ANALYSIS OF THE TECHNOLOGICAL AND SPATIAL NEEDS OF THE MULTIMODAL FREIGHT TERMINAL RAIL BALTICA AT MUUGA HARBOUR (MCTRB)

Work Package 1

Contact details of the Client's representative

Rail Baltic Estonia OÜ
Registry number: 12734109
Address: Harju tn 11, 15072 Tallinn, Estonia

Contact person:

Vaiko Eggert
Vaiko.eggert@rbe.ee

Contact details of Civitta's representative

Civitta Eesti AS
Registry number: 11092241
Address: Lõõtsa 8, 10320 Tallinn, Estonia
DB Engineering & Consulting GmbH
Address: Köpenicker Straße 31, 10179 Berlin, Germany

Report

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Snapshot to the key findings of the WP1 study

The current report reflects the findings of the Muuga Multimodal Freight Terminal Rail Baltica (MCTRB) Work Package 1 "Analysis of the existing situation and prognosis of freight flow demands in the period of 2025-2055". WP1 is a basis for the technical profiling of the terminal together with the cost-benefit analysis.

Rail Baltica (RB) is an international railway corridor and part of TEN-T core network, and it is designed to connect the Baltics with the rest of Europe by European standard gauge (1435 mm). The route will stretch from the Polish/Lithuanian border to Tallinn. In Tallinn, RB will connect to Muuga Harbour, which is specialised in handling transit origin goods and is one of the biggest cargo harbours in the region. The construction of Rail Baltica in the proximity of the main cargo harbour of Estonia is regarded as an opportunity to develop a multi-modal freight terminal (MCTRB) to support the North Sea-Baltic Core Network Corridor. The current study defines the opportunities and barriers in the implementation of the MCTRB project from a transport and economic perspective, provides a benchmark of alternative routes and competition in the area, calculates cargo flows volumes and structure forecast, and gives recommendations on project implementation.

Connecting the largest cargo harbour of Estonia with the trans-European transport network opens up a new paradigm of cargo movement on the North-South axis

Muuga Harbour is the main cargo harbour of the Port of Tallinn. It mainly handles crude oil and oil products (liquid bulk constituted 56 % in 2016), and it also serves dry bulk (26 %), containers (15 %) and other types of cargo. The facilities of the harbour include six liquid bulk terminals, two multi-purpose terminals, container and ro-ro terminals, and dry bulk, grain, steel and coal terminals. Muuga mainly specialises in handling transit goods, which in all account for 80 % of the total transit volume of the Port of Tallinn and around 70 % of all transit cargo passing through Estonia. In the East-West direction, the port of Muuga handles cargo from Russia.

In the North-South direction, Muuga mainly handles Estonian and Finnish cargo exchange, including Finnish exports and imports with European countries. The link to Rail Baltica will substantially increase cargo flows in the North-South direction. The Rail Baltica railway project is the first ever railway project in Estonia with the European 1435 mm gauge. It will establish a better connection between Estonia and Central and Western Europe. It will also bring additional value for Scandinavian and Northwest Russian cargo exchange.

Rail Baltica will boost the organic growth of the economy and widen the catchment area of Muuga port

According to analysis from the World Trade Organisation (WTO), trade has typically grown in recent decades at 1.5 times faster than GDP. In 2012, it slipped towards 1:1 and has remained stable for the last 4 years. The annual GDP growth of the Baltic states is forecasted at 2-3 % throughout the next decade and between 1 and 2 % subsequently. This brings approximately 7.5-8 million tonnes of total cargo volume in the 2015-2035 period, according to our study forecast. This organic growth of the economy will be supported by additional benefits created by Rail Baltica.

In considering the fact that Rail Baltica will bring an entirely new dimension of North-South 1435 mm connection to Muuga and the opportunity to synergise it with the existing 1520 mm East-West connection, the catchment area of the Muuga MCTRB is widening significantly. According to the study results, we see additional volumes of 3.5-4 million at Muuga.

Environmental and economic incentives will increase the role of rail transportation

The split between transportation modes shows a high dependence on road transport. Due to an increasing amount of political measures, the share of road transport is expected to diminish and this will divert additional flow for Rail Baltica and Muuga MCTRB. Rail transport remains a strong priority in the EU TEN-T Regulation.

Rail is to become faster and more reliable. Implementation of the 4th Railway Package will deal with the bottlenecks in the current rail network and improve the competitiveness of rail for longer distances.

According to the current study, rail transportation will be faster (approx. 1:2) and less costly (approx. 0.9:1) than road transportation by 2035.

Muuga port is well positioned against the main competing corridors

The immediate catchment area for Muuga is Sweden, Finland, Latvia, Lithuania and Northwest Russia, which altogether constitute 65 % of Muuga Harbour inbound freight flows. The study examines 17 competing corridors that are relevant for the Muuga multimodal terminal and concludes that Muuga is well positioned against the main competing corridors.

Direction	Corridor though Muuga	Competing routes
North-South	Westward corridor (Warsaw-West of Germany direction) Southward corridor (Warsaw-Vienna-Adriatic Sea)	By sea from Finland to Polish/German ports
		By sea from Finland to North Sea hubs and onwards to Germany
		Finland to Germany via Sweden (Fehmarn tunnel)
		By sea from Finland, southwards from one of the Estonian ports by road
		By sea from Finland, via the Port of Sillamäe by 1520 mm gauge rail to the South
East-West	Railway to Russia and through Russia to Central Asia	Finnish ports linked by rail to Russia
		Cargo directly to Russia's own ports
		East-West cargo through Latvian and Lithuanian ports
		East-West cargo by rail through Belarus
	Road to Russia and through Russia to Central Asia	Finnish corridor
		Cargo directly to Russia's own ports
		Through the port of Sillamäe
		Latvian and Lithuanian corridor
Asia-related	Adriatic corridor	To Finland from the Mediterranean Sea via North Sea hubs or via the Adriatic Sea, rail to North and via the port of Gdansk
	Arctic route	All Southern corridors and the Arctic via the North Sea hubs
	Ocean container carriers from Asia	Through all ports between Gdansk and St. Petersburg
	Transcontinental railway route from China	Through Kouvola, St. Petersburg or Riga

In the North-South direction, the most relevant directions for Muuga multimodal terminal would be the southern branch from Warsaw towards Vienna and from there towards the Adriatic Sea and the western branch from Warsaw to Berlin. In the opposite direction, the Muuga multimodal terminal could be used as a preferred EU location for the warehousing and distribution for European cargo en route to Russia. The option of using Rail Baltica also has a significant time advantage in comparison to several existing ground and maritime transportation routes in the North-South direction. In East-West direction, aside from the current East-West cargo routes, Muuga is expected to become an intermediary stop for Asian cargo. The study reveals the potential of bringing Chinese rail containers to Muuga for redistribution in Scandinavia. This would be faster and for some categories of cargo more cost effective than using the existing routing through the Mediterranean sea.

The peak volumes for the Rail Baltica and Muuga multimodal terminal are forecasted for 2045

According to the modelling results, in 2025 the volume of cargo handled by Muuga Harbour will reach 20.2 million tons (in 2015 it handled 13.7 million t). The highest amount of cargo handled in Muuga is reached in 2045. This will be 26.3 million tons. These are the flows of the harbour activity combined with the benefits from Rail Baltica.

Regarding Rail Baltica cargo flows, the Estonian RB section in 2045 will be dominated by container goods – constituting 48 % of total freight flows. From a commodity type perspective, the largest share of cargo will consist of miscellaneous articles (31 %), wood and cork (12 %), and coal chemicals, other chemicals, paper pulp and waste paper (14 %).

