the country, which is well-developed and has great connections with neighboring Finland and Norway. Kiruna is included in the vast transport corridor of Narvik Link. By the reports, the railways of this region are loaded greatly (**7**).

In conclusion, it can be written, that the railway network is greatly developed in Kiruna, however nowadays reports mention problems with carrying capacity.

Rovaniemi is a city located in the Northern part of Finland. Rovaniemi is mostly known for the Santa-Claus Village, which is located there, but in this region by the information on the Barents Region webpage, paper, wood, steel and electronic goods are also produced (**7**). Rovaniemi is lay claim to be a central point in logistics network of the Barents region. There are some projects in co-operation with Kolarctik (**8**) for building a railway connection between Kirkenes and Rovaniemi. This project is called “Arctic Railway”.

The current situation shows that Rovaniemi has unsufficinent rail connection: to the East railway is built till Salla and on the West it has connection with Kemi. From Kemi to Rovaniemi railroad is used with the capacity of 1 million tons per kilometer. However, after Rovaniemi railroad is used even less: the capacity is less than 1 million tons per kilometer - in comparison to one of the most popular route

from Kotka to Vaalimaa and further to Russia, where the railroad is used with capacity over 5 million tons per kilometer (**7**) (**17**).

However, the project of "Arctic Railway" is not the only one. During the conference with such participants as Head of Murmansk state Gregory Starin and CEO of Restricted Unions of Lapland and Head of Lapland's province Miki Riipi, they discussed the possibility of development of the route for cargo transportation: "Tromso – Kiruna – Rovaniemi – Murmansk" and, what is even more important, this conference had an effect on the co-operation between Finland and Russia. After this conference, Finland agreed to build the missing railroad connection between Salla and Kandalaksha. The distance of the missing connection is 70 kilometers, but furthermore noticable changes should be done on the connection between Salla and Rovaniemi in terms of preparing this part of a railway to a raising traffic flow. In accordance to this project, the railroad of Finland will be connected with "Oktyabrskaya railway" (**18**). This connection will open the opportunity to reach the largest ice-free port in the "Arctic Corridor" – The Transport port of Murmansk. (**8**)

In conclusion, to analysis of this region's transport infrastructure it should be said that if those projects have to be done, the region will become a central point in forwarding, logistics, because it will receive connection with two ports, which can be named as the main points of the "Arctic Corridor": Murmansk and Kirkenes.

Murmansk is the city of Russian Federation, located in the North-West of the country. The city has an access to the Arctic Ocean. Having an ice-free port – the Transport port of Murmansk, the city is known as the owner of the largest port in the Arctic region. The Transport port of Murmansk can become one of the main points in sea-transportation by the "Arctic Corridor". The port of Murmansk has a great railway connection, but the quality of the roads for wheel-transportation leaves something to be desired (**19**).

Rail transport was dominant in this region for years. Murmansk state has greatly developed railway connection in the direction from the South to the North and backwards, but there are still problems with connection on direction from the East to the West and backwards. However, collaboration of the countries and the necessity of this development make projects come true. By the reports from the

Open Joint Stock Market Entity of "RZD" (Russian Rail Roads), nowadays prevalent investment project and strategy of development is connected with the port's infrastructure and the addition of the railways, to avoid traffic block situation today and in the future (**10**).

It is better to add, that currently the part of "Oktyabrskaya" railroad in the Murmansk state is really busy. Nowadays, on each direction over 5 millions of tons cargoes per each kilometer of railways are transported. It is also connected to a current situation and productions, which are located in the state of Murmansk (**7**). Currently, in the state of Murmansk oil, gas, wood materials, food products are produced, which are mainly transported to the South, till Saint-Petersburg or till one of the four border points with Finland, located also in the South. These are: Vartius, Vainikkala, Imatra and Niirala (**20**). This situation gives unreasonable losses in time and in costs, because cargoes should make a considerable round before entering the territory of Finland. Through developing the route of Salla – Kandalakshi Murmansk state and goods, which are produced here will receive straight way to the West and significant amounts of money will be saved, avoiding transportation by means of old routes.

The second way of development was suggested by the government of Norway. They offered a collaboration in building the railway, making a joint of two ports in the "Arctic region". In the plans of connection the Transport port of Murmansk and the port of Kirkines were also featured. The building of this route can decrease the loading of the Transport port of Murmansk, which can solve the problem of traffic blocks in the port. Furthermore, if the project of railway from Rovaniemi to Kirkines will be done within the accomplishment of the Salla – Kandalaksha project, region will receive greatly developed infrastructure triangle: Rovaniemi – Murmansk – Kirkines (**14**).

Although, the state of Murmansk has a greatly developed railroad network, road connection between cities and, especially in the regions of low transport concentration, is in need of serious reconstruction and development. One of the problematic areas is again the border crossing point Salla – Kandalaksha. At the conference with Head of Murmansk state Gregory Starin, CEO of Restricted Unions of Lapland and Head of Lapland's province Miki Riipi questions about

possible development of the direction Rovaniemi – Salla – Kandalaksha – Alakurtti were discussed. It was mentioned that the main problems are the missing railway connection and the poor quality of the roads on this part of the route (**18**). In the terms of the conference a decision was made, that the main expenses in road infrastructure development will be made by Russian side, and nowadays "Murmanskavtodor" announced auction selling for the project of building this road network. The price of this project is 908 million of rubles (**21**), (**22**).

In conclusion to this part of the chapter it would be better to say, that the state of Murmansk has a great variety of alternatives for infrastructure development, but here mentioned only two are mentioned because they have a privileged position: they give noticeable increase in international trade.

- Possible ways for development

After describing the current situation of infrastructure it is logical to describe possible ways of development. In this part of the chapter will be described possible alternatives and alternate plans to make the whole route working in a most convenient way.

In **Tromso** the problem is hidden in the railway connection, better to say in missing connection with the whole Norway's network of the railways. There are 250 kilometers missing (**23**). This makes project managers think more seriously about further development of this area. In a long-term perspective, the railroad should be built, because road transport losing its' effectiveness with a considerable size of the batches. In that case transportation of batches with the weight more than 1000 of tonnes becomes unreasonably expensive. However, development of the railroad requires great money investments.

In that case in future question about straight transportation by sea from Tromso, to Murmansk should be seriously taken into consideration.

As it was already said, **Kiruna** region requires development to increase carrying capacity of the railroad network. As well the work on development regional connection with mining regions should be done(**7**).

Rovaniemi is the most problematic region, but the most promising one, in terms of finishing the projects. As it was written above the most predictable scenario for Rovaniemi in the end gives connection with the whole railroad network of the Scandinavian countries and with two ports, having an access to the "Arctic Corridor". Unfortunately, today Rovaniemi has only a slight connection with the railway network of Finland and is not used as a major logistic center (**17**). To reach this goal the government of Finland should make great co-operation with Norway and Russia. This co-operation is directed on building railway connection. From the side of Norway it will be Rovaniemi – Kirkines, and from the side of Russia it will be part from Salla to Kandalaksha (**14**).

However, great effort should be made from the governmental side to develop road connection with Rovaniemi, it is still a great perspective project, which will give a lot of benefits in the future.

Murmansk district together with Rovaniemi region are the most problematic areas. Nowadays Murmansk is the largest port of Russia in the Arctic region, having an access to the Arctic Ocean 365 days per year and handling 11 million 529 thousands of tons of cargoes in 8 months of 2013 (**24**). However, one of the largest ports of Russia has problems with railroad traffic blocks. Nowadays there is lots of economic news mentioning this problem as critical.

In case of an increase in cargo flow to the port of Murmansk, the problem of traffic blocks can become a disaster for the whole project. To avoid this problem and provide regular sourcing of the port government of the Murmansk State should develop a rail connection in the port. It should include the building of new railroads entering port and outgoing from the port. Moreover, reconstruction work should be performed with old passes and ways (**10**).

The second major problem of the Murmansk state is a missing a road connection between cities as it was mentioned above. Most of the roads do not have the required quality. In the situation when railroad plays prevalent role in transportation, road network should play sourcing role. Road connection should continue transportation of the cargoes from the train till the warehouse of a customer. There are already some projects having cost over 2 billion of rubles for repairing and building new roads. One of the prevalent and first in the line projects

is concerned with building and reconstruction of road connection between Salla and Kandalaksha. Cost of this project, as it was already mentioned, is 908 million of rubles (**21**), (**18**), (**22**).

At the end of the preparatory works, the most preferable way of transportation will go through Kandalaksha, Alakurtti, Apatity and further to Murmansk. It is important to include Apatity in the transportation route, because it is one of the largest mining points in the Murmansk state, where most of the chemicals are mined (**3**). Furthermore, Apatity has great infrastructure development and can be reached from all places of the country by road, railroad and air transport (**25**). This fact gives the city one of the preferable positions in deciding the route planning.

- Traffic flows

Currently this route is not popular at all, on the request from VRgroup about the part Rovaniemi - Murmansk, representatives of this company told that this direction is unknown and is not nowadays in use. Also the problem of connection is for Tromso port, because it does not have any railway connection with the whole Norwegian railroad network. As for the other parts of the route, transportation is held very actively, except for the direction to Rovaniemi.

The most crowded and most used route is in Kiruna, and directed in both ways: to Finland and to Norway. Cargo traffic in Finland is mostly taken by the railways of the Southern direction. Moreover, there are only 4 border crossing points with the Russian Federation. These are: Vainikkala, Imatra, Niirala and Vartius (**20**). Inforamtion about cargo traffic on these border crossing points could be found in Table 1 in appendix.

Moreover, there a problem of changing tracks is having noticeable influence, the switching points are located in Oulu, Kouvola and Tampere, this fact makes all cargo flows transported from Norway and Sweden to Finland or Russia or to East and the way round by railroad hold more Southern direction. This problem can be considered as a critical one, because the changing point in Tornio/Happaranta has now been out of order (**14**).

Currently railroad traffic comes from the North-West of Norway, and goes through the border of Sweden in the direction of Kiruna, Galivare, Boden; mainly to the ports of Sweden and partly further to Kemi, then at the point of Uleaborg splits on 2 considerable traffic flows: the first one Southern in the direction of Helsinki – Kotka, the second one goes in Kajaani's direction. Nowadays the condition of transport infrastructure between Norway and Russia decreases possible trade between these countries, which is small comparatively to the trade between Sweden and Norway . Even Finland has more cargo turnover with Norway.

In accordance to numbers from figures 1 and 2, it is impossible to make a conclusion about the noticeable growth in trade transportation between countries. However, there are also no significant drops in cargo exports and imports, moreover after 2012 growth in accordance to the fact that Russia became a part of the World Trade organization was forecasted

Leading position in trades with Sweden holds Norway as it is clear from the figures 3 and 4, the second place in trade with Sweden holds Finland and the last – Russian Federation. Furthermore, from these figures can be found that Sweden doesn't export goods actively to Russia. However active trade with Finland and especially Norway means existance of the well-developed infrastructure.

Sustainability with growth till 2011 can be mentioned as well. Although, slight drop in trade can be mentioned after 2012, amounts of trade are still significant, giving a necessity of transport infrastructure development.

3. THE CURRENT CARGO ROUTES

To make an evaluation and analysis of the necessity to develop this route, it is important to do research about the current ways of transportation and facilities on these ways. The main attention should be put on the areas with a problematic transport infrastructure. Under problematic it is meant currently missing or not sufficiently developed connection between cities given as a basic route.

- Rail connection: Finland – Russia

Currently to reach Murmansk and to carry goods by means of rail from Murmansk to Finland and further to Sweden and Norway forwarders need to use one of four border-crossing points in Finland, which have facilities to handle cargo flow crossing the border. These are: Vainikkala, Imatra, Niirala, Vartius. Vartlus is the Northern one and the closest to Murmansk. In 2013 Vartius border point handled 54 045 containers, or 3 574 962 million tons of cargo (**20**). At this point the railway of Finland has connection to the Russian railroad in Kivijarvi. This point of Russian railroad belongs to "Oktyabrskaya" railroad and this spur-track leads to the great railroad junction in Kochkoma (**26**). More closely situation could be studied through having a look on figure 5, which has a map of this railroad junction described above and beyond. With a red marks highlighted main points of this spur-track.

It is very important to reach a Kochkoma railroad junction, because at this point spur-track Kivijarvi – Kochkoma is crossing the main spur-track of the Murmansk district, which goes from North to South and the other way round, and goes through Apatity to Murmansk. Distance from Kochkoma to Murmansk is 738 kilometers (**25**). On the part from Kivijarvi till Kochkoma railroad is not electrified and has only single track, it means that this part of the railroad is not ready to receive considerable amounts of cargo for the transportation (**27**). The part starting from Kochkoma and lasting till Belomors has also only single track, but the whole length of this route is made with second track in fittings. A railroad from "Belomorsk" and till "Polyarnie Zori" has double track. Part from Polyarnie Zori till Murmansk is the same like part from Kochkoma till Belomorsk. On the full length of this route the

railroad is electrified (**27**). However, this route is the closest to the Murmansk customs point, Vainikkala is more valuable than Vartius, which is only third by the cargo traffic (**26**). The description written above goes in accordance to the figure 5, and should be analyzed with eyes on this map.

- Characteristics of railroad border crossing points in Finland

  However, railway from Oulu to Vartius which is electrified in the whole length, is not developed enough to arrange transportation of the goods through this spur-track and make it global.

