TransBaltic

Towards an integrated transport system in the Baltic Sea Region

TransBaltic

Rail transport solutions

for North-South and East-West flows

Task 5.5 Final Report

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ØstlandsSamarbeidet
Eastern Norway County Network

Railconsult

Region Skåne

Content

0. Executive summary

Task 5.5 in the TransBaltic project addresses the problem of a very low share of rail transport in international freight operations from Norway east- and southbound, due to weak reliability and flexibility compared with the road services. Through establishing partnerships with freight owners, rail transport companies, forwarders and relevant public authorities the task was to assess bottlenecks and hindrances in infrastructure and transport capacity, identify resolving needs and propose efficient transport solutions to ease administrative and infrastructural constraints.

This can be specified into two deliverables:

- A pre-feasibility study on enhancement of rail transport flows from the Nordic Triangle to Germany/Poland and Finland/Baltic States/Russia

- Developing business concepts for deployment of rail shipments from the Nordic Triangle to Germany/Poland and Finland/Baltic States/Russia

The study concentrated its work on the route to/from south-eastern Norway[1] to the area around the Bay of Finland along the northern leg of the Nordic triangle and the routes to/from south-eastern Norway to Poland, the Baltic part of Germany and the southern part of the Baltic states and their hinterlands both via the western leg of the Nordic triangle and through the ports of Blekinge, see Figure 1 .

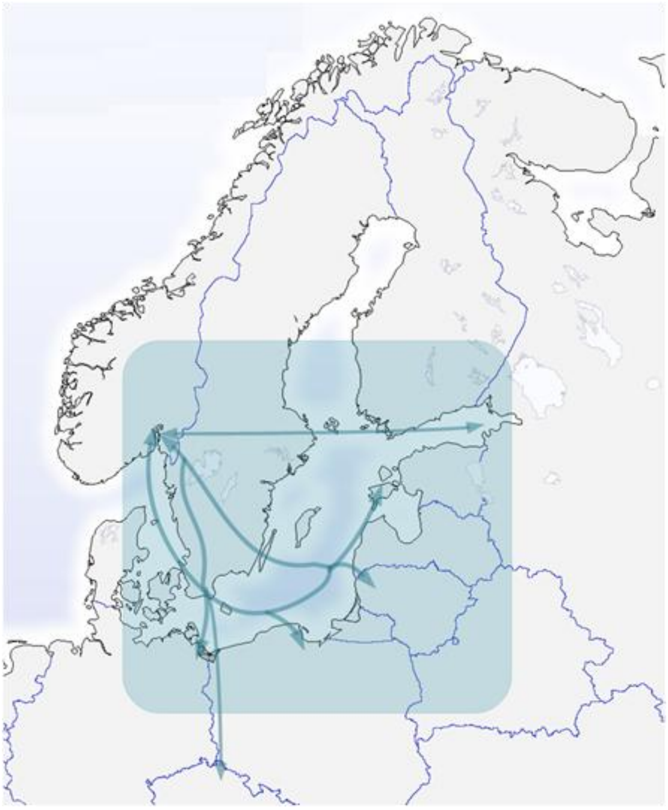

Figure 1 Study area

0.1. Pre-feasibility study on enhancement of rail transport flows

The aim of the pre-feasibility study was to:

- Assess if the goods flows in the study area[2] are sufficient to create profitable[3] rail transports
- Map hindrances and bottlenecks against rail transport in those corridors identified
- Assess possible solutions and actions to resolve the issues stated above

[1] The counties of: Oppland, Hedemark, Buskerud, Akershus, Oslo, Østfold, Vestfold and Telemark.

[2] From Norway to Germany, Poland and Finland/Baltic States/Russia

[3] Profitable as in both price competitive to road transports and profitable for the parties in the intermodal supply chain

0.1.1. Goods flows in the Baltic Sea Region

Trade between Norway and the Baltic Sea Region involves trade between Norway and Finland, Latvia, Belarus, Russia, Lithuania, Ukraine, Estonia, Poland and Germany. In addition, trade between Norway and Hungary, The Czech Republic and Slovakia were also considered as interesting.

To create a potential demand for new rail transport solutions in any given corridor, a minimum level of trade is required and the following assumption was made:

"Volumes larger than 1 million gross tonnes per year in one direction should make it possible to fund rail solutions without unrealistic market shares in that direction."

The market share for rail transport to/from Norway to the different countries in the Baltic Sea Region varies today. Between Oslo and Göteborg, the rail market share is 17 % (in total, both directions)[4]. This decrease to approximately 10 % from Göteborg and southbound. Based on this, we further assumed that:

"1 million gross tonnes per year in one direction, should make it possible to obtain a 10 % market share for rail transports (100.000 gross tonnes)"

Depending on infrastructure restrictions (such as gradient and the length of crossing loops), a normal freight train in Norway can carry between 30 and 40 TEU's[5]. One TEU has an average weight of 10 tonnes[6], and a train with 40 TEU's carries 400 tonnes. With 100.000 tonnes on an annual basis, this equals 250 trains in total or 5 trains per week.

Intermodal rail transports dominate in Norway, as most industrial goods are shipped by sea. The wagonload system was almost completely shut down in 2001. Apart from the train from Kassel to Volkswagen in Lillestrøm (north of Oslo), there are no other wagonload trains today. As a result of the almost complete shut down of the wagonload system in 2001, Task 5.5 decided to focus on intermodal transport.

The assumptions made doesn't consider the need for counterbalance with available volumes in both directions (return transports) and Figure 2 clearly shows that Norway imports more goods from Russia, Belarus and Lithuania than the amount exported. On the other hand, Norway exports more to Poland, Czech Republic and Finland than the amount of goods imported. This also applies for trade between Norway, Estonia and Latvia. Import and export seems to be close to equal between Norway and Slovakia, Hungary and Ukraine.

Trade between Norway and Germany are not shown in this figure, as this exceeds the scale of the graph. Export to Germany from Norway was approximately 35 mill tonnes in 2009, including oil and gas. Export excluding oil and gas were approximately 7 mill tonnes. Norway imported approximately 2.300.000 mill tonnes in the same period.

Volumes exported from Norway to the Czech Republic exceeded 2.500.000 tonnes in 2009, but this trade is considered as irrelevant as most of these volumes are liquid bulk etc.[7] and not feasible for rail transports (in total 2.462.785 tonnes liquid bulk, with only 55.757 tonnes remaining on an annual basis).

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[4] Gods og logistikk i Osloregionen – analysegrunnlag, August 2011

[5] The twenty-foot equivalent unit (often TEU or teu) is an inexact unit of cargo capacity often used to describe the capacity of container ships and container terminals. It is based on the volume of a 20-foot-long (6.1 m) intermodal container.

[6] Based on TØI's (The Institute of Transport Economics) finding in the Portwin statistics where calculations where the calculations show that the average weight per TEU in international transportation are 10 tonnes.

[7] Fuel, propellant, oil and electricity

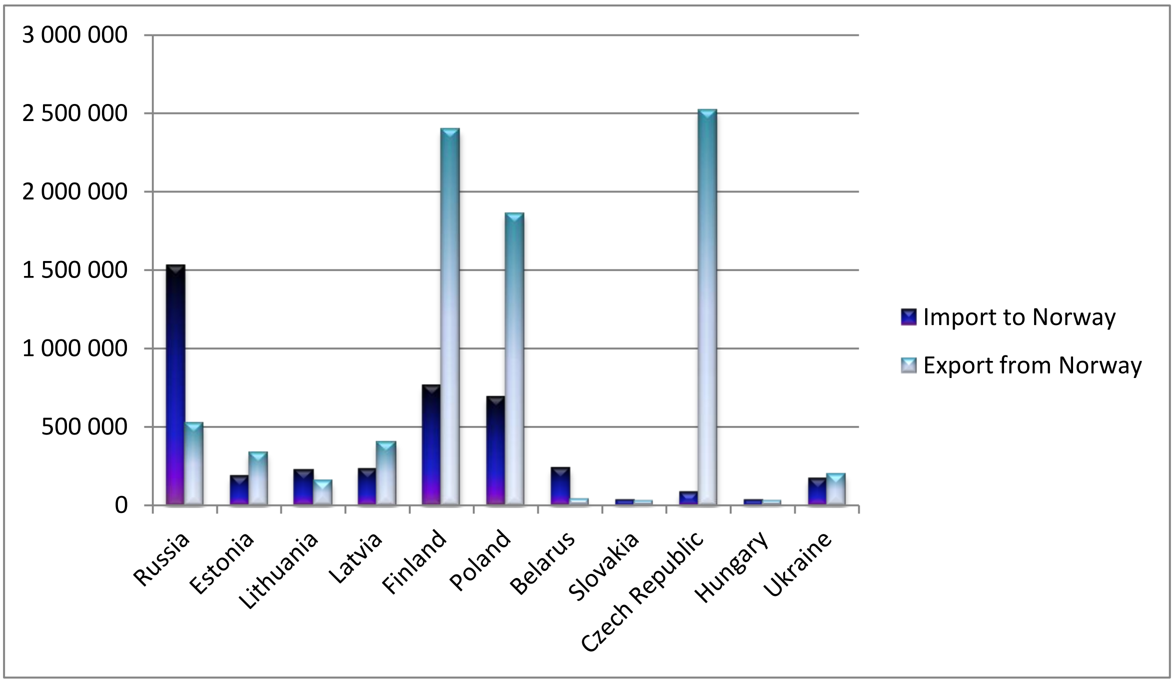

Figure 2 Import and export to/from Norway to the Baltic Sea Region, in addition to Hungary, The Czech Republic and Slovakia, 2009 (excluding Germany)

As seen from Figure 2 , the assumption of possibilities for rail solutions applies for trade between:

- Russia - Norway (import);
- Norway (export) - Finland;
- Norway (export) - Poland;
- Norway (export) - The Czech Republic, and
- Germany - Norway (import and export, although not shown in Figure 2).

Based on these findings, the remaining study focused on freight transports between Norway, Russia, Finland, Poland and Germany, as this are the countries considered to have a sufficient foreign trade to create a potential demand for new rail transport solutions.

Figure 3 Study area

0.1.2. Hindrances and bottlenecks against rail transport in the study area

Hindrances and bottlenecks were identified by a literature study and interviews/workshops with different parties in the intermodal supply chain.

The interviews/workshops highlighted the following factors which reduce the overall competitiveness of rail transports in general[8]:

- Lack of trust in ability to deliver the demanded service level
- Actual lack of ability to deliver the demanded service level
- Immature market (–i.e. there is no demand due to the lack of offers, or the other way around -there is no offer due to a lack of demand)
- Infrastructure related bottlenecks such as lack of capacity during day time, gradient restrictions and capacity in general (prioritising between passenger and freight trains)

The critical hindrances are the lack of reliability and ability to deliver the demanded service level according to the respondents. Logistical trends in the Baltic Sea Region and worldwide shows that production and product flows are adopting Just-in-time principles (JIT), Quick Response (QR) and Efficient consumer response (ECR). Due to this, transport solutions must adapt to meet customer needs, meaning an increased focus on the complexity and sophistication of the product configuration and design.

In the literature study, similar bottlenecks and hindrances were identified, both national and international:

- Infrastructure related bottlenecks and different signalling systems
- Immature market and time consuming processes to create agreements with train operators
- Low reliability
- Low frequency

When comparing these findings with the factors important for the transport buyers in the decision making process (see Figure 4), it became clear that one of the most important factors for the transport buyers is not at a satisfactory level today; namely punctuality. As seen from Figure 4 , punctuality and price are the two factors with the strongest influence on the transport buyers.

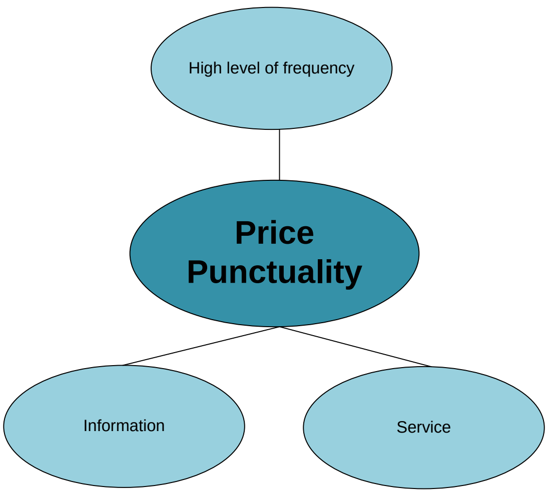

Figure 4 Key influencing factors in the decision making process when choosing mode of transportation (Figure adapted from Jernbaneverket (the Norwegian National Rail Administration))

[8] The hindrances identified were stated as general to the rail freight industry, and not specific to the Baltic Sea Region.

0.1.3. Solutions and actions to resolve some bottlenecks and hindrances

Concentrating on the lack of reliability and ability to deliver the demanded service level, some identified solutions and actions to resolve these issues were:

- Terminals along the route to be utilised as backup, creating flexibility
- Improving logistics education for rail and intermodal transport
- Increase the markets understanding about the possibilities and defuse the technical problems with interoperability that faces international rail freight traffic
- Integration between facilities for logistics operators and intermodal terminals to improve rail freight efficiency

During the project period, Task 5.5 discussed if one should aim for creating a new train system and concept in the study area. Although the transported volumes between Norway and Germany, Poland, Finland and Russia should make it possible to fund rail transport solutions without unrealistic market shares, it proved difficult to identify the exact origins and destinations, and thus identify possible partners.

The transnational working group decided to concentrate on two actions: Back up terminals and More attractive intermodal transport. The last action, More attractive intermodal transport, is a combination of bullet point 2 and 3 in the list above.

The suggested solutions and actions are not corridor specific, but can be applied on an international level.

0.2. Business case for deployment of rail shipments

0.2.1. Freight terminals as back up in case of severe traffic disruption

Lack of flexibility is one of the disadvantages for rail transport compared to road transport. This disadvantage increases in case of disruptions on the rail infrastructure, such as e.g. technical issues on the signalling system that forces a section of the line to be temporary closed. This was also one of the major concerns according to the interviewed parties: what happens if a disruption occurs and the line is temporary closed for traffic?

The EU White Paper (2011) highlights the evident that Mobility Continuity Plans is required to preserve the mobility of passenger and goods in a crisis situation. The transport system needs an increased robustness through scenario development and disaster planning. A delayed freight train might not be defined as a disaster, but a delay can cause ripple effects for the receiver in addition to being expensive.

On several routes from Norway to the study area, a freight train passes intermodal terminals. These are intermediate terminals that could be utilised during a disruption. However, due to different terminal operators and regimes, this cannot be applied in today's situation without settling formal agreements between the train operator, infrastructure manager and the terminal operator.

The concept backup terminal can therefore be described as a series of settled agreements between the involved parties to enable the use of a given freight terminal in case of disruption. This to increase the flexibility in the intermodal supply chain. It might not be the situation that all of the units on a train have to be unloaded from the wagons onto lorries, but only the units that are time critical. This is also in line with the EU White Paper (2011, page 24) where: *Mobility Continuity Plans should ensure the service continuity in case of disruptive events. The plans should address the issue of prioritisation in the use of working facilities, the cooperation of infrastructure managers, operators, national authorities and neighbouring countries, and the temporary adoption or relaxation of specific rules.*

As this concept can apply to any intermodal terminal, the project decided to make a pilot on a terminal in Sweden.

Originally, the pilot was intended for the intermodal terminal in Göteborg as most of the rail transports to the Baltic Sea Region will pass this terminal. Two relevant train operators were contacted, one of which showed interest in the concept. However, during this process the train operator decided to withdraw his service passing Göteborg. The pilot was therefore not completed for this terminal.

Due to this unexpected closure, Task 5.5 needed to find a new pilot terminal and train service, and the relatively new intermodal terminal in Umeå (Nordic Logistic Centre) where ISS TraffiCare AB is the current terminal operator (the train operator involved is Green Cargo AB) was chosen. Although Umeå is considered outside the study area, the backup concept can be adopted on an international level and the geographical location of the pilot was considered as irrelevant.

The concept

In normal operational mode, the railway line (Stambanan) passes the junction to Nordic Logistic Center (intermodal terminal in Umeå in the North of Sweden, NLC) at Vännäs. The train (Train # A in Figure 5) is on time, following the normal schedule. This schedule is booked by the train operator every year by a process of requesting this slot from the national infrastructure manager, which then coordinates and decides the national train schedules. In addition, the train operator can also book a special train schedule as backup and extra flexibility (Special Train #XA in Figure 5). The special train schedule will in this case only be booked from the junction towards NLC and to the terminal, and from NLC to the main line – Stambanan. The geographical scope of the special train schedule is illustrated in orange in Figure 5 .

If, or when, a disruption appears on the line, Train #A (with the necessary agreements in hand) initiates the procedures to enter Nordic Logistic Center to unload time critical units. By doing so, the train operator has to switch to the Special Train Schedule # XA which is reserved for Train # A only.

After unloaded the critical units, Train # XA continues from the terminal to a holding track of the dispatcher's choice to wait for the line to re-open.

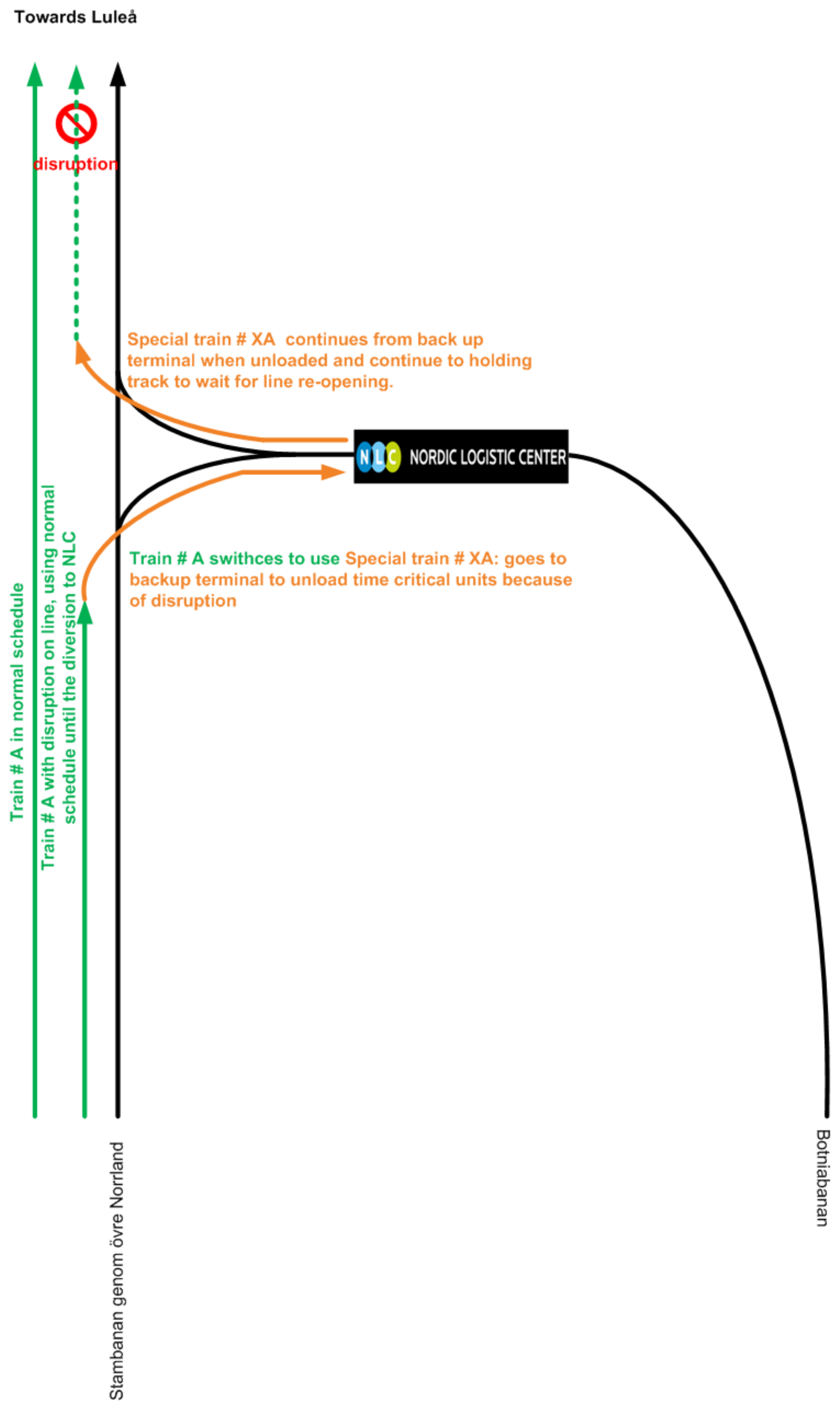

Figure 5 An illustration of a pilot with NLC as backup terminal

The agreements are only for use on an intermediate terminal during special circumstances and should be offered to all train operators on equal terms as a standard procedure. Procedures must be efficient and easy to apply, and the initiation of the action should as little as possible interfere with normal operation on the terminal. For the terminal operator it is important that this is as predictable as possible.

Railconsult AS will continue to follow up GreenCargo AB and ISS TraffiCare AB to conclude the agreement between the two parties. As soon as the agreement is concluded, a neutralized example for the use Nordic Logistic Center as a backup terminal will be published on www.transbaltic.eu.

0.2.2. More attractive intermodal transport

An intermodal supply chain is complex and involves several parties (illustrated in Figure 6). These parties need to have a common understanding of each other's needs and routines/procedures for communication.

Figure 6 Example on the complexity of an intermodal supply chain

In cooperation with Jernbaneverket (the Norwegian National Rail Administration) and NHO[9] Logistikk og Transport (the Norwegian Logistics and Freight Association), a workshop for users of intermodal transports were held.

The aim of this workshop was to identify necessary actions for international intermodal transports to be competitive compared to road transports. The potential issues and solutions relevant for these workshops were assumed as common for all international relations to and from Norway, even though the extent and complexity increases with cultural differences and others when dealing with parties from more than one country.

As a follow up to the first workshop, a second workshop was held to prioritise actions and allocate these. Most of the proposed actions were viewed as possible responsibilities of Jernbaneverket (the Norwegian National Rail Administration) and NHO Logistikk og Transport (the Norwegian Logistics and Freight Association), or in some instances an individual responsibility to all or many of the members of NHO Logistikk og Transport. After the second workshop, two final follow-up meetings were held with Jernbaneverket and NHO Logistikk og Transport to present the result of the workshops and discuss the proposed actions.

The following actions and suggestions are related to national authorities and parties in Norway, but can be used as an inspiration for the relevant parties in the Baltic Sea Region and world wide:

[9] NHO: The Confederation of Norwegian Enterprise

Actions proposed for Jernbaneverket (the Norwegian National Rail Administration)

- Formalise and extend the "International intermodal user workshop" to improve coordination in the intermodal supply chain and overall competitiveness
- Increase the knowledge of the intermodal supply chain
    - Describe the intermodal supply chain and critical success factors in cooperation with the involved parties
    - Prepare information leaflet regarding a supply chain for international intermodal transport. This should be available for all to use, describing the critical success factors in relation to PIMS[10] and in cooperation with NHO Logistikk og Transport (the Norwegian Logistics and Freight Association)
    - Include this as a part in the training of train/truck drivers, dispatchers, transport managers etc.
- The parties in the intermodal supply chain need to (individually and in cooperation) create robust transport schemes that tolerate a certain degree of interference without affecting the quality of the service. To achieve this, the formal process regarding timetabling may need to be improved, giving terminal operators and other parties in the intermodal supply chain the opportunity to be a part of this process.
- A review of the prioritisation practice needs to be conducted, to ensure an optimal solution for both passenger and freight trains. This to ensure less impact of external conditions for the freight operators.

Actions proposed for NHO Logistikk og Transport (the Norwegian Logistics and Freight Association)

- Coordinate a common message from all the parties in the intermodal supply chain: A common information strategy that highlights the following "brilliancies" of rail freight transport:
    - Socio economic benefits as a result of rail freight transport
    - A strong growth in freight traffic is forecasted for the future; information should describe the consequences of this growth (capacity, environment, pollution, noise and the need for development of infrastructure)
    - Intermodal terminals and their significant part of the whole
- Arrange a seminar regarding intermodal rail transport for Jernbaneverket (the Norwegian National Rail Administration), Trafikverket (the Swedish Transport Administration), politicians, Samferdselsdepartementet (the Norwegian Ministry of Transport and Communication), Näringsdepartementet (the Swedish Ministry of Enterprise, Energy and Communications), Vegdirektoratet (the Norwegian Public Roads Administration Head's Office) and more.
- NHO Logistikk og Transport is in the position to contribute to each member improving their performance in the intermodal supply chain, by:
    - Systematic work to establish a culture where parties learns from and improves each other
    - Encourage the use of Service Level Agreements (SLA)
    - Support in nonconformity situations
    - Systematic spread information on best practises (e.g. SLA in reality)
    - Establish a forum for the parties in the intermodal supply chain
- NHO Logistikk og Transport is also in the position to encourage other parties in the intermodal supply chain to (individually and in common) make robust transport schemes that can handle minor disruptions without affecting the quality of the service. Factors to consider are among others:
    - Agreed delivery times need to be kept and the contracts should be created thereafter
    - Capacity utilisation on the line and freight terminals needs to be adjusted to a level where the system gets a sufficient ability to catch up with delays

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[10] PIMS: Punctuality Improvement Method System

- Coordinated action plans to handle disruptions between the parties in the intermodal supply chain (Emergency communication plan)

After the meetings with the two organisations, a meeting with Vegdirektoratet (The Norwegian Public Roads Administration's Head Office) was arranged to discuss its interest in transferring freight transport from road to rail and how they could participate in the actions proposed in the workshops. The main result of this discussion was that Vegdirektoratet confirmed an interest in participating in actions leading to a transfer of transport from road to rail (and sea). Vegdirektoratet was not given any concrete tasks, but is willing to participate in the future work.

All the three parties stated that they have a common interest to transfer goods from road to rail (and sea). In the continued work to achieve this, these organisations must take a role in their separate fields of work.

The proposed actions for the organisations are not viewed as their direct responsibility, but organisations of such authority has the possibility to influence, initiate and participate in future work.

NHO Logistikk og Transport (the Norwegian Logistics and Freight Association) has already started to handle some of the actions identified: In September 2012 they will arrange a seminar called "How can we make each other even better?" This seminar is intended for all the parties in an intermodal supply chain.

Østlandssamarbeidet (Eastern Norway County Network) will continue the dialogue with Jernbaneverket (The Norwegian National Rail Administration), NHO Logistikk og Transport (the Norwegian Logistics and Freight Association) and Vegdirektoratet (The Norwegian Public Roads Administration's Head Office) to follow up the identified actions.

0.3. Concluding remarks

The above described actions and proposals for further work are meant as input to increase the competitiveness of rail transport on an international level. Many of the identified challenges need to be solved in common, involving many of the parties in the supply chain. Findings from the interviews and workshops are not national phenomena; from the literature study it became apparent that the identified bottlenecks and hindrances occur in several European countries.

From the workshops held in cooperation with NHO Logistikk og Transport (the Norwegian Logistics and Freight Association) and Jernbaneverket (The Norwegian National Rail Administration), one main finding was the lack of contingency plans. NHO Logistikk og Transport and Jernbaneverket , are to a certain degree able to take responsibility for initiating contingency plans, but this depends on involvement from the different parties in the intermodal supply chain, even though being competitors.

Growing road transports are a challenge for the future as they lead to increased emissions, road accidents and bursting road capacity. As a result, there is a common interest to transfer cargo units from road to rail(and sea). This has resulted in several studies over the years, with many highlighting the challenges of getting commodity owners to choose rail instead of road. Price is one of the decisive factors when mode of transport is chosen, although not highlighted by any of the interviewed respondents. There are different practices between the countries in the Baltic Sea Region regarding road and rail taxation. For example: In Sweden, the rail taxation has increased over the years while there is close to no road taxation for lorries. This affects the ability of rail to be competitive to road in a significant way, as this increase the operating costs and hence the price offered to the commodity owners. On the opposite, the implementation of the road tax (LKW-Maut) in Germany resulted in a 6 % transfer from road to rail transports[11]. A study performed by Transportøkonomisk Institutt (The Institute of

[11] The UK Commission for Integrated Transport (2007)

Transport Economics), indicates that the largest potential to influence transport buyers to choose rail and sea instead of road transport are the following measures:

- Reducing handling costs at intermodal rail terminals
- Reduce mileage related track fee for rail
- Reduce the terminal costs for both rail and sea
- Increase fuel costs and/or road taxation for road transports

This corresponds with the examples seen in Sweden and Germany. A conclusion one can draw from this is that policy measures should be introduced to a greater extent.

Another interesting assumption that was confirmed during the project is the complexity of border crossing rail transports. The train company that decided to shutdown their service from Oslo to the continent pointed out that the issue with crossing four national boarders and similar borders of technical system was a time consuming challenge. The issue with different technical systems are partly being dealt with already through the ERTMS[12] project. In 1996, EU decided that a European Rail Traffic Management System should become standard for all high-speed lines. The background for this initiative was that over 20 different train control systems have been developed and operated by individual European railways according to their national requirements for technical standards and operating rules[13]. Such diversity does not meet required reliability and efficiency. To overcome this hindrance, the EU council directive 2001/16/EC with respect to the interoperability of conventional rail systems were developed (ETCS[14]). ETCS is developed as a part of the ERTMS initiative. Unifying multiple signalling systems will provide a better interoperability for rail transport in addition to minimizing technical and cultural issues associated with international rail transports, and hence contribute to improve the overall quality and competitiveness of rail transport.

In a long term perspective ERTMS will also help reduce the operating costs for both infrastructure managers and operators. Although, one issue that needs to be assessed further is the implementation costs; both for infrastructure providers upgrading the network and operators' costs for upgrading existing rolling stock. Financing the implementation of ERTMS has been one of the major subjects for discussions the past years.

However, the technical system changes at different boarders are viewed as less problematic than the administrative and legislative differences between countries. Even here the EU regulations have started the process of relieving these differences by introducing common regulations for approval of vehicles and operating companies. In addition, the RNE[15] is introducing simplified methods for ordering routes for international trains. Although, from the interviews and workshop, this process is considered to be further from an efficient solution compared to the technical issues.

The initiatives and actions taken in Task 5.5 can only be considered as a start on increasing the competitiveness for international rail freight transports. We quote ILiM[16]: "*launching regular intermodal connections between Poland and Sweden and Norway seem to be feasible however very challenging"*.
Working with further actions and follow up will be critical to be able to keep the industry's focus on increasing the competitiveness of international rail transports.

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[12] ERTMS: European Rail Traffic Management System

[13] Institution of Railway Signal Engineers

[14] ETCS: European Train Control System

[15] Rail Net Europe (Organization for European Infrastructure Managers)

[16] A description of necessary steps for enabling intermodal connections between the main business centres of Poland, Sweden and Norway, ILiM, April 2012

1. Introduction

1.1. Briefly about TransBaltic

TransBaltic - Towards an integrated transport system in the Baltic Sea Region (BSR) - is a project implemented under the Baltic Sea Region Programme 2007-2013. TransBaltic gathers 20 financial partners – representing regional authorities, academic and research institutions – and 30 associated organisations from 11 countries around the Baltic Sea in joint effort to create an integrated multimodal transport system in the BSR. The three year project led by Region Skåne, started in September 2009.

The overall objective of TransBaltic is to provide regional level incentives for the creation of a comprehensive multimodal transport system in the BSR. This is to be achieved by means of joint transport development measures and jointly implemented business concepts.

1.2. Rail transport solutions for north-south and east-west flows

One of the project activities (Task 5.5) addresses the problem of a very low share of rail transport in international freight operations from Norway east- and southbound. This is due to weak reliability and flexibility compared with the road services. It is thus important to find practical and durable solutions to counterbalance growing road transport volumes in these directions. Through establishing partnerships with freight owners, rail transport companies, forwarders and relevant public authorities, the task was to assess bottlenecks and hindrances in infrastructure and transport capacity. Additionally, to identify resolving needs and propose efficient transport solutions to ease administrative and infrastructural constraints.

This can be specified into two deliverables:

- A pre-feasibility study on enhancement of rail transport flows from the Nordic Triangle to Germany/Poland and Finland/Baltic States/Russia
- Developing business concepts for deployment of rail shipments from the Nordic Triangle to Germany/Poland and Finland/Baltic States/Russia

This study concentrates its work on the route to/from south-eastern Norway[17] to the area around the Bay of Finland along the northern leg of the Nordic triangle. Further, the study contains the routes to/from south-eastern Norway to Poland, the Baltic part of Germany and the southern part of the Baltic states and their hinterlands both via the western leg of the Nordic triangle and through the ports of Blekinge, see Figure 7 .

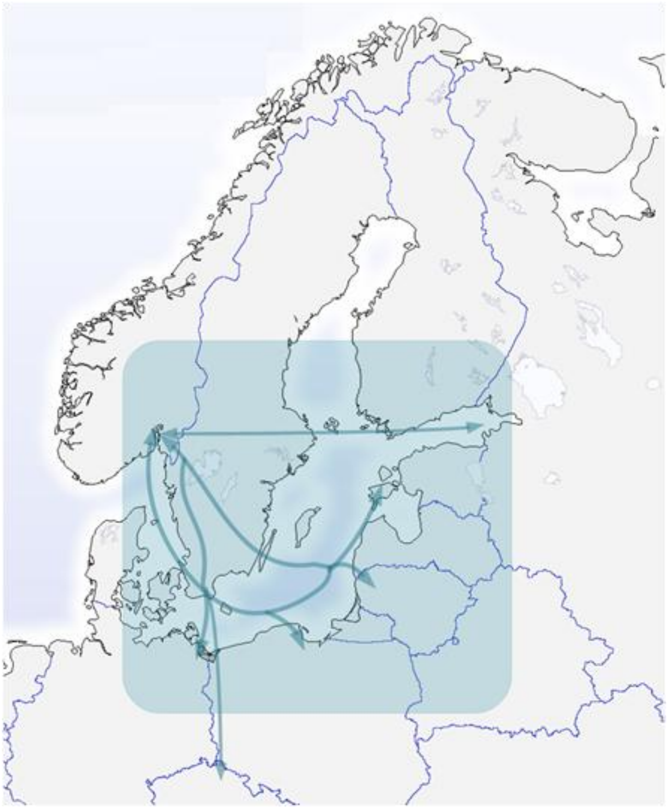

Figure 7 Study area

[17] The counties of: Oppland, Hedemark, Buskerud, Akershus, Oslo, Østfold, Vestfold and Telemark.

1.3. Task partnership

Task 5.5 is managed by Østlandssamarbeidet (Eastern Norway County Network). Other participating partners are Region Skåne, Region Västerbotten, Region Blekinge, Region Sjaelland, Pomorskie Region, Vest Agder County, Västra Götaland Region, The Institute of Logistics and Warehousing (ILiM), West Pomeranian Business School and Latvian Transport Development and Education Association.

The work of Task 5.5 has been done under the auspices of a transnational working group consisting of representatives from the partners. An overview of the working group members can be seen in Appendix A.

1.4. Method

The activities in Task 5.5 were divided into the following milestones (periods), as for the rest of the TransBaltic project.

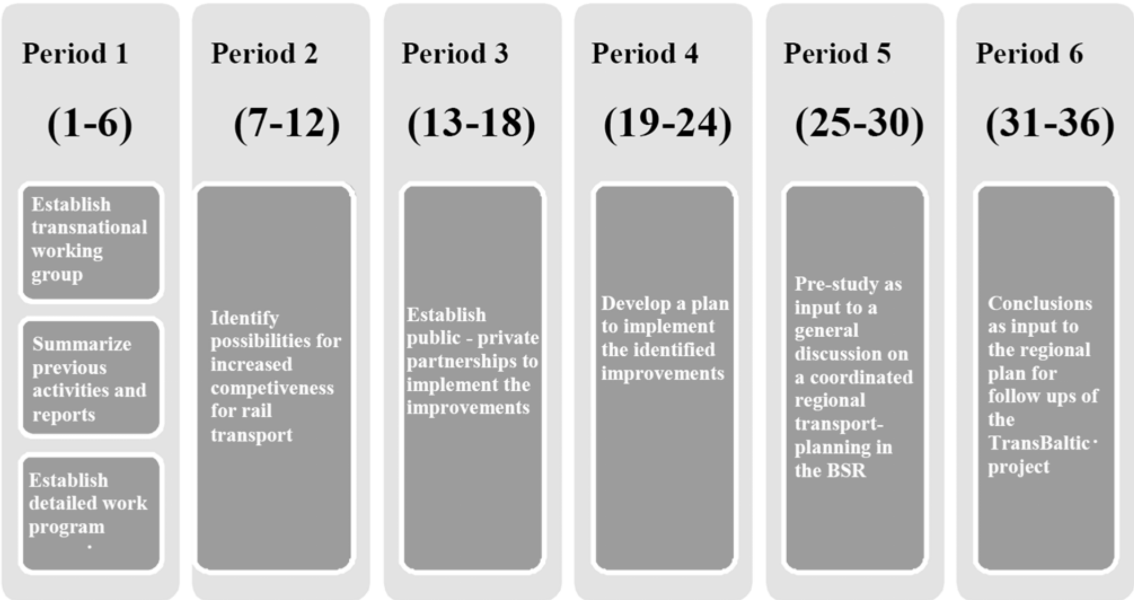

Figure 8 Activities in Task 5.5.

The task activities have mainly been carried out through literature studies, interviews and workshops. This report is a summary of these activities, leading to a couple of actions and suggestions for future rail transport in the Baltic Sea Region.

The remainder of this report is structured as follows:

- Chapter 2: Summary of previous an contemporary conducted work
- Chapter 3: Freight flows and infrastructure
- Chapter 4: Competitiveness of intermodal freight transport
- Chapter 5: Establishment of private-public partnerships to improve rail transport
- Chapter 6: Summaries of supplementary studies[18], here by the;
  - Region Blekinge delivery: The market for intermodal transport in the Trans Baltic Port-Hinterland Corridor to the ferry link Gdynia – Karlskrona
  - The Pomerian Province delivery: Study of the potential and the spatial conditions of the North–South green transport corridor in Poland
  - ILIM delivery: A description of necessary steps for enabling intermodal connections between the main business centres of Poland, Sweden and Norway

[18] The complete reports from the three supplementary studies are published on www.transbaltic.eu

- Chapter 7 : References

2. Summary of previous and contemporary conducted works

The aim while studying previous and contemporary work was to identify noted reasons for the low share of rail transport in the Baltic Sea Region (BSR). This was done in the effort to identify which issues needed to be solved in order to increase the rail freight market in the BSR. The reports and material studied can be divided into the following categories:

Category 1: reviewed studies and reports published before the TransBaltic project (chapter 2.1.)

Category 2: reviewed studies and reports published and conducted in parallel to or as a part of TransBaltic (chapter 2.2.)

2.1. Study of previous work regarding intermodality and interoperability around the Baltic Sea

The Interreg-project InterBaltic – Intermodality and interoperability around the Baltic Sea gives a comprehensive overview of performed studies and projects in the period 2000-2006 for transport in the Baltic Sea Region, and analyses the impact and findings for interoperability and intermodality. The following is a summary of this work, focusing on results and findings that can be further pursued in Task 5.5.