In comparison with other studies where Rail Baltica cargo flows were calculated, this study is moderately optimistic. Rail Baltica CBA (2017) estimates 6.5 million tonnes of cargo in the Tallinn-Pärnu section in 2045, which is lower than this study (9.2 million), due to more conservative estimates for bulk goods on Rail Baltica and presumably a slower increase in the share of containerised goods and Rail Baltica related ro-ro traffic. The Helsinki-Tallinn Transport Link feasibility study (2018) estimates non-tunnel freight flow to peak at 7 million.

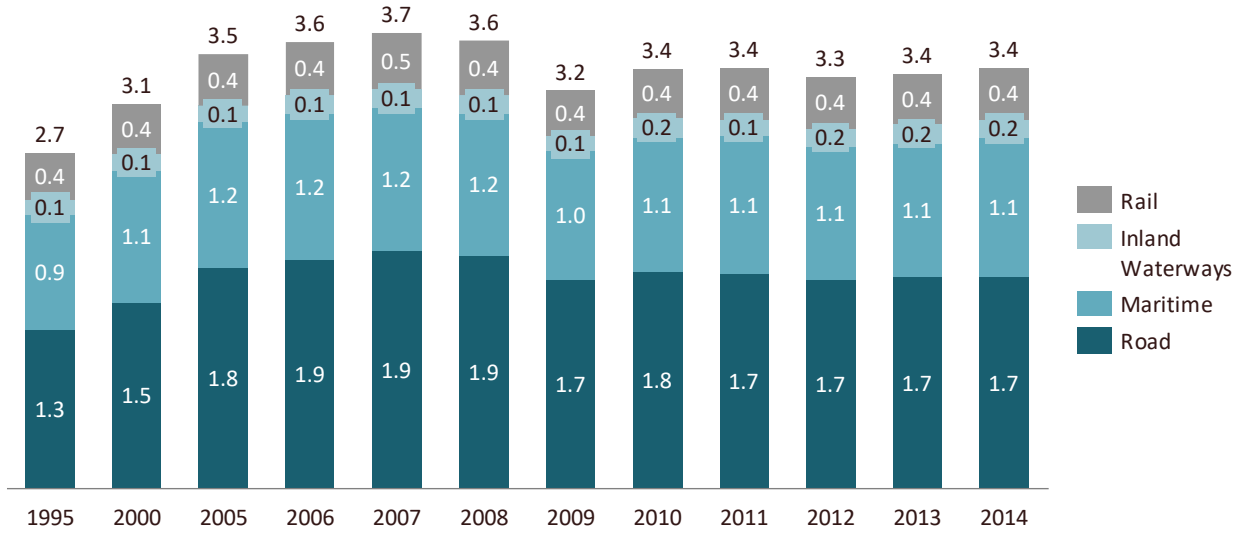
1. Intro to the Future Transportation Development

Transport is embedded in the economy both in terms of operations and demand: transport services require input from several sectors of the economy, i.e. manufacturing, logistics, marketing and insurance. Chapter 1 evaluates the potential effect of particular regulative taxes, road tolls and other direct costs on modal split in freight transport and the European transport and logistics market. This chapter demonstrates that the future developments in European transport policies will improve the rail sector and worsen the competitiveness of long distance road transportation.

1.1. Future Transportation Development

Currently, road transport is dominating freight transportation, especially in intra-EU trade, and rail transport is one of the least competitive means of transportation. There are several reasons for this, such as the higher flexibility of road transportation, more developed infrastructure and lower transportation tariffs. Due to an increasing strength of political measures, the share of road transport is expected to diminish (read more from Annex 6.3).

Figure 1. Freight transport volume and modal split in the EU 1995-2014, billion thousand ton-kilometres



Source: European Environmental Agency[1]

[1] https://www.eea.europa.eu/data-and-maps/daviz/freight-transport-volume-4#tab-chart_1

The main trend in transport and logistics in the EU relates to the environmental restrictions due to increasing greenhouse gas emissions. A range of regulations has been adopted in the EU in recent years that are focused on the reduction of greenhouse gas emissions, the development of a sustainable transport system, the promotion of "green" means of transport and strengthening legislation for road transport. These regulations and directives have been the key challenges for the road transport sector.[2] The EU transport policy aims at a form of mobility that is sustainable, energy-efficient and respectful of the environment. This implies a greater use of multimodal solutions that combine optimally various modes of transport, by utilising each one's strength and minimising the weaknesses, and relying on waterborne and rail modes for long haul.[3] This, combined with EU White Paper strategy and development of the railway network, could lead to a modal shift from sea to rail transport.

The share of road transport is decreasing due to environmental concerns and regulations, strict work and rest time regulations that make road transport less competitive, and congested traffic that limits the speed of road transport.

Estonian respondent (manufacturing)

Rail Baltica and the Muuga multimodal terminal will be influenced by the following measures to be implemented by the EU:

- Adoption of new regulative directives for CO_2. The White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system", adopted by the European Commission in March 2011, aims to reduce greenhouse gas emissions (GHG) in the transport sector by at least 60 % by 2050 compared to 1990; and shift 30 % of road freight over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50 % by 2050, facilitated by efficient and green freight corridors.
- Regulative directives for CO2 for trucks. Since 2010, the European Commission has been developing a computer simulation tool (VECTO) to measure CO2 emissions from new vehicles. This tool will be used to propose legislation that would require CO2 emissions from new heavy-duty vehicles to be certified, reported and monitored. In addition, the Commission may consider further measures to curb CO2 emissions from heavy-duty vehicles, such as by setting mandatory limits on average CO2 emissions from newly-registered heavy-duty vehicles.
- Regulative directives for CO2 for ships. The Baltic Sea is one of the world's most polluted seas. Eutrophication, a major problem in the Baltic Sea area, is caused by the emission of nitrogen oxides. The main cause of nitrogen oxides emission in the Baltic and North Sea is due to ships. To reduce the impact, the North Sea and Baltic Sea region has developed an action plan to improve the condition of the sea by becoming part of NECA (NOx Emission Control Area). In the Baltic Sea, nitrogen oxide emissions are to be reduced by 80 per cent from the present level. The regulation will be applicable to new ships built after 1 January 2021 when sailing in the Baltic Sea and the North Sea. Older ships are being steadily replaced by new ships. As a result, in the NECA scenario, only Tier II ships are being added to the fleet in the 2011-2019 period, and only Tier III ships from 2021 onwards. As a result, Tier 0 ships will be fully phased out between 2026 and 2029, and Tier I ships will be fully phased out in the period from 2036 to 2039. Capital investments in the new fleet would influence companies operating in this area, leading to an increase in the price of shipping. Another established action is the development of LNG terminals around the coastline of the Baltic Sea, which would allow ships to use more environmentally friendly fuels.

Policies discriminating the road transportation mean higher shipping costs for the Baltic consumers.

International logistics company

[2]The 4th Railway Package adopted in 2013 is aimed at completing the Single European Railway area to foster European competitiveness and growth. The main goal is the creation of a single European rail area, which will make rail transport safer and reliable, thereby becoming a more competitive means of transportation.