  The most developed railway route in Finland situated in the South of the country. This fact could be explained through the positioning of the most ports of Finland in this area. Servicing of this railroad traffic, passing the Russian – Finnish border, is a business of Vainikkala customs point. Nowadays in Vanikkala two times more containers than in Vartius are handled. (**20**)

  Furthermore, there are two more border crossing points. The first is in Imatra and the second is in Niirala. Imatra is the second in handling wagons per year, and its location is near to Vainikkala. It will be logical to suggest, that Imatra also works with the containers and cargo outgoing from the ports of Hamina/Kotka, Helsinki. Niirala is the smallest point in the rail-cargo transportation from Finland to Russia and backwards. It handled 21 930 wagons for 2013. (**20**)

  Inspite of the fact that the border crossing points in Imatra and in Vainikkala have more capacity and are more developed than others, there is no reason to use them because their location is too far away from our projected route (**17**). Using of this route would be reasonable if the transportation is performed by the means of marine transport with the use of ports, such as Helsinki, Kotka, Hamina. However, in the case of using marine transportation, arises a question of necessity for railroad development. In this situation old railways could be used as basic ones. In accordance with this it is logical to make a conclusion that these border crossing points are nowadays used mostly for the cargoes which go to the Saint-Petersburg district or in the South direction. However the small amount of cargo traffic going to the North can be performed in these points, but this amount will be transported

from the Europe; and using this route in transportation to Murmansk is more comfortable, than using more northern railroad passes.

- Connection of Finland and Sweden

The connection of Finland and Sweden by railroad is made at the point of Tornio. However, the railway from Tornio till Laurila is not electrified and has necessity of development. Moreover, problems of railroad on the connection between Sweden and Finland would not be solved with electrification of rail-track from Tornio till Laurila. The main problem is the difference in width of the railroad pairs. The width of railroad in Finland is 1520 millimeters, while in Sweden railroad is 1435 millimeters wide (**20**). Difference in gauge mentioned could be found from the **figure 6**. With a red mark were highlighted problematic region and gauge of this region.

The main transportation line in Sweden is used by centuries, it has great carrying capacity and passes through most of the major mining points of Sweden, and also it is a part of the Narvik Link transport corridor (**7**). One of these points is Kiruna, which was included in the basic route of this thesis. A railroad from Kiruna goes down till Boden. At this point railroad is divided into three directions: one of them goes near to the coastline, having connection with all of the coastal ports; second direction goes to the coastal city Lulea with the railroad station; the third one, which is the most important for this topic, goes in direction of Finland (**28**).

As it was mentioned above Finland and Sweden has different railroad width, which makes the transportation process more complicated, making forwarders think about the problem of changing railroad pairs. In case of the railway transportation process of changing was always performed in Happaranta; however, currently the necessary machinery for this process is broken, which makes the transportation process via railway even more complicated, because cargoes should be reloaded to the trains with another spur-track with different gauge (”the distance between a pair of rails or the wheels on one axle” (**29**)) (**14**). As well, change can be performed in Finland in three places: Oulu, Tampere, Kouvola. All of these three particular routes are placed in a different direction to the basic route of Tromso – Kiruna – Rovaniemi – Murmansk. The closest to the given transportation route changing point is located in Oulu. Oulu is 131,2 kilometers away from Tornio and 112,3 kilometers away

from the junction of the railroad tracks. Railroad junction, which was described above could be found from picture from the figure 7.

This junction has direction to Rovaniemi. However, this fact makes rail transport do overlapping of 245,5 kilometers to change pairs, and moreover, direction to Rovaniemi is not in use for permanent cargo transportation because of the dead end in the point of Keiloseika (**17**). Currently it has only 6 trains from Kemijarvi with the wood production and 6 trains per day from Rovaniemi, also carrying round wood. As for the passenger transportation, there is only 1 night train which is circulating between Kemi and Kemijarvi (**14**).

Currently, all types of cargo go further to Oulu and after Oulu all rail transportation is divided into two directions: one passes near a coastline having an access to all of the coastal ports, second direction has connection with Kontiomaki (15).Kontiomaki railroad junction has connection with the whole railway network of Finland. For better understanding picture of railroad junction Kontiomaki could be found from the figure 8.

Two directions are going down to the South in Eastern and Western directions and the third one goes straight to the East and crosses the border of the Russian Federation in Vartius (**17**). As it was mentioned above: in 2013 Vartius border point handled 54 045 containers, or 3 574 962 million tons of cargo (**20**). This statistic includes only railway carrying capacity.

In conclusion, transportation from Sweden to Murmansk and from Murmansk to Sweden should be mainly held, if we consider Kiruna as a starting point and Murmansk as the ending point, through these main stations: Kiruna – Boden – Tornio – Oulu – Kontiomaki – Vartius – Kivijarvi – Kochkoma – Apatity – Murmansk. The main problem of this route is a difference in the width of railroad between Sweden and Finland, which could be solved by changing railroad tracks. However, the current problem of the width is more serious because of broken machinery in Tornio. This fact gives the only alternative to reload batches for a different train in Tornio (**14**).

- Norway as part of the route

  Transportation from the port of **Tromso** is the one of the critical points and one of the main problems of this route. As it was mentioned on the maps and on the main web-page of the port, the port has the only great connection with road network of Norway. (**16**) The distance between Tromso and the closest railway station is 250 kilometers. The closest point with railway connection is Narvik (**23**).

- Importance of Narvik

  Narvik is also a port city, which has a great railroad hub station used in forming trains for the further transportation. Currently the main production comming from the Tromso's port is fish (**16**), and nowadays transportation of small batches can be performed with the use of trucks. From the sum of the facts outcomes the situation, in which the transportation of the goods from Tromso and to Trosmo can be performed only with the use of trucks. However, if this transportation should be made for a long distance, the effectiveness of using trucks becomes equal to zero or even goes to minus. In that case cargo should be reloaded to the rail for the further transportation. The closest point with the railroad is Narvik. As for advantages of this city the linkage to the same spur track with Kiruna can be mentioned (**23**). This connection with the same spur track makes transportation from the ports of Tromso and Narvik performed through this starting station in Narvik. Furthermore, Narvik is a starting point of the Narvik Link transport corridor with the well-developed railroad infrastructure (**14**). Picture of the railroad connection between Sweden and Finland could be found from the figure 9.

  Further train, the one to reach Kiruna, should cross the border in Riksgransen. After crossing the border in Riksgransen train can go straight through Kiruna, to Boden and further to Finland (**28**). Picture of this spur-track could be found from the figure 10.

  The main problem of the transportation in the area of Tromso is a missing a railroad connection. A truck can be used for transportation only in a short distance and with the small size of batches. If the size of the batches will grow, in a long-term basis and strategy should be changed and evaluation should be done, if it is possible to build railroad connection with Tromso's port.

In conclusion to this chapter, there are lots of parts of this route and current ways for cargo traffic, which necessarily should be improved, developed or even re-build or re-engineered.

4. PROJECT OPTION. CARGO ROUTE: TROMSO – KIRUNA – ROVANIEMI – MURMANSK

This part of the work is intended to be a descriptive part. Description was done concerning the current situation on the route and the changes which should be made. This part also includes alternative route. The main topic of this part is projected route: Tromso – Kiruna – Rovaniemi – Murmansk.

The projected route includes some of the fully developed points, which nowadays are in use; however, some of the routes were not in use and did not have sufficiently developed infrastructure, or did not have it at all. In the case of distances, which are presented by this route, it is reasonable to use rail transport that makes the route dependable on railway hubs, stations and railroad connections between cities.

The main problems of projected route are:

1) Missing link between Tromso and the whole railway network

2) Difference in railroad width

3) Not sufficient railroad connection between Rovaniemi and Finnish railway network

4) Missing link between Salla and Alakurtti

Tromso and **Narvik** are both port cities, which are included in international trade routes. Both ports have strategic significance to Norway.

Tromso is the largest fishing port in Norway, and it has great priority for future development in direction of container transportation. The port nowadays is still under development and large investments from the governmental side are made (**14**).

Narvik is also one of the strategic points in the Northern Norway. The port received significant grow in the last time, and current annual turnover of the port is 19 million tonnes (**14**). Narvik is included in the transport corridor called Narvik Link (**7**) and has a great railroad connection with mining production in Sweden, especially Kirkines.

Currently, the port of Tromso has great access only to road network which means that cargo for the long-distance deliveries has necessity to reach the nearest point with the railroad. The closest point with railroad connection is Narvik. Being a part of the Narvik Link, the city can be reached from Tromso only by means of trucks (**7**). Tromso is connected to Narvik with a core road, one of the Russian main road corridors: E6 (**14**).

The transportation process in this area should be carefully measured to make future decision: is it feasible to build railroad till Tromso or just leave road connection with Narvik.

Narvik and **Kiruna** are parts of the transport railroad corridor: Narvik Link (**7**). Connection between these points is significant, because LKAB (one of the biggest mining companies in Sweden (**30**)) has most of the handling operations, which are performed in the port of Narvik (**14**). Currently this connection is well-developed and has necessity only in permanent maintenance.

Region of **Kiruna** is known for its metal ore production and has technical production (**31**). This makes it a region of high priority speaking of including it in projected route. The North Sweden is also called the mining region because of considerable concentrations of metal mines. One of the biggest advantages of this point in the whole route is the presence of the developed railroad network in this region. Through Kiruna "Narvik link" – transport corridor is passing (**7**). Moreover, railroad network is well-developed and has a maximum permitted axle load of 25 tonnes (**14**)

Narvik Link connects Narvik – **Kiruna** and **Boden**. This linkage should be preferable, because in Boden railroad junction is located, which has an access to the coastal ports of Sweden; it can receive cargo for further transportation by means of sea transport. Firstly, Boden has direction to Tornio for the further transportation.

From the reports it is clear that this railroad is in active use, on the part from Kiruna to Boden it provides about 25 million of tonnes per year (**14**).

Boden is a part of the Bothnian Link, which goes around Bothnic Gulf reaching ports around this gulf (**7**). This link has the main priority and is included into main rail corridors. In early 2013 this part of the linkage was renewed and opened for traffic. However, in the past this railroad connection had a bad carrying capacity, it should be measured once again after development. Before this link was open, carrying capacity of this link was around 1 million tonnes per year. Annually border from Finland to Sweden with the use of railroad crossing 6 million tonnes, and in reverse direction railroad is carrying 9 million tonnes (**14**).

This direction is also a part of the Bothnian Link; however, it is not developed enough. The first problem appears with the gauge width. Sweden has a standard European gauge of 1435 millimeters while Finland has an abnormal width of 1520 millimeters. Because of this difference railroad tracks should be changed at this point, or as an alternative variant cargo should be reloaded to the different wagons, over wise it is impossible to perform further transportation. This problem would not be crucial if the changing tracks point would be in working order. Currently it is in need of repair and development (**14**).

The second problem of this direction is not sufficient development of the route. First 20 kilometers of the route, exactly from **Tornio** till **Kemi,** the railroad is not electrified (**14**). Railroad from Kemi to Oulu which is single-tracked was under reconstruction for the last year, but the reconstruction is now expanded in time. As the result of reconstruction, railroad will receive part of the road which will be double-tracked, and its length will be 100 kilometers (**14**). However, currently this route is single-tracked, with about 70 crossing sections, which are mostly fitted with the safety system.

In the case of projected route there is no reason to carry goods till **Oulu** and afterwards back to **Laurila** to perform further transportation on the direction of **Rovaniemi**. If the train will pass through Oulu and come back, the diversion of about 660 kilometers appears (**14**). It would be reasonable to perform transportation from the junction point in Laurila. In Laurila train should enter the track-line of Rovaniemi.

The railroad on this part of the route is quite developed quite well and by reports has carrying capacity of 5 million tonnes annually (**14**). However, the development of this road is not sufficient to consider this route as a core one, through for the local needs it is comprehensive. Rovaniemi is mostly known as a tourist center, furthermore, it is also has mining and energy production (**32**). The whole route is single-tracked and in case of cargo traffic increase has necessity in development.

As the alternative to the route going through Rovaniemi can be direction to **Vartius**. Furthermore route **Tornio – Vartius** is a part of the Barents Link corridor, which has access to a Trans-Siberian transport route (**7**). Railroad on this route is a part of the core route having a carrying capacity of 5 million tonnes per year (**14**).

Despite of the fact that this route has good development, it also has some problems. First of all, this route, being a part of the Barents Link transport corridor which was loaded already: around 50 000 of the wagons are crossing border in Vartius yearly (**20**). Second problem is connected with the Russian side of the railroad and will be described below.

The problem of seeking for the alternative appears with the fact of missing link on the **Rovaniemi** spur track between **Salla** and **Alakurtti** (**33**) and the railroad network after Rovaniemi not sufficiently developed, whereas spur-track to Vartius is a part of a well-developed railroad, the link is in need of a slight improvement. Although the direction to Vartius is developed better, the route to Rovaniemi is still essential because of the noticeable time and distance savings. Due to these facts, the decision concerning this route becomes complex and has a necessity of careful measurements, which will be done below in the next chapter.

In this part attention is put on the railroad connection between **Rovaniemi** and **Salla**, because currently this part of the route, on the direction of Murmansk Link (**7**) between Kemi and Kelloseika, takes full governmental attention. The length of the route is 270 kilometers from Kemi to Kelloseika. On the whole length railroad is single-tracked. However, only part to Rovaniemi is electrified, the electrification after Rovaniemi to Kemijarvi is nowadays under construction, and after Kemijarvi it is totally missing (**15**). The electrification till Kemijarvi should be done this year (**14**).

In case of not sufficiently developed railroads in this area, it cannot be considered as a core route for transportation. Currently there are only six daily trains from Kemijarvi to Kemi and Oulu transporting round wood for paper plants located in there, as well there are six trains from Rovaniemi transporting the same cargo to the same points. For passenger transportation there are 14 trains servicing the route between Rovaniemi and Kemi and only 1 night train servicing the route from Kemijarvi to Kemi and 1 – backwards (**14**).

However, single-tracked system of railroad with automatic security system makes trains move with some time delays, especially cargo trains, and the route should be developed in case of further growth of cargo traffic (**14**).

The critical point of Murmansk Link is a missing railroad connection between **Salla** and **Alakurtti**. Sixty kilometers of the railroad are missing. Furthermore, considerable development work should be done because of inadequate condition of the railroad on the both sides. The length of the areas, which has necessity of development, is 200 kilometers in both directions (**14**).