TEN-T and its extension to neighbouring countries

TEN-T was a programme adopted by the European Union in 2005, and in this context, the Trans-European Transport Network Executive Agency (TEN-T EA) was created (in 2006) to implement and manage the TEN-T programme on behalf of the European Commission.

Some of the prioritised measures in the programme have already been implemented such as the opening of the Öresund Bridge that connects the road and railway networks in Scandinavia with those of Central and Western Europe.

Table 1 gives an overview of prioritized projects in this programme with relevance to Task 5.5:

Project	Prioritized measures	Relevance to Task 5.5 because:
Nordic Triangle[19]	Improved rail and road access for freight and passenger transport between the Öresund fixed link and Stockholm/ Oslo.	Improved rail access for freight trains between Öresund and Stockholm increases reliability.
Fehmarn belt[20]	Railway Tunnel connecting the Öresund link with central Europe.	A railway tunnel between Denmark and central Europe reduces the transport distance to central Europe and especially the port of Hamburg which currently has over 200 international and domestic rail connections that serves the port daily.
Motorways of the Sea (MOS)[21]	One corridor for the Baltic Sea.	MOS aims to introduce a new

[19] http://tentea.ec.europa.eu/en/ten-t_projects/30_priority_projects/priority_project_12/

[20] http://www.femern.com/

		intermodal maritime-based logistic chain in Europe and improve access to markets throughout Europe.
Railway axis Gdansk – Warsaw – Brno/Bratislava – Vienna[22]	Modernizing and upgrading rail route. Aim; an alternative to existing north-south road axis.	The modernisation of the rail lines and the construction of container terminals for example at Gdańsk and Sławków/Katowice should generate better conditions for the development of effective intermodal transport and in addition reinforce the attractiveness of rail, enabling a modal shift from road to rail.
Rail Baltica; Warsaw – Kaunas – Riga – Tallinn – Helsinki[23]	Involves an upgrade of the railway lines in Poland, Lithuania, Latvia and Estonia as well as Finland by improving interoperability and increase capacity. The countries have to settle on gauge width.	This is the only rail connection between Lithuania, Latvia and Estonia to Poland and the rest of the EU. To the north, Helsinki is connected by rail ferry services across the Gulf of Finland which can form a "bridge" to the countries of the Nordic Triangle. Solving the varieties in gauge and operating systems leads to an overall improvement of reliability and reduces some infrastructure related hindrances in this corridor.

Table 1 - Prioritized projects TEN-T, relevant to TransBaltic

Conclusions to bear in mind from the TEN-T programme and its relevant projects are:

- A need for common market standards according to best international practice, in order to develop international trade in these corridors
- Concentration of flows for sufficient critical mass is an important precondition for implementing Motorways of the seas (MOS)

Some specific railway system challenges and recommendations were especially highlighted:

- Political differences
- Technical differences
- Organisational differences, hereby:
    - Lack of a international party under a joint authority for each border crossing
    - Lack of common procedures for rolling stock acceptance

The Baltic Sea Region as a whole

The study Future transport sector cooperation in the BSR was funded by the Nordic Council of Ministers and recommends establishing a common Baltic Sea Transport Forum with relevant parties. The purpose of such an establishment would be to replace a number of existing forums and create a common platform for discussions. Task 5.5 has not been able to identify if such action has taken place.

[21] http://ec.europa.eu/transport/maritime/motorways_sea/motorways_sea_en.htm

[22] http://tentea.ec.europa.eu/en/ten-t_projects/30_priority_projects/priority_project_23/

[23] http://tentea.ec.europa.eu/en/ten-t_projects/30_priority_projects/priority_project_27/

Another study, Transport infrastructure planning in the BSR, had the aim to map current infrastructure planning, identifying common interest and possible conflicts, gaps and missing links in the Baltic Sea Region. Some of the conclusions from this study:

- Strong attention needs to be paid to port-hinterland connections, especially with the aim of strengthening intermodal transports
- There is a need to develop common methods for financing infrastructure investments
- Many projects has a tendency to focus on specific corridors, but more emphasis should be put on interconnecting the metropolitan regions
- There is a need to establish a common knowledge and practice for priorities in infrastructure development

The Botnian Arc, the North Calotte and the Barents region

These are regional programmes of relevance for the Baltic Sea Region, concentrating on rail, road and sea transports. Two of the conclusions from these projects included:

- Challenges with different technical railway systems in Russia and the West (which apply partly also for the Baltic countries)
- Lack of coordination of infrastructure investments in the regions

Baltic Tangent

The aim with the Baltic Tangent was to create a "Baltic Tangent corridor" between Denmark, South Sweden and the Baltic countries to the Far East. The project identified the following bottlenecks in the involved countries:

- Lack of capacity in the Estonian railway infrastructure
- The railway system in Latvia needs reconstruction to improve quality rather than capacity
- The Latvian ports need reconstruction and improvements along with improved organization and environmental protection
- The new railway line Rail Baltica is important in Lithuania (TEN-T 27).
- Lack of intermodal terminals in the Kalmar region and poor railway connections to the ports in Oskarshamn and Västervik in Sweden
- Lack of or poor railway access to the ports
- Lack of ferry line across the Baltic Sea

Some of the overall recommendations from the project:

- Establishment of an intensified transnational network between relevant public sectors and business stakeholders
    - Create concrete partnership agreements about national and transnational /cross border cooperation
- An strategic approach to stakeholders on all levels to inform and highlight the needs for infrastructure investments and solutions
    - Emphasize on sustainability in transport infrastructure development, meaning that transfer of goods from roads to railway and maritime shipping should be the overriding goal

Baltic Gateway

Baltic Gateway, a report from 2006, gives the following conclusions and recommendations:

- Future trade in the Baltic Sea Region is expected to more than double over the coming years. Containers are expected to take a larger share of the intra-European transport
- There is a need for joint interregional action to speed up and influence the development process by launching an interregional investment program, tailor made for the South Baltic Sea Area (SBSA)

Within the project, a list of prioritised rail and sea projects such as Fehmarn Belt, Nordic triangle, Railway axis Gdansk – Warsaw – Katowice – Brno/ Bratislava – Vienna and RailBaltica were mentioned. In addition complementary projects of importance to the SBSA are:

- Development and implementation of an educational program in transport and logistics
- Development of intermodal Promotion centres in the SBSA
- Promotion of interoperable IT-solutions

SEB Trans

The SEB Trans project (1999-2001) aimed to promote the development of transport corridors linking Sweden with Poland and the Baltic countries by the corridor Göteborg – Karlskrona – Gdynia. Some conclusions:

- Future trade and related cargo transport will double in the year 2020 compared to 1997
- Intermodal transport solutions are lacking sufficient volumes
- Infrastructure in the corridors needs improvement, and planning has to commence without delay

SEB Trans-Link (2002-2005) aimed to refine the ideas from SEB Trans and develop fast and qualified preparation process for the investments proposed in the original project. Conclusions from this project:

- Polish and Lithuanian transport systems are being upgraded, but investments in Sweden are lagging behind
- There is a need for rail capacity improvements on the section Göteborg – Borås in Sweden
- The port of Karlskrona needs to be developed to enable railway access

2.2. Studies and reports published and conducted in parallel to or as a part of TransBaltic

The following studies and reports have been examined:

- Godsflödeanalyse – Fyrbodal och Østfold, Intermodala Godstransporter Statistik, Oxford Research, December 2011;
- Samfunnsøkonomisk analyse: Utviklingen av “Green Freight Corridor” Oslo – Göteborg – Øresund – Duisburg”, Analyse & Strategi, 2011
- Godstransport på bane, Jernbaneverket (The Norwegian National Rail Administration), 2007
- Opportunity Study for the efficient transport of goods from Umeå, Sweden through Vasa, Finland to Russia, created by Vectura on behalf of Region Västerbotten within the framework for the EU-financed project TransBaltic
- Review of performed Interreg projects in the Baltic Sea and North Sea and their relevance for TransBaltic, Eva Eide Consulting ANS, May 2011
- A description of necessary steps for enabling intermodal connections between the main business centres of Poland, Sweden and Norway, ILiM, April 2012

The studies and reports point out four main areas for low market share of rail transport: infrastructure conditions, market aspects, the aspect of international transports (crossing national boarders) and lack of quality.

Infrastructure conditions

Several of the interview respondents from the report "Godsflödeanalyse" points out the weaknesses in the rail infrastructure as one of the main reasons why rail is not a preferred transport mode for their goods. The respondents of the latter research consider that large investments on rail infrastructure are required in order to make the railway competitive . The same analysis also states that both the lack of expansion of tracks and access to industrial tracks, are mentioned as barriers concerning the ability to increase the share of intermodal transportation.

Respondents in the same study also mention that an increase of capacity on the tracks is necessary, especially around important nodes.

The "Opportunity Study for the efficient transport of goods from Umeå, Sweden through Vasa, Finland to Russia" points at several infrastructure related bottlenecks and hindrances in Sweden, Finland and Russia:

- The quality standards of the railway between Vasa – Vainikkala is very varied, with both single and double tracks and varying speed limits.
- Differences in electrical systems, signalling and safety systems in Finland and Russia
- Vasa railway yard can only handle 450 m long freight trains, while a standard freight train is 650 m long.
- Lack of electrification between Vasa port and Vasa main station,
- At the ports of Vasa and Holmsund there is a need for areas for transhipping of goods between boat/rail, rail – boat/road.

The opportunity study also highlights a continuously decrease in number of stations and terminals in both Sweden and Finland. Rail operators also agree that the infrastructure is not optimally utilised; while capacity limits are reached on some sections other sections are under utilised.

The report from Eva Eide Consulting ANS identified one single project of relevance to Task 5.5: The SEB Trans-link project as already mentioned. This project identified four suitable transfer points[24] where goods could be transferred from road to rail in Sweden with continuation to Poland and Lithuania. One major infrastructure bottleneck is a missing rail connection to the port of Karlskrona. Investments have been granted for this purpose, by SEB Trans and the EU. A final conclusions was nevertheless that the work with intermodal freight transport needs to be continued.

Market aspects

None of the transport service providers in the "Opportunity study" offers a standard intermodal service in their portfolio. This means that each new project has to be initiated when a customer requests an intermodal service, which results in time consuming planning. Shippers, transport operators and infrastructure authorities have different planning horizons. Due to structural and organizational complexity, intermodal transport solutions require long term planning both during the development process as well as the operational phase. Rail services require larger freight volumes (load factor), and the study reveals that in some cases it takes months for a potential buyer to get a price offer from the company. The freight volumes the rail operators demand in order to implement a new service, can be difficult to obtain by a sole shipper.

Another aspect is that many potential buyers consider rail transport as slow and inadequate. Many commodities, especially time sensitive shipments, needs short, punctual and reliable transport services, and therefore may have to depend on road transportation because of the long planning phase for intermodal transport.

[24] Borås, Värnamo, Alvesta, Emmaboda/Nybro

The "Godsflödeanalyse" states that most goods-owners prefer their goods to be transported by few transporters instead of multiple, as is the case in intermodal transports.

The policy document from Jernbaneverket (The Norwegian National Rail Administration), "Godstransport på bane", claims that rail transport in Norway is competing with road transport, more than sea transportation. Over the last few years it has been an increase in road transports to Norway from Poland and the Baltic countries, which has lead to an extensive pressure on the transportation rates.

Crossing national boarders perceived as time consuming hindrances

According to the Opportunity Study, border crossing between Finland and Russia can be quite time consuming. Due to the different types of signalling and safety systems, as well as the electrical systems. Additionally, the bogies and drivers needs to be swapped at the border.

To export goods from Finland to Russia, an export declaration must be compiled, as Russia is not a part of the European Union. Border crossing by truck takes 18 – 36 hours, and by rail it takes 16 – 24 hours if all wagons meet the standards, and a complete and correct set of documents is provided. Nevertheless, a train can be held for days in customs waiting for documents for one wagon to be corrected if there is found any irregularities.
The regulation concerning securing of cargo differs, not only between the transport modes, but also between the different countries. The Swedish Consultancy firm "MariTerm" states that non-harmonized policies and procedures are a clear obstacle towards interoperability between the network of transport modes and nations.

Regulations and regulatory framework are similar in Sweden and Finland, but there is a huge difference concerning transport between Finland and Russia. Only one rail freight operator, the VR-Group, is allowed to access the Finnish railway net for transit transports to and from Russia.

Lack of quality

International intermodal transports are characterized by lack of quality according to the "Opportunity Study" as "*operational deficiencies are related to transport resources, transport and loading equipment, cargo securing and above all poor time reliability*". Poor infrastructure standards also affect the ability to deliver on time and consequently overall reliability.
The "Opportunity study" also states that it is a disadvantage for freight transport that passenger trains are prioritised before freight trains on the tracks as this may lead to delays in traffic.

In the study conducted by "Analyse&Strategi", goods owners state that long delivery times is a major problem with the existing rail transports, including low speed and dwell times compared to trucks on the same distance. The study also concluded that frequency and regularity is crucial for the customers that choose trucks as the preferred mode of transportation.

Another stated reason for why rail transportation is not the preferred mode of transport is the lack of available rail services within a reasonable distance from the goods owners/ shippers. There are also shortcomings at terminals, where there is a need to handle different types of load-units, for example both loading/unloading and cross docking. Terminal operators also need to improve the handling of fluctuating freight volumes and disruptions.

2.3. Summary of main findings in the literature study

One conclusion from the literature study is that several of these projects come to similar conclusions and recommendations, regardless of country or specific study area. These conclusions and recommendations are further aggregated and generalized to an overall level listed below:

- Prioritised projects in TEN-T is a move towards increased reliability, reduced distances and increased interoperability in Europe strengthening the attractiveness of rail
    - However, some of these projects will not be completed and implemented in the nearest future
- Several studies highlights the following needs, hindrances and bottlenecks, decreasing competitiveness of rail transport:
    - There is a need for common market standards based on international best practise for international trade and one transnational working group/forum for intermodal transport. Today there are several forums/initiatives, which could be concentrated into one. This to speed up influence and development
    - There is a low degree of interoperability as a result of different technical systems
    - There is a lack of coordination and interregional infrastructure planning and a common practice for priorities in infrastructure projects should be developed
    - There are several capacity limits in many of the countries around the Baltic Sea and alternative utilization of lines should be further pursued
    - Intermodal terminals and ports: The number of intermodal terminals is decreasing in addition to poor access to some ports. Intermodal terminals are also decentralised to a certain degree, resulting in a lack of services within a reasonable distance from the goods owners/shippers
    - Trade forecasts for the Baltic Sea Region shows a strong growth in the future
    - To cross borders is a time consuming process and non-harmonized procedures and policies are a hindrance
    - There is a perception among different parties that international rail transports has a low degree of reliability, frequency and punctuality
    - Passenger trains are prioritised before freight trains when disruption occurs

3. Freight flows and infrastructure

3.1. Logistical trends in the Baltic Sea Region

Over the last few years, certain logistic trends have been observed in the Baltic Sea Region. Logistical systems are going through a phase of restructuring and a more special concentration of production is emerging. Production and product flow on the other hand is experiencing an increased adoption of Just-in-time production (JIT), Quick response (QR) and efficient consumer response (ECR). Due to this, products have to change to meet the needs of the customer , which results in an increased focus on the complexity and sophistication of the product configuration and design. There are also signs of realignments of supply chains, resulting in wider geographical sourcing of suppliers and wider distribution. An augmented focus on management of transport resources has resulted in an improvement in transport's relative costs, along with an increased use of third party logistics companies.

These logistic trends have certain assumed effects on transport;

- Increase of the average transportation distance
- Concentration of flows on links and nodes
- Optimization in use of transport resources

Despite the optimization in the use of transport resources, these logistical trends lead to a strong overall growth in transport activity.

3.2. Trade in the study area

Trade in the study area involves trade between Norway and Finland, Latvia, Belarus, Russia, Lithuania, Ukraine, Estonia, Poland and Germany. In addition, trade between Norway and Hungary, The Czech Republic and Slovakia was also considered interesting for this study.

The foreign trade between Norway and these countries was collected from Statistics Norway (2009), Figure 9 gives a summary of the results (more details provided in Appendix B). Trade between Norway and Germany is not shown in this figure, as it exceeds the scale of the graph. Export to Germany from Norway was approx. 35 mill tonnes in 2009, including oil and gas. Export excluding oil and gas was approx. 7 mill tonnes. Norway imported approx. 2.3 mill tonnes in the same period.

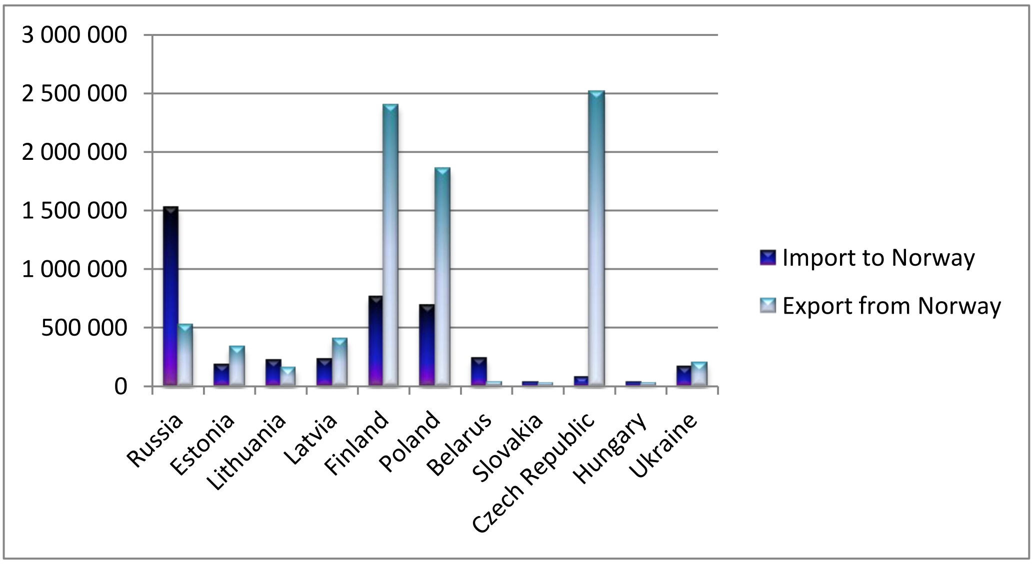

Figure 9 Import and export to/from Norway to the Baltic Sea Region, in addition to Hungary, The Czech Republic and Slovakia, 2009 (excluding Germany)

To create a potential demand for new rail transport solutions in any given corridor, a minimum level of trade is required and the following assumption was made:

"Volumes larger than 1 million gross tonnes per year in one direction should make it possible to fund rail solutions without unrealistic market shares in that direction."

The market share for rail transport to/from Norway to the different countries in the Baltic Sea Region varies today. Between Oslo and Göteborg, the rail market share is 17 % (in total, both directions)[25]. This decrease to approximately 10 % from Göteborg and southbound. Based on this, we further assumed that:

"1 million gross tonnes per year in one direction, should make it possible to obtain a 10 % market share for rail transports (100.000 gross tonnes)"

Depending on infrastructure restrictions (such as gradient and the length of crossing loops), a normal freight train in Norway can carry between 30 and 40 TEU's[26]. One TEU has an average weight of 10 tonnes[27], and a train with 40 TEU's carries 400 tonnes. With 100.000 tonnes on an annual basis, this equals 250 trains in total.

The assumptions doesn't consider the need for counterbalance with available volumes in both directions (return transports) and Figure 9 clearly shows that Norway imports more goods from Russia, Belarus and Lithuania than the amount it exported. On the other hand, Norway exports more to Poland, Czech Republic and Finland than the amount of goods imported. This also applies for trade between Norway, Estonia and Latvia. Import and export seems to be close to equal between Norway and Slovakia, Hungary and Ukraine.

As seen from Figure 9 , the assumption of possibilities for rail solutions applies for trade between:

- Russia - Norway (import);
- Norway (export) - Finland;
- Norway (export) - Poland;
- Norway (export) - The Czech Republic, and
- Germany - Norway (import and export, although not shown in Figure 9)

Volumes exported from Norway to the Czech Republic exceeded 2.500.000 tonnes in 2009, but this trade is considered as irrelevant as most of these volumes are liquid bulk etc.[28] and not feasible for rail transports (in total 2.462.785 tonnes liquid bulk, with only 55.757 tonnes remaining on an annual basis).

Based on these findings, the remaining study focuses on freight transports between Norway, Russia, Finland, Poland and Germany as these are the countries considered to have a sufficient foreign trade to create a potential demand for new rail transport solutions.

Figure 10 Study area

[25] Gods og logistikk i Osloregionen – analysegrunnlag, August 2011

[26] The twenty-foot equivalent unit (often TEU or teu) is an inexact unit of cargo capacity often used to describe the capacity of container ships and container terminals. It is based on the volume of a 20-foot-long (6.1 m) intermodal container.

[27] Based on TØI's (The Institute of Transport Economics) finding in the Portwin statistics where calculations where the calculations show that the average weight per TEU in international transportation are 10 tonnes.

[28] Fuel, propellant, oil and electricity

Imbalanced trade

In general, an imbalance in trade between two countries is a case that hardly can be affected, and all modes of transportation (rail and road especially) has to find return freight elsewhere. Alternatively, continue further onto other destinations. This is illustrated in Figure 11 bellow:

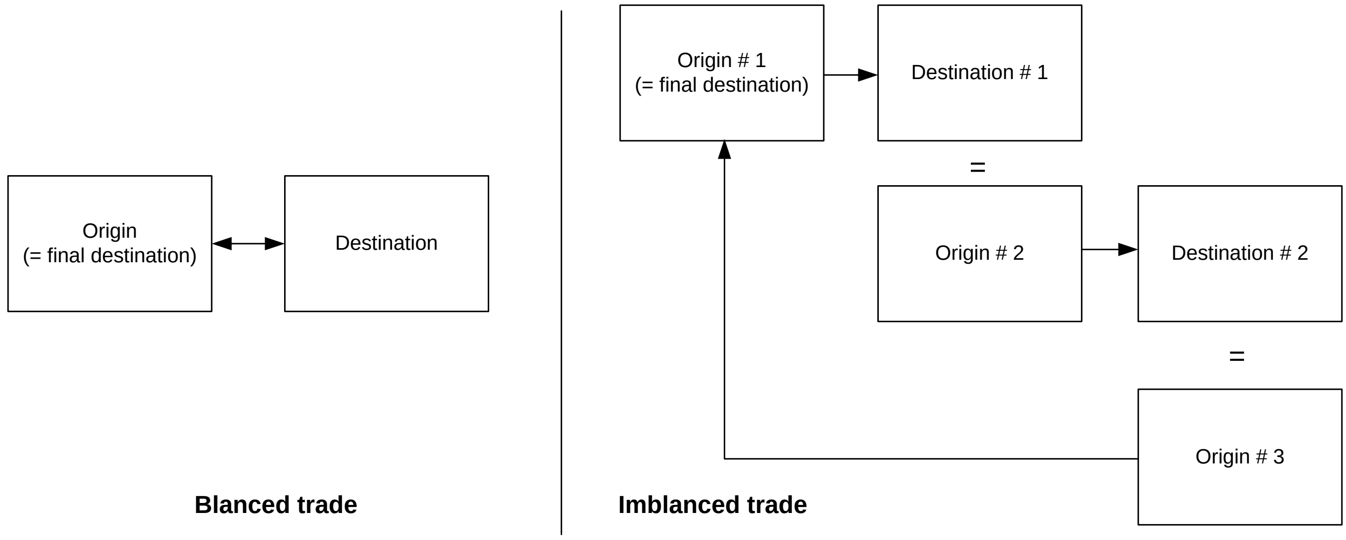

Figure 11 Example on an original and an extended OD[29]-matrix for freight transports

By extending the OD-matrix as illustrated in Figure 11 , this creates a need for the mode of transportation to have a certain degree of flexibility in order to extend the service. Such flexibility is one of the major differences between road and rail transports, looking at the competitive interfaces between road and rail transport: A lorry can easily manoeuvre to and from different locations on usually widespread road networks to a low extra cost. On the opposite, trains are bound to a less widespread rail infrastructure, and as a consequence rail is less competitive than road when considering the flexibility of a transport system.

A sub concept has been initiated by one of the partners in Task 5.5, ILiM. ILiM conducted an analysis of trade between Poland, Sweden and Norway taking into account cargo's susceptibility to containerisation and to be transported on rail shows moderate volumes (ranging to approx.. 100.000 TEU[30] p.a. in the Polish exports and approx. 200.000 TEU in imports) that might be attracted by the potential intermodal connections. One of their conclusions was that the available volumes for intermodal transport between Poland and Scandinavia have a large potential. However, the challenge is to convince stakeholders to change their flows from road to rail which might take some time. To follow up this finding, Task 5.5 tried identifying what these volumes consist of looking at information in both national and international databases. These databases were however not sufficient to identify which types of goods and where the exact origins and destinations are located. A further pursuit of such information was considered as out of scope for Task 5.5.

In addition to have to overcome the challenge of convincing stakeholders to change their flows from road to rail, there is also a difference between rail transports in Poland and Norway: In Poland rail transports are dominated by wagonload systems, and intermodal transports dominate in Norway. Here, most of the industrial goods are shipped by sea and the wagonload system was almost completely shut down in 2001. Apart from the train from Kassel in Germany to Møller (Volkswagen) in Lillestrøm (north of Oslo), there are no other wagonload trains today. One could argue that iron ore trains or pulp wood trains are wagonload, but we consider these services as

[29] OD = Origin Destination

[30] The twenty-foot equivalent unit (often TEU or teu) is an inexact unit of cargo capacity often used to describe the capacity of container ships and container terminals. It is based on the volume of a 20-foot-long (6.1 m) intermodal container.

Project part-financed by the European Union (European Regional Development Fund)
Baltic Sea Region Programme 2007-2013
ØstlandsSamarbeidet Eastern Norway County Network
Railconsult
Region Skåne

separate systems and unit trains. As a result of the almost complete shut down of the wagonload system in 2001, Task 5.5 decided to focus on intermodal transports.

3.3. Current infrastructure in the study area

Based on the defined study area in chapter 3.2 an initial mapping of current and available infrastructure was made.

3.3.1. Road network in the study area

Countries in the study area have a broadly connected E road network as seen from Figure 12 . Main E roads can be divided into two categories:

Category 1: North-south bound roads (illustrated by **bold** black line in Figure 12), with E 20, 30 and 40 passing through the study area.

Category 2: West-east bound roads (illustrated by red line in Figure 12), with E 18, 45, 55, 65 and 75 passing through the study area.

Figure 12 E road network in the study area (Source: figure adapted from UNECE)

In addition to the two main categories, there are numerous E roads in and between these countries, providing a solid infrastructure for land based road transport in the study area. The more densely populated areas, such as Germany and Poland, have a correspondingly dense road network. Although, despite of the lower population in Norway, Sweden and Finland the road networks here are considered as well developed too.

3.3.2. Railway network in the study area

Railway networks in the study area differ in density, gauge, electrification and more. As seen from Figure 13 , Germany has a greater density in its railway network compared to Norway and Sweden. Although, the same principle applies here as for E road density: more densely populated areas have a correspondingly dense railway network. And despite of the lower population in Norway, Sweden and Finland, railway networks here are considered as well developed connecting the major cities.

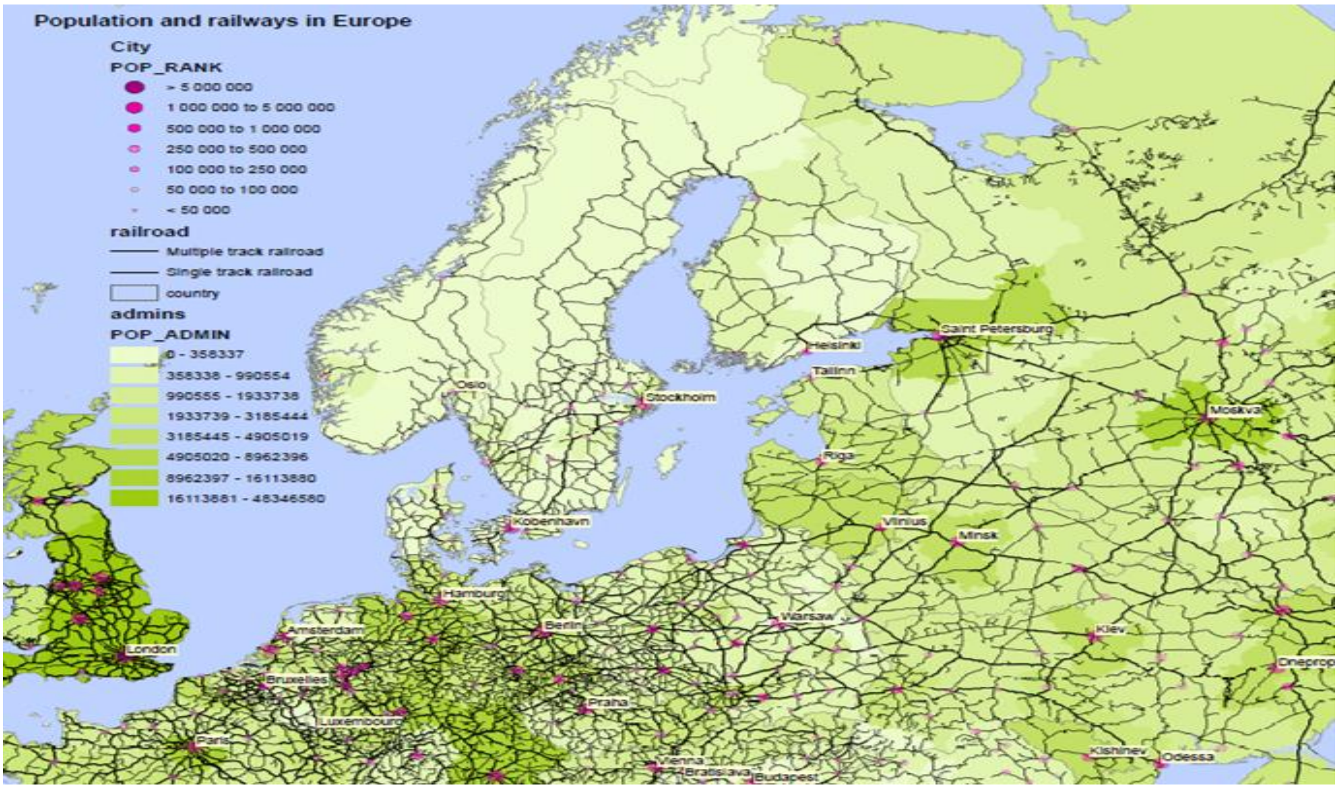

Figure 13 Railways and population in the study area (Source: The Norwegian Rail Administration, 2008)

Following is a brief description of the railway networks in the study area.

Railway network and interoperability in Norway

The Norwegian railway network measures 3.952[31] km whereby 64 % is electrified. There is also an additional 217 km line closed for regular traffic. The railway network in Norway connects to Sweden by:

- Border crossings at Vassijaure, Storlien, Charlottenberg and Kornsjø

Sweden and Norway have the same ATC system and voltage, and hence full interoperability. An overview of intermodal terminals in Norway is given in chapter 3.3.3.

Railway network and interoperability in Sweden

Utilization of the Swedish railway network is a necessity for all rail transports to/from Norway to the study area. The network is approximately 12.000 km long, and almost 90 % is electrified[32]. The railway network in Sweden connects to its neighbouring countries by:

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[31]The Norwegian Rail Administration: http://www.jernbaneverket.no/no/Jernbanen/Jernbanen-i-tall/

[32] The Swedish Transport Administration http://www.trafikverket.se/Privat/Vagar-och-jarnvagar/Sveriges-jarnvagsnat/

- The Öresund bridge and train ferry between Göteborg and Fredrikshamn to Denmark
- The train ferry between Stockholm and Turku in addition to the border crossing at Haparanda to Finland
- The train ferries between Malmö – Travemünde, Trelleborg – Sassnitz and Trelleborg – Rostock to Germany
- Border crossings at Vassijaure, Storlien, Charlottenberg and Kornsjø to Norway
- The train ferry between Ystad and Świnoujście to Poland
- Border crossing at Haparanda to Finland (break of gauge)

Sweden and Denmark have the same gauge but different voltage and signalling system. The differences in electrification between Denmark and Sweden were resolved by electrifying the entire Danish railway, and implementing a change of signal at Peberholm (as Sweden runs railways with left-hand traffic and Denmark with right-hand traffic). The switch is made at Malmö central station.

Sweden and Finland have different gauges (Sweden 1.435mm and Finland 1.524mm) and voltage, but the latter is irrelevant since the final part of the line is not electrified at either side of the border (the Swedish line is under electrification). Freight is normally transhipped at the border, or bogies are changed[33] (especially for liquid goods), and no passenger trains runs across this border. The train ferry between Turku and Stockholm has standard gauge (1.435 mm) and this is solved by the terminal in Turku handling both gauges. An overview of intermodal terminals in Sweden is given in chapter 3.3.3.

Railway network and interoperability in Finland

The Finnish rail network is 5.919 km long whereby 52 % is electrified[34]. Track Gauge in Finland is 1.524 mm. The rail network in Finland connects to its neighbouring countries by:

- border crossings at Vartius, Niirala, Imatra and Vainikkala to Russia
- the train ferry between Turku and Stockholm in addition to the border crossing at Haparanda to Sweden

There is a slight difference in the gauge between Russia and Finland, 4 mm. This difference is within the tolerances and direct trains is achieved. An overview of freight terminals in Finland is given in chapter 3.3.3.

Railway network and interoperability in Russia

The Russian rail network is one of the largest railway networks in the world by its 85.200 km[35] whereby 43.100 km are electrified utilising both 25 kV AC and 1.500 V DC. The rail network in Russia connects to its neighbouring countries by:

- Border crossings to countries with same or similar gauge such as Finland, Estonia, Latvia, Lithuania, Belarus, Ukraine, Georgia, Azerbaijan, Kazakhstan, Mongolia
- Border crossings to countries with break-of-gauge such as China, North Korea, Poland (only from Kaliningrad Oblast)

An overview of some intermodal terminals in Russia is given in chapter 3.3.3.

Railway network and interoperability in Germany

The German railway network is approximately 43.000 km long, whereby 19-21.000 km is electrified[36]. Deutsche Bahn (DB) is the largest rail operator, and operates 33.576 km of the line[37]. The electrified lines have a voltage of

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[33] There is a test involving approx. 10 wagons using variable gauge wheel sets that is able to cross the brake of gauge in speed

[34]The Finnish Transport Agency http://portal.liikennevirasto.fi/sivu/www/s/trafiknat/jarnvagar

[35] Russian Railways http://eng.rzd.ru/statice/public/rzdeng?STRUCTURE_ID=4

15 kV AC. Due to Germanys' geographical location in Europe the rail network is broadly connected to its neighbouring countries by (different voltage in parenthesis):

- Border crossings to Denmark (25 kV AC), Poland (3 kV DC), The Czech Republic (3 kV DC), Austria (15 kV AC), Switzerland (15 kV AC), France (25 kV AC or 1500 V DC), Luxembourg (25 kV AC or 3kV DC), The Netherlands (1500 V DC) and Belgium (3kV DC)

All of these neighbouring countries have the same gauge, 1.435 mm but differing voltage. An overview of intermodal terminals in Germany listed in the AGORA[38] database is given in chapter 3.3.3.

Railway network in Poland

The railway network in Poland measures 19.276 km[39] whereby the vast majority is electrified using a 3 kV DC overhead line system. The railway network in Poland connects to its neighbouring countries by (different voltage in parenthesis):

- Border crossings to The Czech Republic, Germany (15 kV AC) and Slovakia
- Train ferry from Świnoujście to Ystad in Sweden
- Border crossings with break-of-gauge to Belarus (25 kV AC), Lithuania (25 kV AC), Kaliningrad Oblast (without overhead lines) and Ukraine (25 kV AC)

An overview of intermodal terminals in Poland listed in the AGORA database is given in chapter 3.3.3.

[36] Profile of the Rail Transport Sector in Germany, European Foundation for the Improvement of Living and Working Conditions

[37] http://www.deutschebahn.com/en/group/ataglance/facts_figures.html

[38] http://www.intermodal-terminals.eu/content/index_eng.html

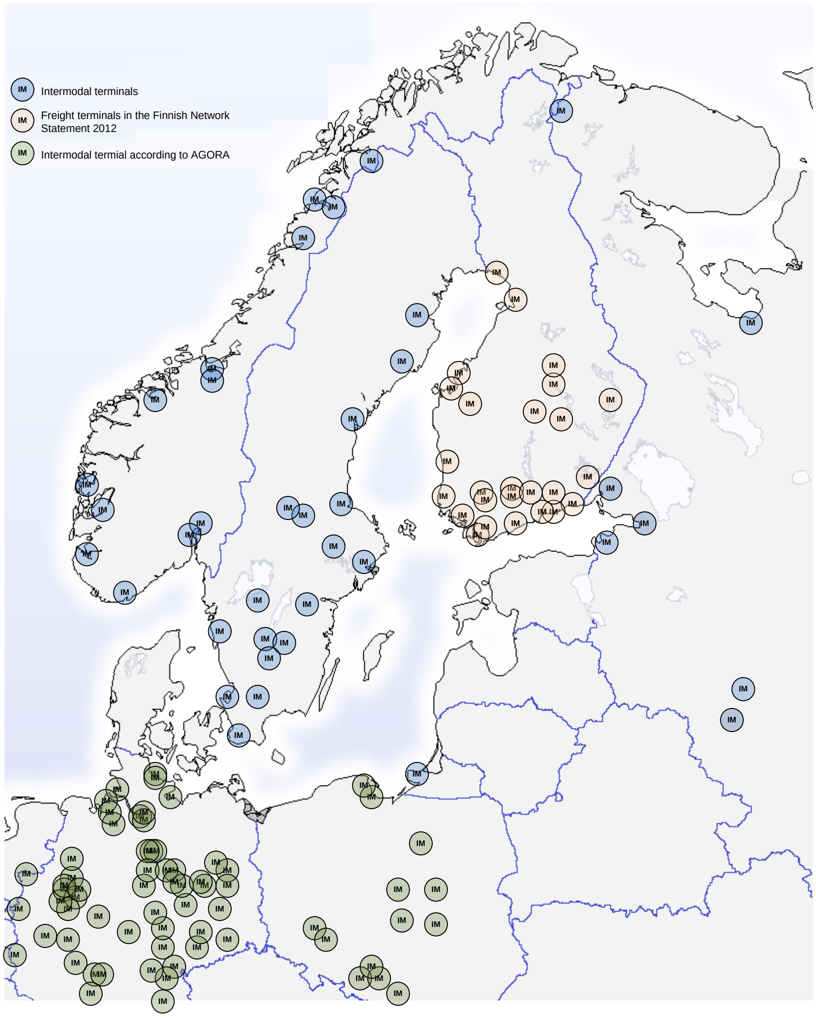
[39] PKP http://www.pkp.pl/

3.3.3. Intermodal terminals in the study area

Intermodal terminals are a key component in the intermodal supply chain, as the role of these terminals are to ensure a safe, reliable and efficient interchange between rail and other modes of transportation.