[3] https://ec.europa.eu/transport/themes/logistics_multimodal_en

- Tax on traffic congestion. The European Commission amended the existing Eurovignette directive[4] to provide Member States with the ability to levy higher toll charges for trucks on heavily congested routes or in environmentally sensitive areas, provided that alternative ways of shifting freight are available. If this directive is fully implemented, it will give road haulers incentives to use cleaner trucks and vehicles that cause less damage to the road infrastructure. As a result, truck operators can be forced to make large investments into new trucks, which can make them less competitive.
- Internalisation of transport external costs. According to the White Paper, all EU countries in the period from 2016 to 2020 have to maintain a mandatory internationalisation of external costs (including noise, local pollution and congestion) for road and rail transport. Since road transport has higher external costs than rail transport,[5] road transport could become less competitive for long-haul transport. According to the paper's forecasts, congestion costs will increase by about 50 % by 2050.
- Road taxation for heavy vehicles. Common rules for road taxation were established by Directive 1999/62/EC[6] (amended by Directive 2011/76/EU).[7] According to this Directive, the cost of constructing, operating and developing infrastructure can be leveraged through tolls and vignettes to heavy goods vehicles (above 3.5 t). Although the application of tolls and vignettes is not mandatory for the Member States, most EU countries adopt charges on heavy vehicles. Some member states (e.g. Denmark, Luxembourg, the Netherlands and Sweden) introduced a common system of charges for heavy goods vehicles above 12 t (Eurovignette system).[8] Austria, Bulgaria, Czech Republic, Hungary, Moldova, Romania, Slovakia, Slovenia and Switzerland use national systems of vignettes while other EU countries use road tolls that are based on distance travelled by a vehicle. Currently, Estonia has an annual tax for heavy vehicles that weigh 12 tons or more. The cars are taxed according to the register of truck weight, the number of axles and type of suspension on the driving axle. In the case of trailers, the tax is determined by the weight or gross laden weight.[9] However, on 1 January 2018, the Estonian government established a time-based road user charge for heavy goods motor vehicles. A similar road user charge is already being levied in Latvia and Lithuania, which make up the Via Baltica road transport corridor with Estonia.[10] The idea is to tax vehicles that pass through Estonia (approximately 5 500 heavy trucks per day). Heavy loads are damaging roads and affecting their maintenance; therefore, the heavy-duty road fee is to be allocated to investment in the development and maintenance of road infrastructure. Estonia is also planning to levy the tax on vehicles with a maximum mass of 3.5 tons or more.[11]

The EU regulations also put pressure on the cost of road transport by increasing employer costs related to workers' social security. In regard to road transport, there is weaker legislation for workers in the Eastern and Southern countries than elsewhere in the EU. If these disparities are addressed in EU regulations, they are likely to increase the costs of road transport in countries where it currently has a competitive edge due to the low price. The following measures are applied:

[4] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0062&from=EN
[5] http://ec.europa.eu/transport/sites/transport/files/themes/sustainable/studies/doc/2014-handbook-external-costs-transport.pdf
[6] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:187:0042:0050:EN:PDF
[7] https://ec.europa.eu/transport/modes/road/road_charging/charging_hgv_en
[8] https://www.eurovignettes.eu/portal/
[9] https://www.riigiteataja.ee/akt/130122011026
[10] http://www.baltic-course.com/eng/transport/?doc=126124
[11] http://majandus24.postimees.ee/4033381/teekasutustasu-hakkab-kehtima-ka-12-tonnist-kergematele-veokitele

- An increase in *per diem* and accommodation costs for truck operators. According to the Regulation 561/2006, commercial truck drivers are prohibited from spending regular weekly rest time in their vehicle cabin. For example, in France, failure to comply with this law could lead to a year's imprisonment and a fine of 30 000 EUR.[12]
- An increase in the minimum wages of drivers. Belgium, Austria, Netherlands, Italy, France and Germany set a local minimum salary for truck drivers. Many other countries may follow this lead.

As a general trend, increasingly strict work-time and environmental regulations in the EU are impeding the use of road transport. Therefore, we see rail as reasonable alternative.

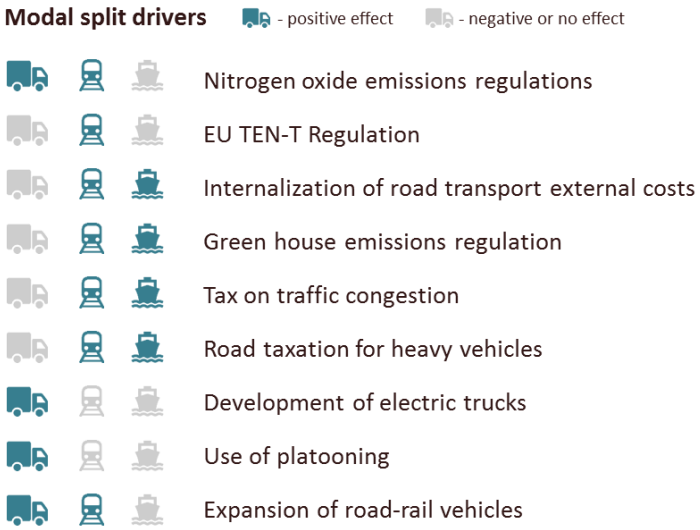
Logistics company, Estonia

There are multiple factors that can positively affect road transportation; however, these developments mainly concern the last miles of delivery:

- Introduction of electric trucks. An electric truck is a truck powered by electricity and considered to be emission-free. Daimler AG, one of the largest producers of heavy vehicles,[13] has already introduced the first electric heavy truck called Urban eTruck,[14] which has a range of up to 200 km, making it ideal for typical distribution runs. Further improvements to the performance of Li-ion batteries can substantially increase the range of the trucks and make them suitable for long haulage. According to Directive 2014/94/EU, the charging infrastructure for electric cars will be created by the end of 2025, at least on the TEN-T Core Network, in urban/suburban agglomerations and other densely populated areas. The introduction of electric trucks will significantly boost the competitiveness of road transport over short distances (up to 300 km), while the competitive advantages of road and rail may vary for longer distances.[15]
- Development of platooning. According to Daimler AG, linking trucks in a "platoon" can lead to 7 % in fuel savings and a 50 % reduction in required road space. In 2016, Netherlands European Truck Platooning Challenge was organised, where 6 automated trucks (DAF Trucks, Daimler Trucks, Iveco, MAN Truck & Bus, Scania AB and Volvo Trucks) ran on public roads from several European cities to the Netherlands. By 2020, it is expected that platooning trucks will become a common means of road freight transportation, with two or more trucks driving in platoon on a motorway or a major road.[16] Before platoons can drive across Europe, various national vehicle and road authorities will have to provide exemptions: until recently, there were major differences in approval regulations regarding the admission of automated trucks on public roads.
- Use of road-rail vehicles. Road-rail vehicles can operate on both railway tracks and conventional roads. They take advantage of the low rolling resistance and fuel economy of rail transport and flexibility of road transport.

[12] http://www.grangeshipping.co.uk/news/france-introduces-ban-on-drivers-sleeping-in-cabs
[13] https://www.statista.com/statistics/270293/worldwide-leading-truck-manufacturers-based-on-production-figures
[14] https://www.daimler.com/documents/investors/reports/annual-report/daimler/daimler-ir-annualreport-2016.pdf
[15] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0094
[16]https://www.eutruckplatooning.com/Workspace/Conference+Truck+Platooning+Challenge+7+April+2016/HandlerDownloadFiles.ashx?id=569893

Figure 2. Summary of EU cargo market forces and their impact on different freight types



Source: Expert assumptions

The modal split trends reveal the potential for Multimodal Freight Terminal Rail Baltica at Muuga Harbour due to the increasing role and active promotion of rail transportation by the EU, which is to result in the increased usage of rail transport, mainly when the transportation distance is longer than 300 km.

Estimation of efficiency parameters of different transportation modes

There is no reliable systematic picture of the comparable ratios of the efficiency of transportation modes. In most Central and Western European countries, the transportation structures are web-type and the distances for overland transport are short.