In the situation if a railroad connection between Salla and Alakurtti would be done, further transportation should be performed by the means of single-track, not electrified railroad. Electrification starts only at the point of Karelian brooks (**27**). From this station starts a core railroad to Murmansk. The route till Apatity is electrified, having sections with double-tracked railroad or with switching track (**27**).

Currently the administration of the Oktyabrskaya railroad is planning development of the route and building second rail track in Korelia to increase carrying capacity, it will give trains an opportunity to make transportation in both directions without any stops and jams (**14**).

The railroad from Apatity to Murmansk is electrified on the whole length, but still has necessity in development, because railroad has single-track with switching tracks (**27**). The fact of having only single-tracked railroad on the way to the large port decreases carrying capacity of this direction.

Although, transport infrastructure in the port area nowadays is not sufficiently developed, and the authorities of Murmansk have in plans the beginning of addition a new passes in the whole transport infrastructure of the city (**30**). The high priority here a railroad network should have.

This route can be considered as an alternative route to the route described above. However, this route has same necessity in development. Being a part of a Barents Link – transport corridor – this route has an access further to the core railroad of the **Murmansk** State and through Saint-Petersburg and Moscow has an access to the Trans-Siberian railroad corridor; these facts make this route pretty busy (**7**). For the disadvantages of this route longer distance can be added and, as it logically comes out, longer time for transportation. In case of transportation of perishables, such as fish – the main product of Tromso (**14**), time becomes a critical point. However, this route can be considered as beneficial, because it needs less investments and the concept of development for a Barents Link already exists (**7**).

In conclusion to this chapter, this route could unite industrial and tourist centers in the Barents region in the most convenient way, increasing the cargo transportation and passenger flow.

5. ECONOMIC FEASIBILITY

The term of economic feasibility is defined as the necessity of making some kind of changes to receive benefits. To prove economic feasibility, few factors should be described. In case of developing new route, the information about prices for development of new route, the necessity of development of existing routes, prices for transportation on existing routes and approximate prices for delivery using the new route should be given. Furthermore, current political and economic situation should be taken into consideration, especially political situation, if transportation is performed between two or more countries. Seasonal variations in cargo flows should be described as well.

- Prices of development

Currently projected route does not exist in the term of railroad transportation, mostly because of missing link between Salla and Alakurtti and missing links to Tromso port.

The situation connected with Tromso was described above: the missing link to the whole railroad network of Norway and the closest point with the railroad connection is Narvik located in 250 kilometers away from Tromso. However 250 kilometers is significant distance for road transport; in case of small amounts of cargo outgoing and incoming to the port of Tromso, there is no reason to make considerable investment into development of the ports infrastructure. Although in the situation, when the port is considered as a future major hub, investments (which were actually done for the last few years) should be put in to provide the port with the sufficient connection. Unfortunately, currently there is no information about the expenses of the project building railroad to Tromso.

The next problematic point, as it was mentioned above, was Salla – Alakurtti and especially Salla customs point. There approximately 60 kilometers of railroad is missing. At 60 kilometers 7 kilometers from Kemijarvi to Salla and 50 kilometers from Salla to Alakurtti are included. In accordance to the report “Transportation needs of mining production”, 10 million euro is needed to develop railroad on the

part from Kemijarvi to Salla, and for the part of Salla – Alakurtti this number goes to 90 million euro (**26**).

In spite of this, building of a railroad link between these points would not be sufficient to fulfill all transportation needs of this region. Passenger traffic should not be forgotten in this case, because Rovaniemi has great significance in case of tourism. Currently the railroad infrastructure in this point of the route is not ready to receive considerable amounts of cargo: starting from Salla, 200 hundred kilometers should be developed in both directions (**14**). Most of the costs on the Russian side are directed to the development of Murmansk port's infrastructure in the direction of Rovaniemi and the North-Finland's mining basin. On this railroad spur-track costs for development are approximately 770 – 1640 millions euro. Approximately 75 – 90 millions euro should be invested in the development of the spur-track on Alakurtti (**26**).

Furthermore, the part of a Narvik Link needs to be reconstructed. By the forecasts, considerable increase in transportation of mining production is coming by the year 2030. Although forecasts are saying about the increase, there are already significant problems with carrying capacity in the transport corridor of the Narvik Link. In accordance with the needs of this line, some projects are given as development possibilities. The investments vary differently from 700 – 1130 millions euro for development of this route. However, most of the investments are put not in the projected route as given here, but for development of direction till Kaunisvara and further to Kolari in Finland. The price for the Kaunisvara – Kolari part is around 110 – 120 millions euro. This development is rational in case of continuing railroad to Sodankyla and further to Kemijarvi to perform Transportation from Norway to Russia and backwards through Finland and Sweden using railroad only (**26**). However, this route should take into consideration transportation differences between Finland and Sweden railroad gauge. As it was mentioned above, Finland has non-standard for Europa gauge of 1524 millimeters, while Sweden has 1420 millimeters wide railroad (**20**). In this case there is a necessity of building new point to change width of railroad track in Kolari. This route will take away loading of Bothnic Link, which currently has problems because of the broken railroad track switcher in Tornio/Happaranta (**14**). Unfortunately, prices for development on the Russian side are not available.

- Projected route versus current route through Vartius

Projected route is not the only one option for cargo delivery. In the local link road passes with simple truck delivery can be used, but it can be performed only at a short distance. Air freight is not considered as a feasible transportation mode, except for performing delivery of the cargo with the high value or perishables. Marine transportation is mostly developed in the Barents region and could be used also, but it takes too much time to fulfill all transport formalities connected with the marine transport. Railroad transport is the best way to connect few points which are slightly away from each other and suits for international linkage. In the case of project route distances are varied differently and the whole transportation route surpasses 1000 kilometers.

One more reason to use railway in this route is the specification of the cargo. Mostly it is ore, timber, oil and gas, which are mainly transported in noticeable amounts. Air and road freight are not feasible in transportation of these types of cargoes. The most reasonable would be marine transport, but unfortunately most of the points in the projected route are sealed in land territories. However, arises a question: should transportation be performed by the means of existed and well developed routes, such as Narvik Link and further through Barents Link, or not?

Firstly, the existing routes are overloaded nowadays. The part of the route Vartius – Kochkoma currently has a lot of problems with carrying capacity and already has programs of development from the Russian side for approximately 8 millions euro (**7**). Furthermore, growth in cargo flows was forecasted, which could make this route overloaded (**26**). In the case of growing cargo flow, new cargo route, built through Rovaniemi, should become a solution, which will take off some traffic capacity on its railways. Moreover, to perform transportation by the means of projected route have to be used, the existed cargo corridors such as Narvik Link and Bothanian Link have to be used (**7**). Although those corridors have developed infrastructure, they are not ready to receive an increase in cargo flows, which was forecasted in accordance to the growth of the mining sector of production, but having problems with carrying capacity. Forecasted growth in transportation should be more than 50%, from current 30 million tons per year to 70 million tons per

year. The difference in the width of railroad track in Sweden and Finland in Bothanian corridor makes significant disturbance for further increase in cargo flows as well (**26**).

Secondly, the main reason to develop a route through Rovaniemi is the growth of the mining production in the Northern Finland. The concentration of the mining production is located around Rovaniemi region; the biggest problem cowered under undeveloped or missing links with the production areas. Moreover, in case of using Vartius to transport mining production to Russia, significant overlapping appears. In addition, the route should go through Rovaniemi and Kemijarvi, because currently there are already existing projects of development railroad connection with the whole mining area (**26**). In advance of Rovaniemi a vast interest from the tourists, visiting Finland, should be added (**13**).

In conclusion, no doubt it is always easier to develop and use previously built routes. However, under the given circumstances development of the routes founded earlier will be not sufficient to perform route which is feasible both from the economic and logistic sides.

- Current economic and political influence on development.

  If the projected route is considered as an economically feasible international transport corridor, the economic and political situation in neighboring countries should be favorable. In current project route includes countries of a Barents region: Norway, Russian Federation, Finland and Sweden. Two of the countries are included into one economic co-operation area; those are Sweden and Finland, which are members of the European Union (**34**). All of the countries are parts of the World Trade Organization as well (**31**). These facts make this route even more valuable, because countries have economic benefits in trading, being a part of the same trade organization. Participation in the same trade organization also gives some derogation in law formalities for customs clearance.

  However, all of the countries are members of World Trade organization Russian Federation joined it only in 2012. In accordance with this fact, the increase in traffic flows was forecasted, especially in a forest industry, which will increase loading of Barents region cargo passes. This increase was forecasted, because the

customs tariffs for wood production of conifer were decreased two times, and three times less customs tariff price received birch wood, which was steamed from World Trade Organization regulations. Furthermore, in 2012 export to Finland took 15% of the whole trade of round timber (**35**). In addition to this, round wood export from Russia to Finland is grown for one and half times (**36**). Moreover, it was mentioned already that growth in export of Russia constitutes 4,1% of total trade between Finland and Russia (**37**).

In the trade of Finland and Sweden growth is mentioned as well. Moreover, here should be included the fact that Sweden and Finland have the same economic co-operation area of the European Union, which is based on a free movement of goods principle. In the period from January till September 2012 the share in cargo turnover in Finland was as follows: Sweden had second place after Russia with approximately 11% of the whole trades. In 2013 figures changed showing the growth and having already 11,5% of the whole trades.

Leading position in trades with Sweden holds Norway as it is clear from the tables 2 and 3, second place in trade with Sweden holds Finland and the last – Russian Federation. Furthermore, from these tables could be found that Sweden doesn't export goods actively to Russia; however active trade with Finland and especially Norway means presence of the well-developed infrastructure.

Norway is non-European Union member; however, this country is a member of the World Trade organization and an active trader. In the period from 2009 till 2013 Norway has shown sustainable growth in trades with the Russian Federation, Finland and Sweden. As we can see from the tables 4 and 5, the main trade partner of these three countries is Sweden.

All of these figures show that sustainable growth in trade between those countries is appearing. This fact makes the development of transport infrastructure and especially the new route's development more and more important for the Barents region. The purpose of development is necessity to decrease loading of the existing routes.

Although sustainable growth was shown in previous figures, there are some problems appeared in relations between countries. These problems are connected

with the current situation around the crisis in Ukraine. Because of the referendum that was held in the Crimea, European Union imposed sanctions against Russia, which will have a bad influence on trade and development of current projects (**38**).

- Seasonal differentiation in trade/transportation.

  To show seasonal differentiation in trade between countries, there was made a decision to take into consideration trade of Sweden with all participating countries: Russian Federation, Finland and Norway. Flow charts given below show the total value of goods which were imported to Sweden from named countries or exported from Sweden to these countries. Information in the charts is shown in Sweden currency, Sweden krones. This information was not transferred into a common currency of euro, because the main aim of these charts is to show trade dependency on the season of the year.

  In accordance to Figures 11 - 20 given in appendences and covering a repetition time of 5 years, any significant dependency on a season in imports and exports of goods can be mentioned. Numbers vary randomly. However, some slight growth can be mentioned at the end of the year, it can be described with an increase in customer activity because of coming Christmas holidays. Although years 2012 and 2013 show slight negative growth in this period.

  The numbers reject straight dependency on seasons of year in trade between countries, which proves that new transportation routes will be feasible all the year round.

  From the figures 11 and 12, describing trade of Sweden in 2009 with Finland stability can be mentioned, without any seasonal variations. Export to Russia was also stable, but an import from Russia to Sweden had some growth and drops in summer and autumn period, and after final growth in October it was stable at the highest point. Trade with Norway varied differently. However, some growth in autumn period and slight negative growth in December can be mentioned.

  Figures 13 and 14 give us a picture of seasonal variations in international trade of Sweden in 2010. Trade with Finland was stable for the whole year, except the negative growth which started in May for imported goods and in June for exported

goods. This negative growth was changed for a positive growth and put a trade number almost to the same level. Trade with Russia varied greatly with a peak in export from Sweden to Russia in August; however, no dependability on season trade could be mentioned. Almost the same situation was in trade with Norway, some fall and growths can be mentioned in spring period, but in July-August everything came back to the same way.

From figures 15 and 16 which are describing import and export of Sweden in 2011, no special seasonal variations could be mentioned as well. Trade with Finland was stable, except negative growth in import from Finland which started in April and changed in July for a positive growth that put Finland at the same level. However, in export to Finland could be mentioned a small growth in July, which put numbers of export on a new level of approximate 700000 thousands in Sweden crones. Trade with Russia was changing for the whole year, but in the second part of the year export and import became a little bit more stable. The same situation appears with the leader of the trades, Norway. Trade there was changing in the first part of the year, then changed for a positive growth and stabilized in the second part of a year.

The information about trade with Finland in 2012 given in figures 17 and 18 is comparatively the same. Finland stays at the same level, having stability in trade with Sweden. Export to Russia was stable, but the price of exported goods was less in comparison to 2011. After significant growth in 2011 import from Russia, staying at the same level till May decreased significantly. This negative growth in May was changed for a slight growth in September. Trade with Norway had ”vawing” variation, however, stayed at the same level by the end of the fiscal year.

From figures 19 and 20 it is clear that trade with Finland usually stable. Export to Russia was comparatively stable with growth starting in October and changed for negative growth in November. Situation with import from Russian Federation is more difficult. The growth could be mentioned till May and June, switched to negative growth stopped at the lowest point for five years in September, though changed for positive growth, reaching the highest point for five years in December. Import from Norway was decreased for a year significantly from 900000 thousands SEK till 700000 thousands SEK at the end of a year. The drop could be mentioned

as well in export from Sweden to Norway, after the highest point in the October negative growth mentioned.

However, the trade with Sweden varied differently for period of these 5 years, and no tendency which would show the dependence of trade on season could be mentioned.