Ownership, operation and management of intermodal terminals differ in the study area. In Scandinavia, as a result of the deregulation of the Railway, operations and management of some intermodal terminals have been reorganized. With an aim to achieve a non-discriminative access to their own intermodal terminals, terminal owners issued an exclusive license to neutral terminal operators for a given time period. This has resulted in a transparent capacity allocation, pricing and equal services to all train companies. Examples on terms and prices for one of the terminal owners in Sweden are available at www.kombiterminaler.se.

Figure 14 gives an overview of freight and intermodal terminals in the study area. Due to lack of available and reliable sources, all terminals in Poland, Germany and Russia are not identified. When there is more than one terminal at a given area, this is not illustrated in the figure. For example there are quite a few terminals in and around St. Petersburg in Russia, but only one is marked in the figure.



The major rail freight hub in Norway is Alnabru freight terminal in Oslo. In addition, intermodal terminals are located in/close to the major cities, such as Trondheim, Bergen, Stavanger and Kristiansand.

Continuing to Sweden, intermodal terminals considered as important by the Swedish government[40] are Göteborg, Hallsberg, Jönköping, Luleå, Malmö, Stockholm, Umeå and Älmhult. The port of Göteborg has over the past few years experienced a yearly growth in rail transport to and from the harbor.

In Germany, there are 18 major rail freight hubs: Bremen, Hamburg metropolitan region, Rhine-Ruhr[41], Hannover/Braunschweig, Magdeburg/Sudenbrug, Berlin/Bradenburg, the Saxonian Triangle, Nordhessen, Thuringia, the Rhine Main region, the Rhine-Neckar region, Stuttgart/Heilbronn, Hahn/Trier, Nuremberg/Upper Franconia, Freiburg/the Lörrach region, Ulm, Danube and Munich.

Figure 14 Location of intermodal terminals in the study area

[40] Strategisk nät av kombiterminaler – intermodala noder i det svenska godstransportsystemet, Banverket 2007

[41] The Rhine-Ruhr region offers one of the densest railway networks in Germany and is also an important hub in the European HSR network. Freight villages are based in Duisburg, Herne and Cologne.

The report "*Utviklingen av "Green Freight Corridor" Oslo – Göteborg – Øresund – Duisburg*" also points out Duisburg (Rhine-Ruhr) as an important freight hub for rail transports from Norway to Germany and vise versa.

Major logistic centers in Finland are located in Raisio, Turku, Vantaa, Kotka, Oulu and Kerri. Direct trains to Russia plays a leading role by making up approximately 40 % of the total transports in Finland.

According to The Baltic Maritime Outlook 2006 Moscow is the nodal point of Russia, from where the railway network radiates around the country. The railway is also connected to ports in the major cities neighbouring to the Baltic Sea: Vysotsk, Vyborg, Primorsk, St. Petersburg, Kronstad, Ust-Luga and Kaliningrad.

In Poland, the intermodal terminals are located in the areas around Poznan, Warsaw, Wroclaw and Krakow.

Localization: Logistic networks connected to the intermodal terminals

Several of the logistical operators (e.g. DB Schenker, DHL etc.) are located adjacent to the intermodal terminals in Norway. This is a result of deliberate strategies of several of the companies that today has become the major logistical operators in Norway, dating as long back as to the seventies.

It must be said that the Norwegian State Railway and its successors also are a major reason for this rail friendly logistics network in Norway today. They have allowed several logistics operators to establish their terminals on railway owned land, not only their "own" Linjegods (which is now DB Schenker) but even its competitors.

Although, Alnabru freight terminal does not have sufficient capacity today to meet the future demand. Decentralisation has already begun to take place, with companies moving their logistic centres out of Oslo either south or east-bound. One of the main reasons for this is increased pressure on available land in the central Oslo region leading to higher costs for land acquisition.

In many other European countries the railway companies have perceived the logistics operators as their competitors and pushed their terminals as far away from the railway as possible. This perception has even gone the other way, i.e. the logistics operators have wanted their terminals as far away from their competitors as possible.

The consequence of such an approach, decentralising different logistics operators, results in higher cost of transportation (increased distance for road transports to/from terminals) in addition to reduced efficiency in the intermodal supply chain (e.g. longer transportation times).

Project part-financed by the European Union (European Regional Development Fund)

3.3.4. Ports in the study area

In total, regardless of commodity handled, the top 20 ports in the Baltic Sea Region (measured by the total traffic volume in 2006) are[42]:

#	Name/Place	Tonnes 2006	#	Name/Place	Tonnes 2006
1	Primorsk	66.078.000	11	Rostock	19.058.000
2	St. Petersburg	54.230.000	12	Brofjorden Preemraff	18.591.000
3	Tallinn	41.084.000	13	Fredrecia	16.108.000
4	Göteborg	39.912.000	14	Kaliningrad	15.225.000
5	Ventspils	29.062.000	15	Gdynia	14.183.000
6	Riga	25.358.000	16	Vysotsk	13.811.000
7	Gdansk	24.207.000	17	Aarhus	11.913.000
8	Klaipeda	23.611.000	18	Helsinki	11.728.000
9	Lübeck	21.056.000	19	Trelleborg	11.381.000
10	Kilpilahti	19.739.000	20	Szczecin	9.965.000

Table 2 – *Top 20 ports in the BSR (total traffic volume), 2006*

Eight of these major ports (listed in grey in table 2) are outside the study area. If one looks at the directions of the freight flows, Primorsk and St. Petersburg exports the largest volumes, while Göteborg and St. Petersburg imports the largest volumes. Liquid bulk, which is not appropriate for intermodal rail transport, was handled in over 110 ports in the BSR in 2006.

Approximately 284.000 train wagons were handled at 11 ports in the study area in 2006. Seven of the biggest rail ports handled almost 89 % of the total train wagons passing through the Baltic Sea (see table 3). Trelleborg and Sassnitz alone handled 50,5 % of all train wagons in 2006. Two of the rail ports (listed in grey in table 3) are outside the study area.

#	Name/Place	Number of train wagons 2006	#	Name/Place	Number of train wagons 2006
1	Trelleborg	78.241	11	Klaipeda	6.456
2	Sassnitz	69.069	12	Fredrikshavn	522
3	Malmö	37.851	13	Göteborg	380
4	Ystad	20.959			
5	Świnoujście	20.955			
6	Rostock	16.672			
7	Turku	14.650			
8	Stockholm	9.600			
9	Puttgarden/Fehmarn	8.326		**In total**	**291.359**
10	Lübeck	7.678			

Table 3 – 13 ports in the BSR handling rail wagons (total volume), 2006

In addition to ports handling train wagons, the port of Hamburg should be mentioned as it is the biggest railway junction for container business in Europe with rail traffic exceeding more than 1.500.000 million TEUs per annum[43].

7.100.000 million[44] trucks and trailers were handled at over 50 ports in the BSR in 2006 (see table 4). The port of Lübeck was the port handling most trucks and trailers, with approximately 800.930 vessels. For trucks and

[42] Baltic Port List 2006, Centre for Maritime Studies

[43] Baltic Maritime Outlook 2006

trailers, there is a wider distribution among the ports compared to train wagons. The top five ports for handling trucks and trailers had a total market share of 39 %.

#	Name/Place	Number of t&t in 2006	#	Name/Place	Number of t&t in 2006
1	Lübeck	800.930	11	Fredericia	192.402
2	Trelleborg	566.691	12	Ystad	184.175
3	Göteborg	486.247	13	Świnoujście	182.886
4	Rostock	482.519	14	Kapellskär	175.000
5	Helsingborg	431.736	15	Kiel	168.280
6	Helsinki	417.090	16	Stockholm	150.031
	Elsinore	380.975	17	Klaipeda	149.684
8	Rødby	346.693	18	Gdynia	136.413
9	Puttgarden/Fehmarn	346.693	19	Turku	128.629
10	Malmö	255.542	20	Naantali	125.177

Table 4 – Top 20 trailer and truck ports in the BSR, 2006

Coastal shuttles for rail wagons and trucks in the study area

An initial study of access to coastal shuttles for rail wagons and trucks in the study area clearly showed that while trucks are offered a comprehensive network of ferries across the Baltic Sea, the same does not apply for rail wagons. This is most likely the consequence of low demand for such services, as most of the rail transport from Scandinavia today goes by the Öresund Bridge to the eastern part of Germany or the Netherlands.

By using the feature on www.ferrylines.com, it became clear that there are two corridors with ferries handling rail wagons today: Trelleborg – Sassnitz (operated by Scandlines) and Ystad – Świnoujście (operated by Unity Line). In addition there are ferries that can handle rail wagons in the sea corridor Trelleborg – Rostock (previously operated by Scandlines) and Stockholm – Turku (previously operated by Silja Line (Tallink Silja)). These are currently not in operation due to a lack of demand. In the literature study, one finding was that a critical issue is the lack of ferry connections[45] across the Baltic Sea.

Figure 15 Coastal shuttles in the study area (Source: www.ferrylines.com)

[44] Baltic Port List 2006, Centre for Maritime Studies

[45] The Baltic Tangent

3.4. Today's freight transport in the study area

Before examining the competitiveness of intermodal transport one needs an overview of which services that are provided in the study area today. Access to such information varies in different countries and between different operating regimes. Mapping current rail and road flows at a micro level did not prove to be realistic as seen in chapter 3.2.

3.4.1. Existing rail transport solutions from Norway and Sweden to the study area

In Norway, the national wagonload system was closed down in 2001. All Norwegian domestic volumes less than an entire train was transferred to intermodal. This was a business decision from the (then) only domestic freight train operator. Thus most of the existing market in Norway is tuned for intermodal, and most of the possible senders/receivers of rail freight to/from the Baltic Sea Region do not have a track connection.

A significant part of the identified marked is consumer goods which traditionally is viewed as most suited to intermodal transport or road transport.

It must however be said that wagon loading is not completely shut down, the Swedish company Green Cargo has extended their Swedish wagon loading network into a few terminals and customers in Norway. These terminals and customers are thus connected to the European wagon loading network and can receive and send single wagons. Since the possibility to send single wagons only is possible to a handful destinations in Norway and significant parts of the market is adapting intermodal transports, Task 5.5 decided to concentrate on intermodal transport solutions.

The Norwegian company CargoNet runs intermodal trains between Oslo - Trelleborg/Malmö, Göteborg and Älmhult on a daily basis (weekdays only). In Göteborg CargoNet reload the trains, and continues towards Stockholm and other destinations in Sweden. There are also other train operators providing services from Göteborg to Herne in the Ruhr area in Germany.

From Malmö the connection to Poznan and Wroclaw was studied by ILiM and the results from this study are presented in chapter 6.3. From Malmö there are also connections to intermodal terminals in the western part of Germany using the Öresund Bridge.

The Swedish operator Green Cargo also provides connections to the European wagon loading network (sometimes in cooperation with the Norwegian company Grenland Rail).In theory, this service could be extended to connect to almost all the terminals in the study area through the rail network, although transport times are expected to be slow.

3.4.2. Direct road transport

As seen in table 5 and 6, vessels and road transport are the most commonly used modes between Norway and the study area, regardless of direction. Rail transport carries a very small share of the total amount of transported goods between the end destinations in this area.

EXPORT FROM NORWAY (in tonnes; 2009)	Vessels, foreign	Vessels, NOR	Trucks on vessels	Trailers on vessels	Rail-wagon on vessels	Rail	Trailer on rail-wagon	Road transport	Aircraft	Mail	Other
Finland	920.321	1.283.147		3 .083	10	475	160	191.249	109	12	899
Russia	170.201	233.425	3.578	5.439		27		112.872	95		26
Poland	1.254.917	387.621	6.846	799		7.349		203.380	101	2	429

Germany	9.366.559	5.423.909	100.769	53.506	35	89.197	777	243.206	401	14	51

Table 5 – Export from the study area to Norway by mode of transportation and tonnes, 2009

IMPORT TO NORWAY (in tonnes; 2009)	**Vessels, foreign**	**Vessels, NOR**	**Trucks on vessels**	**Trailers on vessels**	**Rail-wagon on vessels**	**Rail**	**Trailer on rail-wagon**	**Road transport**	**Aircraft**	**Mail**	**Other**
Finland	236.519	67.325	3.271	1.003		33.158	1.649	421.128	300	56	955
Russia	1.191.792	297.135	212	352		820		37.177	11		74
Poland	324.265	117.929	7.583	1.482		13.319		221.246	85	343	1.015
Germany	1.002.430	510.871	165.034	65.588	26	86.467	5.038	424.959	1.605	272	3.741

Table 6 – Import to Norway from the study area by mode of transportation and tonnes, 2009

According to a survey conducted in 2004 by Vägverket Consult more than 200.000 trucks per year passing the Swedish/Norwegian border at Svinesund are going through Sweden in transit. Approximately 1/3 (of these trucks) passes the opposite border in Sweden via the harbours in Trelleborg, Ystad and Karlskrona and was certainly interesting for this study. But as previously stated: detailed information of these flows proved to be unrealistic to gather, although several parties have been asked for more information.

An overview of coastal shuttles for rail and road transport is given in chapter 3.3.4 and is for this reason not treated any further in the assessment of today's transport in the study area.

Summarised, road transport is the dominant mode of transport in the study area (except from vessels). As seen from Figure 16 , domestic rail transports in Norway have quite a high market share, varying between 50-66 % in the main corridors (Oslo – Bergen, Trondheim and Stavanger). For transport to Stockholm and Göteborg, the market share drops to respectively 10 and 17 % percent. Towards Malmö and southbound the market share for rail freight decrease even further.

As international rail transports has such low market shares compared to national transports, these transports also have a greater potential to increase.

In the following chapters, we will look at the competitiveness between road and rail transports.

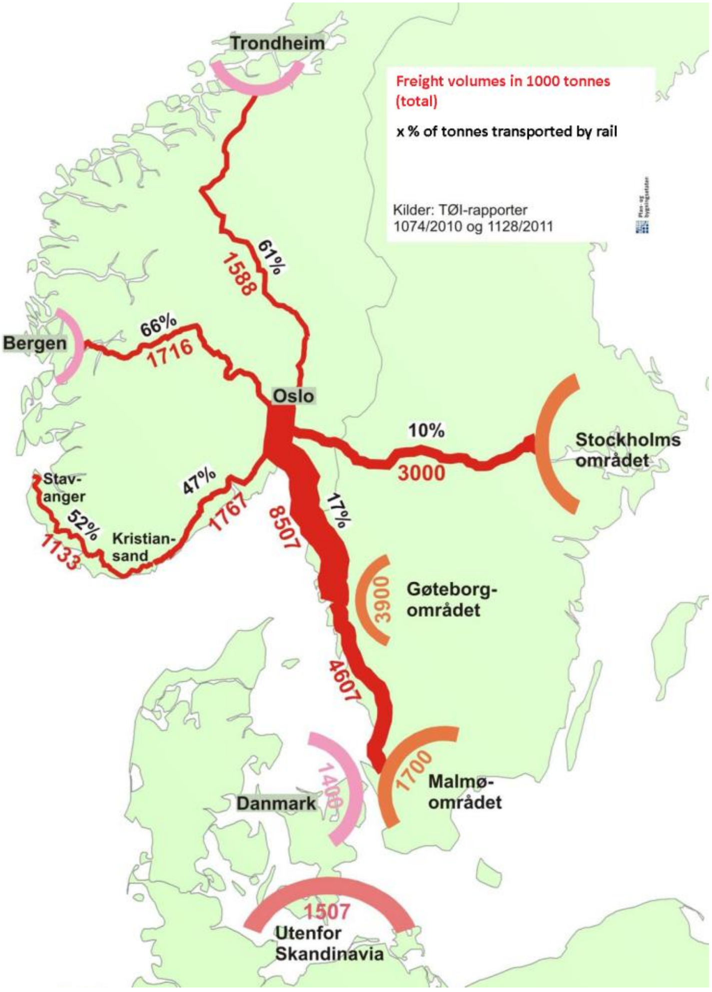


Figure 16 Rail freight market share compared to road transport, Oslo – domestic and Oslo – Sweden (Source: Figure adapted from "Gods og logistikk i Osloregionen – analysegrunnlag, August 2011")

4. Competitiveness of intermodal freight transport

An intermodal supply chain is characterised by several involved parties leading to an increased complexity. In comparison to road transports, where one truck and its driver is responsible for the transport from the origin to the destination. The difference in degree of complexity is obvious from the following figures, whereby Figure 17 illustrates a supply chain with road transportation and Figure 18 an intermodal supply chain:

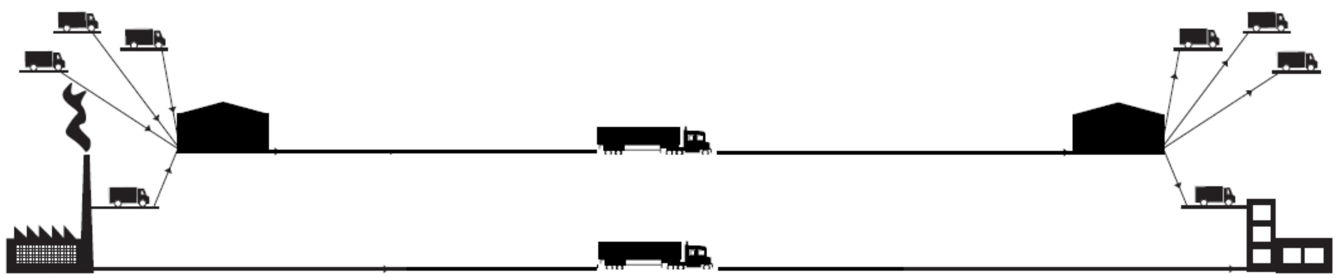


Figure 17 Supply chain based on road transport, decreased complexity

Figure 18 An intermodal supply chain, involving several parties increasing the complexity

Although, if all parties in an intermodal supply chain have all the prerequisites in place to perform their service, increased complexity does not equal increased difficulty to deliver.

In the transport buyers decision making process there are a few important key factors which influence the final choice (in order of priority); (1) punctuality, (1)price, (2)information, (3)frequency and (4)service.

Punctuality equals a given mode of transportation's ability to deliver on time. **Price** relates to a mode of transport's competitive price in the market. Different factors influence the total transportation cost and hence the market price. **Information** relates to information about the services a given mode of transport can provide as well as perceived information flows in the supply chain. High level of **frequency** relates to the number of departures a mode of transport can offer in a day/week This is often limited by the capacity of the railway lines, terminals etc. **Service** relates to the perceived quality of all elements a given company and a mode of transportation can provide. The overall service level is often the sum of all elements such as: lead times, reliability, safety, information flows, adaption to customer needs and flexibility.

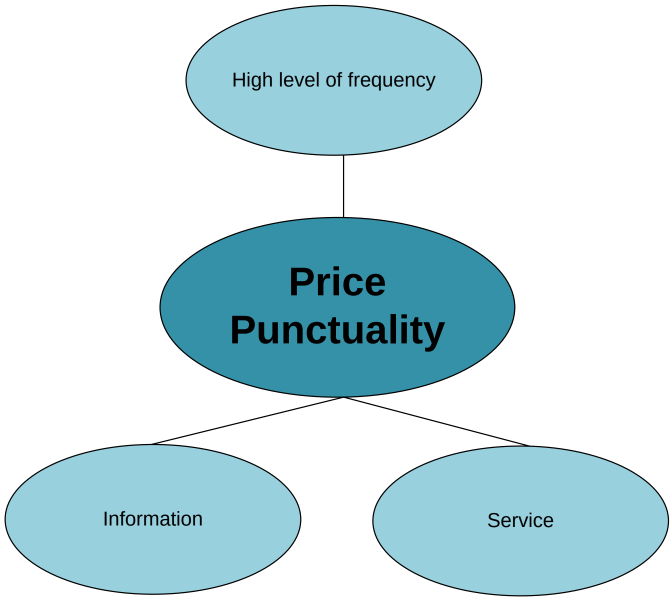


Figure 19 Key influencing factors in the decision making process when choosing mode of transportation (Figure adapted from Jernbaneverket (the Norwegian National Rail Administration))

In this chapter, hindrances against increased rail transport will be discussed in context to these key factors affecting the decision process of the logisticians buyers.

Parts of the charting of hindrances against increased rail transport was done by the literature study summarised in chapter 2. Another important part of the study consisted of interviews with representatives from companies and organisations that are involved in freight transports in the relevant corridors. The selected companies were mainly Norwegian but even Polish and Swedish companies have been approached. A full list of contributing companies is given in Appendix C.

The interviews covered the following themes:

- Role in the supply chain
- Willingness to implement new routines
- Environment and other benefits of rail transports
- Existing transport arrangements and reasons for this
- Actions demanded to change existing arrangements (how to get their goods onto rail)

All the interviewed parties were open and willing to share their knowledge and experiences. The message from the respondents was similar, and the results was considered reliable even with the relatively small number of respondents. Although considered reliable, this does not necessary imply that the project agree with some of the results. The main message was that the railway on an international transport crossing several borders would not be able to deliver the quality needed by the market. This perception was mainly based on experiences from their current domestic rail use, from their knowledge and perceptions of international problems but also second hand experience.

The same information and experiences was given in a couple of workshops held in cooperation with Jernbaneverket (the Norwegian National Rail Administration) and NHO Logistikk og Transport (the Norwegian Logistics and Freight Association). These workshops are further mentioned in Chapter 5.3.

4.1. Rail infrastructure bottle necks and hindrances

There have been several debates in Norwegian and Swedish media the past years, criticising the current state of the rail infrastructure causing an unpredictable transport system. Despite this, the majority of the interviewed parties did not see infrastructure deficiencies as the direct reason for choosing road transports instead of rail transports. Most of the parties believed that there is sufficient capacity to get a few more trains (to carry their goods) through. Never the less, infrastructure related bottle necks and hindrances are further discussed in this chapter, as these currently are present in the study area.

Capacity

The service any given railway line (infrastructure) can provide is limited by the capacity of the infrastructure. In the study area, the different national railway systems have a high degree of utilisation and mixed traffic with different speed characteristics. This results in quality challenges in terms of increased journey times and punctuality issues. Where the demand is greater, capacity is utilised to its maximum level. Single track provides less capacity than double track. Lines with single track are also more vulnerable in case of disruptions, causing irregularities that often follow larger parts of the line.

Also, the number of trains and the degree of mixed traffic on a line has consequences for the quality of the train schedules, journey times and reliability. Different train services such as long distance passenger transport, local passenger trains and freight trains on the same line results in the faster trains catching up with slower trains, reducing overall performance speed of the line. For the same reasons, any delays are spread consequently.

In the study area there are several congested lines and the congestion on these lines has a major impact of the reliability of the railway system as there is little or no excess capacity to recover from delay. On some especially congested sections there are also problems in conducting necessary maintenance without causing disturbances in the traffic. Any increase in traffic will increase this issue.

Below is a list of known possible capacity deficiencies that might hamper operation of freight trains between Norway and the study area that is not included in any plans for infrastructure improvements.

Area	Problem
Lillestrøm – Årnes	Capacity during maximum hours
Katrineholm – Järna	Lack of capacity during day time
Oslo – Moss	Capacity due to a lack of passing loops, the only possibility for faster (passenger) trains to pass slow (freight) trains will be Ski where capacity will be scarce
Göteborg (Olskroken – Almedal)	Lack of capacity during day time
Skåne (Ängelholm/Hässleholm – Malmö – Trelleborg/Öresund/Ystad)	Even with all the planned infrastructure measures the pressure on track capacity in Skåne will still be very high

Table 7 – Capacity deficiencies that's not included in national transport plans

These potential deficiencies are opinions based on knowledge and experience from some of the interviewed parties.

In the freight analysis conducted in the Norwegian High Speed Rail Assessment 2010-12, freight integrators stated that early morning deliveries is essential. For shorter distances which can be undertaken with journey times at approximately 8-10 hours, this is usually possible without utilising the railway in the rush hours. This situation changes when freight trains from Norway to other countries in the study area (and vice versa) need to deliver at this time of the day. The freight train will then have to start, or use the railway, at some point during the rush hours when lack of capacity is at its greatest. The issue with lack of capacity in the rush hours is illustrated in

Figure 20 and Figure 21 , which provides an overview of capacity during the maximum hours[46] in Norway and Sweden:

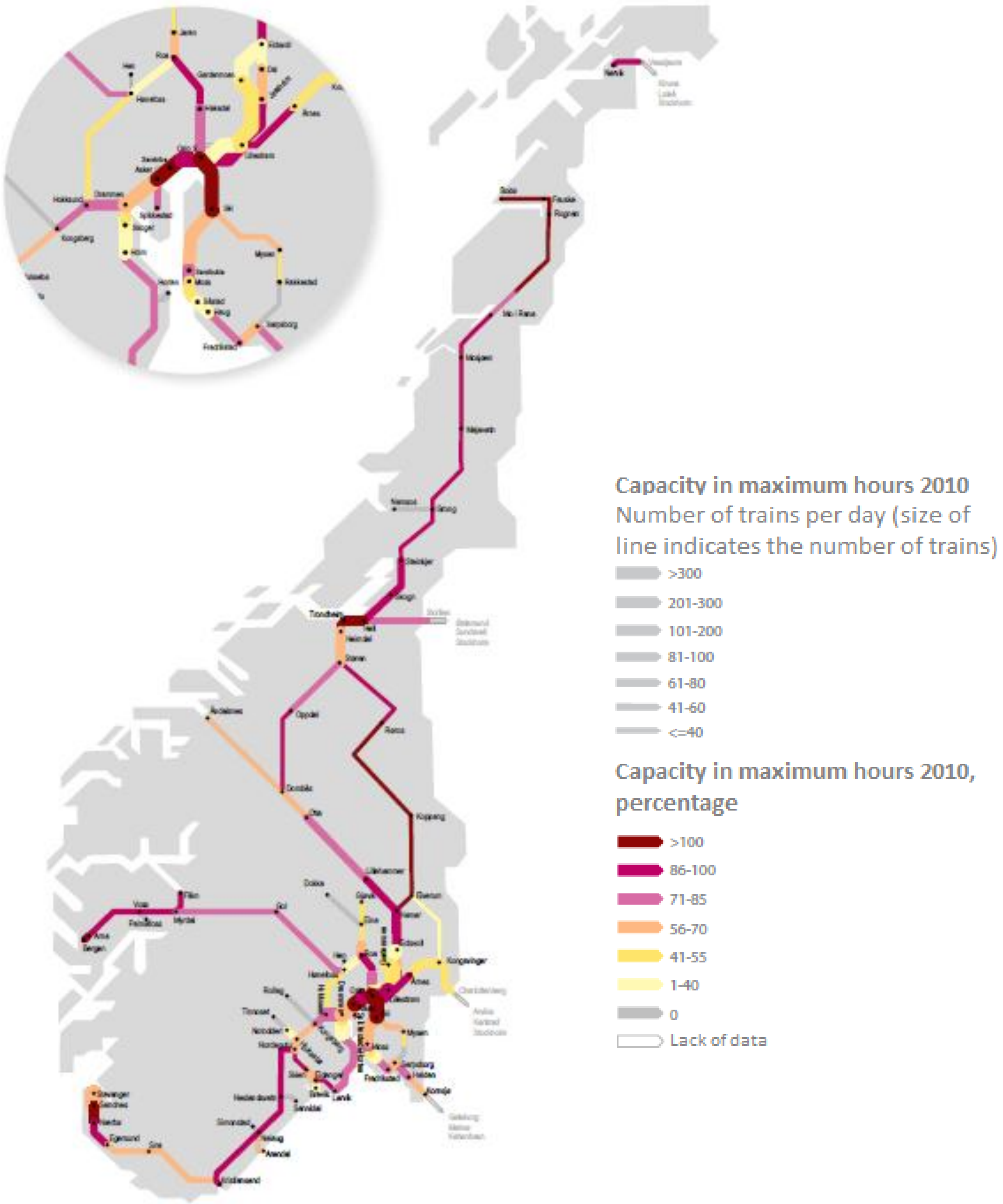


Figure 20 Capacity in maximum hours 2010, Norway (Source: Figure adapted from Jernbaneverket (the Norwegian National Rail Administration))

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[46] Maximum hours: The hours of the day in which the exploitation of the railway network is at its greatest.

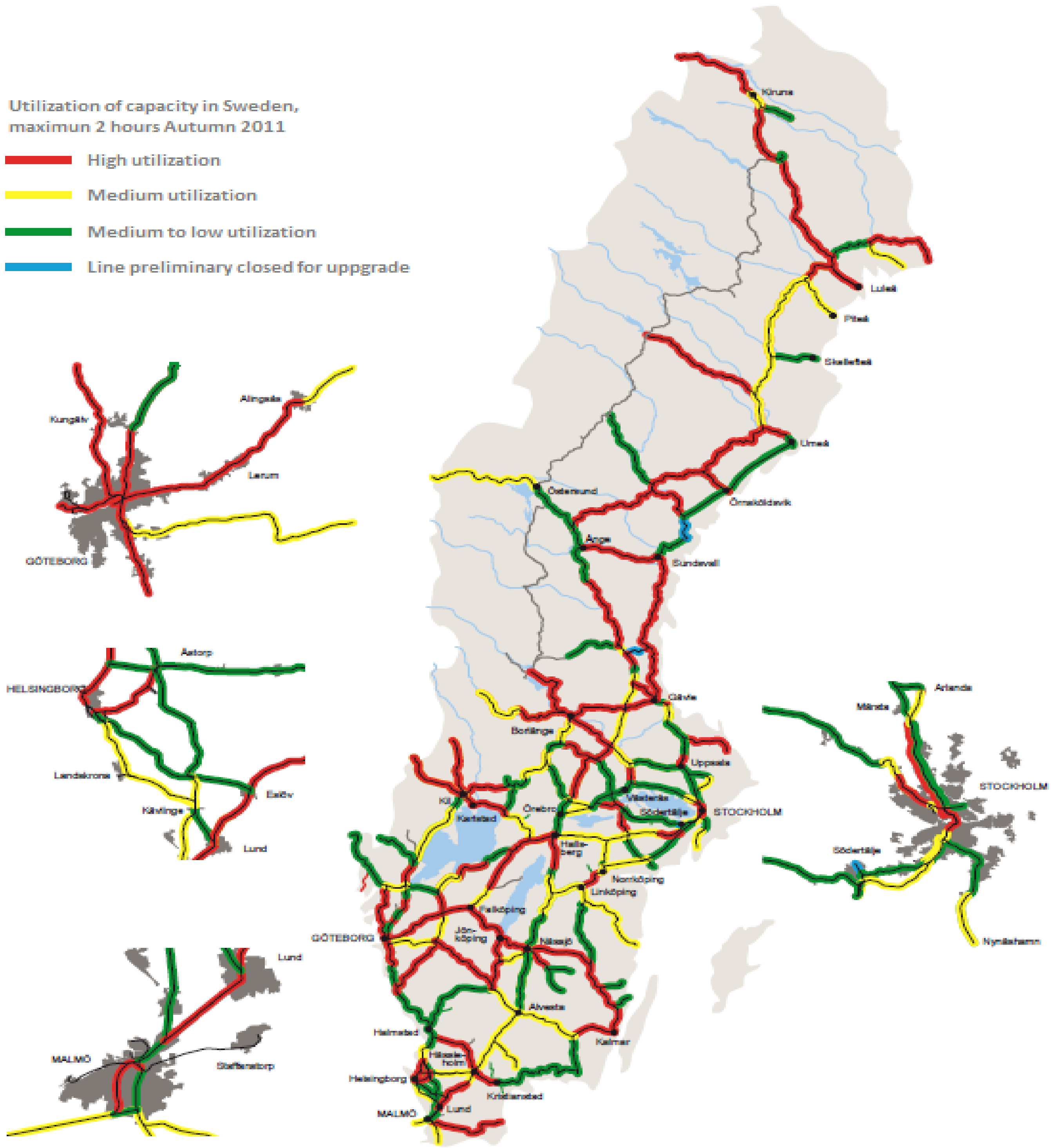

Figure 21 Capacity in maximum hours 2011, Sweden (Source: Figure adapted from Trafikverket (the Swedish Transport Administration))

None of the capacity issues in Table7 will make it impossible to run trains, but may cause problems to pass some sections during maximum hours. From Oslo to for example Poland, a freight train is bound to pass either Malmö, Göteborg or Oslo during rush hours. And of course this problem is even more severe if there are more than one train per day with the same restrictions.

Gradient

From Norway towards the other countries in the study area (regardless of destination) there are two sections where the gradient results in weight restrictions: From Oslo to Alnabru intermodal terminal and from Halden towards Sweden at Tistedal. As the gradient exceeds the recommended 12,5 ‰ (in Norway[47]), the freight trains consequently needs to reduce the total weight. How to deal with these two gradient issues are not included in the Norwegian national transport plan. The solution to this problem might not necessary be costly investment programmes related to infrastructure upgrade or re-location.

Interoperability

There is a mixed degree of railway interoperability between countries in the Baltic Sea Region. The countries can be divided into three groups: The OSJD[48] countries, Finland and the former RIV[49] countries. Within each group there are high levels of interoperability.

The OSJD area, consisting of the Baltic States, Russia and other former Soviet republics, has almost full interoperability for both locomotives and wagons. Any lack of interoperability lies mainly in the use of two different power supply systems. It is possible to run OSJD wagons on the Finnish network at a reduced speed but with the need of a special coupler on the Finnish locomotives.

The RIV area consists of Scandinavia, mainland Europe (except the Iberian Peninsula), Turkey, Syria, Iran and Iraq. Wagons within a certain loading gauge have full interoperability. There are several signalling systems and power supply system's demanding multisystem locomotives or locomotive exchange to run across borders. Norway and Sweden and Germany and Austria are pairs of countries with full interoperability even for locomotives across the border.

The respondents might exaggerate the interoperability problems facing the freight railway systems. Thus it is necessary to inform the market about which technical interoperability constraints that exist, what kind of traffic it is possible to set up today and what will be possible when the new EU regulations fully have become operational.

EU regulations to increase interoperability

The issue with different technical systems are already partly being dealt with through the ERTMS project. In 1996, EU decided that a European Rail Traffic Management System should become standard for all high-speed lines. The background for this initiative was that over 20 different train control systems have been developed and operated by individual European railways according to their national requirements for technical standards and operating rules[50]. Such diversity does not meet required reliability and efficiency. To overcome this hindrance, the EU council directives 96/48/EC and 1001/16/EC with respect to the interoperability of the trans-European high-speed rail system and conventional[51] rail systems were developed. ETCS is developed as a part of the ERTMS initiative. Unifying multiple signalling systems will provide a better interoperability for rail transport in addition to minimizing technical and cultural issues associated with international rail transports, and contribute to improve the overall quality and competitiveness of rail transport.

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[47] Maximum recommended gradient in Sweden is 10 ‰

[48] The Baltic States, Russia and former Soviet republics

[49] Scandinavia, mainland Europe (except the Iberian Peninsula), Turkey, Syria, Iran and Iraq

[50] Institution of Railway Signal Engineers

[51] ETCS

In a long term perspective ERTMS will also help reduce the operating costs for both infrastructure manager and operators. Although, one issue that needs to be assessed further are the implementation costs; both for infrastructure providers upgrading the network and operators costs for upgrading existing rolling stock. Financing the implementation of ERTMS has been one of the major subjects for discussions.

However, the technical system changes at different boarders seem less problematic than the administrative and legislative differences between countries. Even here the EU regulations have started the process of relieving these differences by introducing common regulations for approval of vehicles and operating companies. In addition, the RNE[52] is introducing simplified methods for ordering routes for international trains. Although, from the interviews and workshop, this process is considered to be further from the final solution compared to the technical issues. Administrative and legislation bottle necks and hindrances are further discussed in chapter 4.2.

Preliminary conclusions: Infrastructure related bottle necks and hindrances reducing overall competiveness

In the literature study, several of the studies pointed out different infrastructure measures that needed to take place in order to improve rail freight services. Although, few such measures and issues were identified in the interviews. The main infrastructure related bottle necks and hindrances identified are:

- Lack of capacity
- Gradient issues in Norway (two specific locations)
- Lack of interoperability

Looking back at the factors that influence the transport buyers in their decision making process the identified infrastructure related bottle necks affects four of these factors by:

- Reducing the **punctuality** with lack of capacity in maximum hours and hence lack of extra capacity to recover from delays
- Reducing any opportunity to increase the **frequency,** as there are restrictions in number of trains in maximum hours
- Reducing the overall **service** level, as gradient in Norway sets restrictions on total weight
- Increasing the total transportation cost and hence **price**, as different technical systems leads to longer transport times. Longer transport times following affects the transportation cost and rate, as extra man hours leads to extra costs.

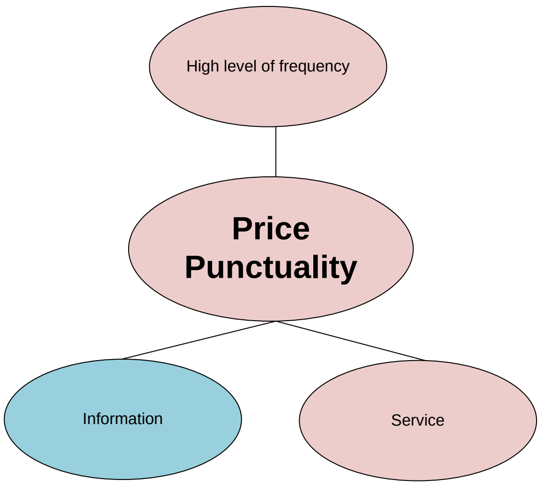

Figure 22 Factors affected by infrastructure related bottle necks and hindrances

[52] Rail Net Europe (Organization for European Infrastructure Managers)

4.2. Administrative and perceptional bottlenecks and hindrances

As mentioned in the introduction to chapter 4.1, there have been debates in Norwegian and Swedish media over the past years where the state of the railway networks has been heavily criticised. With such ongoing debates and focus on different issues, naturally the perception of the railway's condition and ability to deliver is weakened.

The administrative and perceptional bottlenecks and hindrances identified in this chapter are mainly based on findings from the interviews and workshops. Several of these bottlenecks were also found in the literature study.

Administrative and legislation

Normally, authorities' impact on the modal split of freight traffic can be divided in to two groups:

Governing authorities: issues policies, laws and regulations and decides upon taxes and subsidies.

Controlling authorities: controls that laws are followed. Even controlling authorities must issue regulations but only those that are directly to their controlling responsibility (customs, police etc.)

Governing authorities

As the freight industry in the study area is business driven by demand, one could say that there basically is a low degree of direct possibility for a national authority to steer volumes towards any preferred mode of transportation. Implementing taxes, incentives and legal restrictions might have a certain degree of impact, but in reality this possibility is fairly low and there are few signs that the authorities will use this tool to shift transport between road and rail.

Although, there have been examples on measures implemented by governing authorities such as the LKW-Maut (Lastkraftwagen Maut) in Germany. In Germany, as much as 35 %[53] of the truck miles are generated by foreign trucks resulting in an increased pressure on the motorways and hence need for maintenance and expansion. For this reason, the LKW-Maut was implemented in January 2005, and is a distance-based toll for all trucks over 12 gross tonnes that use the motorways (autobahn). The total toll for one truck depends on distance, pollution class of the vehicle, weight and number of axles. The LKW-Maut provides funding (partly) for transportation infrastructure improvements.