Muuga Harbour could be seen as a corridor-type transportation structure that is characterised by longer distances and a high share of transit transport. Table 1 provides an estimate of the potential efficiency of different transportation modes until 2055.

Table 1. Estimation of the modal shift by 2055

	Comparison of cost: railway vs. road transport	Explanation	Measures of rail transport competitiveness improvement
Current situation	Rail transport is more costly	The low competitiveness of rail transport is primarily due to border crossing time and the incompatibility of national railway systems.	-
Likely situation in 2025-2035[17]	Rail transport is less costly.	Measures applied in 2017-2025 (enforcing the 4th Railway Package) will result in an increase in rail transport competitiveness compared with other modes of transport, technological changes regarding road transport take off (interlocked road trains) but are insufficient to compensate for the	Integrating rail transport system into more complex transport systems (multimodality, intermodality etc.). Introducing new profitable block train

[17] The parameters of the RB project (speed etc.) have been achieved, there is greater ecological pressure on road transport and (to a lesser degree) maritime transport, and new technology-related changes in different modes of transport are moderate.

	Comparison of cost: railway vs. road transport	Explanation	Measures of rail transport competitiveness improvement
		decrease in competitiveness of road transport against rail transport.	routes on more long-distance routes.
Likely situation in 2035-2055[18]	The cost of rail transport costs is almost equal to that of road transport.	Due to new techniques, like autonomous trucks, road transport will slightly improve its competitiveness. Maritime transport retains its relative competitiveness (on the one hand, more efficient engines, smaller crew; on the other hand – ecological pressure). Technological opportunities to boost rail transport competitiveness are more limited than those for roads.	Need to utilise more advanced technologies in the coupling and uncoupling of wagons and loading/unloading of containers during short stays in freight stations to gain more flexibility in rail transport.

Source: Expert estimations. The ratios provided in the table represent only approximate hypotheses.

Rail transport for cargo is currently the least competitive means of transportation; it loses both in terms of speed and cost and it can only compete in bulk transport, which is partly due to a higher reliability of delivery. The main reason for the weak performance is the incompatibility of the railway systems of individual countries and border crossings.

Due to EU and national policies, rail will gradually become a more competitive means of transportation. New faster railway lines will be built (e.g. Rail Baltica) and older ones will be modernised, bridges and tunnels will be built, the obstructive effect of state borders will be overcome and national systems of transportation will become compatible.

2. Rail Baltica and the TEN-T network

An effective and well-running transport infrastructure is essential to maintaining the European Union's competitiveness and wealth. The Muuga multimodal terminal should be viewed in the context of the wider TEN-T network.

The TEN-T and CEF Regulations (1315-1316/2013) define the strategic guidelines and technical parameters for the European transport development for 2030 (core network) and 2050 (comprehensive network). The highest strategic level consists of nine core network corridors (CNC). The catchment area of MCTRB includes directly two CNCs: North Sea-Baltic and Scandinavian-Mediterranean. The Baltic-Adriatic CNC has distinct significance in that it forms the outer edge of the catchment area from Poland to the Adriatic Sea. The Orient-East Med and Rhine-Danube CNCs reach the Black Sea and hence merge with the Southern fringe.

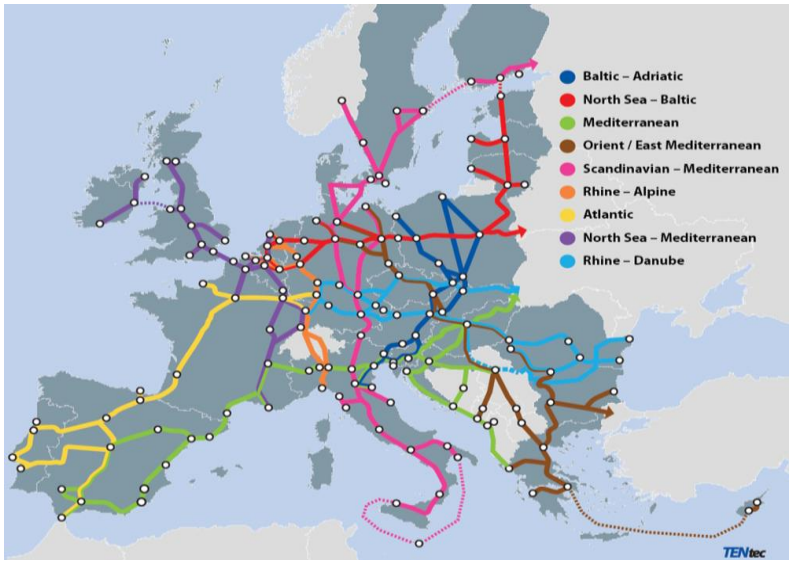
Rail Baltica is an important part of the Trans-European Transport Network project. It is aimed at integrating the Baltic states into the European railway network. The project involves five European Union countries: Poland, Lithuania, Latvia, Estonia and, indirectly, Finland. The rail line will connect Tallinn, Pärnu, Riga, Panevėžys, Kaunas, Vilnius and Warsaw.

Rail Baltica is more than just a connector of the Baltic states to Europe. It also serves as an alternative route to Finland and the Commonwealth of Independent States (CIS). According to the Rail Baltica Global Cost-Benefit Analysis (CBA) prepared by Ernst & Young Baltic Ltd (EY), it is estimated that approximately 57 per cent of all cargo on the new railway will be in transit – first, consisting of Finland's trade with the rest of

[18] Ecological pressure continues, along with changes in the efficiency of use of different modes of transport due to new technological and transport organisation opportunities

the EU and, second, composed of transshipment between the rest of the EU and the CIS. The current study confirms these findings with a more optimistic outlook.

The TEN-T strategy means access to the 1435 mm railway network for the Baltic region. This would make the entire region more competitive. Figure 3. Map of TEN-T routes



Source: European Commission[19]

Additional future trade route potential for the catchment area lies in the Arctic and Northern Sea route and rail connection to Asia (read more in annex 6.5.6).

Most of the railway system in the Baltic states is incompatible with the rest of Europe due to the different gauge size. This makes direct rail linkage between the Central and Eastern Europe regions complicated and relatively expensive. Also, the current infrastructure does not allow for sufficiently fast passenger and cargo speeds in the North-South direction. Rail Baltica aims to bridge these gaps by eliminating this critical missing link in the European railway network and integrating the Baltic states into the European rail logistics ecosystem, thereby also strengthening the functioning of the Single European Market.

The Rail Baltica project aims to ensure a safe, fast and high-quality connection between the Baltic states and the major economic, administrative and cultural centres of Western Europe. Interoperability with the Polish and German 1435 mm gauge networks is an important aspect of the project because international traffic in the North-South direction with the present 1520 mm gauge rail network in the Baltic states is quite inefficient and not effective. Also, the symbolic aim of Rail Baltica is to physically reintegrate the former Soviet Baltic states to Europe's transport infrastructure.