6. Emergency Risk management

- Environmental risks

This chapter is concentrated on the problems concerning maintenance of transport in a given conditions. The definition of Emergency Risk Management covers the aspects of environmental problems which appear with the development of a new route, and the problems of using transport modes to perform delivery in the particular area and natural barriers, which will keep down development of this route.

First of all, the environmental problems of the Barents region should be listed. These are: air pollution, land pollution, sea pollution, forest destruction.

The main reason of these problems is the production in this area and especially manufactures and plants in the Murmansk State. In that case oil and mining production which is prevalent in the Murmansk State has the biggest influence on environment, polluting the air with hazardous emissions. Those emissions are mainly carbonic oxide and suphur dioxide, which have a bad influence on the atmosphere (**39**). In 2011 it was almost 300 thousand tons dropped into the atmosphere (**39**).

There is no secret that not sufficiently developed infrastructure holds production factories out from using full capacity, which means that after the development of the transport system, region, factories and plants located in this area would receive the chance to transport more products at the same time, increasing production capacities alongside with transportation volumes. That will increase hazardous emissions. As far as the railroad connection between Salla and Alakurtti will be finished, production will go faster and more intensively. Currently the regions of Apatity and Murmansk were already named as “hot spots”, which should decrease emissions (**39**).

Figure 21 given in appendences shows that industrial emissions in 2011 were decreased in comparison to 2010, though emissions from transport were increased. Although the numbers of total emissions per unit of Gross Rating Point showing a

tendency of going down, there is a threat that in the near future a fast growth should be expected, because new routes will be available for exporting goods, which will lead as well to increase in production capacities, multiplying industrial emissions. Moreover, with the growth in international trade, cargo flow will be increased, which will lead to more intensive transport usage causing increase in transport emissions. Development of infrastructure is not the only reason of the growth in trade. In 2012 Russian Federation became a World Trade Organization's member, which will give more options to import goods from the countries World Trade Organization members and export from Russian Federation to these countries.

Air pollution is a half of the problem. By development of the transport infrastructure in Murmansk State, which was planned for the year 2014, a lot of forest territory will be damaged in order to give existing routes more carrying capacity. This problem is actually not only for the Murmansk State, because Narvik Link also has to be developed, which will lead to the major building works on the way of the route. Barents Link also has lack of carrying capacity and needs to be developed. Situation with the spur-track of Laurila – Alakurtti is clear: the infrastructure in this area is weak or even does not exist and needs to be developed or built. Furthermore, there are projects of development passes to the major mining area near Rovaniemi, which would connect the Sodankylla region with the main railroad infrastructure of Finland (**26**). All these factors are hazardous for the environment in these areas.

Contrariwise, all disadvantages of building a new route and developing the infrastructure on this route could become not significant in a long-term perspective. If we consider Barents region's countries as sustainable trade partners, which will develop business relations, increasing stakes of exports and imports, this new route with developed railroad connection could decrease transport emissions, replacing the existing unreasonable methods of transportation, decreasing distances of transportation and decreasing time spent in transport collapses, when fuel is burnt for nothing.

- Natural barriers

  As far as this railroad is mostly going through the North areas with bad weather conditions, facilities and service on this route should be checked twice to be ready

for operating in a winter conditions. Most common problems of operating railroad in wintertime are: ice on a contact wire, protection of tracks from snow, problems with crossing and switches problem with visibility of signs and communication problems (**40**).

First of all, there is a problem with crossing and switches. Those can be badly damaged by snow, causing even out of order situations. To avoid this, shields can be used. In this case rails are equipped with a desk or a tarpaulin. The second decision is to equip railroad on the crossings or switching with brushes, but those have a limitation of speed – 160 kilometers per hour for the trains using this point and those lose effectiveness after temperature lowers less than minus 20 degree of Celsius. The last, and the most effective, but the most expensive way to solve the problem is to put electrical heaters (**40**).

Secondly, a problem of ice on a contact wire should be taken into consideration. This problem can damage the whole transportation plan, because ice could disturb or even break a contact of the train with wires. Another scenario, which is more possible to happen, is the appearance of light in time of contact of carbon with the contacts of the trains and copper wires. This light can reach a temperature of 3000 Celsius degree, which causes cracks in carbon element of the train. Several things could be done to prevent the damage: carbon could be deeper, carbon can be changed for aluminum and wires can be covered with a brass strip. Monitoring systems could be replaced as well, to monitor all the needs of the contact wires or occurring problems for immediate solving (**40**).

Thirdly, there is visibility of signs and communication problems. This is one of the most important factors, because it causes the safety of moving on the railroad. All signs should be checked and all electrical parts should be ready for a winter period. All personnel should be ready to react immediately for all of the appearing problems to fix those as fast as possible, because even one broken traffic light can be the cause of delay in the best scenario – in of the crash accident in the worst one.

Last but not least, a problem of snow on the tracks should be described. Snow should be cleaned from the railways and the situation should be monitored for the whole winter period to avoid the situation of stopping the train. The train can be

stopped if bogie of a train will be gathered by snow and ice. To prevent it snow should be removed from rails or rails should be equipped with heaters (**40**).

In conclusion to this chapter it would be better to mention that although this route will bring some hazardous threats for the environment and has lots of problems and costs operation in the winter time, in the outcome it should give sustainable cargo transportation corridor, which will keep the environment far from dangerous emissions growth and will provide exporters with cost saving route with extra carrying capacity.

- Discussion and Conclusion

The main goal of this work was to prove economic feasibility of the new project route: Tromse – Kiruna – Rovaniemi – Murmansk, through giving possible ways of development, comparing carrying capacity of the projected route to existing routes and proving necessity through analyzing statistical data about international trade between countries.

There were a few problems connected with the development of a project route. As far as rail transport was considered as a prevalent one, the missing linkage in some areas was the main problem. The biggest problem was a missing railroad connection of the whole Norway network with Tromso. One more serious problem that could be mentioned was a poor railway connection with Rovaniemi and a missing railway connection between Salla and Alakirtti. During the research it was also found out that current railway passes have not sufficient carrying capacity to cover transportation needs. Moreover, in a sense of forecasted growth, the existing railway routes such as Narvik Link, Bothnian Link and Barents Link would not be able to be economically feasible and beneficial, having collapses nowadays. Murmansk and Murmansk State also could be mentioned as a problematic area, because Oktyabrskaya railroad in this area has not enough carrying capacity to receive significant increase of transport flow, caused by an increase in international trade. Furthermore, Murmansk being the largest port in the North-West of Russian Federation and having all chances to become a main hub port of a Northern Sea route, has a lack of carrying capacity even nowadays, and there were some reports signing collapses in incoming and outgoing cargoes.

Projected route was aimed to decrease loading on existing routes as well as to give more different possibilities to perform transportation between given countries. The second problem of the projected route connected with railroad was the difference in gauge. Currently Norway and Sweden are operating with the width of 1435 millimeters, but Russian Federation has the width of 1520 millimeters, almost equal to Finland’s one – 1524 millimeters. The problem was covered in Tornio/Happaranta railway point, where all trains should change railway track or perform reloading from one rail to another, however the machinery which should

perform the change of railway track broke down, significantly decreasing the carrying capacity of this railway point.

Through the studying and comparing information about the cargo turnover in the Barents Region taken from the official customs and organizations' webpages, such as Kolarctic, it was found out that one could see, if not sustainable growth in, but stable and significant cargo turnover in international trade. In accordance to this fact (and also taking into consideration the fact that Russian Federation became a member of World Trade Organization, which automatically should decrease formalities and difficulties connected with the customs clearance of the goods crossing Russian border thereby increasing the whole international trade and cargo flow), the infrastructure of the Barents region should be able to carry out necessary increase. Moreover, current problems and collapses on existing routes give one more provement of necessity for this route.

However, all numbers of international trade show that this route should be built in the past, there are still some blind sides. Because of inaccessibility for the prices of performing work under construction of this route detailed picture could not be reached. In this work only approximate numbers for development of a certain area of this route are given, but the total price of the building is not available. In a sense of this work it is difficult to calculate the total price, because the project route covers a lot of different territories, which are parts of different development projects with different level of investment necessity and different costs. Furthermore, the costs for maintenance of the new route, because should be considered, as it was mentioned above, the project of the route is planned to go through the North areas of Barent region, where weather especially in a winter time creates a very difficult situation for transport modes. This fact makes project of the route more complicated and more expensive, because all necessary for maintenance equipment should be ready for severe polar winter.

Though this project has a lot of problems, all of them are not crucial in case of close collaboration of countries in finding a solution. Most of the problems if not being solved yet or are not in operating stage, have a project and a plan which will be performed in the near future. There is an already finished project of expanding Narvik Link and Bothnian Link, as well as Oktybrskaya railway has a plan of

increasing the carrying capacity on the direction to and from Murmansk. Rovaniemi and the area around recently received considerable investments to develop infrastructure, for needs of the mining basin in this area. Road transport was not described with full attention, but there are also projects, especially from the Russian side, which consider the improvement of the road network in Murmansk State, especially in the point of Alakurtti, to increase cargo flow.

Having this information one can raise a question: Why should the new route be built, if the old ones can be expanded? But old core routes, especially Barents Link, currently have a lot of development projects, and all of these projects are aimed to solve a problem of insufficient capacity for existing cargo turnover, not taking into consideration the increase which was forecasted. The situation of leaving projected route without development will lead to increased investments to existing routes and continuous tries of expanding its carrying capacity, whereas projected route can give unload of existing routes by taking some cargo traffic on itself and of course giving necessary alternative of shorter and as a result economically feasible route.

In a long term perspective and especially in case of active development of the Northern Sea route this route will be essential for countries of the Barents region.

At the end, I wanted to add that I strongly believe that this route should be built, because in spite of all the difficulties, problems and expenses which are connected with this route it will provide the Barents region with: necessary carrying capacity; the competitive alternative for transportation; necessary entrance to the biggest ice-free port in the North-West of Russian Federation with the greatest access to the highly promising Northern Sea route. Moreover, in a long-term collaboration money spent on building of this route would be more efficient, than continuous investments in existing routes, with a hope of expanding those till needed condition.

• APPENDICES

- Table 1. Amounts of cargo crossing the border between Russia and Finland using railroad. Tonnes. (**20**)

	2009	2010	2011	2012	2013
Imatra	6080479	5919331	4913607	5765700	5821913
Vainikkala	1614096	2213933	2232251	2238206	2994724
Niirala	1036135	1248419	957608	1035025	1046033
Vartius	2502101	2736448	3013053	2538715	3574962

- Table 2. Imports of goods from countries of consignment to Sweden. Adjusted for non-response, SEK thousand by trading partner and year (**41**)

Imports of goods from countries of consignement, total values, SEK thousand					
	2009	**2010**	**2011**	**2012**	**2013**
Finland	47008826	56486392	61244959	56752477	57605876
Norway	82 061 333	97478572	97406088	101066281	92476300
Russian Federation	31 487 684	50304267	63120065	60268100	45541456

- Table 3.. Exports of goods to countries of destination from Sweden. Adjusted for non-response, SEK thousand by trading partner and year (**42**)

Exports of goods to countries of destination, total values, SEK thousand					
	2009	**2010**	**2011**	**2012**	**2013**
Finland	63896347	70349594	73992753	75344357	77025877
Norway	105769566	113366686	114853529	120501565	116710504
Russian Federation	14027857	20781101	27613962	23641193	23614854

- Table 4. Imports of goods from countries of consignment to Norway. Thousands of Norwegian Krone (**43**).

External trade in goods, by imports country, commodity group, time and contents						
		2009	**2010**	**2011**	**2012**	**2013**
		Value (NOK 1 000)	**Value (NOK 1 000)**	**Value (NOK 1 000)**	**Value (NOK 1 000)**	**Value (NOK 1 000)**
FI Finland	**- TOTAL**	12525754	11919233	12906550	14076326	13390633
RU Russia	**- TOTAL**	7071971	12156722	10556460	10311040	9072616
SE Sweden	**- TOTAL**	59231557	65303217	68037843	68734810	70287338

- Table 5. Exports of goods to countries of destination from Norway. Thousands of Norwegian Krone (**43**).