As a result of the implementation, freight companies now have an incentive to purchase vehicles with lower emission rates as this provides lower LKW-Maut. The UK Commission for Integrated Transport (2007) cites a 6% decrease in the number of empty runs and a 6% shift to rail from road freight mode as a result of the implementation. These two factors are likely to decrease the emissions of carbon dioxide and other pollutants on German roads. Although, one can also manoeuvre around such measure: some trucks turn off the motorways and onto other roads, resulting in additional noise and congestion on these routes.

Other examples can also be found: In Sweden the government has decided to increase the track access fee. Several parties have reacted on this measure, stating that such a measure will decrease the competitiveness of rail transports even further. The Swedish government argues that such taxes will help financing a needed upgrade of the infrastructure, which in turn will increase the reliability of the railway network. A newsletter from a Swedish freight operator in December 2011 states that this doubling of railway taxes is the main reason for Cargo Net ending their business in Sweden. As seen from these examples, new measures can lead to some changes in the transport industry. Although, policies and practises of the different governing authorities in the study area does not appear to have a big impact in the decision making process. High track access fees in Poland were also raised as a challenge by the Pomerian Province in the supplementary study to Task 5.5 as these decrease the competiveness of intermodal transports.

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[53] UK Commission for Integrated Transport, 2007

Another interesting aspect is the prioritisation made between passenger and freight trains. In the capacity allocation process in Norway, there is a greater demand for passenger trains than freight trains, and thus passenger trains are prioritised. In the interviews, freight operators stated that freight traffic has a much less public impact than passenger traffic and the parties in freight traffic have had little impact when lobbing for improved infrastructure. Consequently they have found such activities not to be profitable.

Controlling authorities

During the interviews, several of the parties had the perception that border crossings and customs by train is a time consuming challenge. In the opportunity study performed by Vectura in WP 3, the customs work was stated to be quite extensive and any cases of irregularities can in worst case scenario cause a whole train to be held for days waiting for the document of one wagon to be corrected. This scenario is specific for rail transports to Russia.

From the interviews and workshops it was clear that border crossings for rail are (viewed as) a significant barrier against rail freight. This barrier has two main groups of problems. One is different technical solutions and systems in different countries and the other is administrative routines and systems that is focused on national traffic in each country. Both of this groups hail from a history of national railways in each separate country.. In fact the only borders where train can pass without a change of some kind of technical system (power supply, signalling and/or gauge) is Norway – Sweden, Germany – Austria and the Czech Republic and Slovakia.

In the last 10 – 20 years, EU and other international organisations have begun a process to tear down the borders even for rail transportation and the Technical Specification for Interoperability for rail has been published. Both through the Intergovernmental Organisation for International Carriage by Rail (OTIF) and through EU the legislation have been made more compatible in the different countries. Even though the implemented changes are a step in the right direction, the practical results of the changes come slowly since the changes appear in the legislation and not in the operational practices and routines.

An example of such a situation is a train service, which ran from Oslo to the continent. This train service was withdrawn as the operator was not able to deliver the agreed service level: especially he was not able to deliver on time. The operator had sold their service to the customers with a promise of high punctuality and relatively short transport times, as a significant part of the cargo was fresh fish and other time sensitive products. The production of the train was complicated involving the passage of four national borders and similar number of borders between technical systems and procedures. It was not possible to achieve the punctuality that was promised and thus the customer with the most time critical goods had to find alternative modes of transportation.

This was also one of the main findings in Region Blekinge supplementary study to Task 5.5 (see chapter 6.1) where they conclude that fresh fish is not the cargo for commodity suitable for forming the base volume in an intermodal transport system. Reasons for this was among others: road is flexible for re-routing, low concentration in the industry, fresh fish is time sensitive, cargo owners are sceptical to rail and more.

Perceptional bottle necks

There was a general assumption among the respondents that they would, in theory, choose rail over road if rail solutions are faster and cheaper than road transportation.

Despite this, one of the major findings from the interviews was that there are several other issues that impact transport buyers, resulting in the fact that rail is not considered as an option. Therefore transport buyers do not examine whether there are faster and/or cheaper rail solutions. These issues can almost completely be explained by a lack of trust in the ability of the railway to deliver the necessary quality.

The causes of mistrust mentioned bellow are a summary based on the perceptions of those respondents interviewed. One cannot say that these factors are general worldwide, but it gives an indication of which factors that should have a certain focus in the work of increasing rail transport between countries in the study area. Some factors may already been solved, but many of these perceptions are often long lasting and difficult to counter even if the situation they stem from has been solved some time ago.

According to the respondents, some of the causes of their mistrust to the system were:

- Lack of reliability
- Lack of information about delays, damaged goods etc.
- Cultural differences
- Education of the logisticians buying transports/Lack of knowledge

In addition, Task 5.5 also decided to high-light the pricing mechanism for road versus rail freight, to highlight the impact authorities can have on the price for intermodal transports.

Lack of reliability

To know the reliability of a system, one needs to know the reliability of each element in the system. An intermodal supply chain from Norway to one of the other countries in the study areas of high complexity, if one considers the number of parties involved. But as previously stated: an increased number of parties in an intermodal supply chain should not necessary equal increased difficulty to deliver. Although, the likelihood of something to occur increases with several parties involved.

Volumes transported on a train are between 20 - 50 times larger than the volumes transported by one truck. As a consequence, a delayed freight train will have a greater impact as it affects a larger group of customers than a similar delay for one truck. Consequently one can say that the demand for reliability is higher for rail transports compared to road transports.

The reliability of intermodal transports in the Baltic Sea Region were viewed as challenging by the respondents, due to a complexity which is depending on each involved party having the ability to deliver in line with the agreement. The poorest performing element in the system influences the potential buyers and the railway in several of the countries in the study areahave had problems with lack of reliability in the latter years.

This perceived lack of reliability especially becomes apparent during periods of adverse weather. In the winter of 2009-2010 this culminated and rail traffic in large parts of Europe halted. The upside of the situation is that the problems now are obvious for all relevant parties and rectifying programs has been started on all levels. In Norway (in the Oslo area) and Denmark, where the problems became critical earlier than in other countries, we can see that the programmes are working and that the reliability has improved. But still, long lasting discussions in the media certainly affects the potential buyers, weakening the perception of rail transports.

Another concern regarding reliability discovered in the interviews were that there is also a great concern regarding flexibility: are there any backup plans for situations where a train operator is unable to deliver due to e.g. a closed line or a line burdened with heavy delays? In theory there are two (or more) ways to deal with this issue:

1. run the train on a different line if such line is existing (flexibility), or
2. get the goods off the train and use alternative modes of transportation

In case of an incident blocking the intended route, a road transport is also more flexible as it is able to go around the blocked area. As seen from the initial study of current infrastructure in the study area, there is a wider and denser road network for trucks and trailers in addition to coastal services. This is one area where rail transports are less competitive than road transports: when interruptions occur on a line, the train often has to wait for a line to re-open in lack of re-routing possibilities.

Even if there should be an opportunity to redirect a train by using another route to the destination, this will be challenging in terms of train schedules: In the study area there are different routines in how and when to order train schedules, and this is normally done once a year. The possibility might be to work with the infrastructure managers and planners in studying whether reliability and redundancy (alternative solution or back up plan) is sufficiently taken into account in the planning of infrastructure projects. This could also include working with the different models for socioeconomic evaluation of projects.

The possibility to get the goods off a train and use alternative modes of transportation in case of disruption is not a common practice today. On several of the relevant corridors there are trans loading facilities which could be used to transfer the goods units onto trucks. In this way, time sensitive goods can reach their destinations in time. There are several administrative and infrastructure related bottlenecks that need to be resolved before one can utilise any trans loading facility in the event of a delay.

Lack of information about delays, damaged goods etc.

If a delay occurs, all parties in the intermodal supply chain are dependent on information about the situation, to ensure that proper contingency plans can be activated. However, several of the respondents do not trust the systems' ability to convey the information properly.

The reason for this mistrust is mostly connected to a perceived difficulty as a result of the complexity in the intermodal supply chain. When a delay occurs the company with information on the delay only inform their direct customers, and sometimes only reluctantly. The routines and systems for relaying information further down the intermodal supply chain is often lacking, leading to the companies affected by the delay get the information late or not at all. One reason for this issue is that one company in the intermodal supply chain often have little or none information about the end user or other parties in the intermodal supply chain. Thus all the information has to go from the supplier to the customer through several parties, resulting in a time consuming information process.

All information needed to provide information about a delay is today available in at least one computer at one of the companies involved in the transport. Most of the parties are working on improving their system so not only themselves, but even their customers have access to that information. The use of automated information is increasing, and more and more customers have a demand for being able to follow their goods from the factory/storage facility until received.

When or if the computer systems of all involved parties are connected, information about any delay will flow freely relaying information to all parties in need of such information. RNE, Rail Net Europe, has developed The Train Information System (TIS, formerly EUROPTIRAILS) which is a web-based application that supports international train management by delivering real-time train data concerning international passenger and freight trains[54]. The relevant data is processed directly from the Infrastructure Managers' systems. With such tools at hand, there is clearly a need to educate and inform potential buyers and also other parties in the supply chain of these available systems.

Another interesting aspect in this issue is the information process in it selves. During one of the interviews, a freight forwarder made the following statement: If we were to use rail transport, we would demand one key account manager from the train operator that has direct contact with our company. As we (the freight forwarder) are responsible for the customer, we should be provided with information about delays, progress etc. In the end, the customer has made an agreement with us and we are responsible to inform him.

Clearly there is a need to gather all the parties in the intermodal supply chain to agree on common procedures for communication and information, both in normal operation mode and in case of disruption.

Cultural differences

The performance of an international alliance is determined by the performance of several factors; difference in the partner's national, organisational and professional culture and the partners related complementary resources. A

[54] More information available at http://www.rne.eu/index.php/tis.html and animation availble at http://www.rne.eu/index.php/tis-animation.html

study performed by Sirmon and Lane (2004) cites that organizational culture differences tends to be more disruptive than national differences, and differences in the professional culture most relevant to alliance value creation typically will be the most disruptive.

Even though the cultural differences in form of different perceptions, views and approaches over the Baltic Sea is getting smaller, they are still significant in certain areas. This may make it difficult for parties in a value chain that crosses borders to fully understand each other's expectations to the delivery. There may be different perceptions of agreements or different approaches to transport solutions. Other factors that can contribute to misunderstandings may be different views on the role of the freight railway in the society, and different expectations concerning long-term commitment and cooperation.

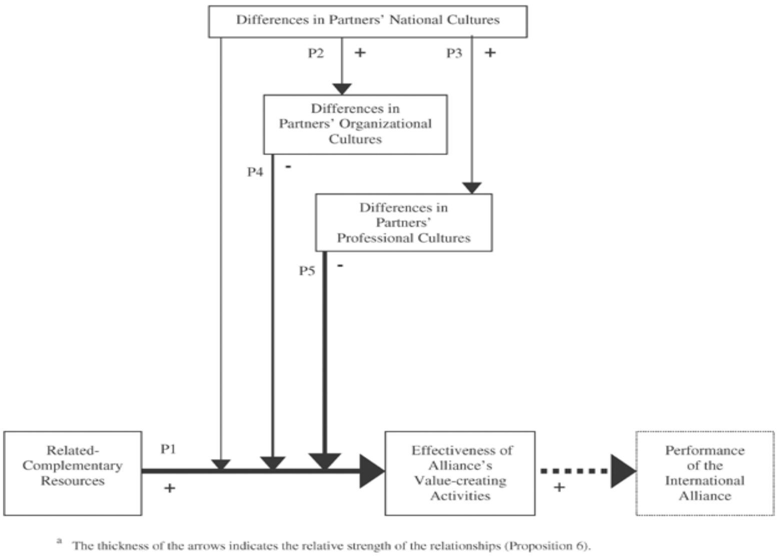


Figure 23 Factors influencing the overall performance of an international alliance (Source: Journal of International Business Studies 35, 306-319 (July 2004))

There have been examples in the transport industry in the Baltic Sea Region where cultural differences have lead to actions that, for one party seems natural and logical, by another party is viewed as unacceptable and bordering breach of contract.

It seems that these differences might amplify the mistrust that rail transport already is suffering from. Road transports on the other hand are viewed as less bureaucratic than rail transports, but even here there are some issues related to cultural differences. There is a major fear that these issues will be multiplied when dealing with large and (partly) state owned railway companies.

With more interaction between people and organisations in the Baltic Sea Region the understanding of the cultural differences will increase and thus the importance of them as a hinder against business will be reduced. These are however relatively slow processes and it will take several decenniums until cultural differences cease to be a factor. Furthermore, the effect of such misunderstandings often lingers long after the real problem is solved as for several of these bottlenecks and hindrances, infrastructure related as well as perceptional.

Education of the logistician buyers/Lack of knowledge

The logistical education in Norwegian universities tends to concentrate on road transport logistics with some attention also to sea transport and even less in domestic intermodal transport. Most administrative staff in logistics companies that have no or little academic background, have often started their career in the transport business as lorry drivers and from there built their competence within the transport companies.

Outside the railway companies there have been little or no educations in the organising of successful rail transport solutions. This may result in newly educated logistics managers not knowing the opportunities and challenges related to rail transport. Rail transport seem complicated and not as an option to road transports, as road transports might seem easier to administrate than rail transports.

There is a need for someone to take the responsibility for education about the entire transport chain in the study area, and maybe in general. The train operators and railway companies, that have the railway specific logistics competence, should be involved in this. In the literature study, Baltic Gateway also suggested the development and implementation of an educational program in transport and logistics.

Reliability depends on systematic routines

Mistrust is often viewed as a difficult problem to overcome. Once could say that “the quick fix” is to prove that the mistrust is the result of a misunderstanding (given that evidence exists to resolve the misunderstanding). If the mistrust is based on facts, or if it is difficult to find relevant examples, one will have to work with the problem areas that lead to the mistrust.

Usually when a system is prone to not achieve the desired quality, one put up a system of routines, tools and procedures that controls the performance of the system, including backup solutions. This has long traditions in the safety departments in both rail and air transport, and is the basis of the ISO 9000 standards.

To gain the desired trust, the parties in the supply chain need to provide evidence of their established systems. Such systems need to contain routines on:

- How to deliver the agreed quality
- How are potential issues discovered and handled in order to be pro-active

Due to the number of parties in the intermodal supply chain, the quality systems must not only cover each single company but also overlap onto the entire intermodal supply chain. Thus the quality systems of the parties in the intermodal supply chain should be connected.

This relates to the information process and the need to increase the common understanding of each element in the supply chain: One interviewed company stated that a potential train operator would have to provide evidence of their current performance before even considering switching to rail transports: what are the current routines if disruptions appear and how are deviations handled today? In other words, this potential buyer is not willing to choose rail transport if procedures and control systems aren’t implemented and handled at an acceptable level.

Competitive price

After the opening of the market in Norway and Sweden for cabotage of foreign trucks, the relative price level for road transport has fallen, due to the increased market share by the low cost east European trucking companies. This has lead to an extensive pressure on the transportation rates in the freight industry.

Price is one of the most important factors in the decision making process when choosing mode of transportation. Two studies performed by KTH[55] in respectively 1977 and 1999 both showed that price was the number one factor when choosing mode of transport, although these studies were conducted with 20-year intervals! Therefore, it was also quite interesting that some interviewed parties in the study performed by Vectura in WP 3 stated that *“the rail operators require large freight volumes to be interested at all and it takes months to get an offer or price indication”.*

There is little or no evidence for why such instances occur. One assumption is that the international intermodal freight market still is at a immature level. Since the opening of the markets in several countries, competition has

[55] TITRA-IP FR 00-81, Nelldal B.L et.al, page 54-56

Project part-financed by the European Union (European Regional Development Fund) Baltic Sea Region Programme 2007-2013 ØstlandsSamarbeidet Eastern Norway County Network Railconsult Skåne

increased with more freight operators and hence requirements from the stakeholders of beneficial and profitable business. As rail transport has a much higher fixed cost than road transport and a comparatively low increase in costs for additional volumes, rail transport needs a fairly high total volume to be profitable, or at least, make break even. In their contribution to Task 5.5, Region Blekinge defines a base volume as: *an inital volume guaranteeing the profitability of the transport service during the critical implementation phase. When a base volume is secured, the intermodal service provider can start to expand the service based on an implementation plan.* If a potential customer only generates e.g. 10 TEU, consequently the train operator has to find more goods to establish a profitable service. This might be one of the reasons for such a time consuming process of order.

The cost structure between road transports and intermodal transports mainly differs in additional costs for transportation to/from the terminals and terminal handling costs for rail. Figure 24 , illustrates the different cost structure for rail and road transports:

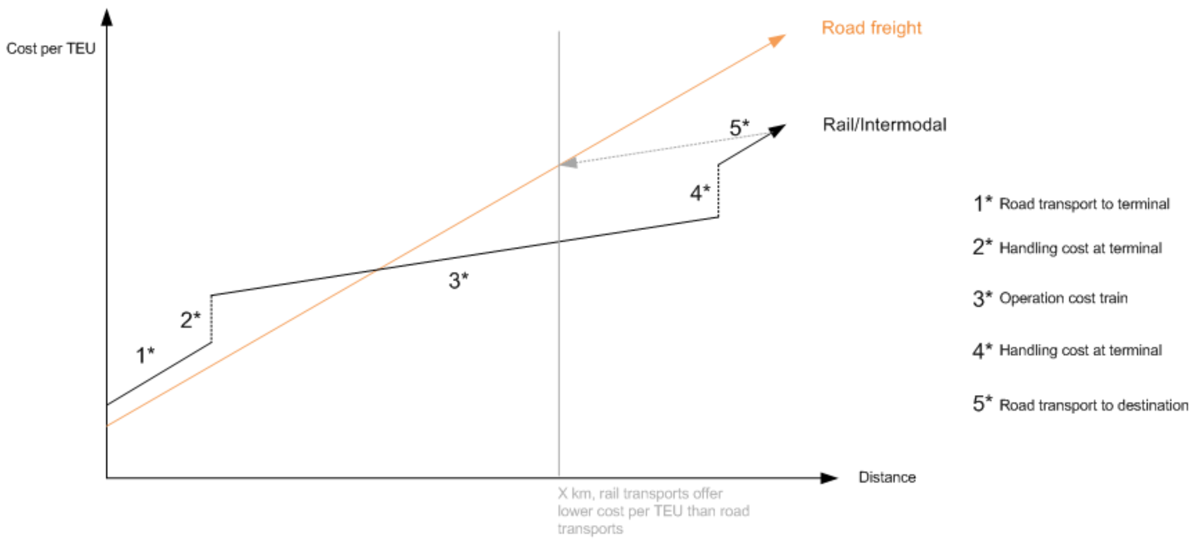


Figure 24 Differences in cost structure road versus rail transports

Figure 24 shows that the operation cost for rail transports are significantly lower than for road transports, and rail transports increases its competitiveness over longer distances. The figure indicates that rail is more competitive than road after a given distance (x km). As seen in chapter 3.1, one of the logistical trends in the Baltic Sea Region is increased transportation distances, which in theory should favour rail transports. An exercise of comparing total transport costs between two major cities in Norway (Oslo and Bergen), clarifies this picture even better: While the operation cost for road transport is approximately 91 % of the total price (per TEU), operation cost for rail transports are approximately 52 %, provided a loading degree (on the train)at minimum 90 %.

A conclusion one can draw from this is: by reducing handling costs in addition to facilitate logistic centres and hubs, rail transports will be able to increase its competitiveness when it comes to pricing. The given distance needed for rail transports to be profitable also decreases, making rail transports more competitive at even shorter distances (see Figure 25).

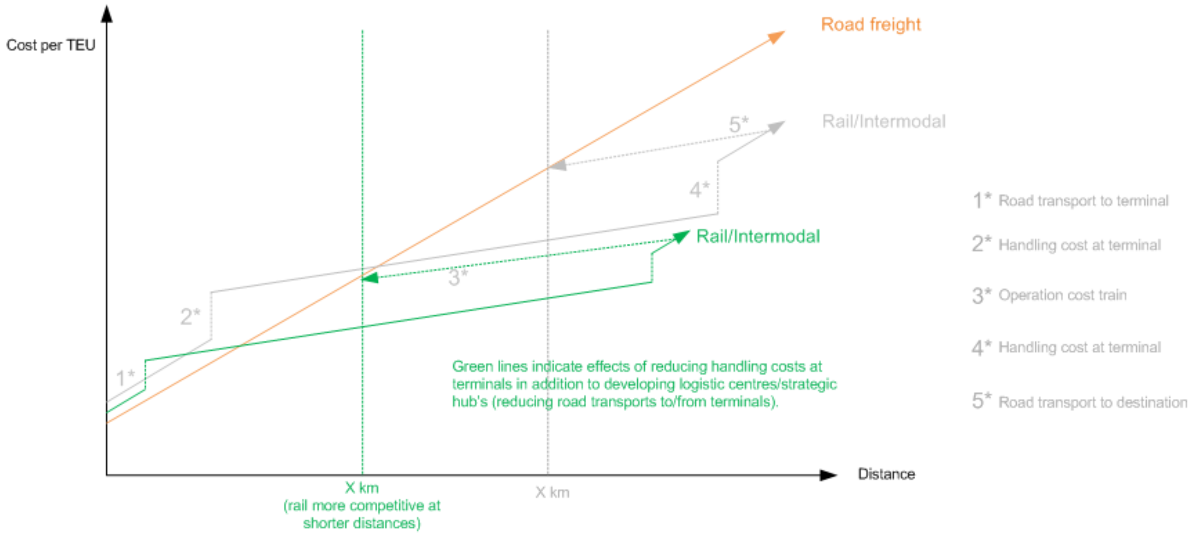


Figure 25 Effects of reduced handling costs in addition to developing logistic centres/ hubs

Localisation and logistics networks are previously discussed in chapter 3.3.3. This exercise highlights the importance of centralising the logistic operators, to be able to increase the efficiency in the intermodal supply chain and hence reduce costs.

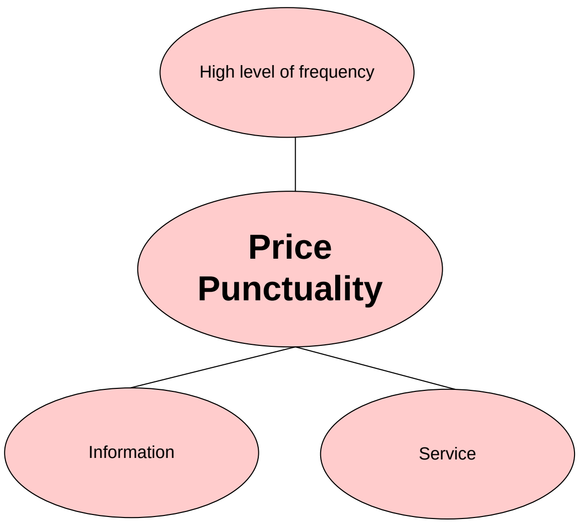
Preliminary conclusions administrative and perceptional bottle necks and hindrances reducing overall competiveness

From the interviews and workshops it became clear that the perceptional bottlenecks and hindrances have a greater impact than specific infrastructure related bottle necks. The main administrative and perceptional bottle necks identified can be summarised into:

- Lack of reliability
- Lack of information about delays
- Cultural differences
- Knowledge of the logistician buyers
- Few incentives from national authorities

Looking at the factors that influence transport buyers in their decision making process, the identified administrative and perceptional related bottle necks affect these by:

- The lack and presence (!) of regulations such as no road taxes and instead increasing rail taxes, reduce the ability to deliver a competitive **price**
- Reduced **information** with the absence of a common knowledge and interaction in the industry
- A perceived reduced overall **service** level, as there is a perception that border crossings are time consuming and challenging
- Reduced believe in rail freight ability to deliver on time (**punctuality**) as the mode is considered as less reliable



- Reduced **flexibility** and **frequency** due to the perception of low reliability
- Reducing **price** competitiveness by decentralizing intermodal terminals from the logistic operators, decreasing efficiency and increasing overall transport costs

4.3. Conclusions competitiveness

Without being able to overcome the mistrust from the goods owners and transport buyers towards international rail transport solutions, especially directed towards the relations relevant for the Baltic Sea Region, establishing new rail transports solutions will be challenging.

As seen from the previous chapters, there are several issues affecting the decision making process when choosing mode of transportation. These issues create a challenge for international intermodal transports, as intermodal transports are perceived as less competitive than road transports.

The mistrust and some of the other hindrances discovered could be eased if a train system could prove that it is not as complex as many believe. There are also several actions that can be made that do not have such a high threshold as starting a new train system. For Task 5.5 the following measures were identified as possible actions to relieve the observed hindrances and bottlenecks:

- Assess how terminals along the route can be utilised as backup terminals to increase flexibility in case of disruptions
- Assess how logistics knowledge for rail and intermodal transport can be improved
- Increase the markets understanding about the possibilities with intermodal international transports and defuse the technical problems with interoperability that faces international rail freight traffic
- Assess how integration between facilities for logistics operators and intermodal terminals can improve rail freight efficiency

5. Establishment of private-public partnerships to improve rail transport

5.1. Introduction

During the project period, Task 5.5 discussed if one should aim for creating a new train system and concept in the study area. Although the transported volumes between these countries should make it possible to fund rail solutions without unrealistic market shares, it proved difficult to identify the exact origins and destinations, and thus identify possible partners.

Based on the findings in chapter 4, the transnational working group decided to focus on resolving and implement actions for two of the main challenges:

- Backup terminals along the route, and
- More attractive intermodal transport (a combination of bullet point 2 and 3 in the previous chapter: Knowledge of logistics buyers and Increase the markets understanding about the possibilities)

The suggested solutions and actions are not corridor specific, but can be applied on an international level.

5.2. Freight terminals as backup in case of severe traffic disruption

As previously stated, lack of flexibility is one of the disadvantages for rail transport compared to road transport. This disadvantage increases in case of disruptions on the rail infrastructure, such as e.g. technical issues on the signalling system that forces a section of the line to be temporary closed. This was also one of the major concerns according to the interviewed parties: what happens if a disruption occurs and the line is temporary closed for traffic?

The EU White Paper (2011) highlights the evident that Mobility Continuity Plans is required to preserve the mobility of passenger and goods in a crisis situation. The transport system needs an increased robustness through scenario development and disaster planning.

A delayed freight train might not be defined as a disaster, but a delay can cause ripple effects for the receiver in addition to being expensive.

On several routes to and from Norway, a freight train passes intermodal terminals. These are intermediate terminals that could be utilised during a disruption. However, due to different terminal operators and regimes, this cannot be applied in today's situation without settling formal agreements between the train operator, infrastructure manager and the terminal operator.

The concept backup terminal can therefore be described as a series of settled agreements between the involved parties to enable the use of a given freight terminal in case of disruption. This to increase the flexibility in the supply chain. It might not be the situation that all of the units on a train have to be unloaded from the wagons onto lorries, but only the units that are time critical. This is also in line with the EU White Paper (2011, page 24) where: *Mobility Continuity Plans should ensure the service continuity in case of disruptive events. The plans should address the issue of prioritisation in the use of working facilities, the cooperation of infrastructure managers, operators, national authorities and neighbouring countries, and the temporary adoption or relaxation of specific rules.*

As this concept can apply to any intermodal terminal, the project decided to make a pilot on a terminal in Sweden. Originally, the pilot was intended for the intermodal terminal in Göteborg as most of the rail transports to the Baltic Sea Region will pass this terminal. Two relevant train operators were contacted, one of which showed interest in the concept. However, during the process the train operator decided to withdraw his service passing Göteborg. The pilot was therefore not completed for this terminal.

Due to this unexpected closure, Task 5.5 needed to find a new pilot terminal and train service, and the relatively new intermodal terminal in Umeå (Nordic Logistic Centre) where ISS TraffiCare AB is the current terminal operator (the train operator involved is Green Cargo AB) was chosen. Although Umeå is considered outside the study area, the backup concept can be adopted on an international level and the geographical location of the pilot was considered as irrelevant.

The concept

In normal operational mode, the railway line (Stambanan) passes the junction to Nordic Logistic Center (intermodal terminal in Umeå in the North of Sweden, NLC) at Vännäs. The train (Train # A in Figure 26) is on time, following the normal schedule. This schedule is booked by the train operator every year by a process of requesting this slot from the national infrastructure manager, who then coordinates and decides the national train schedules. In addition, the train operator can also book a special train schedule as backup and extra flexibility (Special Train #XA in Figure 26 Figure 5). The special train schedule will in this case only be booked from the junction towards NLC and to the terminal, and from NLC to the main line – Stambanan. The geographical scope of the special train schedule is illustrated in orange in Figure 26 .

If, or when, a disruption appears on the line, Train #A (with the necessary agreements in hand) initiates the procedures to enter Nordic Logistic Center to unload time critical units. By doing so, the train operator has to switch to the Special Train Schedule # XA which is reserved for Train # A only.

After unloaded the critical units, Train # XA continues from the terminal to a holding track of the dispatcher's choice to wait for the line to re-open.

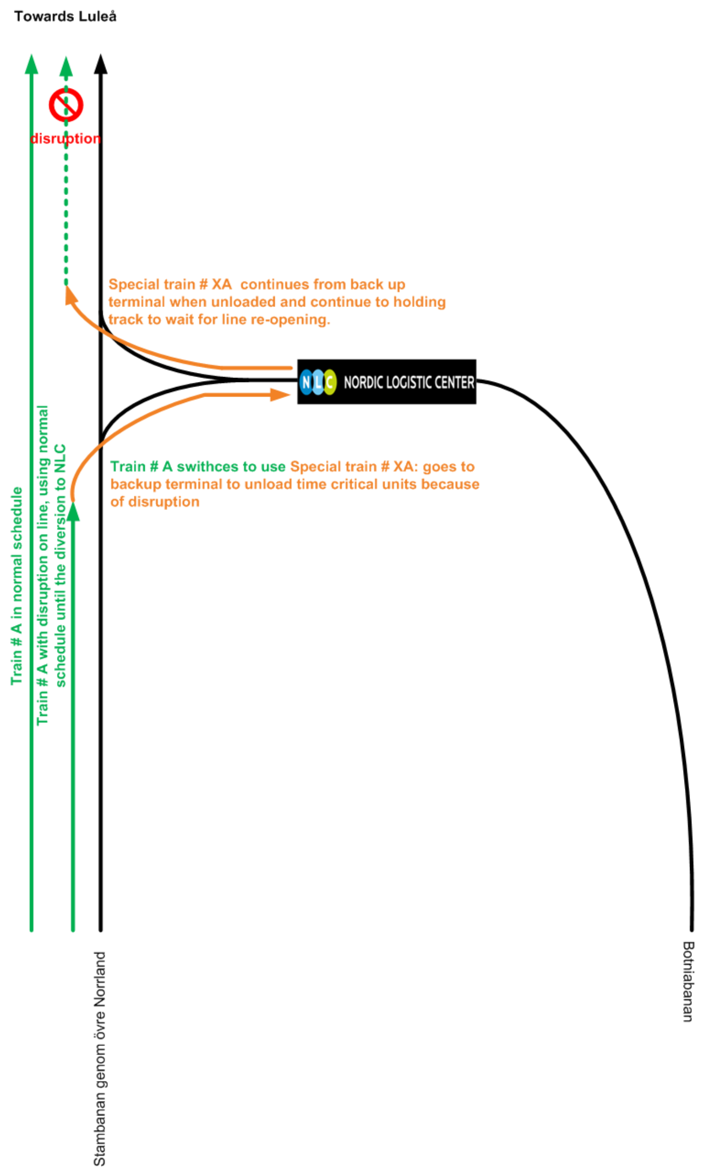


Figure 26 An illustration of a pilot with NLC as backup terminal

5.2.1. Interface, responsibilities and commercial aspects

There must be an agreed contract to be able to activate the backup plan. In most aspects, this plan is similar to the existing terminal contracts between the terminal operator on the backup terminal and its customers. The main differences are in the responsibilities of the terminal operator regarding the recourses he shall activate , the pricing of this service and communication procedures.

An agreement between parties to utilise a terminal as a backup solution needs to consist of the following aspects:

- Criteria for implementing the backup plan (what are the circumstances required for the plan to be implemented?)
- Commercial aspects such as handling and access price in addition to regulation of dwell time for load units and wagons
- Operational responsibilities
- Routines on:
    - Implementation of disruption routine (how to order the actions needed to use the terminal)
    - Rerouting of the train from the scheduled route to the terminal
    - Reporting between terminal and train operator
    - Order alternative transport from the terminal to the destination

The agreements are only for use on an intermediate terminal during special circumstances and should be offered to all train operators on equal terms as a standard procedure. The procedures must be efficient and easy to apply. Even more important: the use of a terminal as backup must not interrupt normal operation on the terminal.

For the terminal operator it is important that this is as predictable as possible, meaning that an agreement only covers one specific train schedule.

The agreement between the train operator (the company that is sitting on the agreements with the company that is shipping the trailers and containers with the train) and the terminal operator defines a minimum level of service . An example on minimum resources can be:

- One crane/reach stacker including operator for three hours[56]
- One person manning the gate that administers arrival/departure of lorries, documents and electronic registrations (minimum three hours).
- One yard worker to assist in the shunting of the train to the load area
- Five lorries, including drivers, (e.g. three that pulls semitrailer and two that carries containers) from the back-up terminal to the original destination (including empty run back).
- Power for 10 temperature controlled load units

Normally it will be the terminal operator that is responsible for finding the resources, but if the train operator is involved in lorry transport in the vicinity of the terminal, he might want to organise the road transport himself.

[56] I.e. the minimum hours a worker get paid when called in to do a job

5.2.2. Work flow

Figure 27 illustrates the activities connected to the backup plan. The flow chart was developed (and agreed) in cooperation with ISS TraffiCare AB and GreenCargo AB.

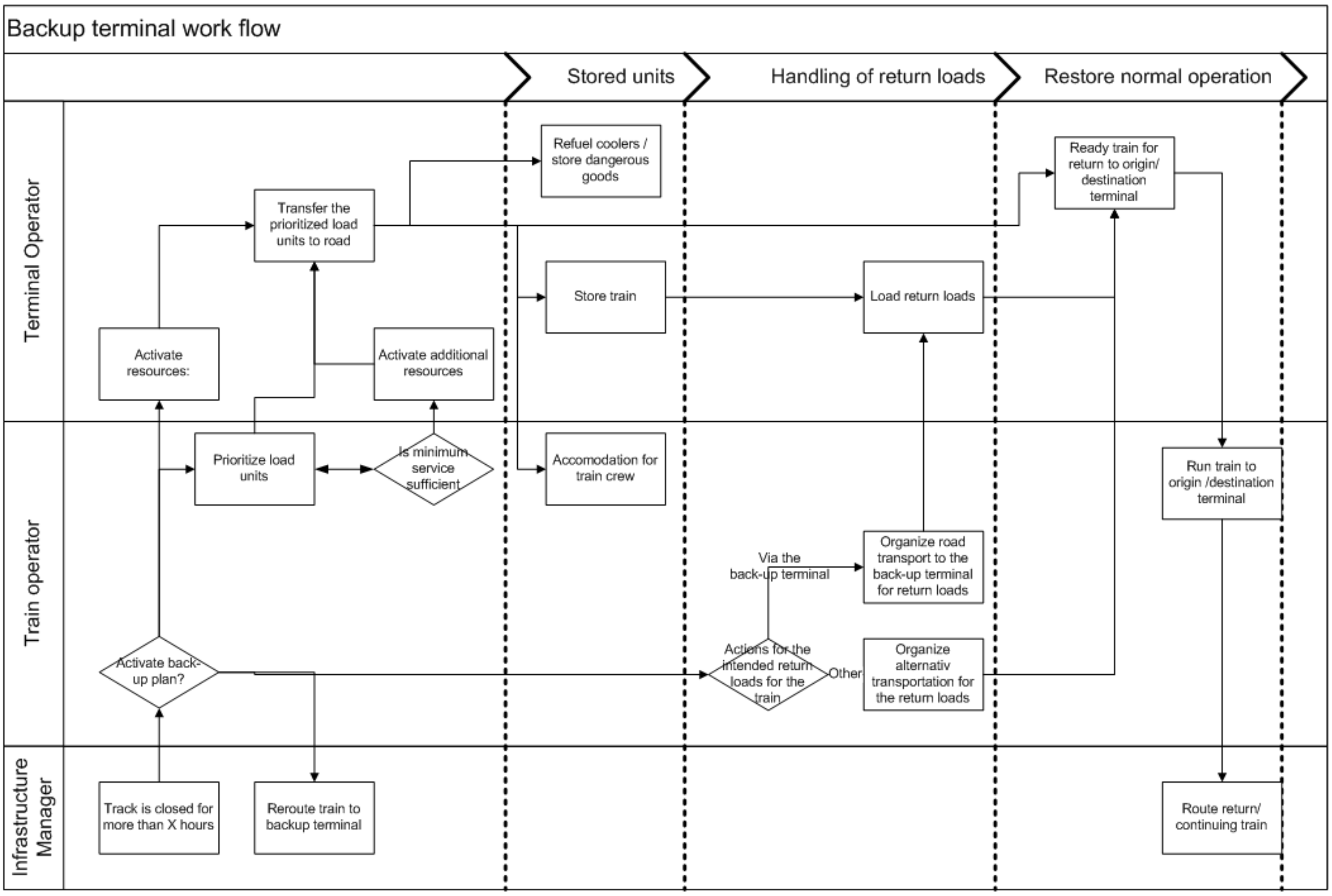


Figure 27 Flow chart backup terminal[57]

5.2.2.1. Explanation to the details in the flow chart (Starting in lower left corner)

Activity: Track is closed for more than X hours

When an incident occurs that have the potential to lead to delays, the infrastructure manager informs its customers.

Decision point: "Activate back-up plan"

The following questions must be answered with a "yes":

- Is the prediction from the infrastructure manager probable or will the closure be shorter than announced?
- Is the minimum cost in the agreement with the terminal operator and infrastructure manager smaller than the probable gain from alternative plan?
  - What is the minimum cost of the alternative plan? I.e. which resources will the terminal operator immediately activate as a result of
  - Is the cargo time sensitive enough?
  - Is the closure long enough so that the back-up plan actually saves time?

[57] The normal use of the decision rhomb is not followed so that several lines from the rhomb can follow the same decision

- Is the loading gauge on the line to the terminal large enough for the load on the train?

If the decision to activate the backup plan is taken the train operator must order the infrastructure manager to reroute the train to the backup terminal and order the activation of the backup plan according to routines in the agreement with the terminal operator.

Activity: "Activate resources"

Since the backup un-loading should avoid affecting ordinary traffic to the terminal extraordinary resources must be mustered. Since it normally is not possible to find additional cranes or container lifts/reach stackers the unloading must be done during slow hours at the terminal, normally this means that terminal and yard workers must do this on overtime.

To transport the un-loaded units from the backup terminal to the intended destination terminal lorries and drivers must also be activated. The drivers of these lorries must have enough time left on their allowed driving time to reach the destination terminal. Since this use of back-up terminal is a very seldom occurring incident there would not be pre-planned or pre-booked lorries so the activation of these lorries will have to rely on the contact network of the terminal operator.

Activity: "Prioritise load units"

In cooperation with the customers decide which loading units are going to be transferred to lorries for road transport to the destination. If any load units shall be stored at the back-up terminal until the line is reopened or if any load units shall be shipped back to the origin terminal.