[19]http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/maps_upload/SchematicA0_EUcorridor_map.pdf

Figure 4. Rail Baltica axis: Warsaw-Kaunas-Riga-Tallinn-Helsinki

Source: RB Rail[20]

[20] http://www.railbaltica.org/about-rail-baltica/maps/

3. Port of Muuga

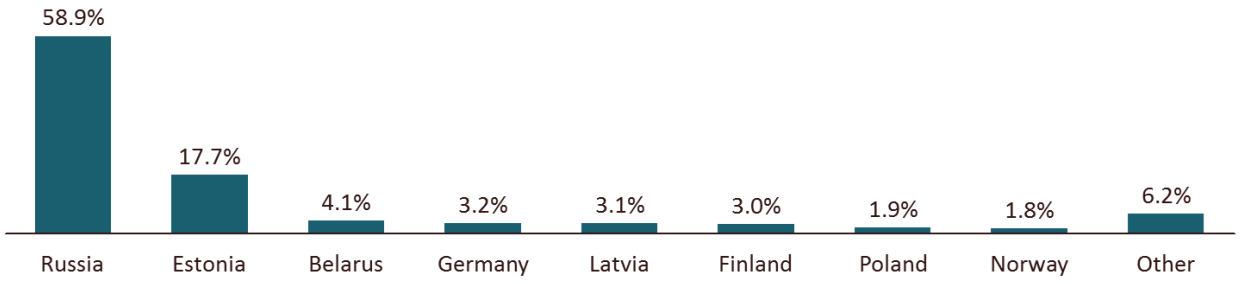
Port of Muuga is the biggest cargo harbour in Estonia and it mainly specialises in handling transit origin goods. It is the main cargo harbour of the state-owned company Port of Tallinn, which operates as a landlord port model. It is among the deepest and most modern ports in the Baltic Sea region and the future location of the Rail Baltica multimodal terminal.

3.1. Role of Muuga Harbour

The cargo volume handled through Muuga Harbour accounts for around 80 % of the total cargo volume of the Port of Tallinn and approximately 70 % of the transit cargo volume passing through Estonia. Nearly 3/4 of cargo loaded in Muuga Harbour includes crude oil and oil products, but the harbour also serves dry bulk (mostly fertilisers, grain and coal) and other types of cargo.

The major transport flows through Muuga have always been associated with Russia, mainly due to the transit of oil products. Despite the recent decline, Russia still occupies the main place, accounting for almost 60 % (9 m tons) of Muuga cargo freight (see Figure 5).

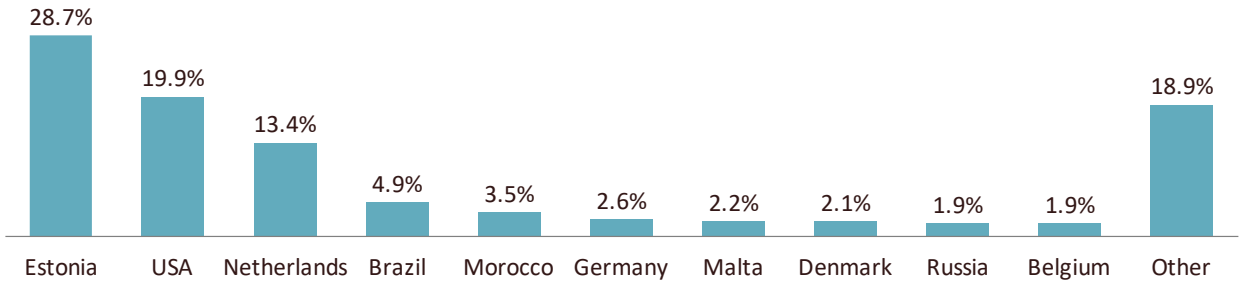
Figure 5. Structure of freight flows through Muuga Harbour by origin country in 2015



Source: Port of Tallinn internal data

The international destinations of the goods transported through Muuga are more diverse and include the USA (mainly oil products), Netherlands (oil products and products in containers) and Brazil (fertilisers) (see Figure 6).

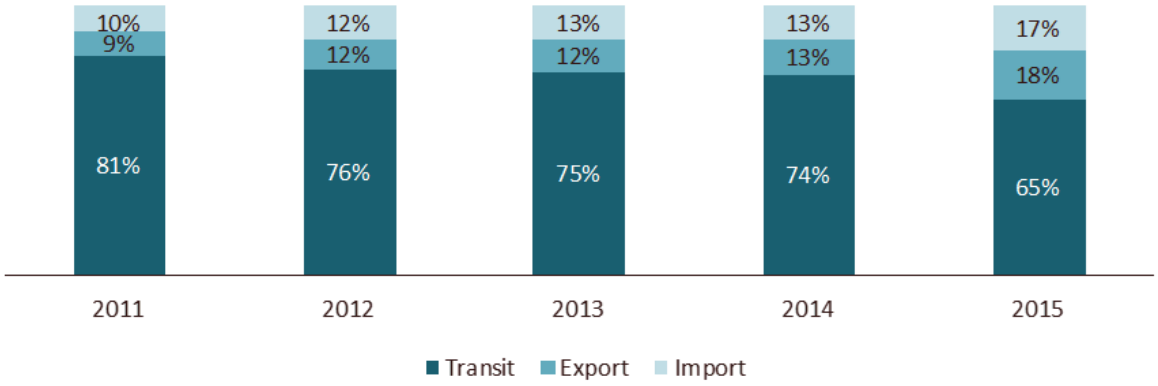
Figure 6. Structure of freight flows through Muuga Harbour by destination country in 2015



Source: Port of Tallinn internal data

The majority of international freight traffic in Estonia travels solely through ports or through ports together with a road/rail combination. **Transit goods still dominate in the operations of Estonian ports** (see Figure 7)**.**

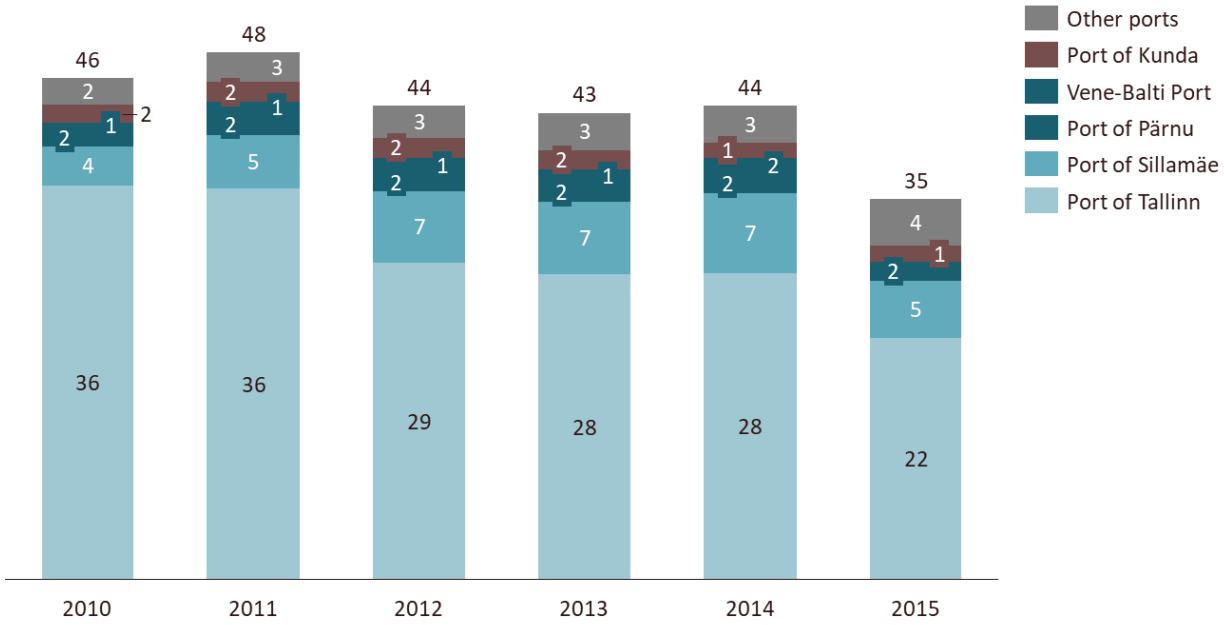
Figure 7. Freight flows through Port of Tallinn



Source: Port of Tallinn annual report 2017[21]

The Port of Tallinn was influenced by geopolitical change (see Figure 8), particularly Muuga, which accumulates around 70 % of Estonian transit flow. By 2015, the volumes of oil through Muuga decreased more than twice in comparison to 2011. The main reason for this is the significant drop in transit from Russia, which now mostly relies on its own infrastructure. The volume of liquid cargo in 2016 decreased more than three times in comparison to 2011 and resulted in 6.6 m tons. Instead, the harbour increased the freight of dry bulk and container cargo.