External trade in goods, by export country, commodity group, time and contents						
		2009	**2010**	**2011**	**2012**	**2013**
		Value (NOK 1 000)	**Value (NOK 1 000)**	**Value (NOK 1 000)**	**Value (NOK 1 000)**	**Value (NOK 1 000)**
FI Finland	**- TOTAL**	8878158	9879532	14127320	13647708	9510750
RU Russia	**- TOTAL**	5697497	6940250	7671330	8481566	8610375
SE Sweden	**- TOTAL**	43094064	55306500	58134061	59306389	52340930

- Table 6 Import of goods from countries of consignment to Sweden. 2009(**42**)

	Imports of goods from countries of consignement, total values, SEK thousand											
	2009M01	2009M02	2009M03	2009M04	2009M05	2009M06	2009M07	2009M08	2009M09	2009M10	2009M11	2009M12
Finland	3536176	3663033	4012443	3841776	3519957	4014876	3372155	3685266	4334366	4390143	4431483	4207155
Norway	6696079	5690128	7963541	5785296	6547367	6341613	5430573	5879481	8105829	8659719	8114116	6847590
Russian Federation	1916670	2014882	2186546	2142413	1920595	2315056	3523488	1892739	3995748	1821662	3938549	3819335

- Table 7 Import of goods from countries of consignment to Sweden. 2010(**42**)

	Imports of goods from countries of consignement, total values, SEK thousand											
	2010M01	2010M02	2010M03	2010M04	2010M05	2010M06	2010M07	2010M08	2010M09	2010M10	2010M11	2010M12
Finland	3471255	4530209	5000189	4743109	4668981	5199796	3311299	4532075	5107748	5202341	5533147	5186245
Norway	6052921	7083822	6834428	9199056	8011727	9457897	6674698	7587588	8123120	9292240	9947882	9213192
Russian Federation	2716119	4670622	4115621	4479056	4435619	4492370	4049182	7210726	3598071	2976614	2925654	4634612

- Table 8 Imports of goods from countries of consignment to Sweden. 2011(**42**)

	Imports of goods from countries of consignement, total values, SEK thousand											
	2011M01	2011M02	2011M03	2011M04	2011M05	2011M06	2011M07	2011M08	2011M09	2011M10	2011M11	2011M12
Finland	4528664	4680953	5872679	5428000	5986356	4626679	3841116	4836375	5511816	5485440	5534738	4912142
Norway	8749216	7378432	9523969	7701963	8153608	9203348	7985588	6778412	7298795	8046808	8166823	8419126
Russian Federation	4668461	5295885	5966749	5775923	4853086	4588520	5072733	4853348	5306078	4790882	5499174	6449227

- Table 9 Import of goods to countries of destination from Sweden. 2012(**42**)

	Imports of goods from countries of consignement, total values, SEK thousand											
	2012M01	2012M02	2012M03	2012M04	2012M05	2012M06	2012M07	2012M08	2012M09	2012M10	2012M11	2012M12
Finland	4351212	4568755	5718514	4684204	4866774	4705325	3762829	4830335	4682529	5209078	5000310	4372614
Norway	7124678	9078469	9741081	8996348	7985148	8388923	7956794	9611329	8078022	8079689	8859472	7166328
Russian Federation	5350348	6433610	6488360	5770072	6051767	4183328	2982507	4527285	3523471	5445872	4874802	4636678

- Table 10 Import of goods to countries of destination from Sweden. 2013(**42**)

	Exports of goods to countries of destination, total values, SEK thousand											
	2009M01	2009M02	2009M03	2009M04	2009M05	2009M06	2009M07	2009M08	2009M09	2009M10	2009M11	2009M12
Finland	5113776	5436890	5783293	5156893	5235585	5470246	4469827	4973140	5702254	5648329	5588363	5317751
Norway	8017058	8070602	9068970	8462650	8210370	10110658	7598340	8728450	9711575	9554588	9745266	8491038
Russian Federation	1135386	1057069	1247869	1473295	1014400	1168861	1127877	1035183	1240169	1273742	1288549	965458

- Table 11 Export of goods from countries of consignment to Sweden. 2009(**42**)

	Exports of goods to countries of destination, total values, SEK thousand											
	2010M01	2010M02	2010M03	2010M04	2010M05	2010M06	2010M07	2010M08	2010M09	2010M10	2010M11	2010M12
Finland	5090881	5498850	6142209	5628418	5693871	5821986	5129005	6149321	6535991	6256031	6401538	6001494
Norway	7681893	8121049	9852317	9794125	9117856	11143127	7867460	10078887	10538656	9414480	10465222	9291613
Russian Federation	913504	1171040	1512777	1597084	1692694	1648225	1611793	1655866	2101052	1904119	2736654	2236292

- Table 12 Export of goods from countries of consignment to Sweden. 2010(42)

	Exports of goods to countries of destination, total values, SEK thousand											
	2012M01	2012M02	2012M03	2012M04	2012M05	2012M06	2012M07	2012M08	2012M09	2012M10	2012M11	2012M12
Finland	6505005	6109680	6530719	6103313	6434656	6166998	5189280	6336391	6121916	6781013	6519625	6545763
Norway	9556424	10172553	10479183	8860774	10455052	10447432	8480368	10253111	10178290	11632632	11189674	8796074
Russian Federation	1344539	1640338	1955359	1892336	2384872	2626926	1783685	2117630	1695042	2321164	2361750	1517551

Table 13 Export of goods to countries of destination from Sweden. 2011(**42**)

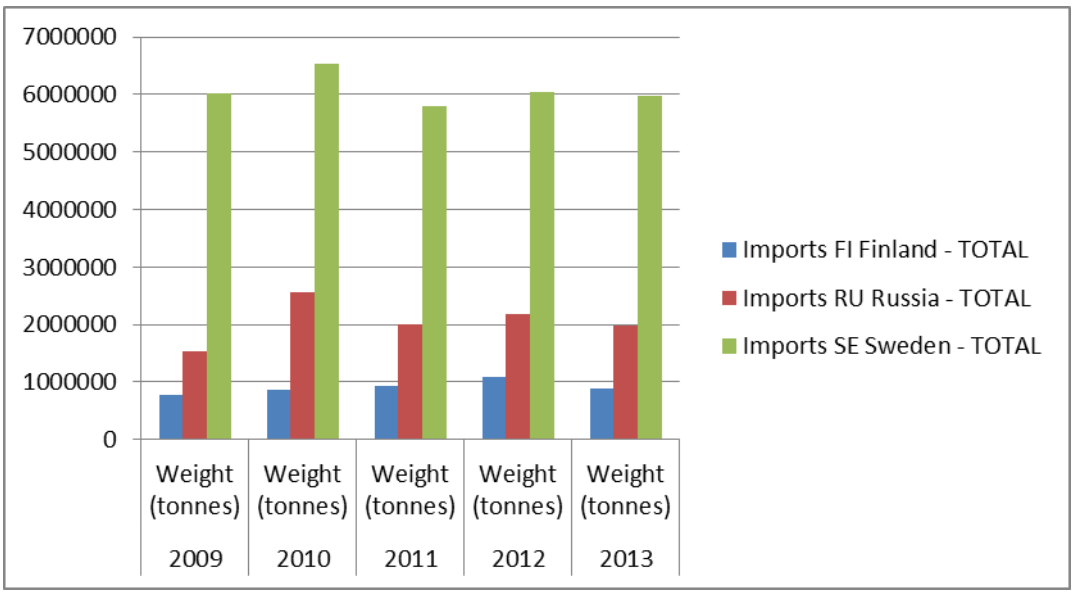
	Exports of goods to countries of destination, total values, SEK thousand											
	2011M01	2011M02	2011M03	2011M04	2011M05	2011M06	2011M07	2011M08	2011M09	2011M10	2011M11	2011M12
Finland	5322423	5783839	6621859	5710310	6376554	5870382	5300772	6940276	6913534	6127718	6585828	6439257
Norway	8718695	8533495	10048250	8792071	10167828	9409001	7832906	9846188	10471426	10497590	10740790	9795289
Russian Federation	1509262	1980174	2881953	2463542	2526032	2438810	2166883	2090863	3127126	2510178	2345119	1574020

- Table 14 Export of goods to countries of destination from Sweden. 2012(**42**)

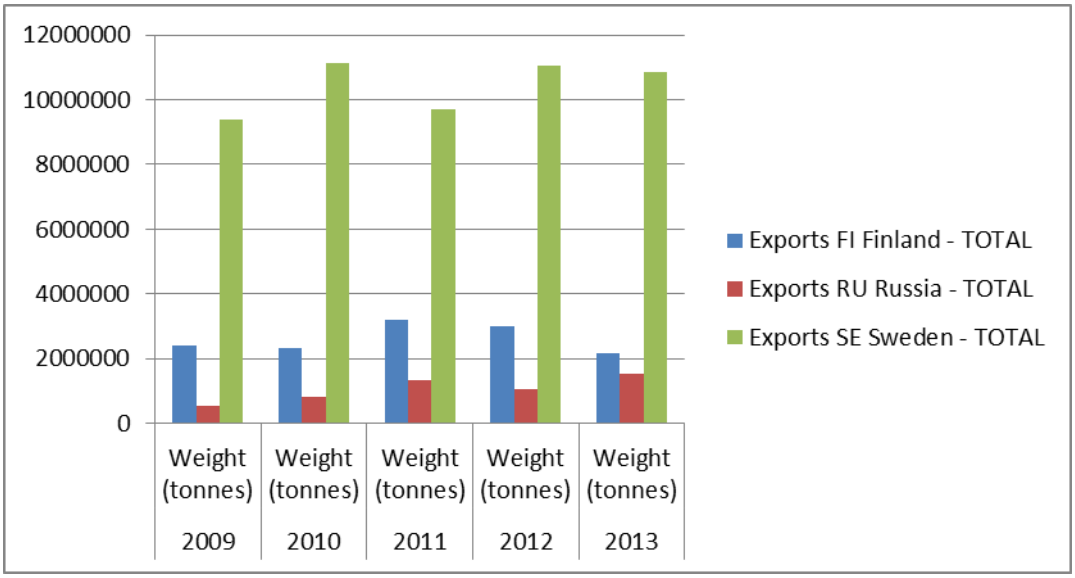
	Imports of goods from countries of consignement, total values, SEK thousand											
	2013M01	2013M02	2013M03	2013M04	2013M05	2013M06	2013M07	2013M08	2013M09	2013M10	2013M11	2013M12
Finland	4958951	4641652	4164678	4568717	5195728	4540457	4608402	4610374	5180835	5209832	5007303	4918947
Norway	8998684	6735801	7177136	7126851	7724076	8710244	8134648	7711898	8199305	7061762	7731610	7164286
Russian Federation	2743698	4559725	4316410	3159351	5195442	5148543	3919512	3421644	1313311	3087464	2994254	5682102

- Table 15 Exports of goods to countries of destination from Sweden. 2013(**42**)

	Exports of goods to countries of destination, total values, SEK thousand											
	2013M01	**2013M02**	**2013M03**	**2013M04**	**2013M05**	**2013M06**	**2013M07**	**2013M08**	**2013M09**	**2013M10**	**2013M11**	**2013M12**
Finland	6383720	5978380	6617962	6669328	6557701	5883708	5977443	6580749	6663306	6776541	6658397	6278641
Norway	9998595	9163136	9531262	9889341	9690244	9966017	8380347	9729199	9979082	11106864	10265280	9011137
Russian Federation	1380689	1589913	1892556	2056264	2417503	1896871	1854887	1617684	1976601	2115147	3086136	1730603

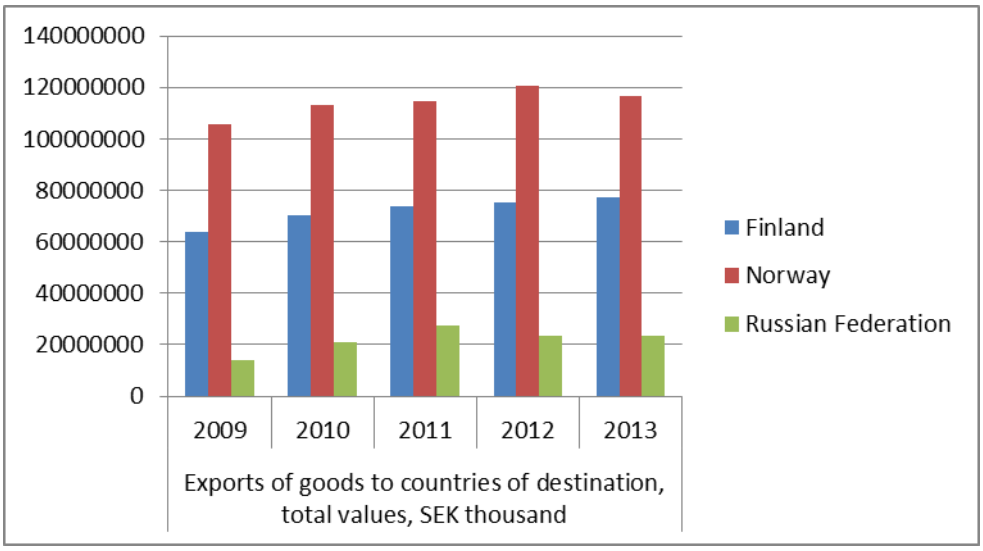


- Figure 1. External trade in goods, by imports, country. Norway statistics (**44**). In accordance to Table 4.

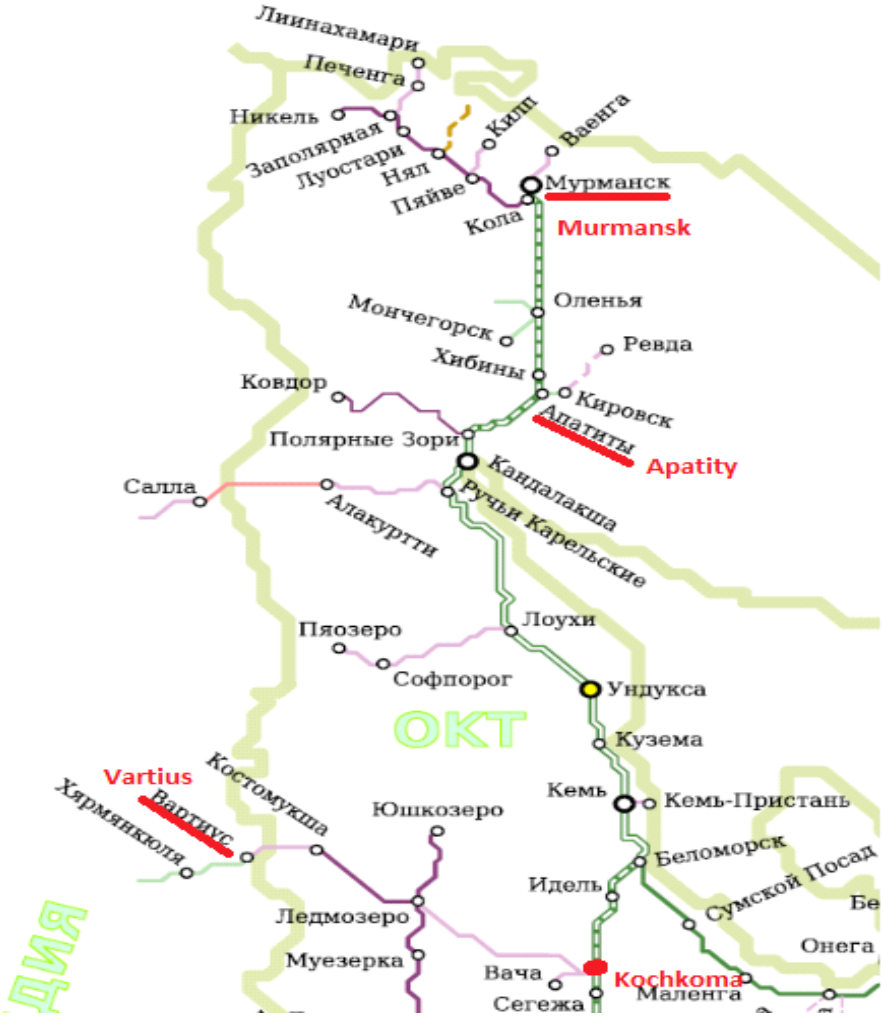


- Figure 2. External trade in goods, by exports, country. Norway statistics. In accordance to Table 5 (**44**).