Decision point: "Is minimum service sufficient"

In cooperation with the customers and the terminal operator decide if capacity for un-loading and road transport to the destination terminal of more load units than the pre-agreed minimum level of service is necessary and possible.

Activity: "Transfer the prioritised load units to road

This is a collection of the practical work (shunting, controls, un-loading and lorry driving) and administrative work (issuing of new consignment note, registering in IT-systems etc.) that is needed to get the prioritized load units from the backup terminal to the destination terminal.

Activity: "Accommodation for train crew"

When the backup plan was activated the train crew ended up at an unplanned location. Thus a backup solution has to be found for them too.

Activity: "Store train"

Depending on what is decided to the un-loaded train and the capacity for storing the train set might have to be stored at the terminal for a significant time. Especially if it is decided that the train shall await lorries ferrying the load units intended for the planned return run of the train. It might not be possible to do this at the terminal track and thus the train must be shunted do a dedicated parking yard.

Activity: "Refuel coolers/store dangerous goods"

The train might carry perishable goods that are not enough time sensitive to defend the significant additional cost for the back-up road transport. The coolers/heaters for these units must either be connected to electrical power to keep the correct temperature or their coolers/heaters must be refuelled.

It might be necessary to store load units containing dangerous goods and that is not prioritized for road transport in dedicated areas at the terminal.

Decision point: "Actions for the intended return loads for the train"

The train operator normally has booked loads for the return run of the train. Due to the disruption and the activation of the back-up plan there will not be a train set available for this return train.

Thus the train operator must decide how he is going to handle these load units. There are several possibilities, he can:

- Ship the load units to the origin terminal (their destination) via an alternative solution e.g. road transport the entire way
- Ship the load units to the backup terminal per road, either with lorries activated at the destination terminal (their origin) or vie the returning lorries that has shipped units from the backup terminal (the latter will normally be cheaper and much more time consuming in addition to the time it takes to drive form the backup terminal there might be obligatory rest time for the driver to take into account)
- Wait until the line is reopened and the delayed train arrives from the backup terminal.

Which alternative he choose might vary with the situation (time of the closing of the line, distance between backup terminal and destination, time sensitivity of the load, distance between origin and destination terminal).

Activity: "Load return loads"

When the lorries carrying load units that was intended for the return run of the original train arrives at the terminal these must be loaded onto the train and documents and IT-systems must be updated.

Activity: "Ready train for return to origin / destination terminal

This is all the normal activities for a train leaving the terminal. I.e.

- Coupling of train
- Pre run checks of train, loads and locomotives
- Shunting to departure tracks

5.2.3. Continued work to conclude an agreement

Railconsult will continue to follow up GreenCargo and ISS TraffiCare to conclude the agreement. As soon as the agreement is concluded, a neutralized example for the use Nordic Logistic Center as a backup terminal will be published on www.transbaltic.eu.

5.3. Intermodal transport user workshops

Can one develop a system for intermodal freight transports on rail with the same quality as road transports in the Baltic Sea Region?

As seen in previous chapters, significant volumes are shipped by road transport between Norway and the Continent today. These volumes are of such a number that they in some relations probably are adequate volumes for a freight train without requiring unrealistic market shares.

The respondents reported a mistrust to intermodal freight transports as it was stated that rail is not able to deliver the agreed level of service and quality (based on comparing an intermodal system and a more simplistic system with one truck and its driver). Another finding in the interviews was that international rail transports are considered more complex with a higher risk than national intermodal rail transports.

This should be viewed in the context of the theory in chapter 4.2: the economic benefits for the users by choosing intermodal transports generally increases with increasing distance. Thus international transports should be able to have larger market shares of intermodal transports on rail than nationally.

To deal with these findings, the second action was to initiate and invite selected users for a separate "Intermodal transport user workshop". The workshop was held in cooperation with Jernbaneverket (the Norwegian National Rail Administration) and NHO Logistikk og Transport (the Norwegian Logistics and Freight Association).

A group of parties were identified as relevant for the workshop: It was not considered likely that the solution lies within only one of the parties in the intermodal supply chain – it was therefore important to gather a representative group to be able to identify solutions that were acceptable and feasible for all the parties involved in the intermodal supply chain. Also, by gathering several parties in the intermodal supply chain, this was an opportunity for the parties to learn from each other's experiences, demands and needs.

The aim of this workshop was to identify necessary actions for international intermodal transports to be competitive compared to road transports. The potential issues and solutions relevant for this workshop were assumed as common for all international relations to and from Norway, even though the extent and complexity increases with cultural differences and others when dealing with parties from more than one country.

As a follow up of the first workshop, a second workshop was held to prioritise actions and find out who would be in best position to initiate these actions. Most of the proposed actions were viewed as possible responsibilities of Jernbaneverket (the Norwegian National Rail Administration) and NHO Logistikk og Transport (the Norwegian Logistics and Freight Association), or in some instances an individual responsibility to all or many of the members of NHO Logistikk og Transport. After the second workshop, two final follow-up meetings were held with Jernbaneverket and NHO Logistikk og Transport to present the result of the workshops and discuss the proposed actions.

The actions are related to national authorities and parties in Norway, but can be used as an inspiration for the relevant parties in the Baltic Sea Region and world wide:

Actions proposed for Jernbaneverket (the Norwegian National Rail Administration)

- Formalise and extend the "International intermodal user workshop" to improve coordination in the intermodal supply chain and overall competitiveness
- Increase the knowledge of the intermodal supply chain
  - Describe the intermodal supply chain and critical success factors in cooperation with the involved parties
  - Prepare information leaflet regarding a supply chain for international intermodal transport. This should be available for all to use, describing the critical success factors in relation to PIMS[58] and in cooperation with NHO Logistikk og Transport (the Norwegian Logistics and Freight Association)
  - Include this as a part in the training of train/truck drivers, dispatchers, transport managers etc.
- The parties in the intermodal supply chain need to (individually and in cooperation) create robust transport schemes that tolerate a certain degree of interference without affecting the quality of the service. To achieve this, the formal process regarding timetabling may need to be improved, giving terminal operators and other parties in the intermodal supply chain the opportunity to be a part of this process.
- A review of the prioritisation practice needs to be conducted, to ensure an optimal solution for both passenger and freight trains. This to ensure less impact of external conditions for the freight operators.

[58] PIMS: Punctuality Improvement Method System

Actions proposed for NHO Logistikk og Transport (the Norwegian Logistics and Freight Association)

- Coordinate a common message from all the parties in the intermodal supply chain: A common information strategy that highlights the following “brilliancies” of rail freight transport:
    - Socio economic benefits as a result of rail freight transport
    - A strong growth in freight traffic is forecasted for the future; information should describe the consequences of this growth (capacity, environment, pollution, noise and the need for development of infrastructure)
    - Intermodal terminals and their significant part of the whole
- Arrange a seminar regarding intermodal rail transport for Jernbaneverket (the Norwegian National Rail Administration), Trafikverket (the Swedish Transport Administration), politicians, Samferdselsdepartementet (the Norwegian Ministry of Transport and Communication), Näringsdepartementet (the Swedish Ministry of Enterprise, Energy and Communications), Vegdirektoratet (the Norwegian Public Roads Administration Head’s Office) and more.
- NHO Logistikk og Transport is in the position to contribute to each member improving their performance in the intermodal supply chain, by:
    - Systematic work to establish a culture where parties learns from and improves each other
    - Encourage the use of Service Level Agreements (SLA)
    - Support in nonconformity situations
    - Systematic spread information on best practises (e.g. SLA in reality)
    - Establish a forum for the parties in the intermodal supply chain
- NHO Logistikk og Transport is also in the position to encourage other parties in the intermodal supply chain to (individually and in common) make robust transport schemes that can handle minor disruptions without affecting the quality of the service. Factors to consider are among others:
    - Agreed delivery times need to be kept and the contracts should be created thereafter
    - Capacity utilisation on the line and freight terminals needs to be adjusted to a level where the system gets a sufficient ability to catch up with delays
    - Coordinated action plans to handle disruptions between the parties in the intermodal supply chain (Emergency communication plan)

5.3.1. Meeting with Vegdirektoratet (The Norwegian Public Roads Administration's Head Office)

After the meetings with Jernbaneverket (the Norwegian National Rail Administration) and NHO Logistikk og Transport (the Norwegian Logistics and Freight Association), a meeting with Vegdirektoratet was held to discuss its interest in transferring freight transport from road to rail, and how they could participate in the actions proposed in the workshops.

The main result of this discussion was that Vegdirektoratet has an interest in participating in actions leading to a transfer of transport from road to rail (and sea).

The representative from with Vegdirektoratet mentioned that they and other public offices has Research and Development (R&D) funds that could be used for national and international R&D to increase rail competitiveness. He also referred to the proposal for a new national transport plan from the transport agencies[59] where a Norwegian “Marco Polo” program is a part. This program could be used to supplement a Marco Polo project for Norwegian costs that is not covered by EU or alternatively used on domestic projects.

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[59] (Jernbaneverket (the Norwegian National Rail Administration), Vegvesenet (the Norwegian Public Roads Administration), Kystverket (the Norwegian Coastal Administration) and Avinor (the Norwegian Civil Aviation Administration)

5.3.2. Further cooperation with Jernbaneverket (the Norwegian National Rail Administration), NHO Logistikk og Transport (the Norwegian Logistics and Freight Association) and Vegdirektoratet (The Norwegian Public Roads Administration's Head Office)

The three organisations have stated that they have a common interest to transfer goods from road to rail (and sea). In the continued work to achieve this, these organisations must take a leading role in their separate fields of responsibility.

NHO Logistikk og Transport has already started to handle some of the actions identified above: In September 2012 they will arrange a seminar called "How can we make each other even better?" This seminar is intended for all the parties in an intermodal supply chain.

Østlandssamarbeidet (Eastern Norway County Network) will continue the dialogue with Jernbaneverket, NHO Logistikk og Transport and Vegdirektoratet to follow up the identified actions.

6. Summaries of supplementary studies to Task 5.5

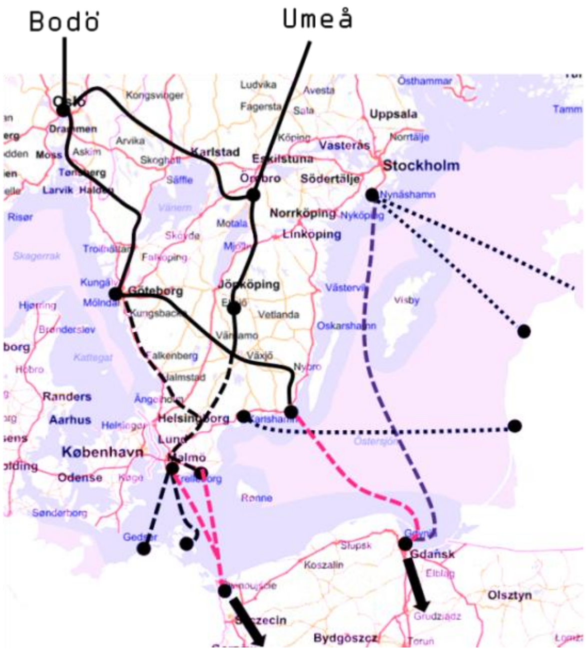
Following is a summary form the three supplementary studies and their contributions to Task 5.5.

6.1. Region Blekinge delivery

Reported by: Mr Leif Petersson, June 15th 2012
Region Blekinge
Title: *The market for intermodal transport in the Trans Baltic Port-Hinterland Corridor to the ferry link Gdynia – Karlskrona*

Freight transport between the Nordic Countries (Sweden and Norway) and Eastern Europe as well as the Baltic States, though originating from an invisible level, have erupted since the fall of the Iron Curtain in 1989. Despite the tremendous and continuous growth, the freight flows are not visible in the National statistics used when prioritizing infrastructure investments or as argued by Bengt Birgersson in the Port Strategy Investigation in 2008: “The structure of the Swedish transport flows has been stable for the last 20 years and hence will be for the next 20 years”.

The frequent ferry connection service between the Scandinavia Peninsula and Eastern Europe is a natural consequence of the lack of land bridges between the peninsula and the continent. To conclude, the ferry is part of the Trans-European infrastructure and is a prerequisite for the trade between Eastern Europe and Scandinavia. For the focal port, Port of Karlskrona, the transport volume has seen a 19 % annual increase since 1999, and the market share has increased to 22 %. Currently, the upgrading of the Coast to Coast Line, Emmaboda - Karlskrona, and the upgrading and electrification of the railway to the Port of Karlskrona. In the Port an intermodal terminal, able to handle 600 m long trains, are being built. All these investments are made in the context of MoS project "Baltic-Link Motorways of the Sea, Gdynia - Karlskrona", funded by the EU, the Swedish Transport Administration and the Municipality of Karlskrona.

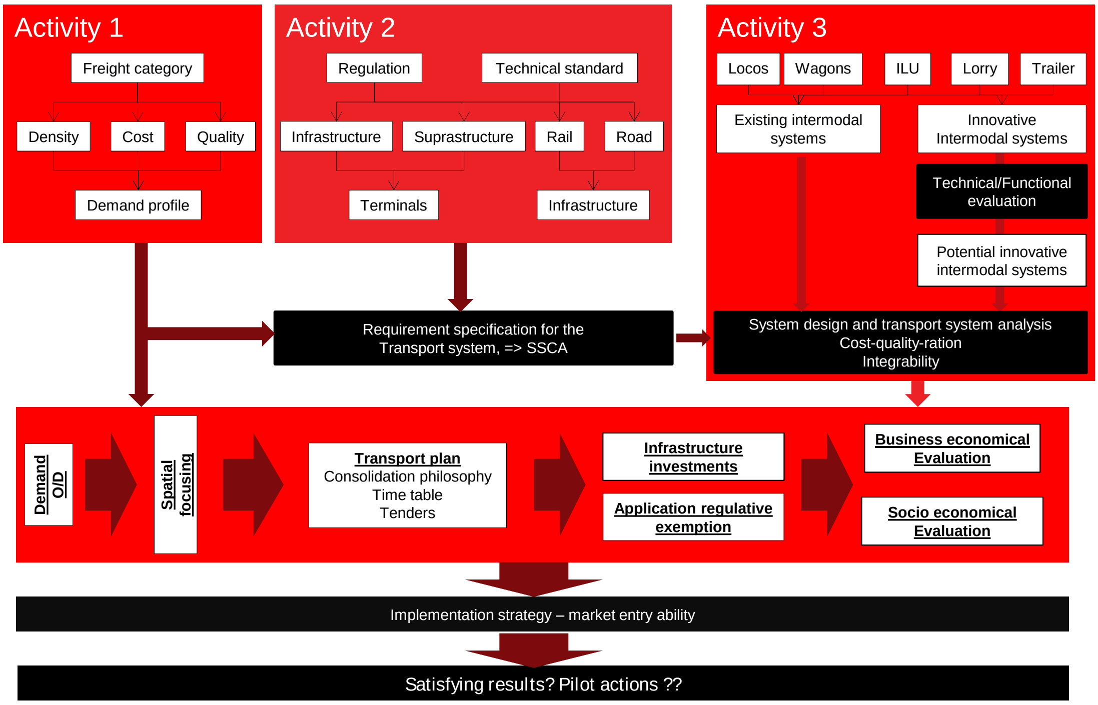


The aim of this study as a part of Task 5.5 is to discuss and analyze if an intermodal hinterland transport service connected to the ferry link Gdynia – Karlskrona could increase the attractiveness and competitiveness of the ferry link. In accordance with Van Klink and van den Berg (1998), we argue that the port authorities or shipping lines should change attention from the organization of the seaside to the land side. The new role would be to support and coordinate initiatives for development and implementation of intermodal hinterland corridors and in co-operation identify markets and customer segments that could be reached and/or attracted by intermodal transport systems. Subsequently, in the second step, organize sufficient capacity. However, if such a service should be able to enter the highly competitive and fragmented transport market, the intermodal transport solution should be designed based on following principles:

- Offer a significant, sustainable competitive advantage (SSCA)
- To be integrable with the dominating transport systems
- Be implemented based on a well-developed marketing orientation (spatial and commodity) in order to secure a base volume.

The competitiveness of intermodal systems reaches its optimum when large frequent transport volumes are transported over medium or long distances, i.e. where an intermodal service provider (ISP) can benefit from system's inherent economies of scale while maintaining sufficient frequency. At the port and hinterland terminal nodes the diverging characteristics of the transport modes are bridged to allow time and spatial consolidation of shipments. Between the nodes high capacity links are needed to supply the producing industry with cost and time efficient transport systems. The identification and evaluation of these links and nodes is vital for the ISP to be able to offer a more cost efficient transport service than the present and a service it is able to market towards its potential users in one or several potential spatial markets. Hence, the aim of the study is to analyze the opportunities to design and implement a competitive hinterland service adapted to the needs and requirement of the corridor via Karlskrona – Gdynia.

The project has been based on a structured analytical approach, shown below, starting with activity 1 (Market), and followed by activity 2 (Standards and regulations) and activity 3 (Transport resources). Based on activity 1-3 a transport system analysis was made in activity 4, including the sub processes: spatial focusing, transport plan, need for infrastructure investments or regulatory exemptions and finally business economical/socio-economical evaluation of the proposed transport services. Activity 4 would in the subsequent steps lead to proposal for implementation and/or pilot actions.



Schematic sketch of the structured analytical approach used in the project.

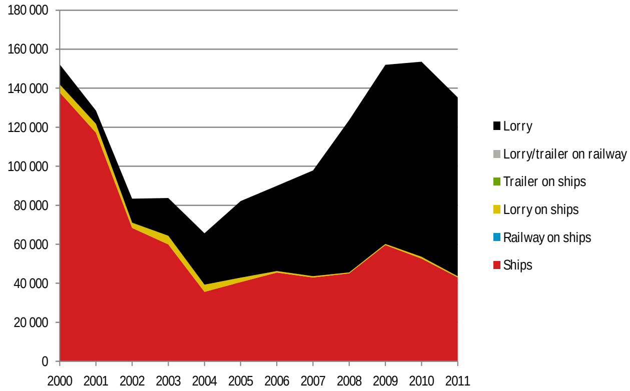
Activity 1: in accordance with the project steering group we decided to initially focus solely on fresh fish (including back haul) as base volume for the transport service. A base volume is defined as the initial volume guaranteeing the profitability of the transport service during the critical implementation phase. When the base volume is secured and the quality is stable, the ISP could start to stepwise expand the service based on the well-developed implementation plan.

Fish accounts for 6.6 % of the Norwegian export (2010) and is one of the major export articles to Poland. Today a clear majority of the Norwegian fresh fish export, except for volumes to e.g. France, is transported by truck, however there are several business trends indicating an increased potential for the intermodal transport:

- Future growth of export will primarily come from fresh fish segment. Salmon represented 61% of exports in 2010 and out of this 74% was exported fresh. Nearly half of the total volume of salmon and trout is produced in the four northern most counties: Nordland, Nord-Trondelag, Troms, Finnmark.
- There is a shift in trade relations from Western towards Eastern Europe.
- Strong international competition will force the aquaculture industry towards continued restructuring, streamlining, leading towards growing cooperation in the industry. Already today we can see emerging joint sales organizations, cooperation in harvesting and packaging. Moreover, number of factories, exporters, licensed farmers has been reduced, while volumes have grown. Today, 25% of companies having salmon export licenses control 90 % of the exports.
- Location of the industry creates favorable conditions for intermodal rail in terms of long distances to the consumer market, combined with long distance repositioning of road vehicles (only 1 out of 4 road vehicles is unloaded in the fishing regions);
- Signs of new technology that would increase the shelf life of the products, which indicates opportunities for increased lead time, as receivers of cargo are not interested in increased inventories.

Strong interest from the local communities and severe problems with foreign road hauliers, particularly during winter conditions.

Poland is the third largest market for Norwegian fish after France and Russia. It is a large processing country and 60% of volumes are re-exported (mostly to Germany). These processing industries are located on the Baltic coast line and buy the fresh fish largely on ex-works terms. Hence the decision whether to use intermodal transport or pure road transport lies at the Polish Processing Industry side. The lead time requirement is 48-72 hours from Norway and requires dedicated temperature regulated trailers.

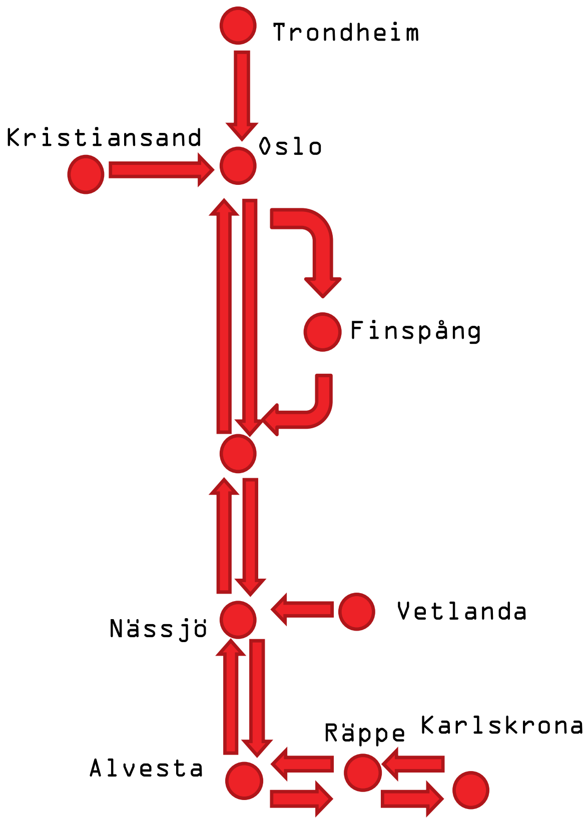


The Norwegian fish industry and its agents are according to the study satisfied with the present service and do not expect any large changes in cost/quality ratio of this service and hence the incentives to change both marketing and logistics channels is small or nonexistent. Costs only represent 6-8 % of the product price and hence there is mainly a strong focus on the quality. However, there are quality problems due to seasonal variations and winter conditions. During high season there is lack of truck capacity and during winter time accidents and delays on the snowy/icy road are highly common (only in February-March 2012 200 foreign trucks were off the road in Nordland County).

Existing set-ups	road – cheap despite problems with road transport, cargo owners too large extent satisfied road - flexible for re-routing (fewer long term contracts) partly triangular traffic possible adjustments in internal processes to synchronize with rail transport low concentration in the industry food imports (potential return cargo) in Sweden concentrated in Malmö/Helsinborg region Transport buying too large extent ad hoc vs. 2-3 year contracts with Norwegian operators
Organizational	many actors transport buyers - too large extent not the senders who should the leading role? (channel manager/leader)
Infrastructural	industry located far from rail terminals increased rail track charges in Sweden lack of road tolls
Operational, logistical and service related	need for door-to-door services- who should take the responsibility fresh fish time sensitive delays affect stronger consolidated shipments
Regulative	lack of regulations on winter tires
Technical	2-10% of trailers equipped for intermodal handling
Attitude	cargo owners skeptical to rail haulers not interested

Barriers towards intermodal transport

To conclude, fresh fish is not the cargo commodity suitable for forming the base volume in an intermodal transport system. As pointed out there are several reasons for this, however there are complementing cargo commodities that might serve as base volume. For instance, in the southbound direction - paper and pulp, aluminium, while northbound - colonial foods, perishables and recycled paper. In the report these flows are presented and discussed extensively based on the knowledge gathered about flows of aluminium bars to sub-suppliers for the automotive and furniture manufacturers from Mo i Rana, Farsand (South coast) and Sundalsöyra (West coast), based on recycled paper (northbound), tissues (Northbound) and paper products (south bound). Together these commodities form a base flow with a hub in Vetlanda and Alvesta/Räppe as shown in the schematic figure.



In the report two different set ups are presented and discussed. The first is based on the national intermodal operator Cargo Net and the second on a present set up operated by the Swedish Rail operator TÅGAB. Due to the complex structure and the service supply Vectura has favored the latter solutions for a potential pilot between the countries.

6.2. The Pomerian Province delivery

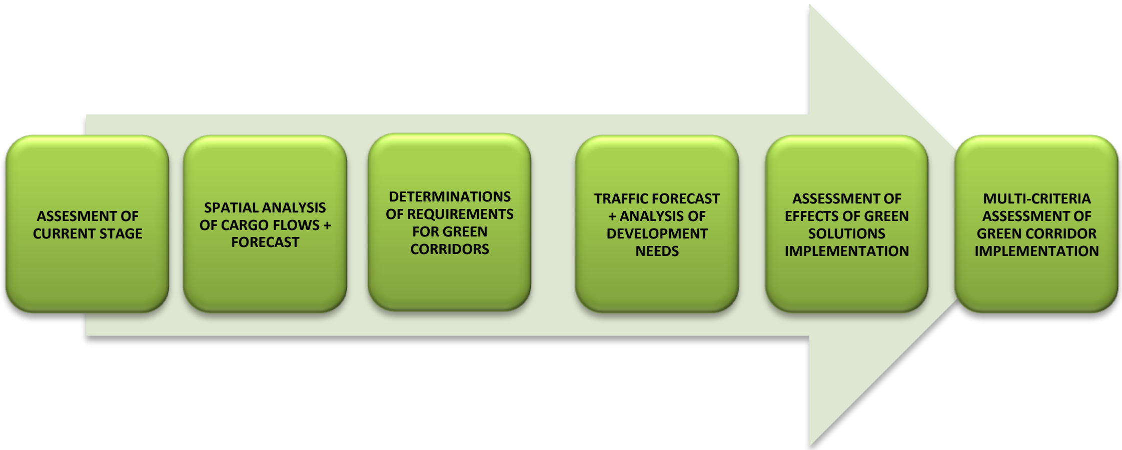
Reported by: Mr Michał Ostrowski, May 31st 2012
Department of Regional and Spatial Development
Title: *Study of the potential and the spatial conditions of the North–South green transport corridor in Poland*

Condition of the environment is one of the fundamental elements which, apart from economic development, determine quality of life in modern world. Therefore, a transport system has to meet the requirements of technical and economic efficiency, and take into account the scale and forms of its external costs. The idea to create "green transport corridors" should therefore be a serious challenge for the future development of transport in the European Union, including Poland.
The aim adopted in the work entitled *Study of the potential and the spatial conditions of the North–South green transport corridor in Poland* was to assess current and potential infrastructural and economic requirements to create a competitive range of freight services in the multimodal North–South corridor in Poland, including in particular the possibility to transform the corridor into a so-called green transport corridor.

The object under analysis is one of the EU transport corridors[60] located in Poland connecting ports in Gdańsk and Gdynia with the south border of the country. The corridor includes in practice 36 Polish sub-regions, located in 9 provinces[61]. The first part of the study describes social and economic systems of the provinces and sub-regions, as well as their share in generating the country's external exchange.

On an international scale, the Corridor connects Scandinavian countries with the southern part of Europe, reaching as far as the Adriatic Sea. The connection operates also containerised cargo arriving to Europe from overseas countries (both supported by the Baltic Sea and the Adriatic Sea). It is also important thoroughfare for Polish foreign trade, directed on Scandinavia and Southern Europe.

The research process was divided, in accordance with the scope of the order, into several key stages, presented in the diagram below.



The first stage of the analysis included assessment of current state of transport infrastructure development, as well as market and organisational conditions related to provision of transport services. Assessment of the current

60 There are two TEN-T priority projects in the corridor: No 23 – combined railway line Gdańsk–Warsaw–Brno/Żylina (E/CE-65); No 25 – motorway Gdańsk–Katowice–Brno/Żylina–Vienna (A1). The corridor is also connected with the Baltic Sea Motorway projects (No 21).

61 Pomorskie Province, Warmińsko-Mazurskie Province, Kujawsko-Pomorskie Province, Mazowieckie Province, Wielkopolskie Province, Łódzkie Province, Świętokrzyskie Province, Śląskie Province, Małopolskie Province.

state of development of linear infrastructure located in the Corridor was focused on describing its quantitative and qualitative features[62]. The research included determining the share of sections which meet target parameters in the total length of individual connections, and description of operational parameters (permitted pressure and average permitted speed), as well as degree of technical degradation (on the basis of the ruts parameter). Moreover, the progress of works related to development of individual connections has been presented taking into account time of projects' completion. Among the most significant conclusions of the first analysis are the following elements:

- no consistent network of motorways and expressways which would form a basic complementary system of connections;
- investments implemented on the remaining national roads are dispersed, reflecting local needs of particular provinces, as well as financial limitations;
- technical condition of national roads surface (excluding motorways) is varied; It is therefore necessary intensify investment activities, to improve this condition;
- railway infrastructure, in terms of functionality, is not fully adapted to the needs of modern transportation market;
- there are great differences in permitted speed for freight trains, which affects total time of transport and flexibility of services provided;
- as regards the permitted axle pressure, railway lines in the analysed corridor have uniform parameters, consistent with European norms;
- works of the largest scope focus on the CE65 line, Gdynia–Warsaw, which is used mainly for passenger transport;
- the line No 131 (CE65) is undergoing revitalisation works aimed at replacing the surface, the result of which will be increase in maximum permitted speed for trains.

The second area under analysis were nodal elements of the transport infrastructure, the analysis included maritime and inland intermodal terminals. In the Baltic–Adriatic corridor there are 22 of them, four of which are maritime terminals. At present, the largest of Polish port container terminal is the DCT Gdańsk, which in 2011 attained market share of 48%. Next are the BCT[63], GCT[64] and GTK[65] terminals. In 2011, the terminals serviced 1,289,041 TEU in total, which means that the average use of their capacity was 83%. In practice, this signifies that little free capacity is available, which necessitates implementing investments aimed at development. Almost all terminals have such plans concerning investments both in infrastructure (extension of the DCT pier, construction of the GCT quay, dredging the port in Gdynia for the BCT and GCT), and in equipment (development of intermodal facilities in the BCT, GCT and DCT terminals). This part of the study refers also to the branch structure of hinterland container transport, in which railway transport share in 2010 was 14.4%. Information concerning ports was supplemented by the offer of ferry terminals, which may also serve as an important link in the intermodal supply chain[66]. Presented are also basic operational parameters of 18 intermodal terminals located in the country's interior. Essential challenges for development in this area include poorly developed railway infrastructure of the terminals (small share of facilities with track length exceeding 600 m), as well as shortage of handling equipment. On the other hand, there are new facilities built and handed over for operation (e.g. PCC Intermodal Kutno terminal, Hub Terminal Poznań Polzug). Based on a set of four key intermodal service centres in Poland (trójmiejski, wielkopolski, łódzki, warszawski, śląsko-krakowski), current handling capacity of four

[62] The analysis mainly included such connections as: road (A1, DK5/S5, DK7/S7, DK8/S8) and railway (CE65 – lines 131 and 9) connections.

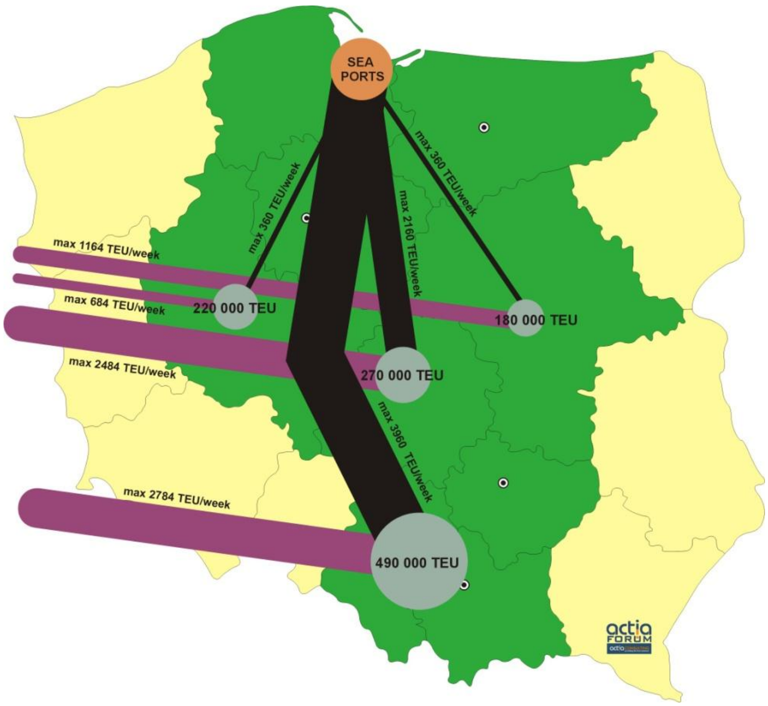
[63] Baltic Container Terminal.

[64] Gdynia Container Terminal.

[65] Gdańsk Container Terminal.

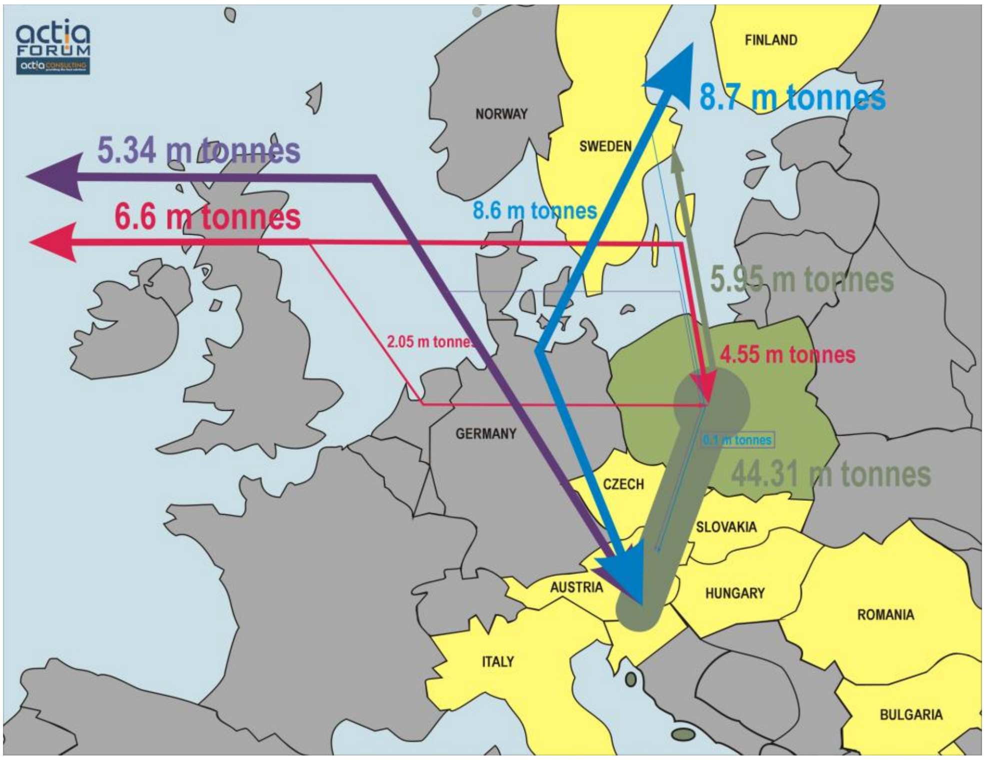
[66] Among terminals presented in this part are: Baltic General Cargo Terminal Gdynia, Westerplatte Terminal, and Duty Free Zone in Gdańsk.

terminals was assessed, as well as current transport capabilities for containers in the combination sea ports – intermodal terminals. The map below presents the results.



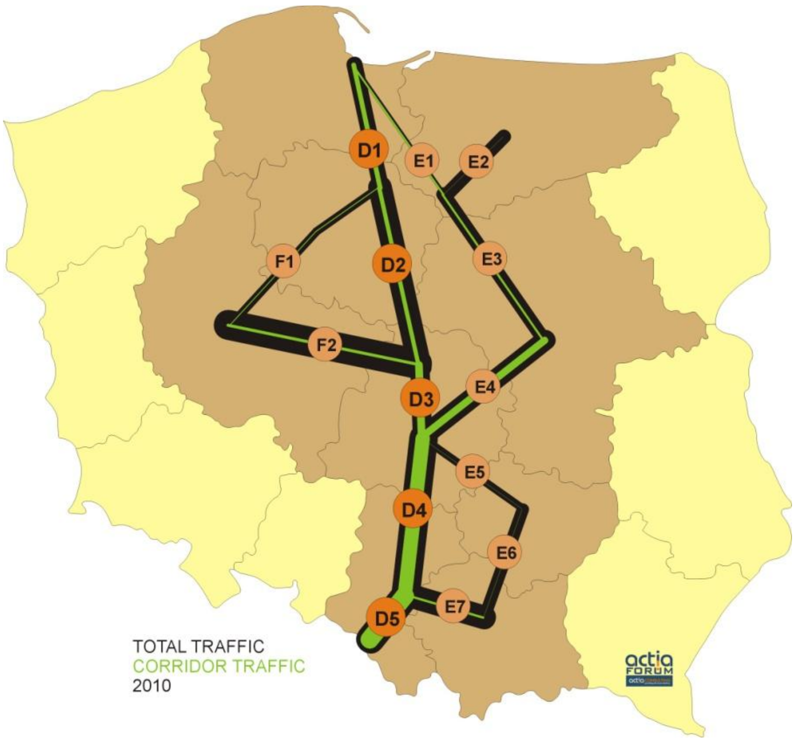
It should be underlined that transport capacity was analysed with respect to the direction north–south, as well as east–west (connections of intermodal terminals with ports and the North Sea). Summing up, it may be indicated that the largest intermodal centre is the one located in the south, with total capacity close to half million of TEU per year. It is important to note that in this centre, the predominating cargo stream are goods serviced longitudinally (59%). In the remaining centres – łódzki (53%), wielkopolski (64%), and warszawski (76%) – latitudinal direction visibly dominates. It is probably caused by the fact that the distance between the Tri-city and particular locations is too small.

Assessment of the current state of development of the corridor included also transport carried out there. The demand side of the market was analysed using two approaches: potential and effective. The first one specifies general cargo stream currently present in the corridor and includes: commercial exchange between Scandinavian Countries, Central and South Europe, commercial exchange between Central Europe and overseas countries (cargo stream servicing), Polish foreign trade in the direction of north and south, as well as commercial exchange between Poland and overseas countries. The resulting findings are that potential cargo load in the corridor is 53.7 million tons in total (year 2010), and that the commercial exchange between Poland and Scandinavian countries, and south of Europe is of key importance (see the picture below). It can also be indicated that in the analysed relation (effective demand) there are currently approximately 38.7 million tones of the cargo volumes under analysis. It can be indicated, therefore, that 15 million tones bypass Poland, being transported, mainly in transit relations, by rival transport systems, mainly German.



Carried on an estimate of the burden on the individual analysis, key sections of the network infrastructure charges, in general system (total traffic) and relating to international trade (traffic corridor). What is important, this analysis was conducted in part by particular modes transport. Core flow analysis was supported by the motor transport and rail. It also sets out the possible use of inland waterways, which currently has a marginal significance in the transport of the analyzed corridor. On the basis of the results obtained it was possible to show that share of railway transport in the corridor ranged between 17.6% (Małopolskie Province) and 34.3% (Śląskie Province).

By combining the previously analysed elements (arrangement of basic intermodal connections, structure and size of cargo streams, as well as branch division at individual relations), the spatial arrangement of cargo flows in the Baltic–Adriatic corridor was analysed. For that purpose, a map of connections was created, where both total freight traffic, and transport related to the so-called corridor traffic (external relations) were indicated. The picture below presents the road connections loads.