Figure 8. Freight volumes through the main ports of Estonia, million t



The "Other ports" category includes ports handling less than 1 million t of goods annually.

Source: Statistics Estonia[22]

[21] http://www.portoftallinn.com/annual-reports

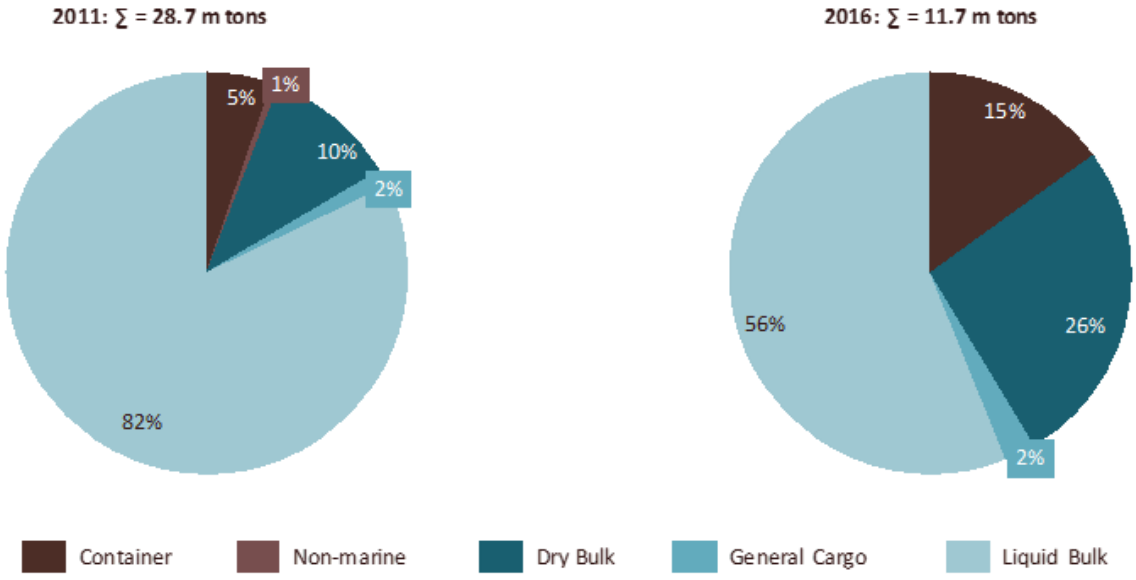
[22] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC175&ti=GOODS+TRANSPORT+THROUGH+MAIN+ESTONIAN+PORTS+BY+CARGO+TYPE+%28QUARTERS%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=TC175&lang=1

The "Estonian transport development plan 2014-2020"[23] outlines the development of infrastructure. In 2020, Estonia should have a capacity to serve at least 86 million tons of cargo, out of which 60 m tons will be handled by ports, 21 m tons by rail and 5 m tons by road. The infrastructure development measures include cooperation with the maritime network, promoting the development of port infrastructure and support for the development of international maritime freight transport.

The potential for Muuga Harbour and Rail Baltica can be seen when taking into consideration Estonia's main trading partners, which in 2015 were Sweden, Finland and Latvia (see Annex 6.5.1).

In terms of commodity structure, Muuga specialises in the transportation of oil and fertilisers, which account for 69 % and 11 %, respectively, of all cargo volumes through Muuga, while products in containers occupy 15 % (see Figure 9). The main international partner in container cargo transportation for Muuga is Germany: in 2015, Germany accounted for 26 % of all containers that were delivered to Muuga Harbour (445.6 thousand tonnes).

Figure 9. Structure of freight flows through Muuga Harbour

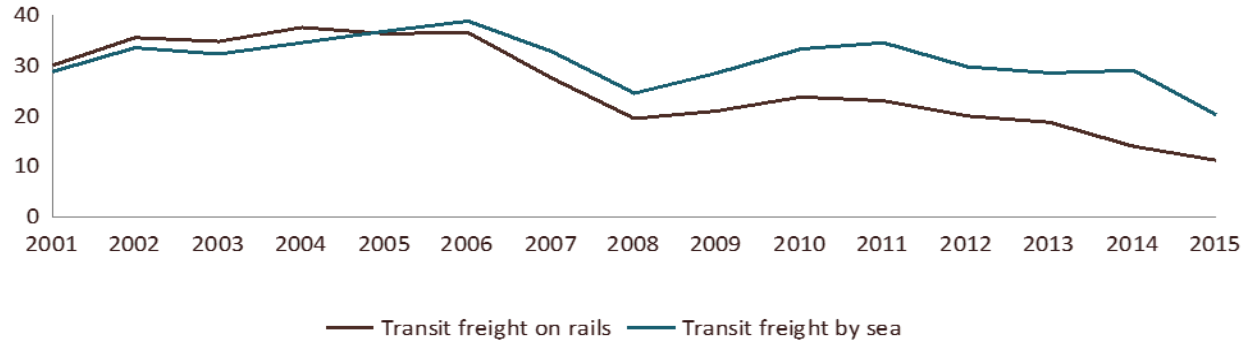


Source: Port of Muuga statistics

Prior to 2007, Muuga port was in a good position to handle Russian transit flows, primarily because of its advantageous geographical position and the insufficient capacities of ports and infrastructure within Russia. Since around 2007 Russia has begun to actively develop its transport infrastructure and shift cargo flows to internal ports. As a consequence, transit through Estonia over the last decade has declined significantly.[24] This decline is primarily due to a decrease in oil flows and **could be mitigated by replacing this flow with other types of cargo; expert estimations and modelling show that most increases in cargo from Russia could be in the form of containerised goods.**

[23] https://www.riigiteataja.ee/aktilisa/3210/2201/4001/arengukava.pdf
[24] https://www.riigikogu.ee/wpcms/wp-content/uploads/2014/11/Eesti_transiit_ja_logistika_II_osa.pdf

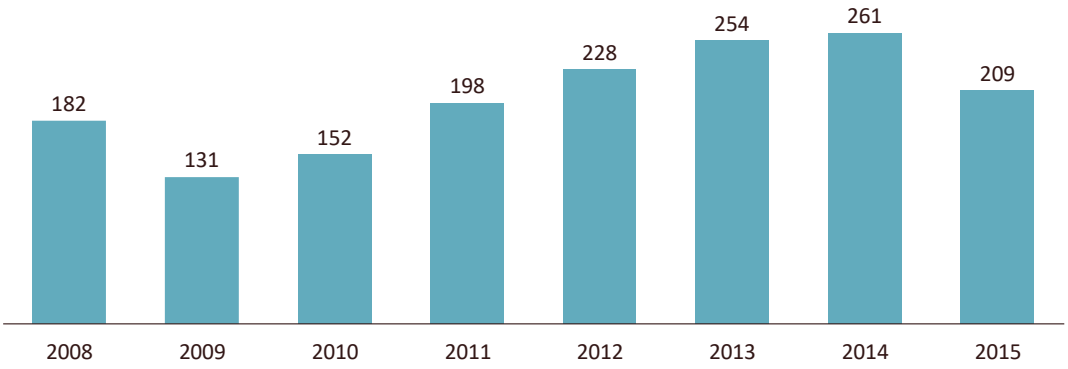
Figure 10. Estonian transit freight by transport mode, million t