- Figure 3. Imports of goods from countries of consignment to Sweden. Adjusted for non-response, SEK thousand by trading partner and year. In accordance to Table 2 (**41**)



- Figure 4. Exports of goods to countries of destination from Sweden. Adjusted for non-response, SEK thousand by trading partner and year. In accordance to Table 3 (**42**)



- Figure 5. Railroad of the Oktyabrskaya district in Russia Federation (**27**)

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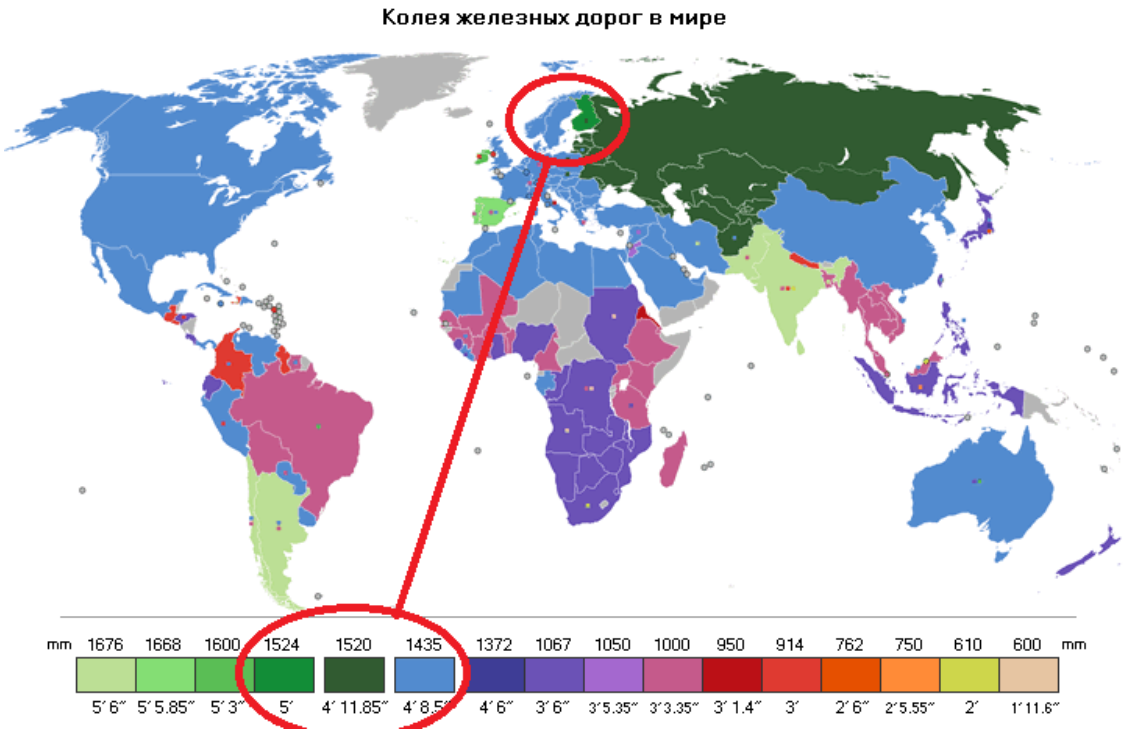


- Figure 6. The difference in width of the railroad (**45**).

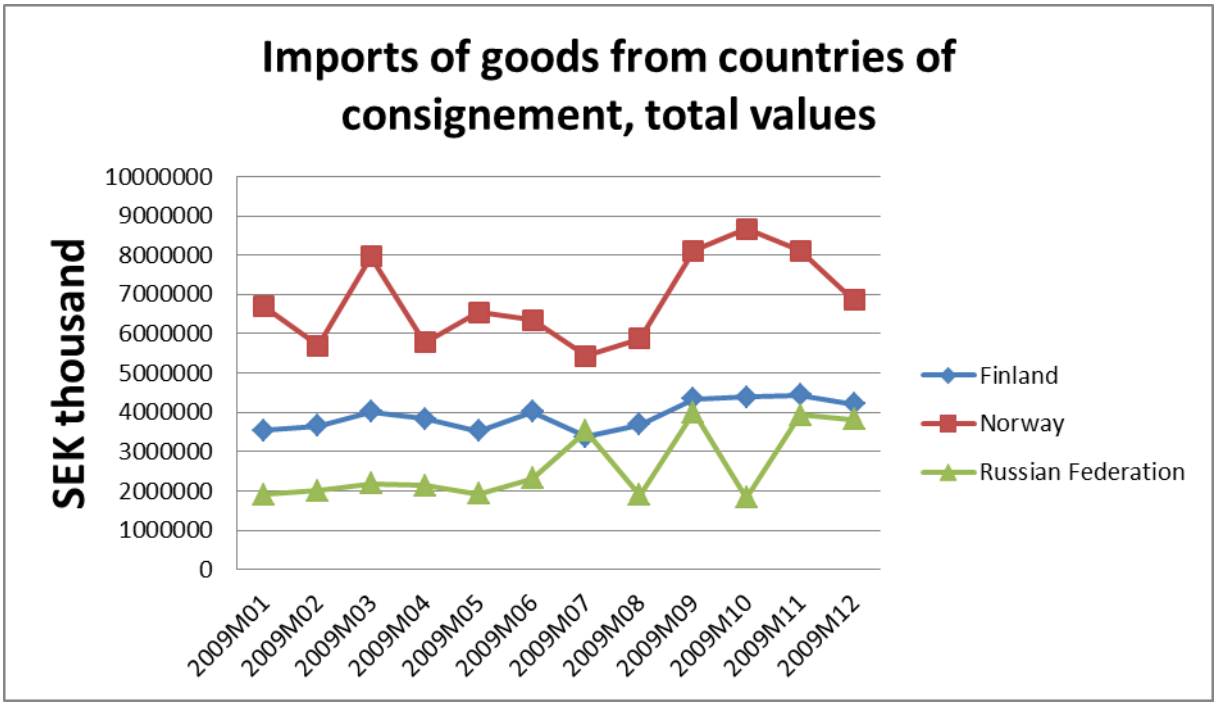
- Figure 7. Tornio – Lurila – Oulu (**17**)

- Figure 8. Kontiomaki junction (**17**)

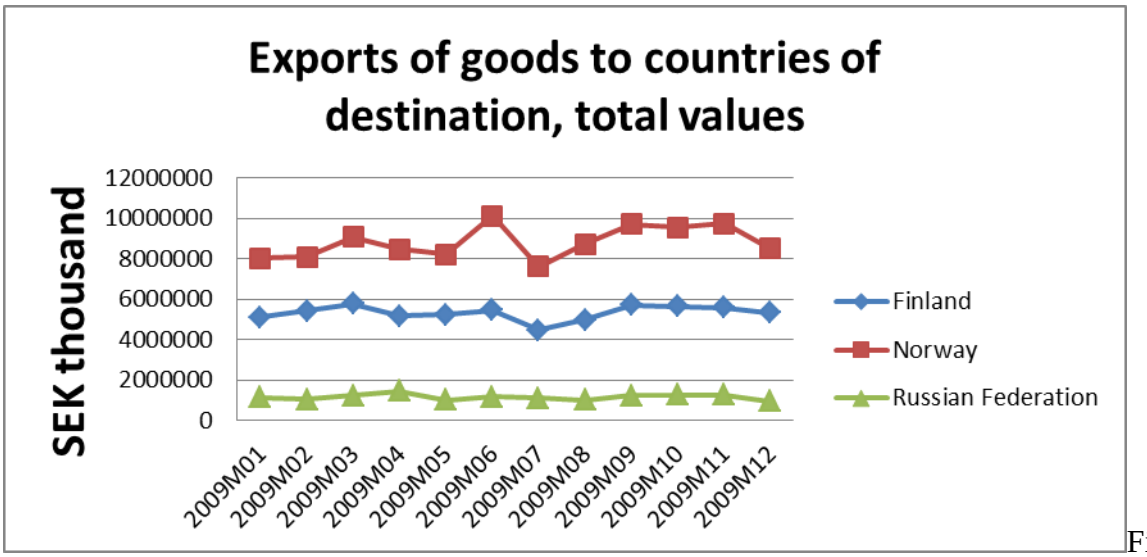
-

- Figure 9. Narvik rail connection (**23**).

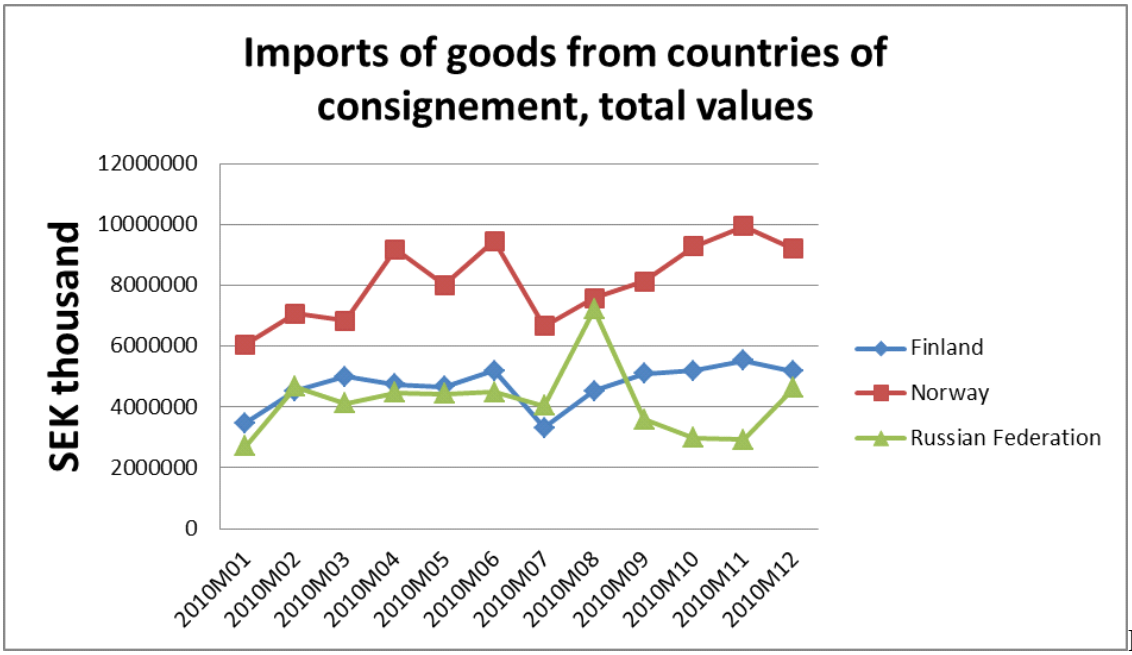
- Figure 10. The border crossing point in Sweden (**46**).



- Figure 11. Imports of goods from countries of consignment to Sweden in 2009. Statistics Sweden (**42**). In accordance to Table 6



- Figure 12. Exports of goods from countries of consignment to Sweden in 2009. Statistics Sweden (**42**). In accordance to Table 11



- Figure 13. Imports of goods from countries of consignment to Sweden in 2010. Statistics Sweden (**42**). In accordance to Table 7

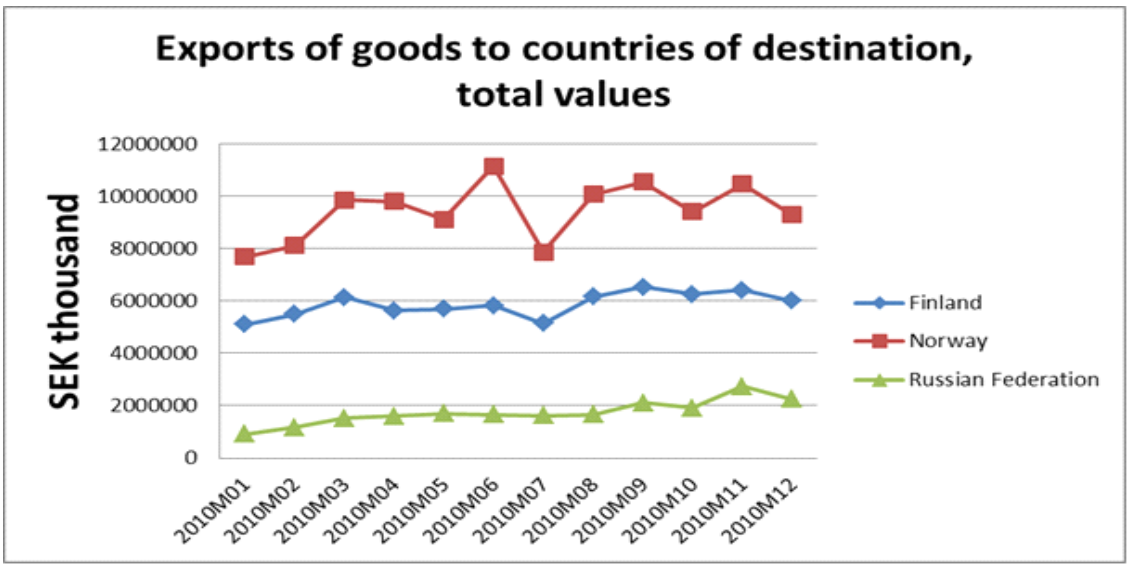


Figure 14. Export of goods from countries of consignment to Sweden in 2010. Statistics Sweden (**42**). In accordance to Table 12