A model analysis of costs related to north–south corridor transport serves supplements this part of the study. For this reason, the authors compare prices of transport services performed solely by road and intermodal (railway + road) transport. The calculations were carried out for two posting points, including container terminals in Gdańsk and Gdynia. As target points such cities as Siedlce, Grodzisk Wielkopolski, Kędzierzyn Koźle and Tarnów were indicated. The choice was primarily determined by location of intermodal terminals in central and southern Poland. The rates presented have been calculated by enterprises which run business of container forwarding. The results indicate relative predominance of road over rail intermodal transport in terms of prices for transport services. The difference results from burdens borne by carriers for the use of transport infrastructure. Full payment system implemented in railway transport is a much heavier burden for infrastructure operators. This suggests access to infrastructure costs are a part of the transport price, constituting 30% in case of railway transport, whereas in road transport the share is 5% to 10%.

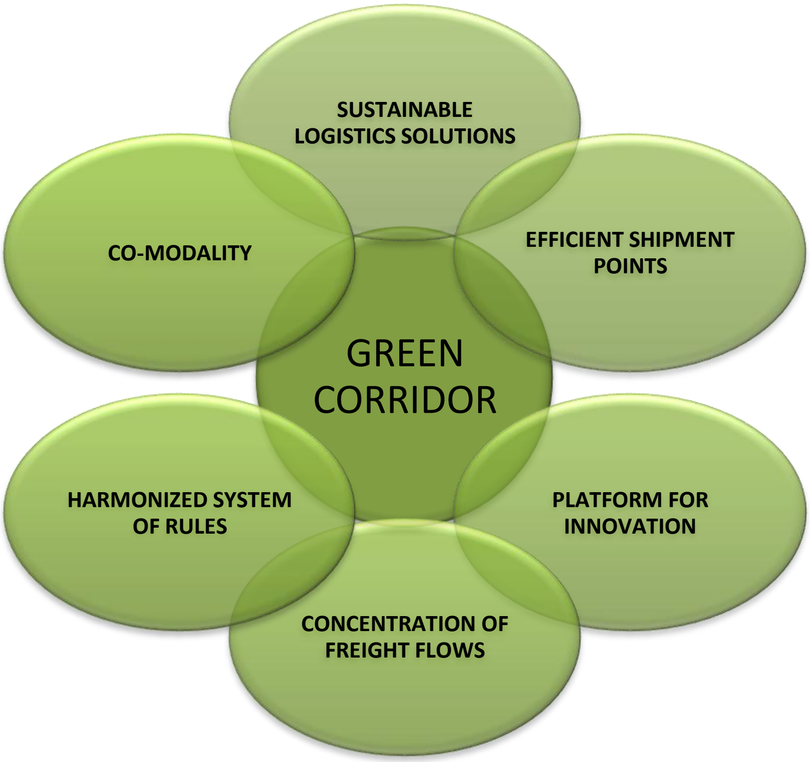
Research related to assessment of the Corridor's current state of development was concluded by an analysis based on Key Performance Indicators (KPIs) which were defined within the *SuperGreen* project. However, the proposed set had some shortcomings, which were pointed out both by the authors of the KPIs, and by the authors of this study. For this reason, they have been slightly modified and as a result, a new KPI set emerged, which both suited the needs of the study, and allowed the authors to obtain particular information (see table below).

KPI GROUP	KPI
Initial conditions	Connection length (km)
	Transport weight (million tones)
	Transport performance (tkm)
	Availability for public (yes/no)
Cost efficiency	Absolute costs (PLN / 2 TEU round trip)
	Unit costs (PLN/TEU/km)
Service quality	Transport time (hours)
	Average speed (km/h)
	Service frequency (per week)
	Transport capacity (TEU/week)
	Service capabilities of terminals (TEU/year)
Infrastructure	Share of high flow capacity sections (%)

Modal structure	Modal split (%)
External costs	Value of emitted costs (EUR/year)

With a view to the fact KPIs have to be applied with respect to a specified transport relation (see initial conditions), the authors carried out an analysis of model transport relations (created for the cost analysis) for the combination road transport – intermodal transport. Based on KPI results and using appropriate statistic tools (Pearson correlation coefficient and multiple regression), the authors sought relationship between individual parameters and the branch division structure (flexibility of demand for intermodal services relative to individual factors). The results did not allow for indicating basic relationships. Reasons for this are seen mainly in limited scope of research, as well as random nature of the relationships, and occurrence of several subjective factors in the process of modal choice. At the same time, KPIs have been shown as having little usefulness for the analysis of dynamic changes in a transport system. Therefore, it can be stated that in practice, potential changes of branch structure will be caused by a range of independent factors, by infrastructure quality and accessibility, by service capacity and market prices, as well as by changes in mentality and habits of decision-makers. An additional element which occurred in the KPI set was calculation of external costs related to performance of a specific range of transport services (using the Marco Polo calculator).

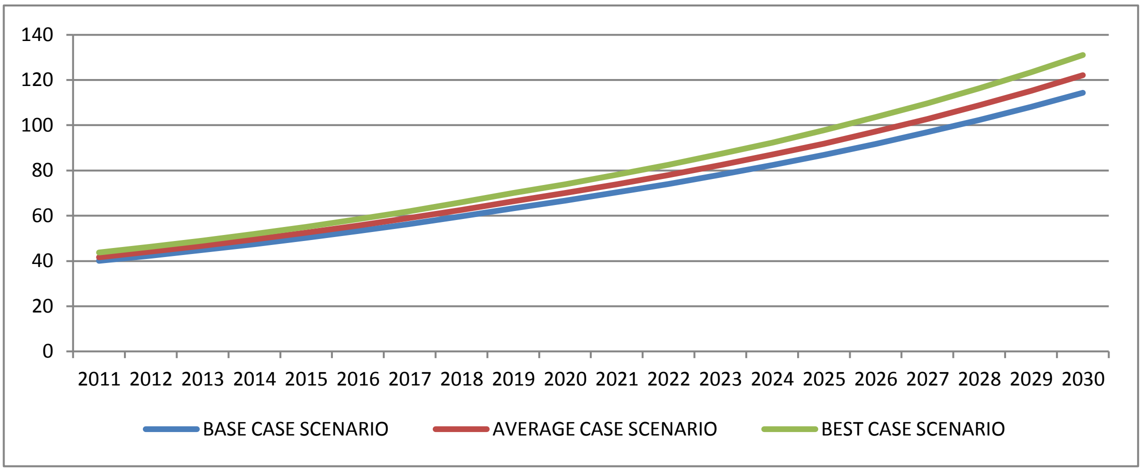
Future development of green transport corridors requires to first determine prerequisites to be fulfilled by transport arrangement of this kind. For this reason, the basic requirements imposed on green corridors under European transport policy priorities has been analysed:



Therefore, it can be pointed out that developing the North–South Green Corridor requires taking intensive and consistent actions both by public authorities, and by companies operating on the transport and logistic market. The basic problem in our analysis is that there are no ways indicate measurable prerequisites for development of said green corridors.

A question arises: *when does a corridor turn "green"?* As all the above-mentioned pillars of such approach refer to qualitative elements, the authors of the study assumed as guidelines for developing green transport and logistic solutions the principles detailed in the EU Transport White Paper *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, where, according to the third target, such actions were recommended which would result in transfer, by 2030, of 30% of goods now transported by motor vehicles to other means of transport (trains, inland shipping). Therefore, such change in the branch structure was adopted by the authors as a quantitative measure of the “green transport solutions” implementation requirement conception.

Wishing to create a basis for further analysis, the authors of the study have prepared a forecast of freight development in the Corridor by 2030. A division of freight flow to corridor transport (generated by foreign trade and transit) and other types of transport (internal traffic) was applied. In the two cases the authors employed different development criteria. The forecast for the corridor transport was based on forecast changes in foreign trade between Poland and the countries of central and southern Europe, whereas the basis for internal transport was a forecast presented in the study by Professor Jan Burniewicz[67] (an average transport weight increase rate was taken in to account). A particular element of the corridor traffic forecast was the adoption of specific value of share that the corridor has in servicing transit relations and in commercial exchange between Poland and overseas countries. It was done by means of scenarios (base case, average case, best case), applying for further calculations the average values[68].



Results obtained this way served as a basis for determining spatial arrangement of cargo flows (according to provinces), which were subsequently subdivided into particular infrastructural sections (in accordance with the previously adopted method). However, it should be emphasised that the spatial arrangement of traffic flows was determined by the new modal split. Two scenarios were adopted in this respect: BASE CASE and GREEN. The base case scenario assumed changes in the branch structure consistent with the forecast for Polish transport, according to which, by 2030, the share of railways will decrease by 2.6%, and share of road transport will increase by 2.4%. The green variant assumed a transfer of 30% cargo weight, on sections of length exceeding 300 km, from roads to intermodal connections. The result of calculations illustrates general modal shifting structure due to playing out of a particular scenario (see figure below).

[67] J. Burnewicz, *Wizja struktury transportu oraz rozwoju sieci transportowych do roku 2033* [*Expected Transport Structure and Transport Network Development until 2033*].

[68] Due to relatively little differences between the scenarios.

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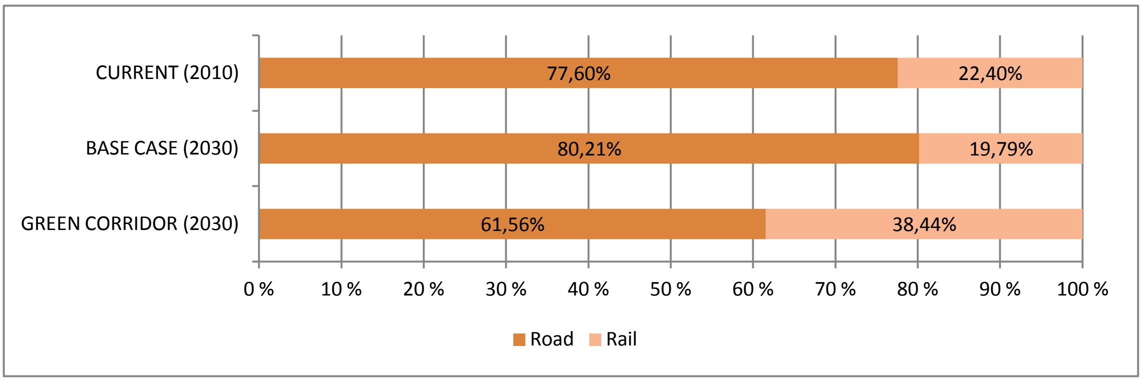
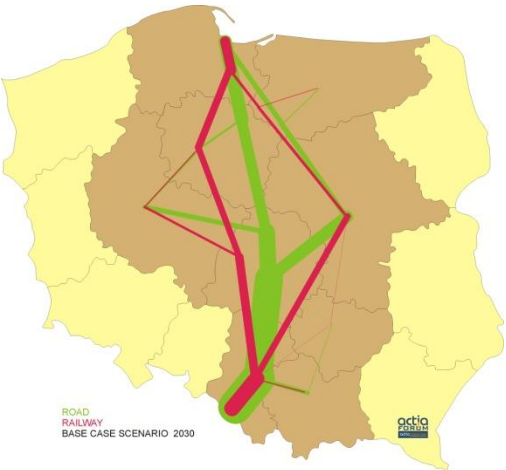
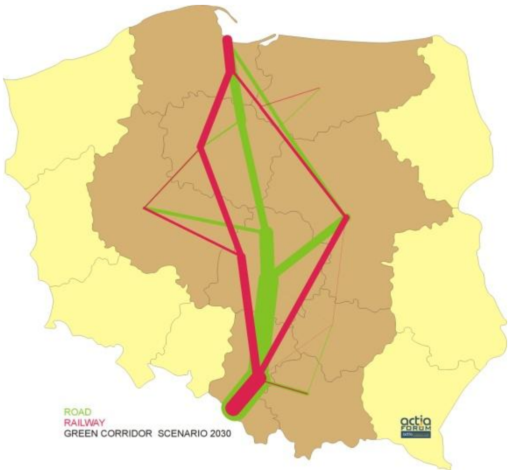
ØstlandsSamarbeidet Eastern Norway County Network
Railconsult
SKÅNE



The spatial analysis allowed also for illustrating the size and arrangement structure of corridor traffic flows.





Observation of the results indicates an exceptionally high share of railway transport in the green scenario, which will be very challenging to achieve. A question raised based on an analysis performed in this way concerns the scope of actions which have to be taken so as the green variant is possible to achieve. Moreover, taking an analytical approach to the issue in question, the authors attempted to determine the set of costs and benefits related to development of such structure and to decide, if total effects of the green variant, considering both quantitative, and qualitative aspects, will exceed those of the base case.

The first of the analysed conditions for creating green corridors is development of linear and nodal infrastructure. It should be emphasised that the analysis was carried out using a set of three variants (zero, formal, benchmark). Taking into account the target branch arrangement and the need to achieve high competitiveness of intermodal transport over motor transport, the necessity of benchmark development of railway and terminal-modal infrastructure seems almost certain. It should be highlighted that simultaneously the roads are being developed, which, considering the analysis is based on relative values, may undermine the possibility to create green solutions. An important factor for development, apart from infrastructure, will be the service capacity of the corridor. This is applicable also to the means of transport and available technologies. It has been estimated, in the first case, that a need will arise for substantial development of the means of transport, related to the need to launch additional connections (train frequency will have to increase from ca. 50 runs/week to ca. 140–180 runs/week). Moreover, the currently available services, focused on container transport, should be supplemented with other technologies (semitrailers, swap bodies or even entire combinations in the Ro/La system). The organisational factors, which have similarly important influence on the competitiveness of the intermodal, have also been referred to, for instance infrastructure or means of transport. The authors of the study indicated such aspects as: appropriate traffic scheme of railway connections which would take into account needs and demands of cargo transport, compliance with regulations concerning road transport of heavy loads, appropriate shaping of level of rates and of the mechanism for calculating rates payable for accessing railway infrastructure, with preferences for intermodal transport, as well as implementation of a system of motor transport external cost internalisation.

Assuming that the above-mentioned needs are met, and so is the requirement to create north-south green transport corridor (increase in motor transport), the authors attempted to determine the effects of implementing thus defined development strategy. In this case, seven aspect have been indicated, including: technological efficiency based on a time criterion, spatial accessibility, transport costs levels, mass character of transport, ecological effects, influence on the quality of logistic services, strategic considerations, as well as impact on the social and economic development of regions. Regarding subsequent questions, the following issues may be indicated:

1) increase in transport time and decrease in temporal flexibility versus service accessibility (it is necessary to redefine functioning of supply chains based on the intermodal, taking more broadly into account the in-transit storage costs);
2) lack of significant changes in spatial accessibility of services, stemming from development of road feeder services;
3) decrease in intermodal service costs, it should be attempted to achieve absolute changes (e.g. decrease in railway infrastructure accessibility costs), and not relative changes (improvement of the position of the railways due to increase in burdens placed on road transport), which may cause decrease in competitiveness of the whole industry;
4) considerable increase in the mass character of transport due to significantly higher flow capacity of railway infrastructure and its possibility to operate heavy loads;
5) relative decrease in external transport costs (-18%), however, the basic factor generating such costs is the increase in transport itself;
6) development of logistic services due to the necessity to create comprehensive services (railway + road transport), as well as expansion of nodal infrastructure (intermodal terminals and logistic centres heading for the terminals).
7) the need for stronger regulation of the transport market, what will be seen in a significant increase investment in rail (probably at the expense of other modes of transport) , and the necessity of cutting the functioning of the market mechanism.

Regarding the point 6 (development of regions), both positive effects (intensification of investment process, new jobs, increase in added value generated in a region, increase in tax revenues, increase in possibilities for allocation) and negative (increase in road traffic on connections to/from terminals, disproportionate allocation of funds to infrastructural development, tunnel effect in transit regions) aspects should be indicated.

As the transformation of Baltic–Adriatic transport corridor into a green corridor generates many costs and revenues, as well as positive and negative effects, a multi criteria analysis has been carried out, resulting in comprehensive assessment of two variants: base case and green. To this end, the authors chose the ANP method (analytic network process), which is based on specific criteria for decision-making grouped according to the so-called control criteria, arranged according to: benefits, opportunities, costs and risks (see diagram below).

Benefits	• unification of technical parameters of the infrastructure, • decrease in transport time on main routes, • optimisation of road infrastructure use, • increase in transport safety.
Opportunities	• improvement of spatial accesibility, • stopping the decrease in the share of railways in transport, • improvement of the logistic service quality, • potential for mass transport • portential for egional development,
Costs	• costs of transport service, • investment outlays for transport infrastructure.
Risks	• scale of investment not suited to the changing needs of the market, • unbalanced modal shift, • Increase of the average time of transit, • high level of public intervention in transport, • limitation for the increase of rail transport time.

Each of the control criteria was assigned appropriate weight (summing up to 1), with the biggest importance placed on risks (primarily due to the time horizon of the analysis). The final result of the analysis was obtained and the optimum variant chosen through assessing the impact of each scenario on maximising benefits, opportunities, costs and risks regarding particular sub-criteria, and then by combining the results of the comparison, using weights of particular control criteria and their sub-criteria. As a result of the calculations made using a dedicated application, the following weights were obtained and assigned to both analysed scenarios of corridor transport branch structure development:

- BASE CASE scenario – 0.658975;
- GREEN scenario – 0.341025.

Summing up the results, it should be stated that in the existing conditions the scenario, consistent with the recommendations of the European Commission, are not possible. Environmentally friendly option does not include differences in the level of development of transport systems in individual countries. In the case of Polish there are significant delays in developing the basic infrastructure network. Despite of the fact that other potential opportunities are related to the “green” scenario, they were survey by high level of risk and costs, associated with the desire to implement it in perspective for 2030

It is especially important in a situation, where the transport infrastructure in the corridor requires comprehensive modernisation due to the needs of each type of transport. It is necessary, therefore, to seek to maintain reasonable proportions of outlays for particular investments, so as to create, without interfering in the existing transport capacity, basis for long-lasting actions serving firstly to stop degradation of railway transport and of other types of transport, and secondly, to increase their attractiveness, leading to increase in transport share.

The expert analysis was supplemented also by confronting the results with opinions of transport industry representatives. To this end, a series of industry consultations was carried out, including questions about basic opportunities (growth factors) and risks for intermodal transport development in Poland. The growth factors indicated included: continuing revitalisation of railway infrastructure, increase in freight trains speed (infrastructure + new stock), automatisation of the traffic control process, new large cargo streams, EU policies of intermodal promotion, development of intermodal terminals, improvement of technical control and increase in costs of road transport infrastructure, increase in importance of Poland on the Baltic market, southward cargo streams operation, development of new intermodal technologies. On the other hand, the following factors were pointed out: lack of interoperability on an international scale, low parameters of intermodal terminals, high costs of access to infrastructure and ineffective mechanism of tariff design, shortcomings in organisational system, lack of stable rules of market functioning, impact of sea carriers politics concerning empty containers on transport efficiency, time-consuming pre-advice procedures, radically longer delivery time, as well as higher unit cost of service.

The last element of the study was to define recommendations which would suggest desired directions for actions, in order to approach the green scenario for Baltic-Adriatic transport corridor. The said recommendations have been defined according to the basic groups of entities, such as:

1) infrastructure authorities (continuing railway infrastructure revitalisation and modernisation process, changing pricing policy, taking into consideration the transport demands in railway lines management process, creating public intermodal terminals, maintaining and continually improving parameters of inland waterways, making investments in inland ports, broader use of the PPP formula);
2) regional and local self-government (limiting road traffic of heavy loads in agglomerations, supporting traffic regulations control, supporting businesses which make investments in the intermodal, supporting logistic investments – logistic centres as cargo weight concentration points, promoting intermodal solutions among shippers – pilot programmes, taking into account more broadly the needs of the intermodal in development programmes for 2014–2020);
3) economic self-government (lobbying for broader use of the intermodal, promoting the region and seeking investors from the industry, promoting the Baltic-Adriatic corridor as a transit connection, promoting Tri-city ports as centres for servicing the Asia–Europe exchange);
4) government administration (supporting development of Gdańsk and Gdynia sea ports, implementing the rule of transport external cost internalisation, changing the mechanism for calculating rates payable for accessing infrastructure, carrying out policy to promote intermodal transport, preparing long-lasting programme for Vistula waterway development, preparing comprehensive and cohesive investment programme in the Baltic-Adriatic corridor, which would be financed in the next EU budget period (2014–2020).

Project part-financed by the European Union (European Regional Development Fund)

6.3. ILIM delivery

Reported by: Mr Leszek Andrzejewski , April 21st 2012
Institute of Logistics and Warehousing (IliM), Poznań
Title: *A description of necessary steps for enabling intermodal connections between the main business centres of Poland, Sweden and Norway*

The main objective of the study produced by IliM was to describe the necessary steps for enabling regular intermodal connections between the main business centres of Poland, Sweden and Norway, meaning Stockholm, Göteborg and Oslo with Wroclaw, Poznań and Katowice.

The BSR transport system is changing due to huge infrastructure investments in fixed connections as the Öresund Bridge or the planned Fehmarn Belt Link which will increase the competitiveness of rail transport significantly on trade lanes linking Sweden and Denmark with German transport networks.

Meanwhile the profile of transport system between Poland and Sweden remains unchanged since it is still based on traditional ro-ro ferry connections.

Poland has a reasonably well developed intermodal service for hinterland container transports via the North Range ports of Hamburg, Rotterdam or Antwerp where railway networks can offer competitive conditions for suppliers compared to road hauliers or feeder fleets.

However, the transport system on the North-South axle, linking Poland with its Scandinavian neighbours is determined by the Baltic Sea separating the two and the most common way for transporting goods is by trucks crossing the sea on ro-ro ferries. It is symptomatic that containers practically are not used on this connection even though there are a few ferries adapted to carry railway stock equipped with rail tracks. The use of rail only participates for approx. 4% (tonnage wise) of the transport service between the two regions.

There are two main transport corridors important for flows of goods between these countries. The first one links the western part of Poland with Scandinavia by using the ferry connection Świnoujście-Ystad and the second links the central and eastern parts of Poland with Scandinavia by using the ferry line Gdynia- Karlskrona.

The Świnoujście-Ystad connection offers co-modal solutions since some of the ferries may carry both trucks and rail wagons. There are several regular railway connections from Malmö to Poznań (6 departures weekly), Wroclaw (3 departures) and Vienna (4 departures). Conventional wagons are mainly used on these routes, however, container wagons may be attached. For the future intermodal trains deliveries through Trelleborg instead of Ystad have to be foreseen. Contrary to Ystad, the ferry terminal in Trelleborg is connected to the rail container yard being important part of the Swedish intermodal transport system.

The Gdynia-Karlskrona corridor in turn does not offer international rail connections. There is neither rail nor intermodal infrastructure in the ferry port of Karlskrona nor ferries carrying railway stock from Karlskrona to

Project part-financed by the European Union (European Regional Development Fund)

Gdynia. The ferry terminal in Gdynia again is not able to receive rail stock as well.

However it is going to be changed soon. There are ongoing works in the port of Karlskrona being performed within the Motorway of Sea programme. The newly renovated railway connection with the port and the establishment of new intermodal terminal in the harbour, giving the harbour fully developed intermodal infrastructure to be fully operational by late summer 2013. In parallel the ferry terminal in Gdynia is also investing in road and rail access to serve ro-ro vessels. Until the end of Setember 2014 it will be equipped with 1.700 m of roads, 1.400 m of rail track , 40.000 sqm of manouvre yards and brand new ramp for handling ro-ro cargo. These investments will certainly open the new opportunities for the intermodal North-South connections.

Since containers are nowadays completely absent in trade between Poland and Scandinavia a few basic conditions are required to be fulfilled in order to start-up intermodal traffic between the analysed regions; the first one being available volumes

An analysis of trade between Poland, Sweden and Norway taking into account cargo's susceptibility to containerisation and to be transported on rails shows moderate volumes (ranging to ca. 100.000 TEU p.a. in the Polish exports and ca. 200.000 TEU in imports) that might be attracted by the potential intermodal connections. This volume could, however, be doubled by the transit cargo being transported between Scandinavia and the Czech Republic, Slovakia, Hungary, Ukraine or Belarus .This volume might also be significantly increased by consolidation of flows to and from Scandinavia with a large number of containers transported between Poland and other continents. Some 700,000 TEU coming to or from Poland are reloaded annually in the ports of Gdansk and Gdynia and another 50,000 TEU p.a. go through the ports of Swinoujscie and Szczecin. To sum it up, the available volume for intermodal transport between Poland and Scandinavia has a large potential; however, the challenge is to convince stakeholders to change their flows from road to rails which might take some time.

In parallel to those opportunities the rail track infrastructure in Poland has to be modernised. Intensity of traffic on the North-South rail routes in Poland is relatively low with a possibility to increase the number of trains but there are severe problems with the quality of the track network resulting in numerous velocity limitations. The commercial speed of trains at an average 30 km/h makes them less competitive time-wise. With the opportunity for European funding the Polish rail track infrastructure is currently undergoing modernization aiming at obtaining trains at a velocity of 120 km/h and the improvement of analyzed transport corridors planned until 2014 amounts to EUR 1.5 bln.

It is quite optimistic that in all countries involved, intermodal solutions are increasingly getting acceptance of shippers. In Poland it encouraged the private sector to invest in container terminals these years. Polzug Intermodal has launched lately operations in the brand new container terminals in Poznan (Gadki) and Katowice (Dabrowa Gornicza) starting to build another new terminal in Warszawa (Brwinow). In parallel PCC Internmodal started operations in the modern terminal in Kutno. In a few years the dry port of Tczew will consolidate all containers arriving in the ports of Gdansk and Gdynia to send them all to the central and south parts of Poland as well as to the Central European markets. Massive increase of volumes going through the Polish ports has intensify intermodal hinterland connections. Today ca 30% of container volumes leaving Polish ports are transported on rails. The very recent connections are Maersk Amber Express and Maersk Baltic Express linking the Deepwater Container Terminal in Gdansk in the southern parts of Poland. twice a week each.

Railway transports of course take longer time than truck haulage. Oslo can be reached by truck from Poznan in 2 days while railway transit time takes at least 3-4 days. Truck transport is also much cheaper comparing to 40-foot container rail carriage reaching ca. 30-40% of rail freight charge.
The analysis show, that based on operational expenses for container block trains with 3 departures per week, intermodal operators are able to offer competitive freight charges. It needs however the flexible attitude of long term return.

In spite of quite effective intermodal transport systems domestically in Sweden, Norway and Poland, it looks like the market was not able so far to generate volumes large enough to launch block trains connections across the Baltic sea. One of the reason for this was certainly the lack of effective intermodal infrastructure interfaces between Poland and Sweden especially between Karlskrona and Gdynia.

The good news for the further developments is that the both ports have taken a big investment effort to handle intermodal shipments. The bad news is the partial resignation of Cargo Net – one of the leading intermodal operators from their rail services in Sweden announced in the late 2011.

In parallel to ongoing infrastructural investments the public sector may support launching intermodal services in obtaining the following targets.

- Performance of market research identifying commodities being susceptible to containerization and transported on rails with concrete routes and trading partners in order to select to select the most promising routes securing profitability. It needs deep field research because existing transport statistics are not helpful.

- Meeting favourable attitude of the intermodal transport operators in offering competitive rates to truck freights. It needs time to win new customers however it should not be difficult to build block container trains due to large possibilities for consolidation new flows with the ones coming through the sea ports. The container flows being the last mile of supply chains linking Europe with the Far East or the North America are in constant growth in Poland and Sweden and may creatively support launching intermodality across the Baltic Sea.

- Solving the problem of empty containers return. Competitiveness of intermodal trains maybe achieved only if the transport of empty containers will be reduced with the help of depots.

From this perspective launching regular intermodal connections between Poland and Sweden and Norway seems to be feasible however challenging.

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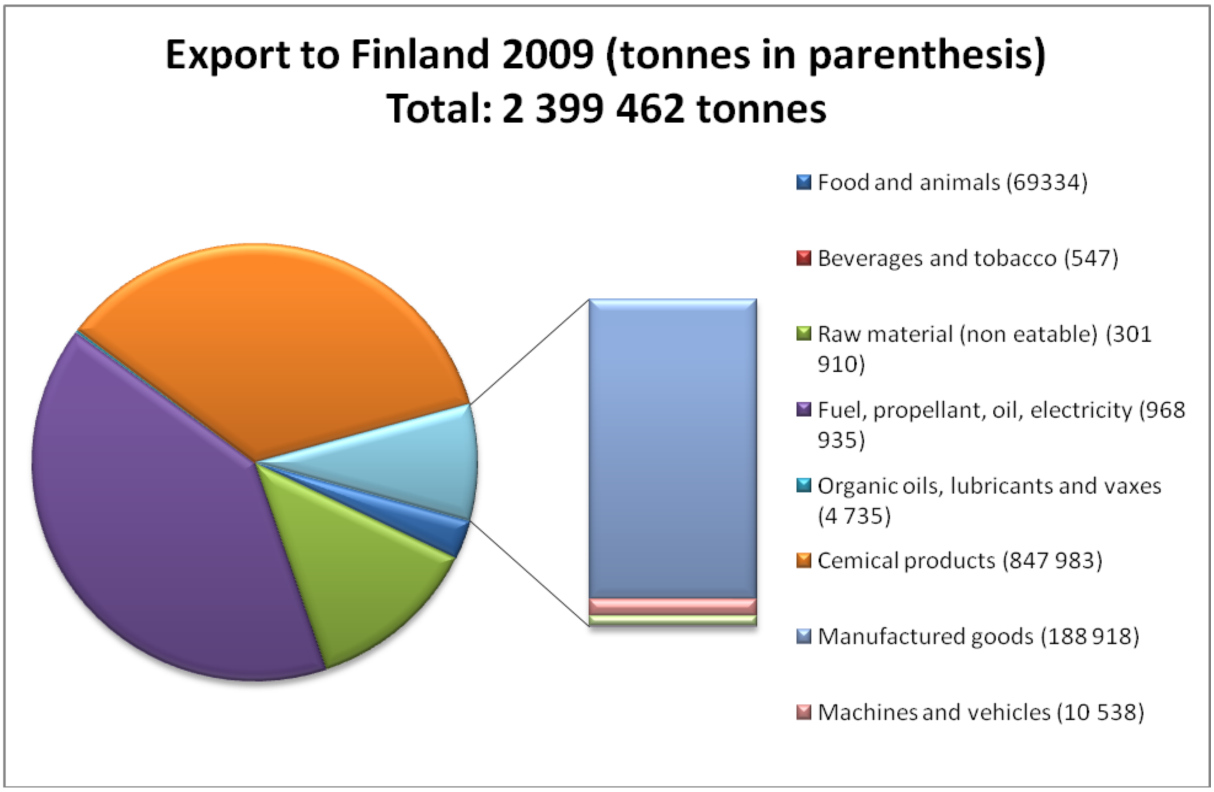
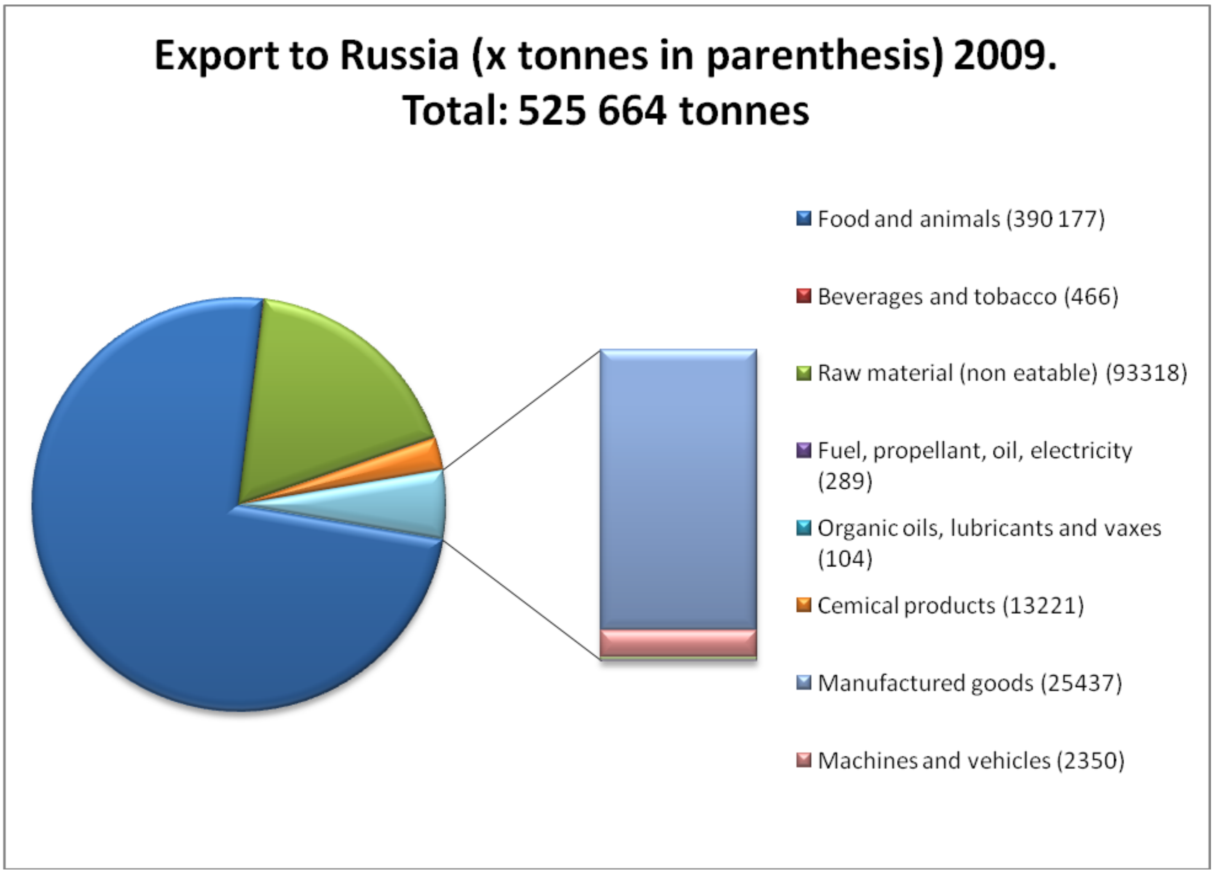
Appendix A. **Working group members**

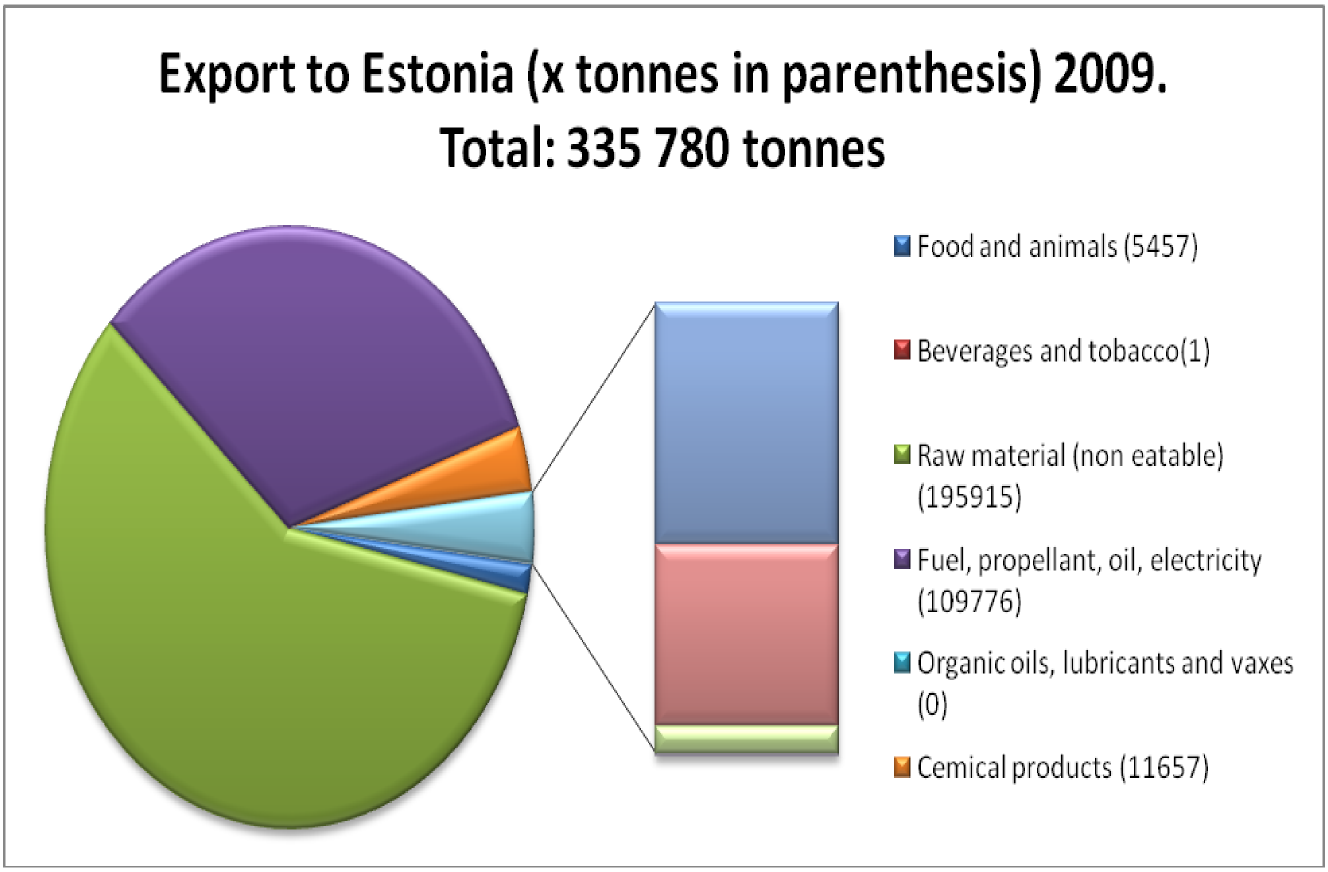
Name	Organization	Role
Inge Brørs	Eastern Norway County Network	Task Leader
Bjørn Bryne	Railconsult AS	Task Manager
Liv Bergqvist	Railconsult AS	Task Manager final phase 2012
Leszek Andrzejewski	Instytut Logistyki i Magazynowania	Manager ILIM sub concept
Leif Petersson	Region Blekinge/Karlskrona Town	Manager Blekinge sub concept
Tomas Debicki	Instytut Logistyki i Magazynowania	ILIM sub concept
Mats Pettersson	Region Skåne	Active member
Kaj Ringsberg	Västra Götalandsregionen	Active member
Stig Hjerpe	Region Västerbotten	Active member
Jon Halvard Eide	Vest-Agder Fylkeskommune	Active member
Dariusz Milewski	West Pomerian Business School	Active member
Bengt Gustavsson	Region Blekinge	Active member
Wiktor Szydarowski	TransBaltic main project	Active member
Michal Ostrowski	Pomerian Province Government	Active Member
Natalya Kozhemyakina	Latvian Transport Development and Educatino Assoc.	Observational member
Morten Peter Jørgensen	Region Sjælland	Observational member
Ove Skovdahl	Railconsult AS	Support to task managers
Dagfinn Berge	Railconsult AS	Support to task managers
Kjell Frøyslid	Railconsult AS	Support to task managers
Christer Bejbom	BIRMA	Support to task managers