Source: Statistics Estonia[25]

In 2015, container transport volumes in ports fell from 261 thousand TEU to 209 thousand TEU, in line with the general decrease in freight flows. The volume of container goods decreased by 1.74 million tons, or 12 % (see Figure 11).[26]

Figure 11. Container transport via Estonian ports (thousand TEU)

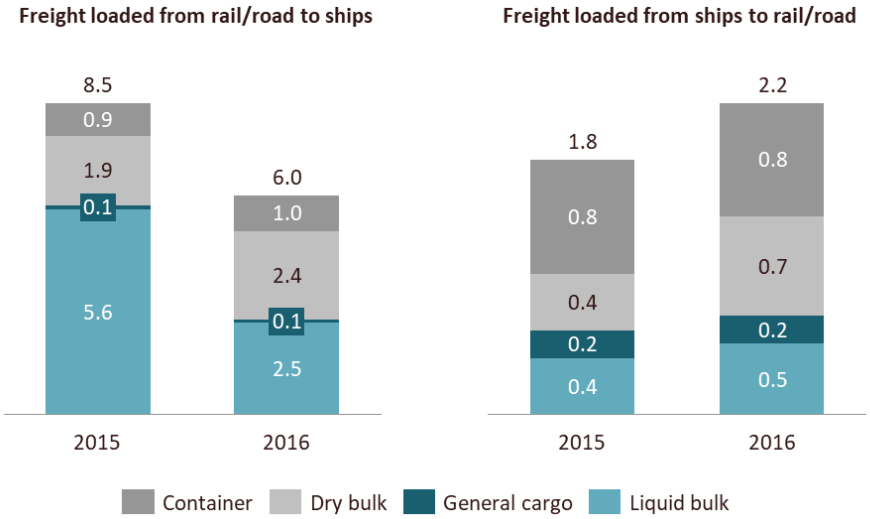


Source: Statistics Estonia[27]

Muuga occupied **34 % of the total volume of cargo** loaded by the Estonian ports. In 2016, loading decreased by 21 %, mainly due to liquid bulk. In terms of cargo types, the largest increase is observed in dry bulk (around 35 %). Despite the overall decline in container turnover in Estonia, Muuga Harbour experienced a slight increase in handling containers (from 1.71 m tons to 1.76 tons, particularly, 40 ft. containers) (see Figure 12).

[25] http://pub.stat.ee/px-web.2001/I_Databas/Economy/34Transport/04General_data_of_transport/04General_data_of_transport.asp
[26] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf
[27] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=Tc1812&ti=TRANSPORT+OF+SEA+CONTAINERS+THROUGH+PORTS&path=../I_databas/Economy/34Transport/16Water_transport/&search=CONTAINER&lang=1

Figure 12. Freight flows through Muuga Harbour by cargo type, million t[28]



Source: Port of Muuga statistics

Following the intermodal transportation development trend in the EU, the carriage of containers by road (see Table 2) and rail (see Table 3) are also increasing in Estonian ports (including Muuga).

Table 2. Sea containers passing through Estonian ports by road transport 2008-2013, thousand TEU

Year	Exported full containers	Exported empty containers	Imported full containers	Imported empty containers
2008	76.4	17.4	33.3	58.3
2009	49.6	25.0	38.5	36.1
2010	59.6	28.3	43.6	42.6
2011	76.9	30.9	46.8	59.9
2012	85.0	30.8	48.9	62.9
2013	87.1	35.5	55.6	63.8

Source: Statistics Estonia[29]

Table 3. Sea containers passing through Estonian ports by rail transport 2008-2013, thousand TEU

Year	Exported full containers	Exported empty containers	Imported full containers	Imported empty containers
2008	11 816	10	123	3 801
2009	11 869	1	26	2 243
2010	18 421	12	84	2 106
2011	23 306	90	200	8 363

[28] Loading is from rail/road to ship, while unloading is from ship to rail/road; this does not include loading to/from storage
[29] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC534&ti=GOODS+CARRIED+BY+ROAD+BY+TYPE+OF+CARGO&path=../I_databas/Economy/34Transport/08Road_transport/&search=CONTAINER&lang=1

2012	30 934	82	1 726	15 756
2013	34 035	31	1 562	26 564

Source: Statistics Estonia[30]

[30] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC1414&ti=TRANSPORT+OF+CONTAINERS+BY+RAIL+TRANSPORT&path=../I_databas/Economy/34Transport/06Rail_transport/&search=CONTAINER&lang=1

4. Competing Corridors of the Muuga Catchment Area

The aim of this chapter is to evaluate the competitiveness of MCTRB and to assess the possibilities in relation to competitors and competing transport corridors after Rail Baltica will be launched. The chapter includes analyses of the transport corridors passing Muuga, including North-South/South-North cargo flows, East-West/West-East cargo flows and cargo flows related to Asia (East and South Asia), and it examines their competitiveness in relation to the competing corridors. The findings of this chapter were compared and correlated with the modelling results.

4.1. Evaluation of appropriate multimodal transport corridors

4.1.1. Definition of the catchment area of Muuga Harbour

The MCTRB catchment area is defined through the geography of cargo movement relevant to the Port of Muuga. It mainly stretches out as a North-South and East-West axis and primarily focuses on the target countries of the trade flows to Estonia, which are countries that use Estonian infrastructure for the purpose of transporting goods for either trade or transit: Finland, Latvia, Lithuania and Northwest Russia.

The North-South axis of trade flows through Estonia mostly involves freight **flows to and from Finland and other Baltic states**. This represents important potential for Rail Baltica and the Muuga multimodal terminal. The most important region in terms of cargo flow in the northeast corner of the catchment area is the **St. Petersburg region**. This direction is currently vulnerable due to changes in the political climate, but in the long run it also represents promising potential for the Muuga multimodal terminal and Rail Baltica.

This potential is not only attributed to Russian cargo exchange but also to the growing share of EU-Asian inland corridor trade. The annual growth of Asian trade is expected to reach 10 % in 2021-2030.[31] The catchment area towards the East connects strategically with the catchment area in the North-South direction – a land connection that did not exist previously (from Finland to South-East EU and connection routes towards Asia). In the West, the **Benelux countries** and the **United Kingdom** form an important element of origin-destination matrix in the northeastern EU. Currently, maritime transport is the prevailing transport mode in trade between countries of the North Sea and Baltic Sea, but Rail Baltica would diversify shipping opportunities here as well. Various companies are already shipping to their British locations through Muuga Harbour. Rail Baltica will diversify this option further.

[31] www.about.hsbc.de/-/media/.../2015-12-08-hsbc-global-trade-forecast-dez-2015.pdf

By rail, the Rail Freight Corridor North Sea Baltic (former RFC 8) covers the East-West axis on the same alignment as the North Sea-Baltic core network corridor (from Antwerp/Rotterdam/Amsterdam seaports) at the North Sea reaching through Germany and Poland to Kaunas. In the future, enabled by Rail Baltica, the Rail Freight Corridor North Sea Baltic will extend to Tallinn.

A full overview of the countries in the Muuga catchment area is provided in the Annex 6.4.

4.1.2. Multimodal transport corridors: approach to competitiveness

For the purposes of this analysis, a "corridor" refers to a direction with a significant amount of goods flowing consistently, usually combining different transportation modes. These corridors do not necessarily overlap with corridors defined by the TEN-T. The analysis of transport corridors is split into three parts:

1. North-South/South-North (N-S/S-N) cargo flows. Cargo transportation between the northern, western and southern European countries. Ukraine and Belarus are also included here.
2. East-West/West-East (E-W/W-E) cargo flows. Cargo flows related to Russia, Kazakhstan and the Central Asian countries.
3. Cargo flows related to Asia (East and South Asia). Cargo flows related to China and the rest of East Asia, if they arrive to Estonia directly without reloading. If cargo from China reaches Muuga by a feeder ship from Rotterdam, it is treated as part of the West-East cargo flow.