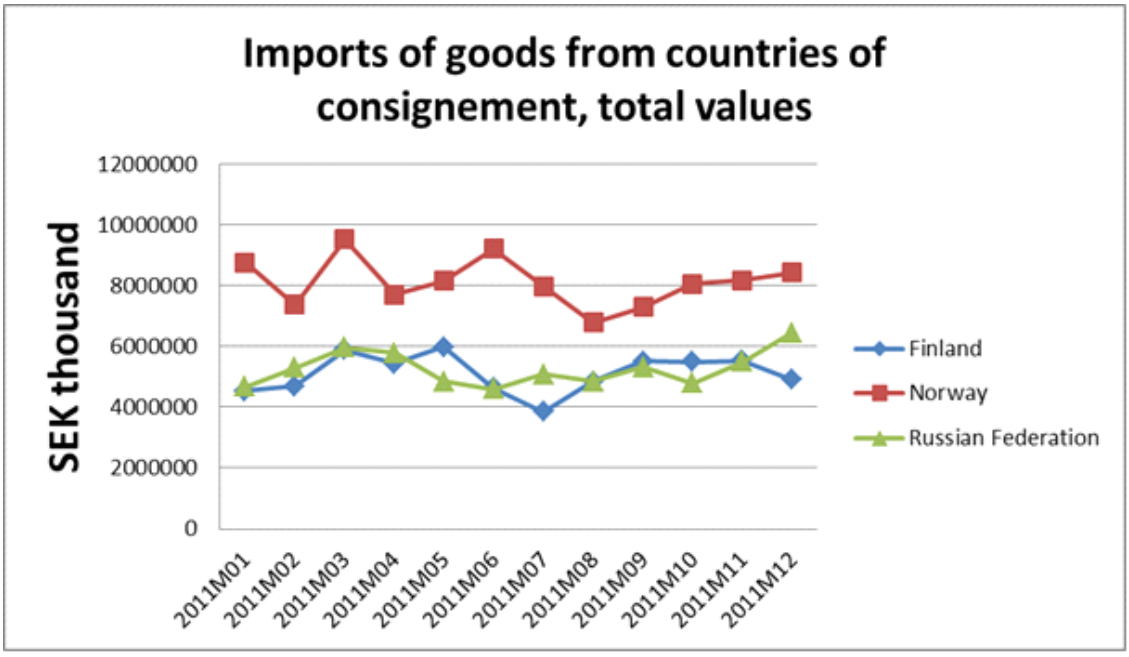
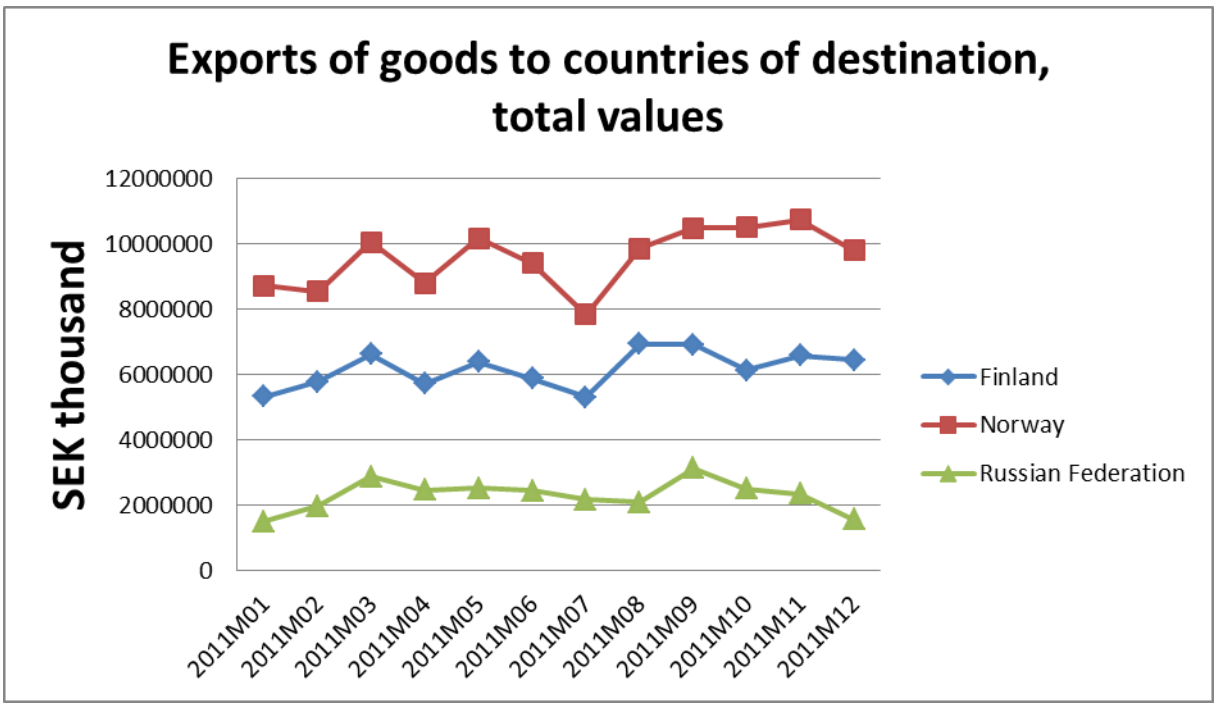
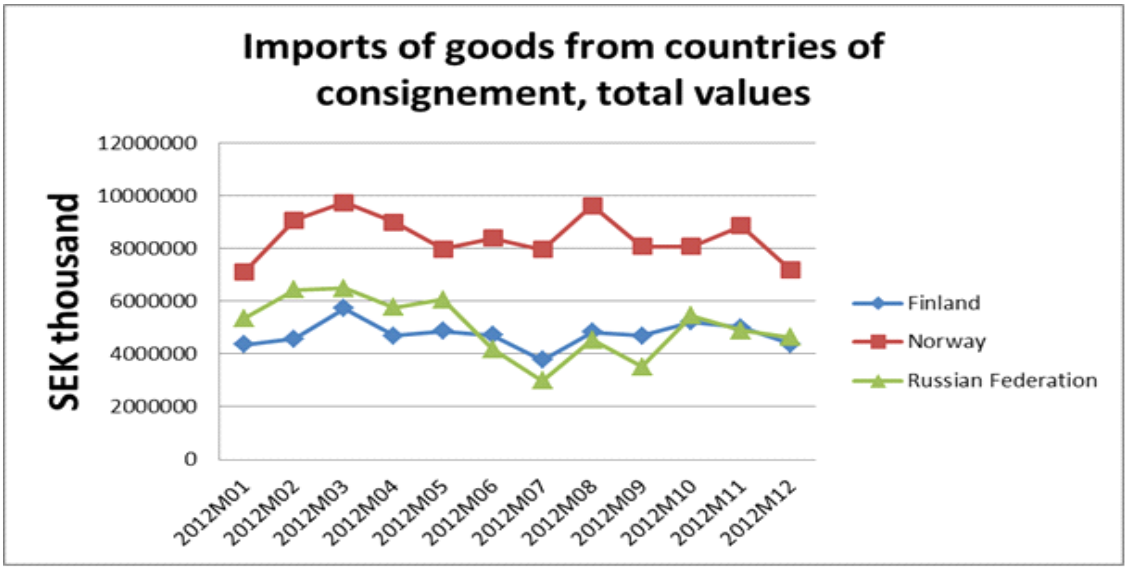


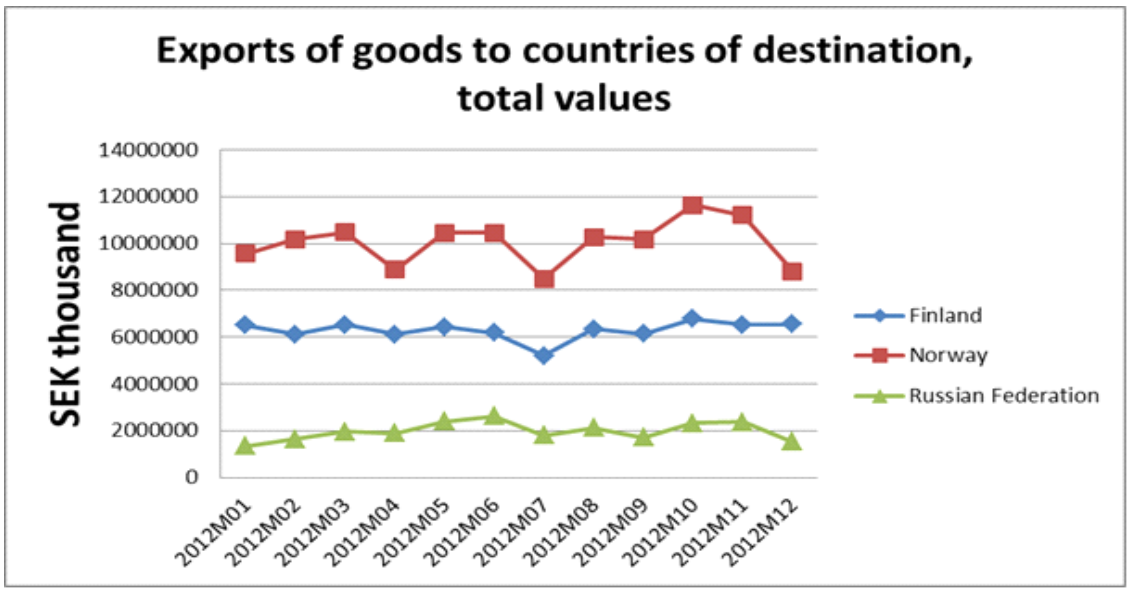
Figure 15. Import of goods from countries of consignment to Sweden in 2011. Statistics Sweden (**42**). In accordance to Table 8



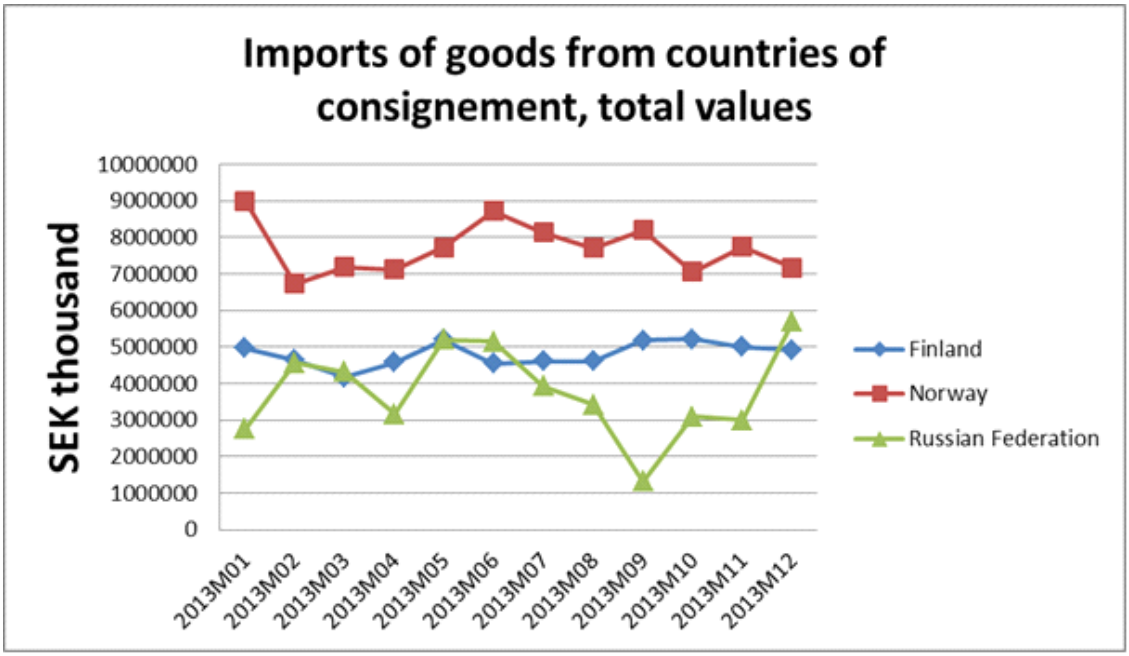
- Figure 16. Exports of goods from countries of consignment to Sweden in 2011. Statistics Sweden (**42**). In accordance to Table 13