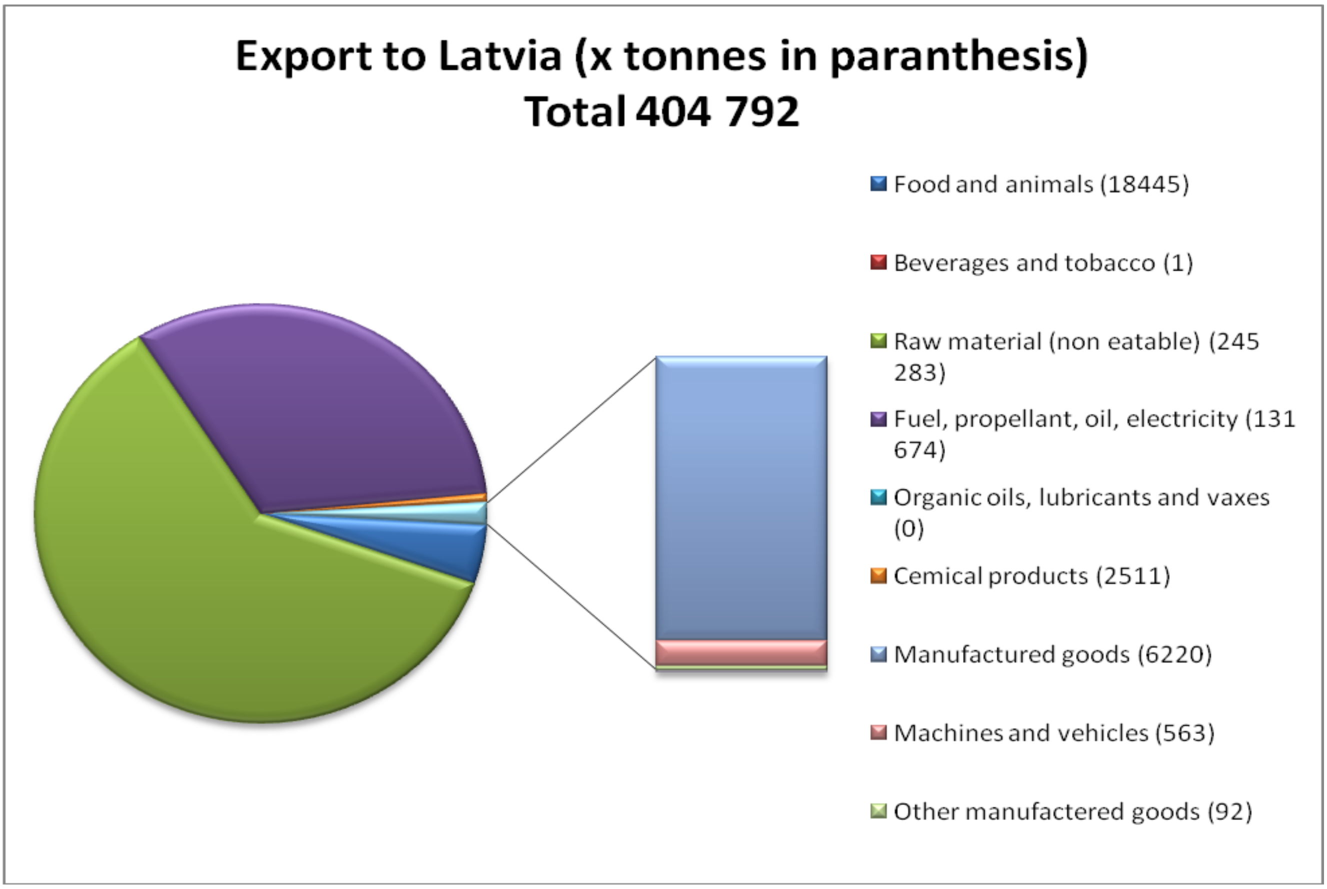
Appendix B. Goods flows in the BSR, 2009

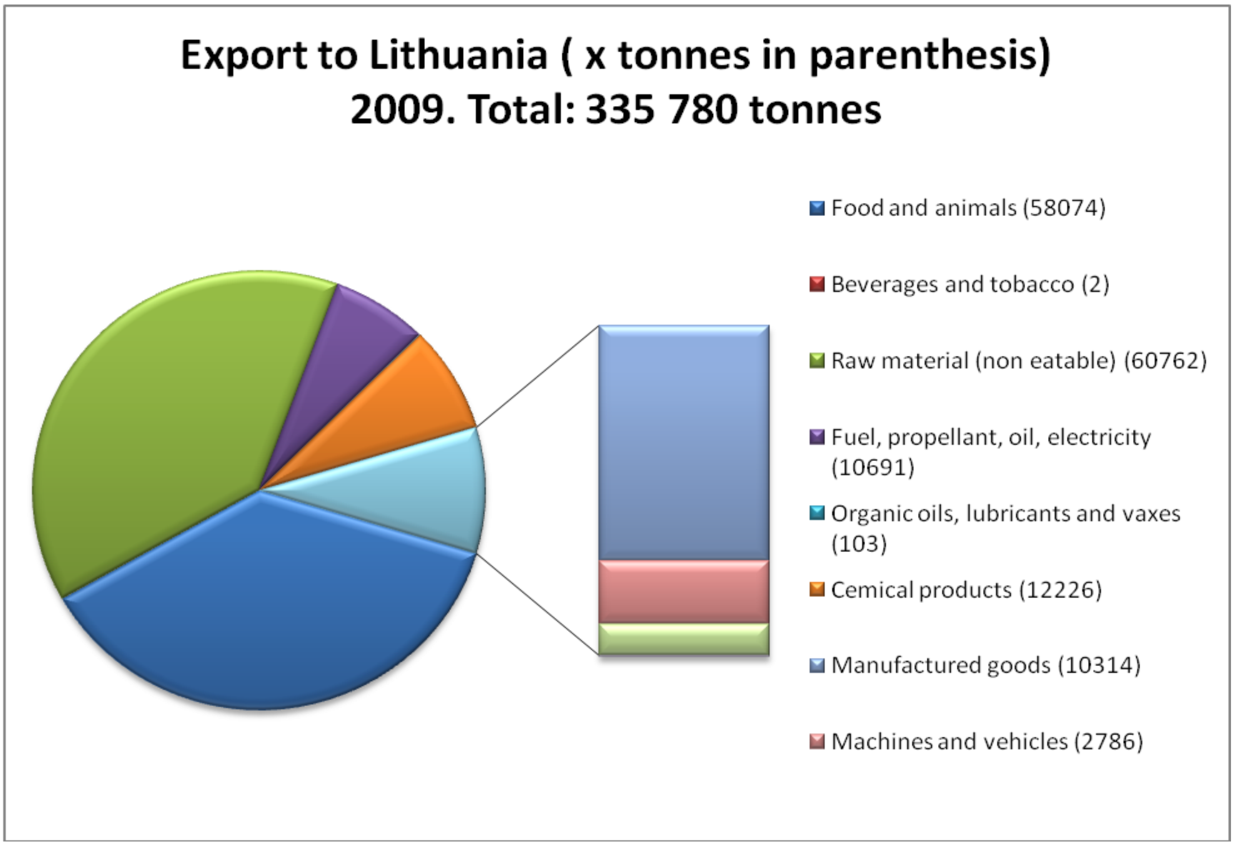
Following is a presentation of goods flows in the BSR in 2009.

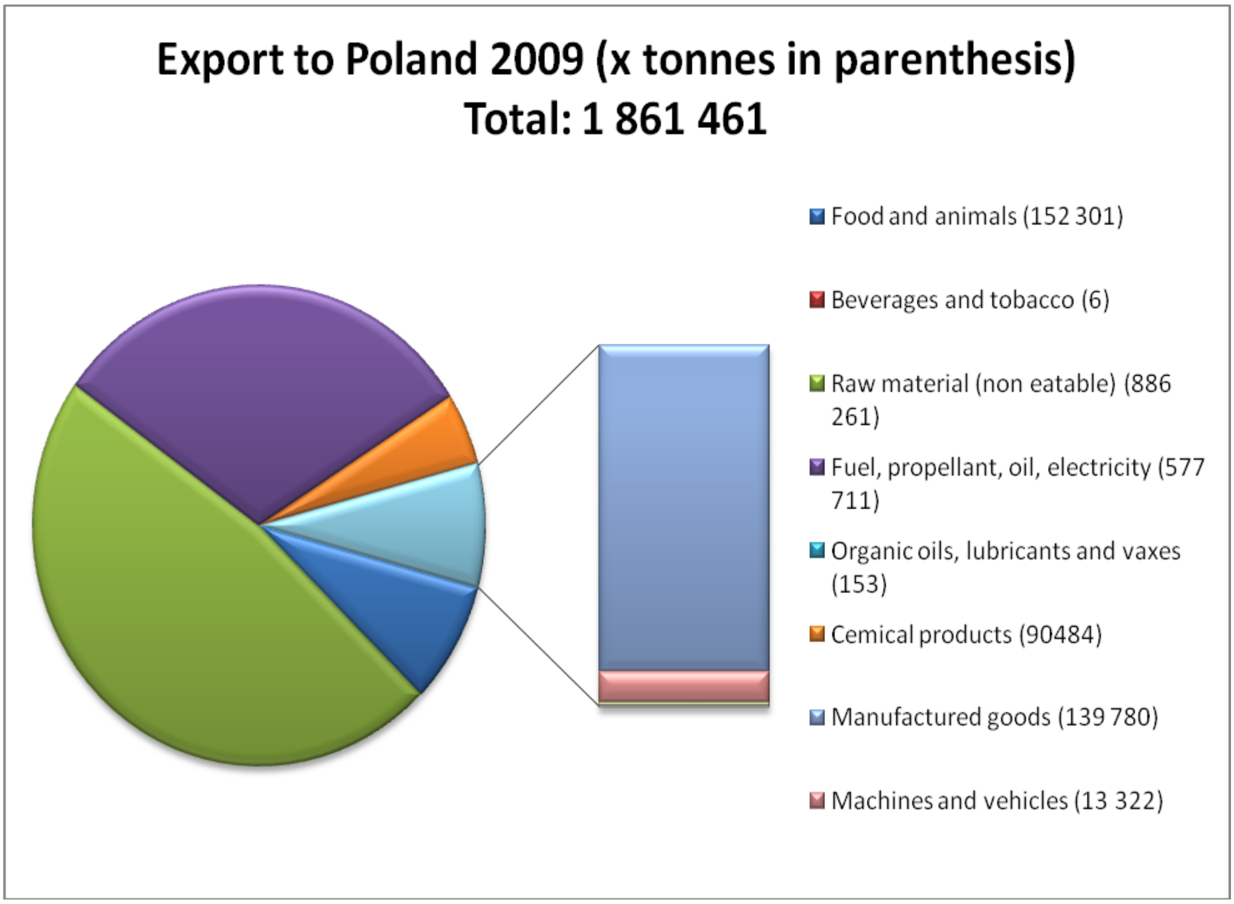


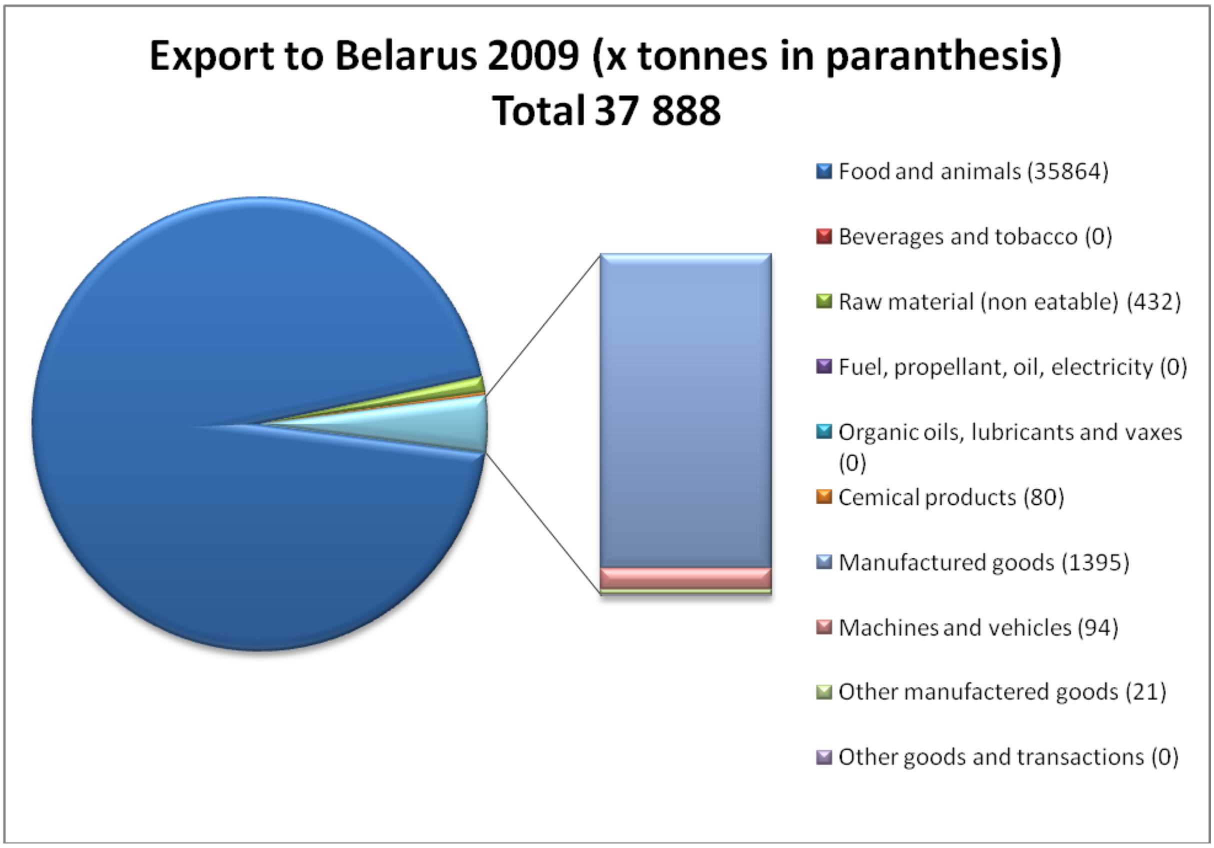

Export to Russia (x tonnes in parenthesis) 2009.
Total: 525 664 tonnes
Food and animals (390 177)
Beverages and tobacco (466)
Raw material (non eatable) (93318)
Fuel, propellant, oil, electricity (289)
Organic oils, lubricants and vaxes (104)
Cemical products (13221)
Manufactured goods (25437)
Machines and vehicles (2350)


Export to Estonia (x tonnes in parenthesis) 2009.
Total: 335 780 tonnes
Food and animals (5457)
Beverages and tobacco(1)
Raw material (non eatable) (195915)
Fuel, propellant, oil, electricity (109776)
Organic oils, lubricants and vaxes (0)
Cemical products (11657)

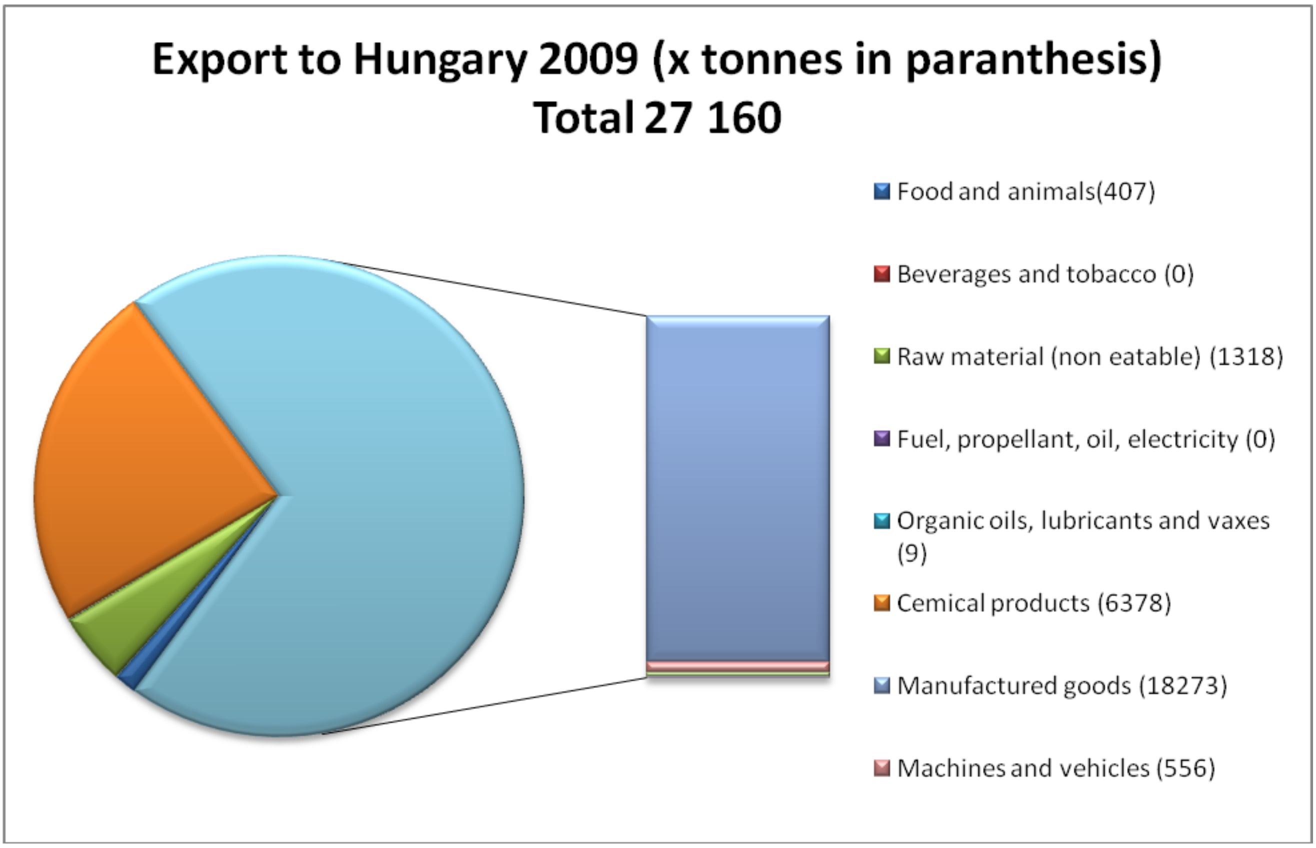

Export to Latvia (x tonnes in paranthesis)
Total 404 792
Food and animals (18445)
Beverages and tobacco (1)
Raw material (non eatable) (245 283)
Fuel, propellant, oil, electricity (131 674)
Organic oils, lubricants and vaxes (0)
Cemical products (2511)
Manufactured goods (6220)
Machines and vehicles (563)
Other manufactered goods (92)

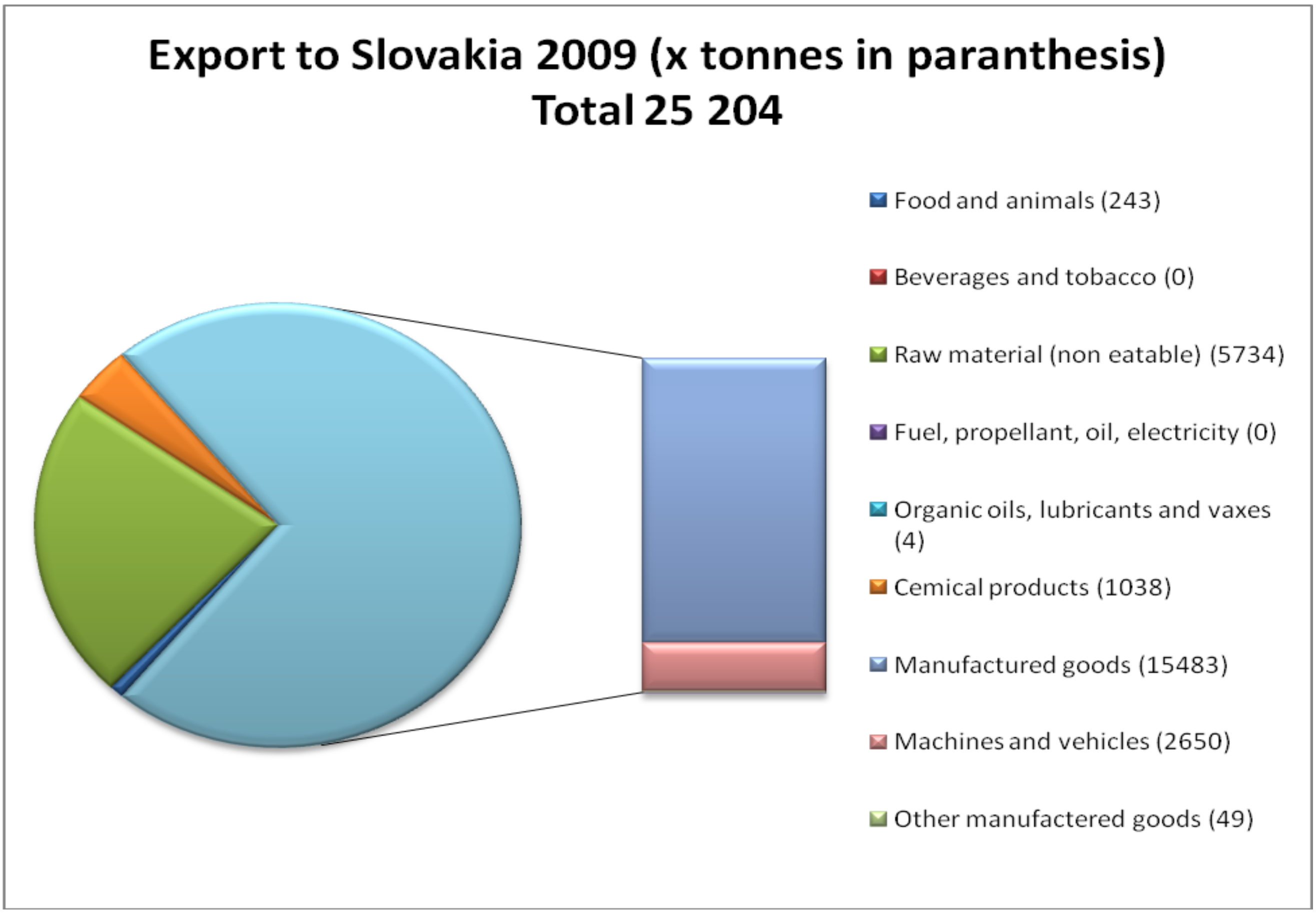

Export to Lithuania (x tonnes in parenthesis)
2009. Total: 335 780 tonnes
Food and animals (58074)
Beverages and tobacco (2)
Raw material (non eatable) (60762)
Fuel, propellant, oil, electricity (10691)
Organic oils, lubricants and vaxes (103)
Cemical products (12226)
Manufactured goods (10314)
Machines and vehicles (2786)

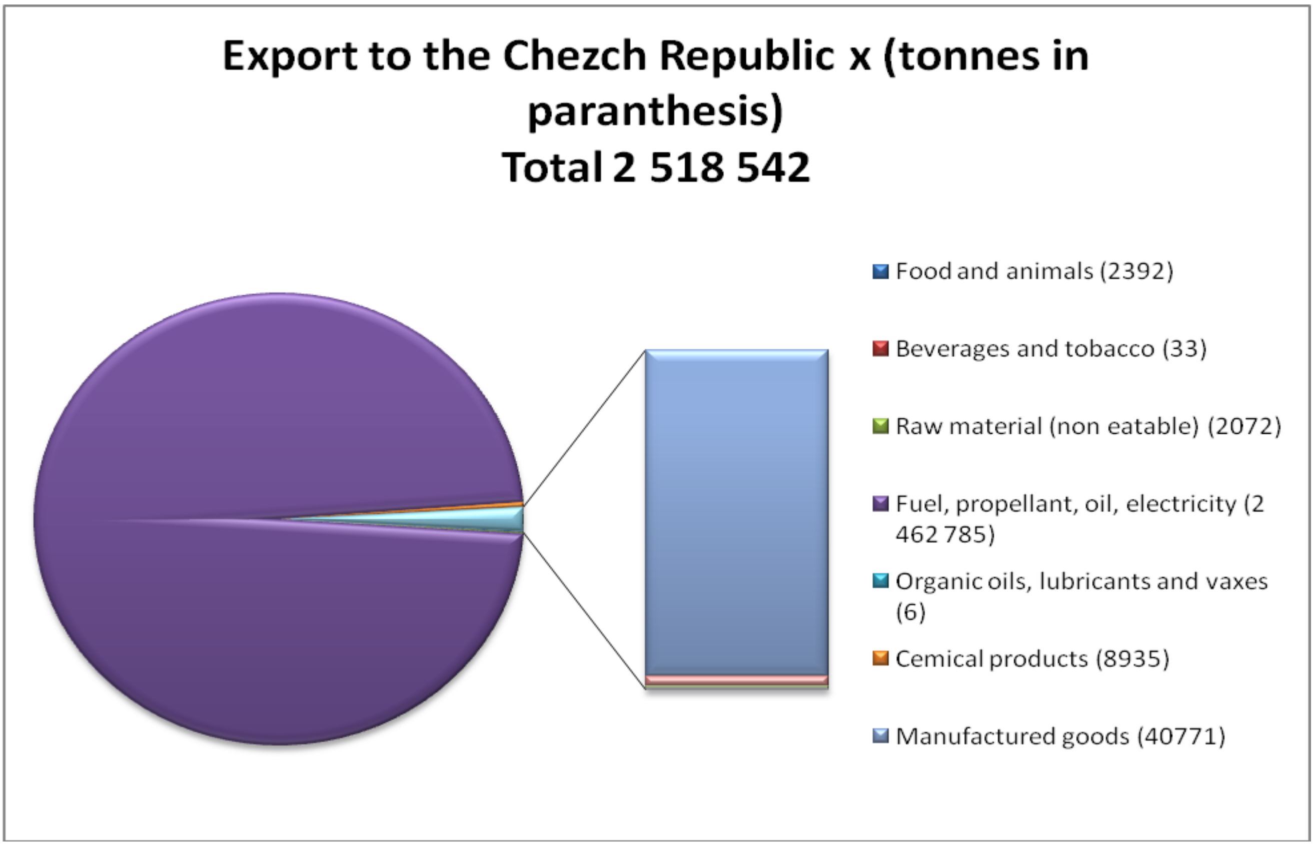

Export to Poland 2009 (x tonnes in parenthesis)
Total: 1 861 461
Food and animals (152 301)
Beverages and tobacco (6)
Raw material (non eatable) (886 261)
Fuel, propellant, oil, electricity (577 711)
Organic oils, lubricants and vaxes (153)
Cemical products (90484)
Manufactured goods (139 780)
Machines and vehicles (13 322)

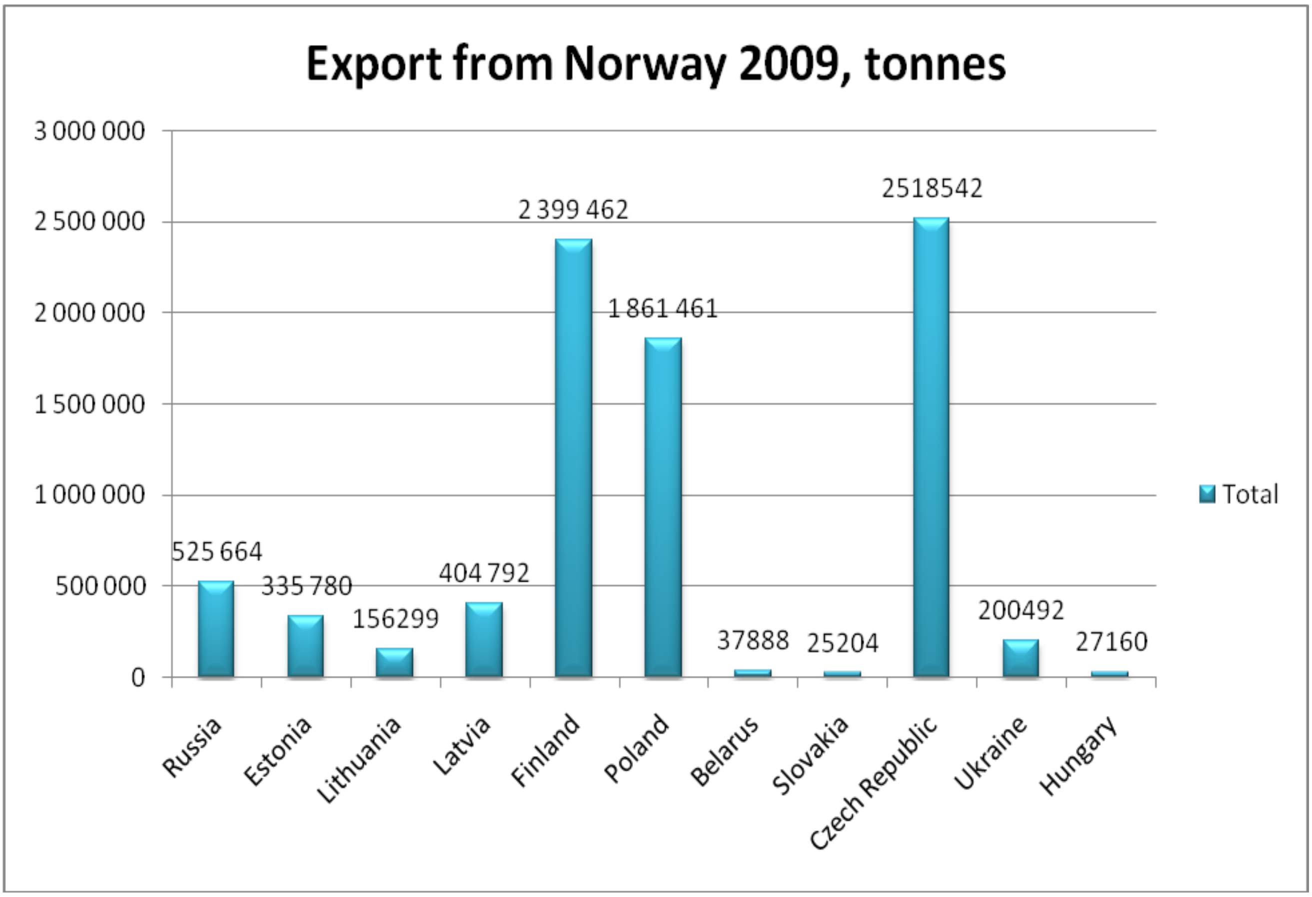

Export to Belarus 2009 (x tonnes in paranthesis)
Total 37 888
Food and animals (35864)
Beverages and tobacco (0)
Raw material (non eatable) (432)
Fuel, propellant, oil, electricity (0)
Organic oils, lubricants and vaxes (0)
Cemical products (80)
Manufactured goods (1395)
Machines and vehicles (94)
Other manufactered goods (21)
Other goods and transactions (0)

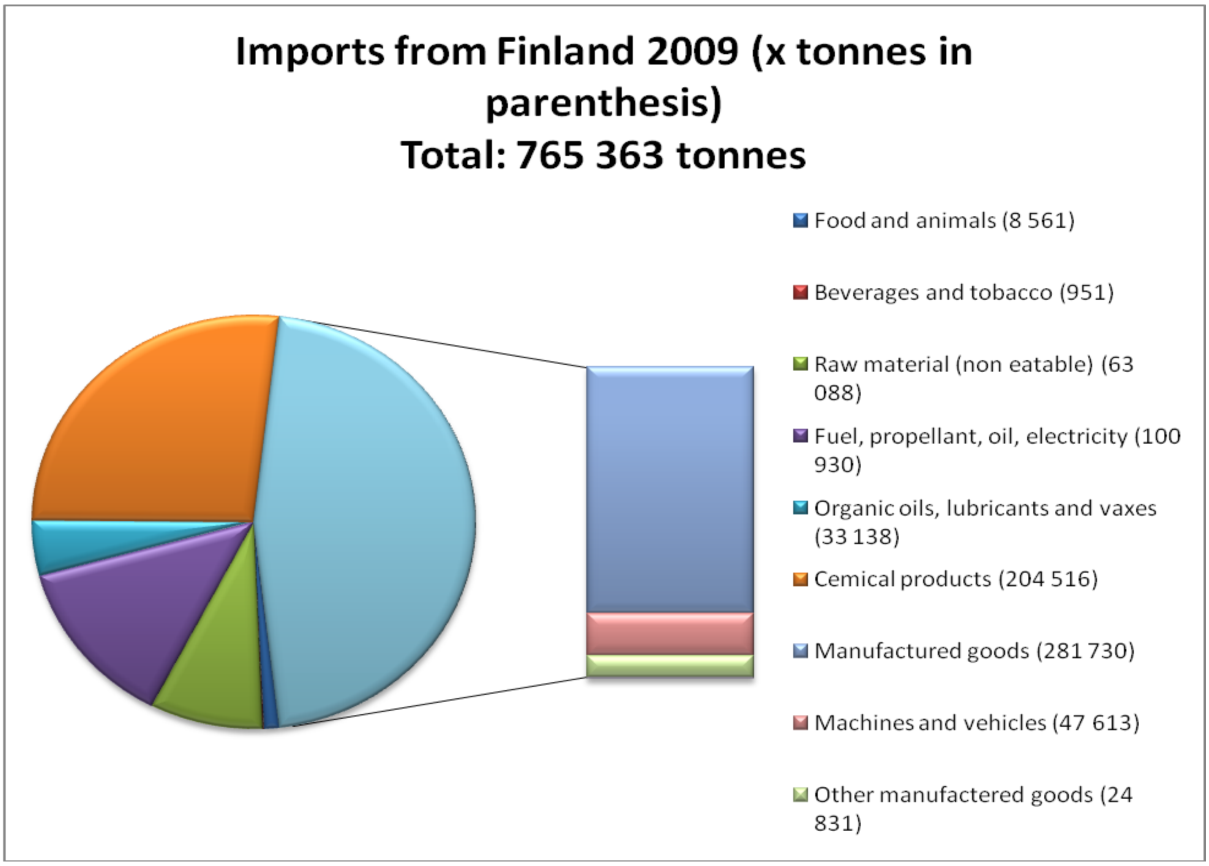

Export to Ukraine 2009 (x tonnes in paranthesis)
Total 200 492
Food and animals (197823)
Beverages and tobacco (3)
Raw material (non eatable) (778)
Fuel, propellant, oil, electricity (0)
Organic oils, lubricants and vaxes (0)
Cemical products (967)
Manufactured goods (649)
Machines and vehicles (222)
Other manufactered goods (46)

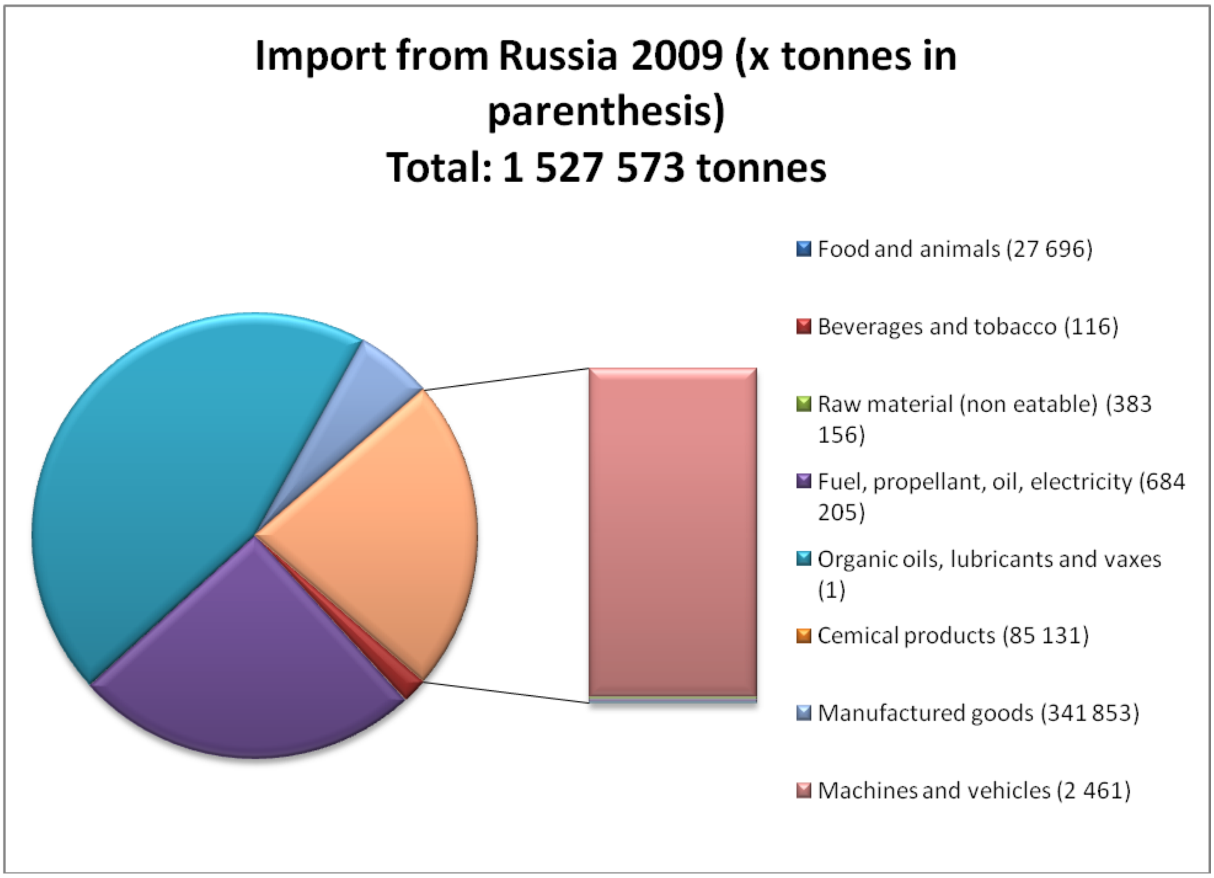

Export to Hungary 2009 (x tonnes in paranthesis)
Total 27 160
Food and animals(407)
Beverages and tobacco (0)
Raw material (non eatable) (1318)
Fuel, propellant, oil, electricity (0)
Organic oils, lubricants and vaxes (9)
Cemical products (6378)
Manufactured goods (18273)
Machines and vehicles (556)