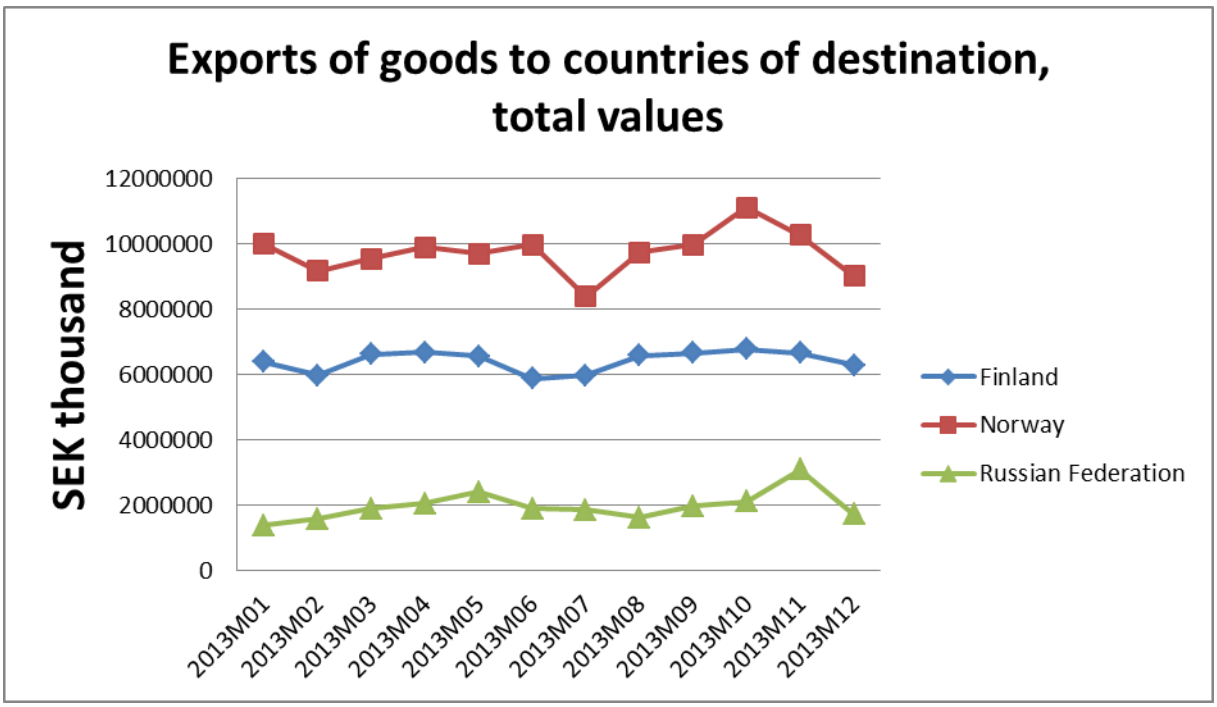
- Figure 17. Import of goods from countries of consignment to Sweden in 2012. Statistics Sweden (42). In accordance to Table 9



- Figure 18. Export of goods from countries of consignment to Sweden in 2012. Statistics Sweden (**42**). In accordance to Table 14



- Figure 19. Imports of goods from countries of consignment to Sweden in 2013. Statistics Sweden (**42**). In accordance to Table 10

- 

- Figure 20. Exports of goods from countries of consignment to Sweden in 2013. Statistics Sweden (**42**). In accordance to Table 15

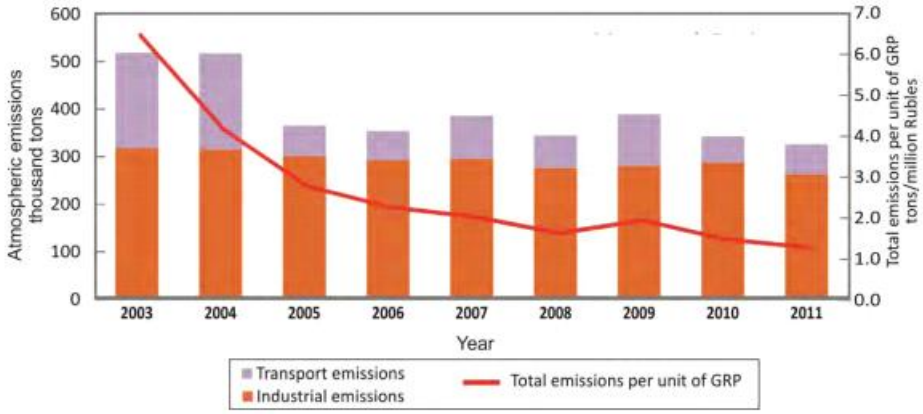


Figure 5.1.1. Dynamics of atmospheric emissions in the Murmansk region in 2003-2011

- Figure 21. Assessment of the Barents Hot Spot Record. Murmansk State (**39**).

- References:

(1) Investopedia. 2014. *Term of Globalization* [Online] Available from: http://www.investopedia.com/terms/g/globalization.asp [Accessed 20 April 2014]

(2) Nord-News, info agency. 2013. *Transport problems of the Murmansk State disturbing collaboration with Finland* [Online]. Available from: http://nord-news.ru/video/2013/07/09/?newsid=51020 [Accessed: 16 April 2014]

(3) Kolarctic official web-page. 2014. *About Kolarctic* [Online]. Available from: http://www.kolarcticenpi.info/ru [Accessed: 24 April 2014]

(**4**) Barents Info. 2014. About Barents Region [Online]. Available from: http://www.barentsinfo.org/Barents-region [Accessed: 16 April 2014]

(**5**) Gilligan C. and Hird M., 1989, 1993, International Marketing Strategy and Management, London: Routledge

(**6**) Paul Procter, 1995, *Cambridge International Dictionary of English*, Press Syndicate of the University of Cambridge

(**7**) BarentsLink. Report. 2009. "The concept of marketing and development of international railway communication Vartius - Kochkoma" [Online] Available from: http://sote.kainuu.fi/general/Uploads_files/Julkaisut/Sarja%20b/b15_barentsvenaja_kevyt.pdf [Accessed: 23 March 2014]

(**8**) Kolarctic report. 2013. Growth through Arctic Resources. [Online]. Available from: http://www.arcticcorridor.fi/assets/Esitteit/JKyleisesiteENGSCR2-2.pdf [Accessed: 22 March 2014]

(**9**) Official web-page of Apatity. 2014. Economic and geographic location of the city. [Online] Available from: http://www.apatity-city.ru/city/geography/ [Accessed: 4 April 2014]

(**10**) "RZD" report. 2013. Main Investment Projects on "Oktyabrskaya" railroad. [Online]. Available from:

http://ozd.rzd.ru/static/public/ru?STRUCTURE_ID=14&layer_id=3290&id=2056 [Accessed: 22 March 2014]

(**11**) The transport port of Murmansk. 2014. About the transport port of Murmansk [Online] Available from: http://www.portmurmansk.ru/index.phtml?3 [Accessed: 4 April 2014]

(**12**) Business facts sheet for Rovaniemi. 2009. *Barents Business Hub. Business excellence in the hearth of Lapland* [Online] Available from: http://www.rovaniemenkehitys.fi/loader.aspx?id=15fa3b51-04a6-4c2f-907d-dc0f6230c98b [Accessed: 7 April 2014]

(**13**) Official web-page of Rovaniemi. 2006. Twin cities: Kiruna [Online] Available from: https://www.rovaniemi.fi/International/English/Twin-Cities/Kiruna [Accessed: 7 April 2014]

(**14**) – The Barents Euro-arctic region. 2013. *Joint Barents Transport Plan* [Online] Available from: http://www.regjeringen.no/pages/38460560/JointBarentsTransportPlan200913r.pdf#search=rail map&regj_oss=1 [Accessed: 6 April 2014]

(**15**) The port of Tromso, official web-page. 2014. Port of Tromso [Online] Available from: http://www.tromso.havn.no/en/port-of-tromso/ [Accessed: 20 March 2014]

(**16**) The port of Tromso official web-page. 2014. Connections [Online]. Available from: http://www.tromso.havn.no/en/port-of-tromso/connections/ [Accessed: 20 March 2014]

(**17**) Finnish transport agency, official web-page. 2012. Valtion rataverkko [Online]. Available from: http://portal.liikennevirasto.fi/portal/page/portal/f/liikenneverkko/rautatiet/Valtion_rataverkko_15_6_2012.pdf [Accessed: 4 April 2014]

(**18**) Online journal "Expert of the North-West". 2013. *Murmansk and Finland – new perspectives for development* [Online] Available from: http://www.expertnw.ru/news/2013-07-10/murmansk-i-finlyandiya--novyey-perspektivy-razvitiya/ [Accessed: 7 April 2014]

(**19**) The official web-page of Murmansk. 2013. "Pasport of Murmansk" [Online] Available from: http://citymurmansk.ru/img/all/162_pasport_angl.pdf [Accessed: 7 April 2014]

(**20**) The customs of Finland. 2013. Statistics on Finland's land border traffic. [Online] Available from: http://www.tulli.fi/ru/finnish_customs/reports/statistics_on_land_border_traffic/092013.pdf [Accessed 15 March 2014]

(**21**) State district fiscal organization for managing motorways in the Murmansk district. 2014. State program's realization plan in Murmansk district: "Transport network delopment". Pdf. [Online]. Available from: http://www.madroad.ru/rabota_uchrezhde/gosudarstvennaya/ [Accessed: 23 March 2014]

(**22**) The transport junction of the Murmansk state. 2013. "Summer of roar repairing works in Murmansk" [Online]. Available from: http://51transport.ru/leto-remonta-dorog-v-murmanskoy-oblasti/ [Accessed: 8 April 2014]

(**23**) Scanrail. *Map Scandinavia* [Online] Available from: http://www.scanrail.com/multimedia/archive/ScanRail_Scandinavia_ver.0112_small.pdf [Accessed: 17 April 2014]

(**24**) The transport port of Murmansk. 2013. Results of Work for August 2013. [Online]. Available from: http://www.portmurmansk.ru/index.phtml?2482 [Accessed: 23 March 2014]

(**25**) "RZD" 2014. - the map of railroad district "Oktyabrskaya", official web-page. "Oktyabrskaya" railroad [Online] Available from: http://ozd.rzd.ru/static/public/ru?STRUCTURE_ID=14& [Accessed: 4 April 2014]

(**26**) Finnish Transport Agency. 2013. Report: *"Transportation needs of mining production"* [Online]. Available from: http://www2.liikennevirasto.fi/julkaisut/pdf3/ls_2013-04_transportnie_potrebnosti_web.pdf [Accessed: 4 April 2014]

(**27**) Map of railroads in Russia and Baltic countries [Online] 2014. Available from: http://www.parovoz.com/maps/supermap/ [Accessed: 4 April 2014]

(**28**) RailEurope, official web-page. 2014. Rail Map of Sweden [Online] Available from: http://www.raileurope.com/europe-travel-guide/sweden/map.html [Accessed: 4 April 2014]

(**29**) Judy Pearshall and Bill Trumble, 2003, *Oxford English Reference Dictionary* by Oxford University Press Inc., New York

(**30**) – The online journal "Expert of the North-West". 2013. *Transport junction in Murmansk will be built in 2014* [Online] Available from: http://www.expertnw.ru/news/2013-06-21/v-murmanske-nachnut-stroit-transportny-uzel-v-sleduyushchem-godu [Accessed: 4 March 2014]

(**31**) World Trade Organization official web-page. 2013. *Members and Observation* [Online] Available from: http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm [Accessed 3 April 2014]

(**32**) – Rovaniemi official web-page. 2014. *Barents Business Hub* [Online] Available from: http://www.rovaniemenkehitys.fi/In-English/Investment-Opportunities/Barents-Business-Hub [Accessed: 6 April 2014]

(**33**) – Info blog of Murmansk State about public transport. 2013. *Finland stays for development of transport link with Murmansk State* [Online] Available from: http://51transport.ru/finnyi-vyistupayut-za-rasshirenie-transportnogo-soobshheniya-s-murmanskoy-oblastyu/ [Accessed: 6 April 2014]

(**34**) The European Union official web-page. 2013. *EU member countries* [Online] Available from: http://europa.eu/about-eu/countries/member-countries/index_en.htm [Accessed: 4 April 2014]

(**35**) Forest Online. 2013. *Wood Export 2012* [Online]. Available from: id=227257 [Accessed: 8 April 2014]

(**36**) Forest Online. 2014. *Wood Export 2013* [Online]. Available From: http://www.lesonline.ru/analitic/?cat_id=12 [Accessed: 7 April 2014]

(**37**) Portal of the external trade. 2013. *About the condition of the Russia – Finnish trade relations* [Online] Available from: http://www.ved.gov.ru/exportcountries/fi/fi_ru_relations/fi_ru_trade/ [Accessed: 16 April 2014]

(**38**) tvrain.ru 2014. *USA named terms of new sanctions against Russian Federation* [Online]. Available from: http://tvrain.ru/articles/ssha_nazvali_uslovija_novyh_sanktsij_protiv_rossii-367093/ [Accessed: 17 April 2014]

(**39**) A. Bambulyak, S. Golubeva, V. Savinov, NEFKO repor. 2013. *Assessment of the Barents Hot Spot Report* [Online] Available from: http://www.nefco.org/sites/nefco.viestinta.org/files/BHSR_2013_Assessment_Eng_LowRes_0.pdf [Accessed: 5 April 2014]

(**40**) UIC/SIAFI report about. 2011. "*Winter and Railways"* [Online] Available from: http://uic.org/forms/spip.php?article1205&var_mode=calcul [Accessed 5 April 2014]

(**41**) Statistic Sweden. 2014. *Imports of goods from countries of consignment. Adjusted for non-response, SEK thousand by trading partner and year* [Online]. Available from: http://www.scb.se/en_/Finding-statistics/Statistical-Database/TabellPresentation/?layout=tableViewLayout1&rxid=16c1591d-30b8-4abe-9744-7bea06dd174d [Accessed: 16 April 2014]

(**42**) Statistic Sweden. 2014. *Exports of goods to countries of destination. Adjusted for non-response, SEK thousand by trading partner and year* [Online]. Available from: http://www.scb.se/en_/Finding-statistics/Statistical-Database/TabellPresentation/?layout=tableViewLayout1&rxid=16c1591d-30b8-4abe-9744-7bea06dd174d[Accessed: 16 April 2014]

(**43**) Statistic Norway. 2013. *Statistic Yearbook of Norway 2013* [Online]. Available from: http://www.ssb.no/en/befolkning/artikler-og-publikasjoner/_attachment/146776?_ts=143c3b051c8 [Accessed: 16 April 2014]

(**44**) Statistics Norway. 2014. *External trade in goods, by imports/exports, country, commodity group, time and contents* [Online]. Available from: https://www.ssb.no/statistikkbanken/selectvarval/saveselections.asp [Accessed: 16 April 2014]

(**45**) Agota transport company. 2012. *Difference in gauge* [Online]. Available from: http://www.agonta.com/cont_ru/railcars/info/info_gauge.html [Accessed: 4 April 2014]

(**46**) Sweden-Info.ru. *Scheme of railroad connection in Sweden* [Online]. Available from: http://www.sweden-info.ru/carts/chemin-rail.htm [Accessed 20 March 2014]