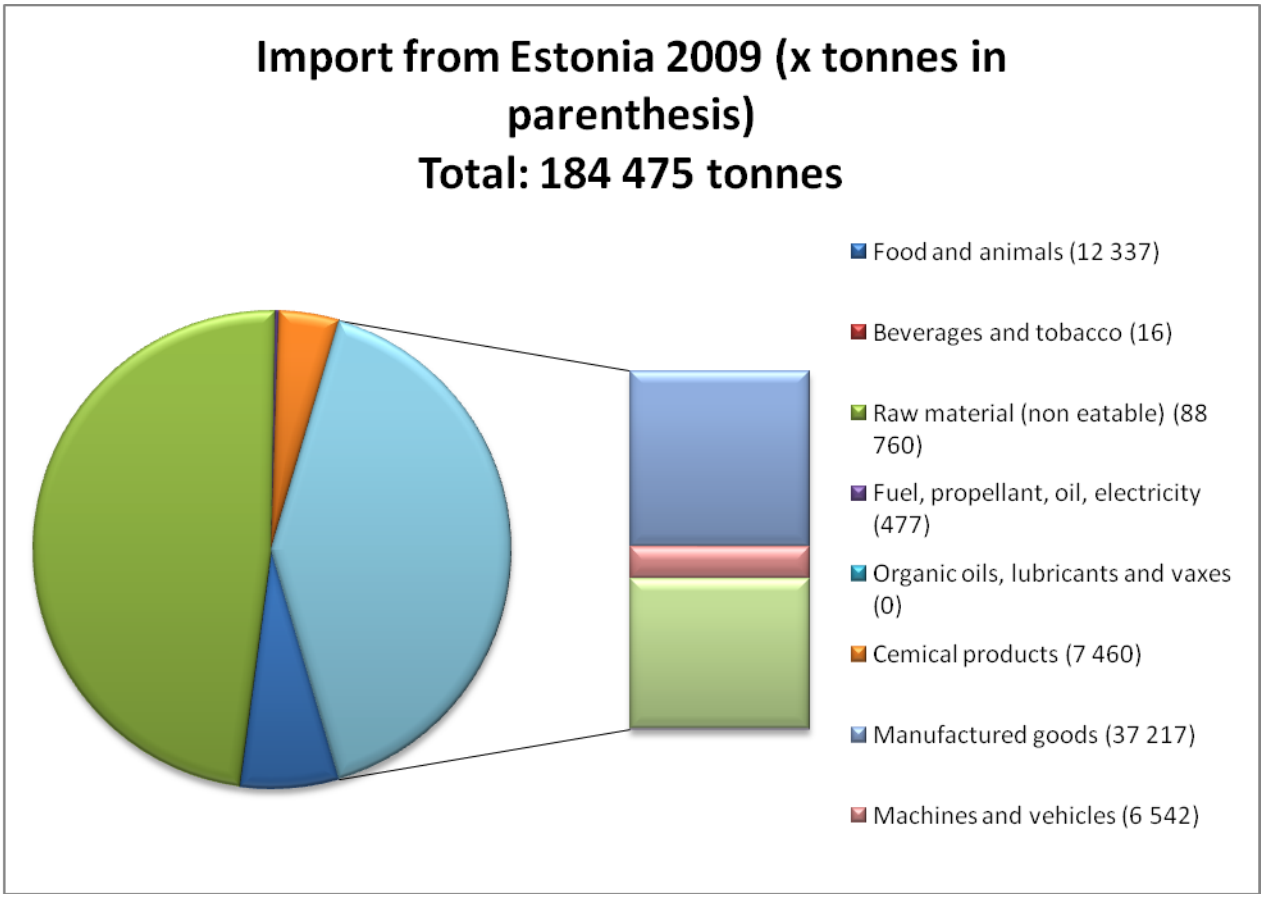

Export to Slovakia 2009 (x tonnes in paranthesis)
Total 25 204
Food and animals (243)
Beverages and tobacco (0)
Raw material (non eatable) (5734)
Fuel, propellant, oil, electricity (0)
Organic oils, lubricants and vaxes (4)
Cemical products (1038)
Manufactured goods (15483)
Machines and vehicles (2650)
Other manufactered goods (49)

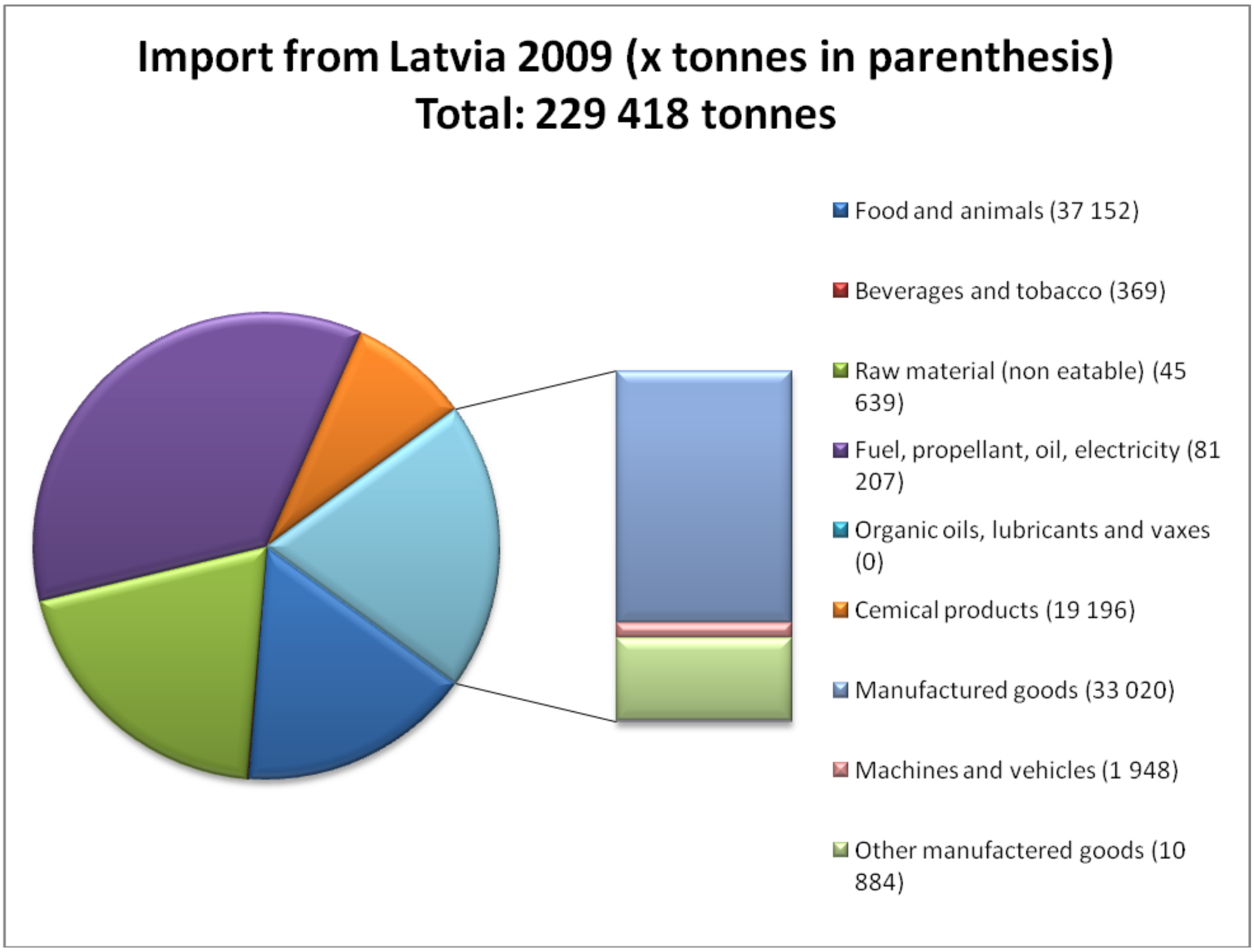

Export to the Chezch Republic x (tonnes in paranthesis)
Total 2 518 542
Food and animals (2392)
Beverages and tobacco (33)
Raw material (non eatable) (2072)
Fuel, propellant, oil, electricity (2 462 785)
Organic oils, lubricants and vaxes (6)
Cemical products (8935)
Manufactured goods (40771)

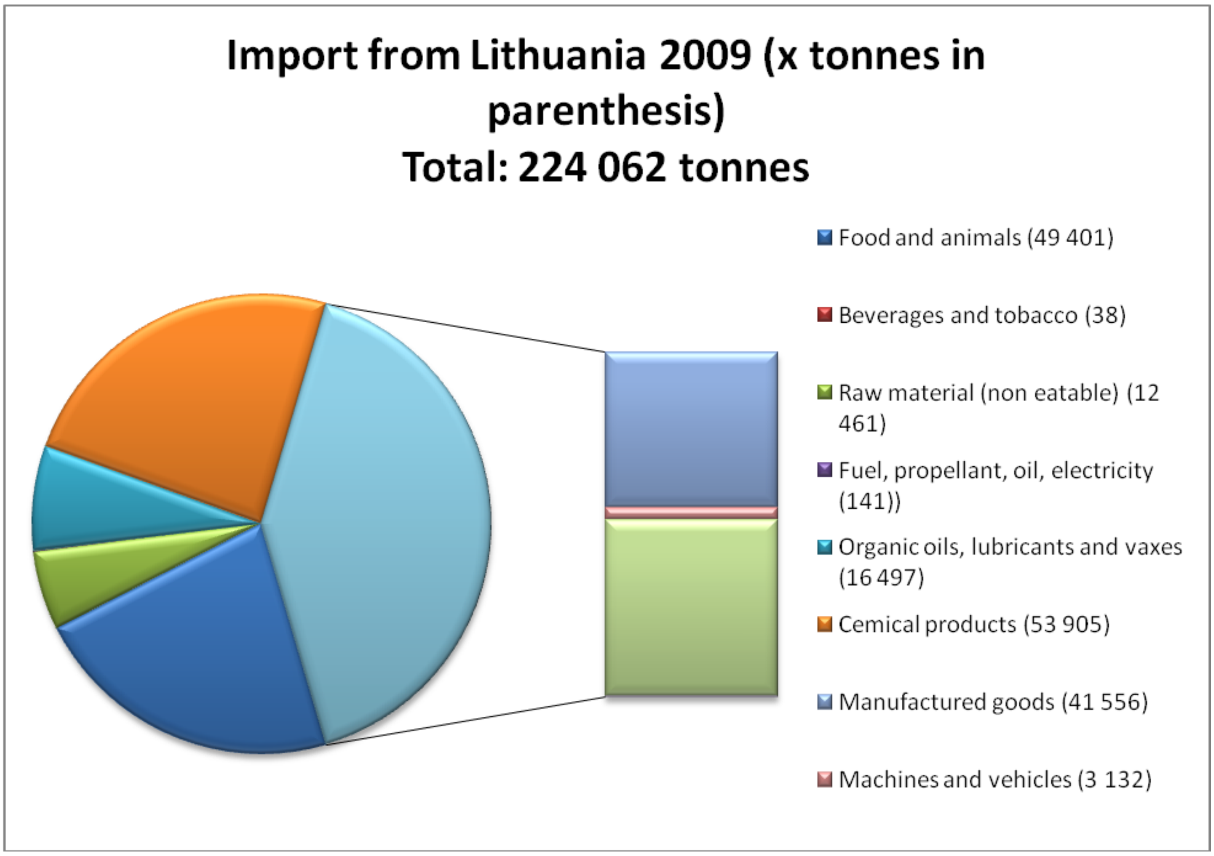

Export from Norway 2009, tonnes
3 000 000
2 500 000
2 000 000
1 500 000
1 000 000
500 000
0
525 664
335 780
156299
404 792
2 399 462
1 861 461
37888
25204
2518542
200492
27160
Russia
Estonia
Lithuania
Latvia
Finland
Poland
Belarus
Slovakia
Czech Republic
Ukraine
Hungary
Total

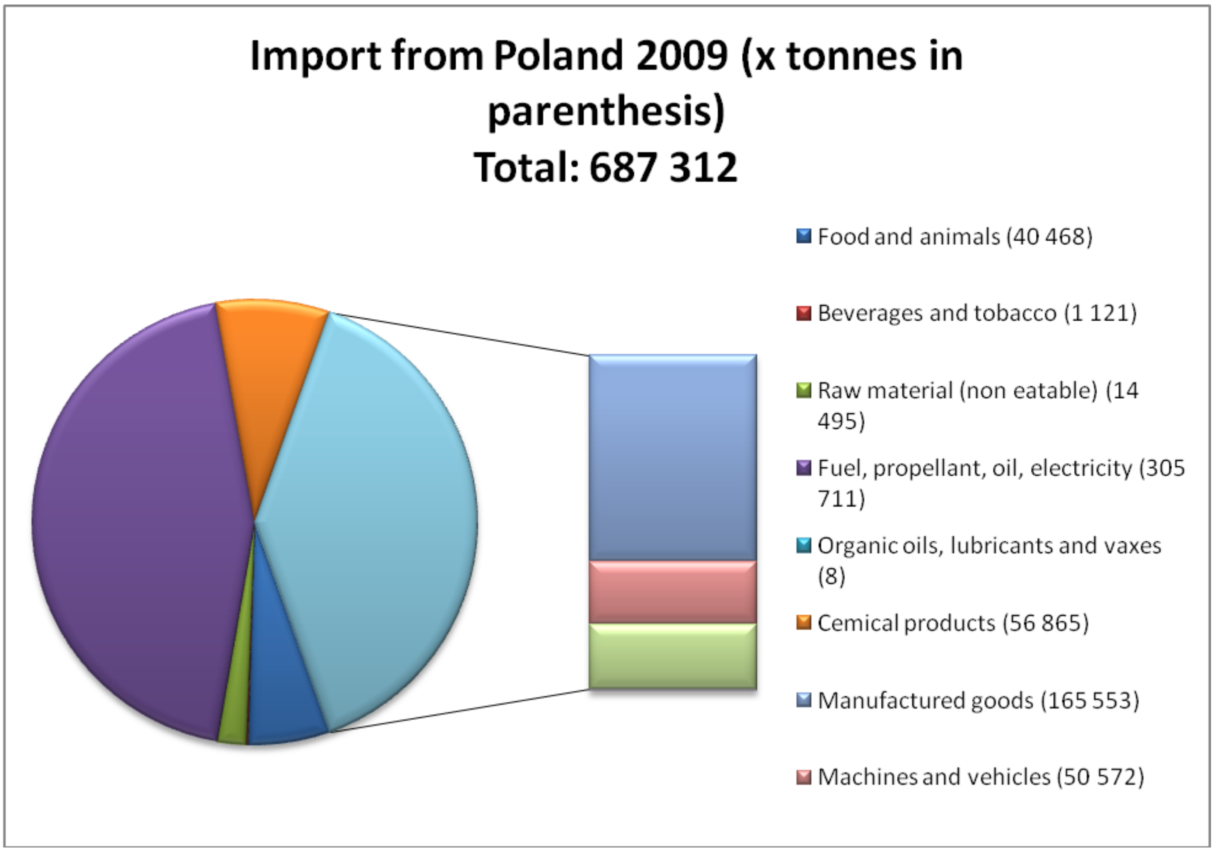

Imports from Finland 2009 (x tonnes in parenthesis)
Total: 765 363 tonnes
Food and animals (8 561)
Beverages and tobacco (951)
Raw material (non eatable) (63 088)
Fuel, propellant, oil, electricity (100 930)
Organic oils, lubricants and vaxes (33 138)
Cemical products (204 516)
Manufactured goods (281 730)
Machines and vehicles (47 613)
Other manufactered goods (24 831)

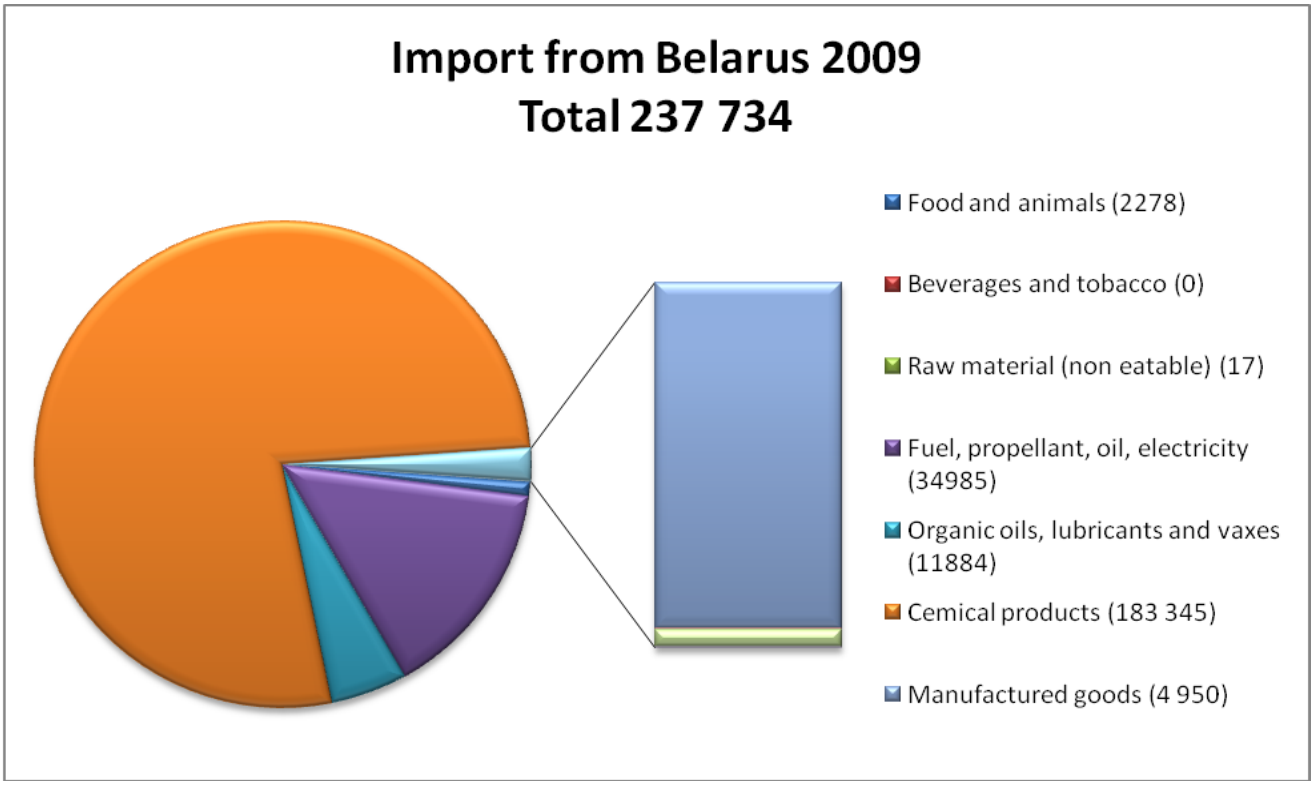

Import from Russia 2009 (x tonnes in parenthesis)
Total: 1 527 573 tonnes
Food and animals (27 696)
Beverages and tobacco (116)
Raw material (non eatable) (383 156)
Fuel, propellant, oil, electricity (684 205)
Organic oils, lubricants and vaxes (1)
Cemical products (85 131)
Manufactured goods (341 853)
Machines and vehicles (2 461)


Import from Estonia 2009 (x tonnes in parenthesis)
Total: 184 475 tonnes
Food and animals (12 337)
Beverages and tobacco (16)
Raw material (non eatable) (88 760)
Fuel, propellant, oil, electricity (477)
Organic oils, lubricants and vaxes (0)
Cemical products (7 460)
Manufactured goods (37 217)
Machines and vehicles (6 542)

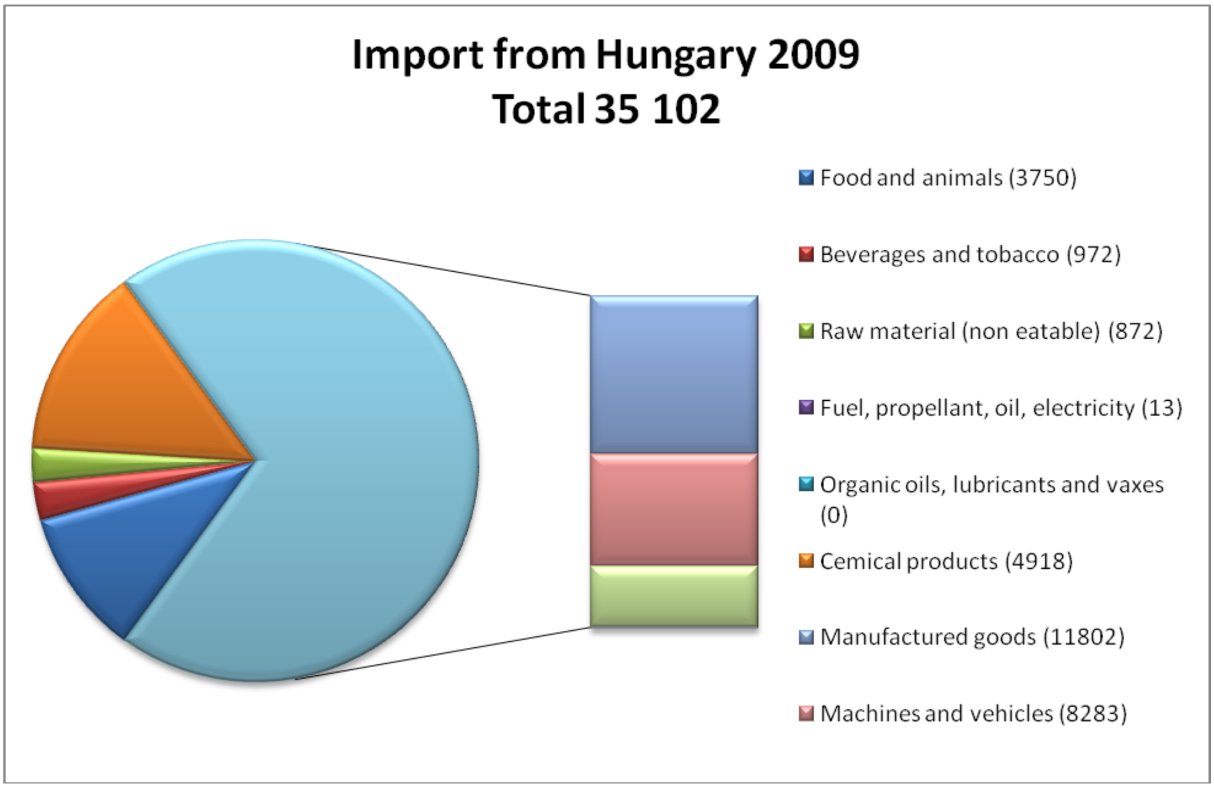

Import from Latvia 2009 (x tonnes in parenthesis)
Total: 229 418 tonnes
Food and animals (37 152)
Beverages and tobacco (369)
Raw material (non eatable) (45 639)
Fuel, propellant, oil, electricity (81 207)
Organic oils, lubricants and vaxes (0)
Cemical products (19 196)
Manufactured goods (33 020)
Machines and vehicles (1 948)
Other manufactered goods (10 884)

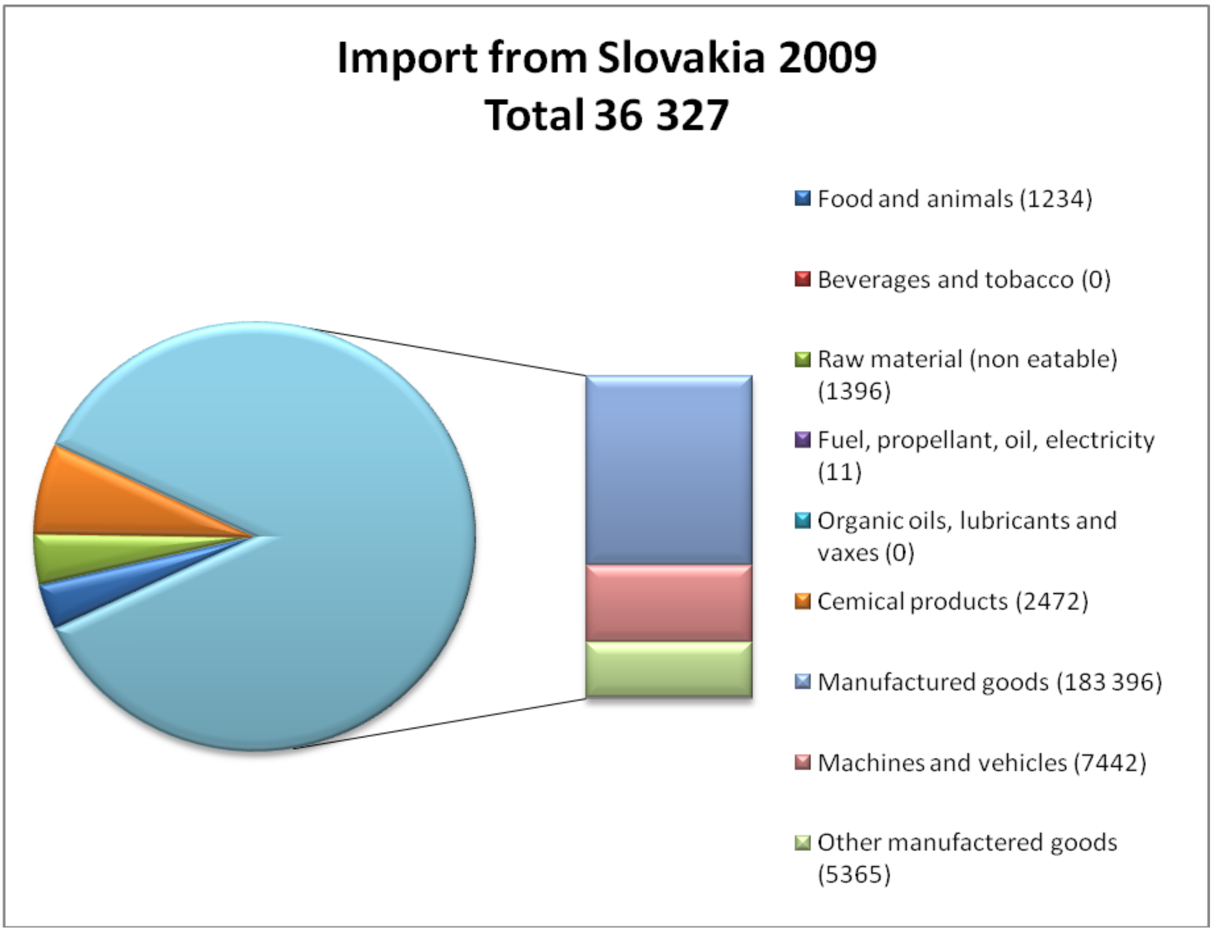

Import from Lithuania 2009 (x tonnes in parenthesis)
Total: 224 062 tonnes
Food and animals (49 401)
Beverages and tobacco (38)
Raw material (non eatable) (12 461)
Fuel, propellant, oil, electricity (141))
Organic oils, lubricants and vaxes (16 497)
Cemical products (53 905)
Manufactured goods (41 556)
Machines and vehicles (3 132)

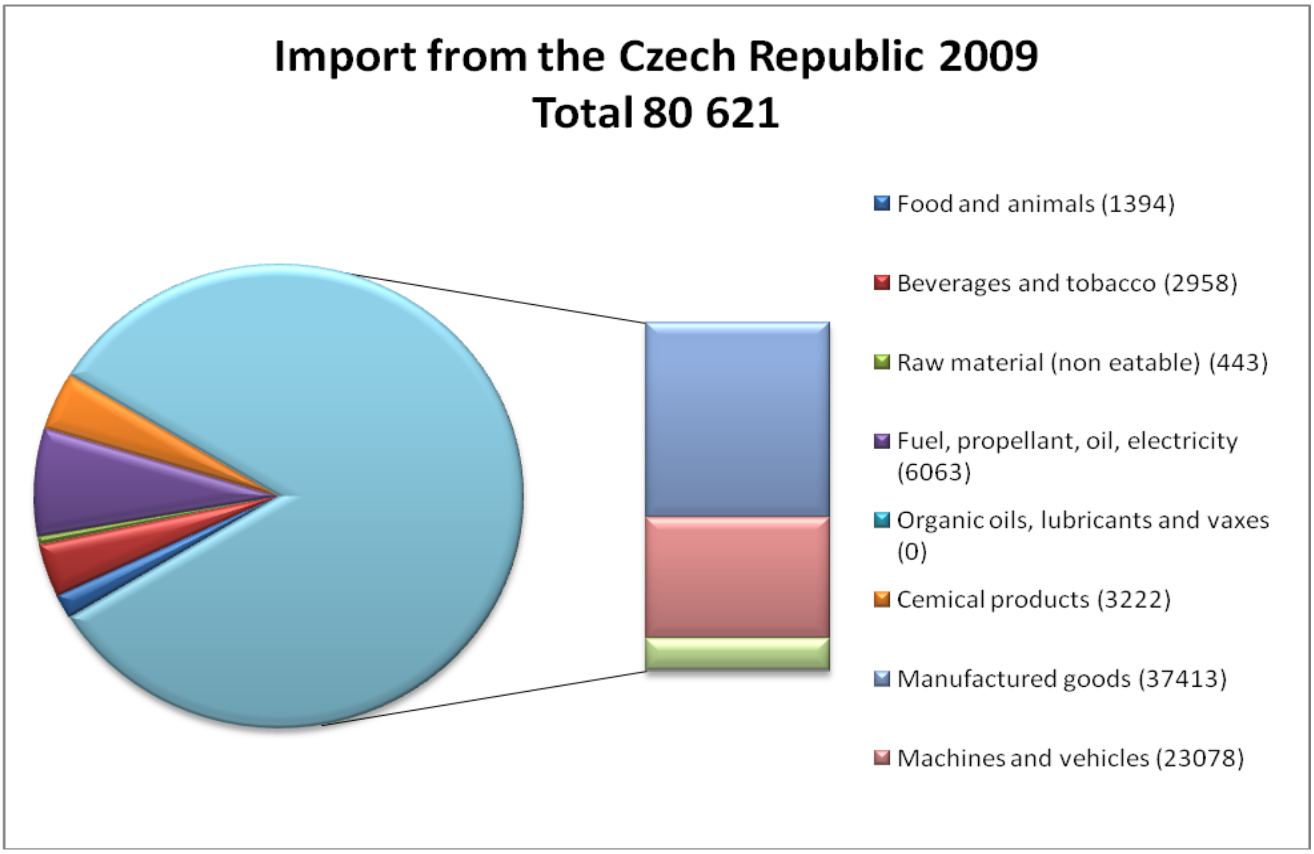

Import from Poland 2009 (x tonnes in parenthesis)
Total: 687 312
Food and animals (40 468)
Beverages and tobacco (1 121)
Raw material (non eatable) (14 495)
Fuel, propellant, oil, electricity (305 711)
Organic oils, lubricants and vaxes (8)
Cemical products (56 865)
Manufactured goods (165 553)
Machines and vehicles (50 572)

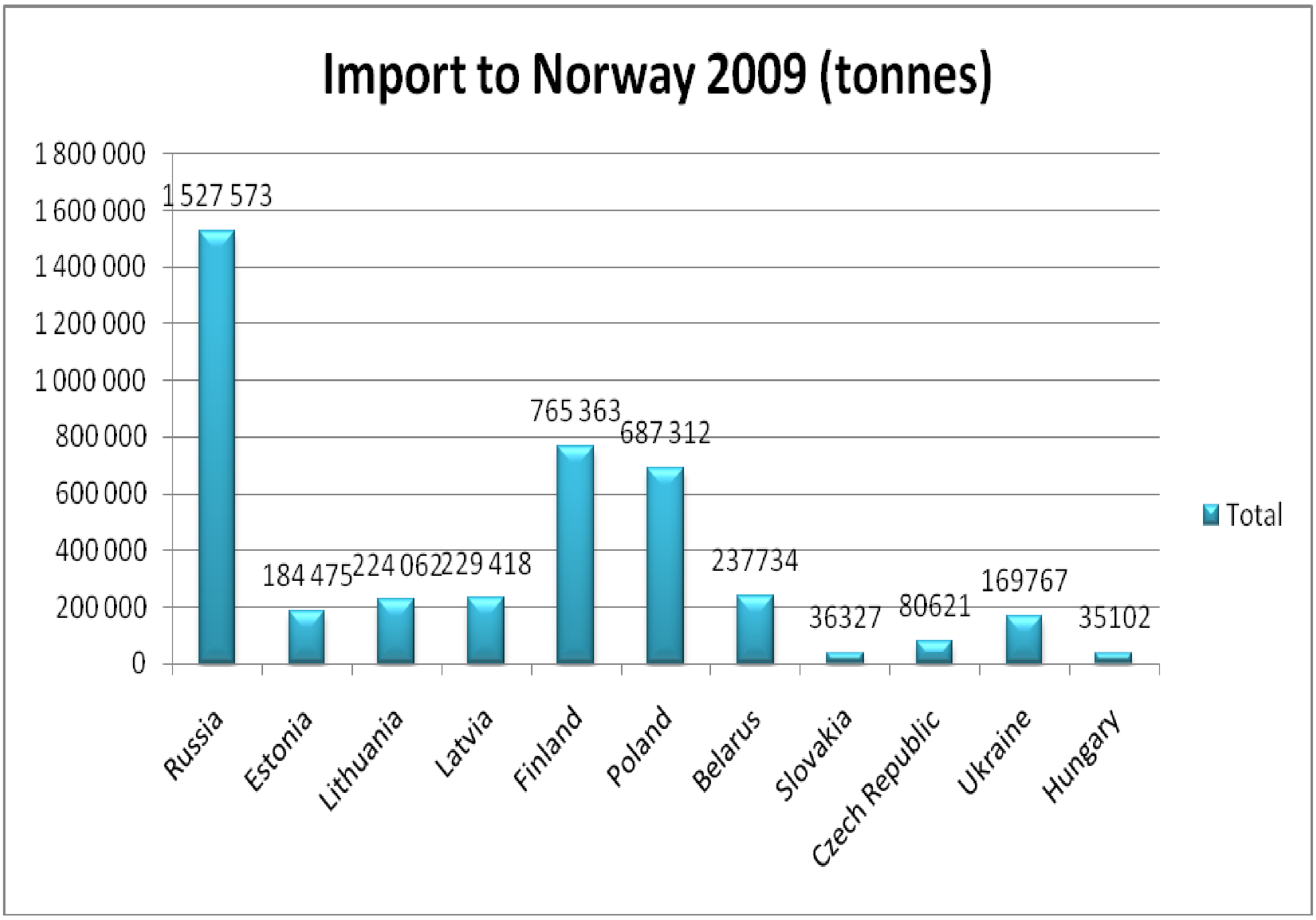

Import from Belarus 2009
Total 237 734
Food and animals (2278)
Beverages and tobacco (0)
Raw material (non eatable) (17)
Fuel, propellant, oil, electricity (34985)
Organic oils, lubricants and vaxes (11884)
Cemical products (183 345)
Manufactured goods (4 950)


Import from Ukraine 2009
Total 169 767
Food and animals (73182)
Beverages and tobacco (0)
Raw material (non eatable) (18300)
Fuel, propellant, oil, electricity (0)
Organic oils, lubricants and vaxes (4527)
Cemical products (68272)
Manufactured goods (4270)


Import from Hungary 2009
Total 35 102
Food and animals (3750)
Beverages and tobacco (972)
Raw material (non eatable) (872)
Fuel, propellant, oil, electricity (13)
Organic oils, lubricants and vaxes (0)
Cemical products (4918)
Manufactured goods (11802)
Machines and vehicles (8283)


Import from Slovakia 2009
Total 36 327
Food and animals (1234)
Beverages and tobacco (0)
Raw material (non eatable) (1396)
Fuel, propellant, oil, electricity (11)
Organic oils, lubricants and vaxes (0)
Cemical products (2472)
Manufactured goods (183 396)
Machines and vehicles (7442)
Other manufactered goods (5365)


Import from the Czech Republic 2009
Total 80 621
Food and animals (1394)
Beverages and tobacco (2958)
Raw material (non eatable) (443)
Fuel, propellant, oil, electricity (6063)
Organic oils, lubricants and vaxes (0)
Cemical products (3222)
Manufactured goods (37413)
Machines and vehicles (23078)


Import to Norway 2009 (tonnes)
1 800 000
1 600 000
1 400 000
1 200 000
1 000 000
800 000
600 000
400 000
200 000
0
1 527 573
184 475
224 062
229 418
765 363
687 312
237734
36327
80621
169767
35102
Russia
Estonia
Lithuania
Latvia
Finland
Poland
Belarus
Slovakia
Czech Republic
Ukraine
Hungary
Total

export 2009	Vessels, foreign	Vessels, NOR	Trucks on vessels	Trailers on vessels	Railwaggon on vessels	Rail transport	Trailer on railwaggon	Road transport	Aircraft	Mail	Other
Finland	920 321	1 283 147		3 083	10	475	160	191 249	109	12	899
Lithuania	76 361	51 980		851		190		26 724	21		172
Latvia	297 779	90 336		455	23			16 185	4		11
Estonia	214 099	99 541		365			38	20 424	39	1	1 271
Russia	170 201	233 425	3 578	5 439		27		112 872	95		26
Poland	1 254 917	387 621	6 846	799		7 349		203 380	101	2	429
Belarus	6560	26386	0	99	100	0	0	4688	0	0	55
Slovakia	5744	11882	0	168	22	91	1	7279	19	0	0
Czech Republic	5335	22796	3	2357	105	92	0	25049	25	1	2
Hungary	6946	4679	0	1623	129	404	0	13365	15	0	0
Ukraine	48940	134821	0	245	69	0	0	16402	15	0	0

import 2009	Vessels, foreign	Vessels, NOR	Trucks on vessels	Trailers on vessels	Railwaggon on vessels	Rail transport	Trailer on railwaggon	Road transport	Aircraft	Mail	Other
Finland	236 519	67 325	3 271	1 003		33 158	1 649	421 128	300	56	955
Lithuania	68 998	68 536	1 619	30		17 320	23	67 441	33	4	59
Latvia	144 324	28 287	155	156		1 104	11	55 346	9	1	27
Estonia	89 647	16 776	515	96	5	701	4	76 681	23	6	21
Russia	1 191 792	297 135	212	352		820		37 177	11		74
Poland	324 265	117 929	7 583	1 482		13 319		221 246	85	343	1 015
Belarus	221631	15674	0	4	24	80	8	312	0	1	0
Slovakia	4 637	901	0	1012	728	4 622	12	24 376	29	4	7
Czech Republic	9 253	6 001	0	4754	2235	2 301	14	55 950	92	14	9
Ukraine	99 289	67 232	0	424	44	255	24	2 493	7	0	0
Hungary	1 124	1 955	0	1043	333	5 237	11	25 346	37	10	7

Appendix C. Contributing companies

The following companies have given information that has contributed to the study:

Company	Category
PKP Cargo	Freight train operator
Green Cargo AB	Freight train operator
Trafikverket (the Swedish Transport Administration)	Infrastructure manager
BAMA Gruppen AS	Cargo owner
Marine Harvest ASA	Cargo owner
Schenker AS	Forwarder
Jernbaneverket (The Norwegian National Rail Administration)	Infrastructure manager
Jernhusen AB	Infrastructure manager (freight terminals and stations)
Toten Transport AS	Road transport
Cargolink AS	Freight train operator
CargoNet	Freight Train Operator
TX Logistik AB	Freight Train Operator
ISS Facility Services	Terminal Operator
Baneservice Scandinavia AB	Terminal Operator
BIRMA AB	Logistics Consultant
NHO Logistikk og Transport (the Norwegian Logistics- and freight Association)	Logistics association

In addition the project group has had a reference group consisting of Kjell Frøyslid former director of CargoNet AS and the Freight Division of the Norwegian State Railway and Christer Beijbom former director of IKEA Rail and the freight division of the Swedish State Railways.

We sincerely thank you all for your time and contribution.

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