All these directions are not isolated and can mutually augment each other. The future of Muuga multimodal terminal depends on handling these three types of flows. All the relevant transport corridors within these flows are listed in Table 4.

Table 4. Current and potential transport corridors passing through Muuga and competing corridors

Direction	Corridor though Muuga	Competing corridors
North-South	Westward corridor (Warsaw-West of Germany direction) Southward corridor (Warsaw-Vienna-Adriatic Sea)	By sea from Finland to Polish/German ports
		By sea from Finland to North Sea hubs and further to Germany
		Finland to Germany via Sweden (Fehmarn tunnel)
		By sea from Finland, southward from Estonian ports by road
		By sea from Finland, via the Port of Sillamäe by 1520 gauge rail to the South
East-West	Railway to Russia and through Russia to Central Asia	Finnish ports linked by rail to Russia
		Cargo directly to Russia's own ports
		East-West cargo through Latvian and Lithuanian ports
		East-West cargo by rail through Belarus
	Road to Russia and through Russia to Central Asia	Finnish corridor
		Cargo directly to Russia's own ports
		Through the port of Sillamäe
		Latvian and Lithuanian corridor
Asia-related	Adriatic corridor	To Finland from the Mediterranean Sea via North Sea hubs or via the Adriatic Sea, rail to North and via the port of Gdansk
	Arctic route	All Southern corridors and the Arctic via the North Sea hubs
	Ocean container carriers from Asia	Through all ports between Gdansk and St. Petersburg

Direction	Corridor though Muuga	Competing corridors
	Transcontinental railway route from China	Through Kouvola, St. Petersburg or Riga

A detailed description of each of the competing corridors with illustrations and evaluations is presented in annexes 6.7.1.1, 6.7.1.2 and 6.7.1.3.

4.1.3. North-South/South-North direction corridors

The N-S/S-N catchment area is relatively narrow at the Northern end (Finland, as well as Sweden to a limited extent), but much wider at the Southern end, where it covers most of Central and Southern Europe. Since the potential cargo flow from South to North derives from various sources and geographic locations, its content and transport requirements are more diversified than for the cargo moving southward.

In total, we identified 5 competing corridors of the MCTRB region in the N-S/S-N direction. One of the main competitors to Rail Baltica and Muuga multimodal terminal is the maritime transportation route from Finland to Polish/German ports. This competing route has the potential to serve a substantial amount of Finnish imports and exports related to Germany and also industrial hotspots in Central and Eastern Europe, for example. Other competing routes on the N-S/S-N would include the following:

a) The maritime route from Finland to Latvian or Lithuanian ports, extending southward via rail or road. Possible in principle, e.g. from Southwest Finland, but involves longer travel time and lower frequency issues (less ro-ro lines in comparison with Muuga).

b) The maritime route from Finland past Estonia to the Southern Baltic ports in Poland (port of Gdansk) or Germany, then by rail or road southward and later towards Southern or Western routes. As sea transport generally costs lower, this corridor could be competitive as it also threatens other destinations.

c) Finland's link to Europe through Sweden (after the completion of the Fehmarn tunnel).

The competitiveness of the N-S/S-N corridor through Muuga depends on how rail transport can compete with other corridors and modes of transportation. The Muuga multimodal terminal would need to attract cargo from the competing corridors with faster, cheaper, more frequent shipment or value-added services.

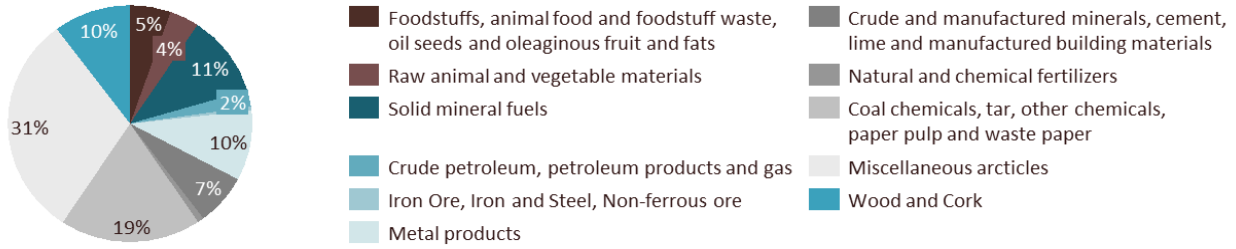
The Rail Baltica trade corridor would initially reach to Warsaw by rail. Further on, it would split into several branches:

- **Southern branching in the direction of Austria/Adriatic Sea.**
- **Western branching in the direction of Germany.**

These two directions define the core business of the Muuga multimodal terminal in the NS-SN direction.

The Southern branching is a connection point to the Adriatic Corridor that would enable access to Mediterranean EU and non-EU countries.

Figure 13 illustrates our modelled cargo distribution arriving and departing Finland in 2035 by commodity types. Here, we can identify a substantial amount of containerised goods and traditional Finnish export commodities such as paper, wood products and chemicals. These findings are very similar to previous studies in terms of composition.



Source: Goudappel model

The existing 1520 mm gauge railway (see also Annex 6.7.1) would not be an alternative to N-S/S-N cargo traffic, as it is slower and requires a gauge change along the way. However, it could be used for transporting Finnish cargo in the Ukraine and Belarus direction (incl. Odessa port and onwards to Turkey). This route can be used by Muuga itself as well as competing Estonian ports. Muuga multimodal terminal would have an advantage due to its multimodality.

Part of the N-S/S-N corridor from Muuga Harbour to Kaunas or the Lithuanian-Polish border is viewed as the home corridor of Rail Baltica. In this limited geographical area, road transportation maintains its competitiveness within an approx. 500 km range. For certain goods (smaller shipments with swift loading time), rail could compete for the routes as Muuga and Kaunas for example, provided there will be frequent departures from both sides.

The potential competition for Finnish cargo also comes from the Polish ports: Gdansk, Gdynia and Swinoujscie/Szczecin. This is an alternative gateway to and from the industrial hotspot of the Katowice and Wroclaw area, an area with a substantial automotive and chemical industry and a population of 25 million people. The current maritime traffic volumes between the ports of Hanko and Gdansk do not represent any threat for Muuga Harbour as the Finnish connector. However, according to our transport model, the Hanko-Gdansk connection could be one of the alternatives for Finnish cargo in the long run. The active development of the Polish ports confirms this scenario.

> *The biggest potential for Muuga terminal is to further reduce Finnish dependency on maritime transportation by offering a frequent rail service with European customers.*
>
> ***Estonian freight forwarder***

The main catchment area of the N-S/S-N corridor for Rail Baltica generated cargo flows is seen as being approx. 600+ kilometres away from the Baltic Sea coastline. This is the equivalent of a day trip of road transportation together with port formalities. In this area, maritime transportation as a primary mode of transportation would have a higher probability of prevailing over rail, making Rail Baltica a less attractive mode of transportation.

Rail Baltica Muuga route could potentially attract 1-1.3 million tons of cargo from the current Finnish-German and Finnish-Czech Republic stream. This could happen within 10 years from Rail Baltica becoming operational. Finnish-Polish trade is smaller than Finnish-German trade but it is constantly growing. Here, Muuga terminal could expect 0.6-0.7 million tons of cargo per year each decade following the launch of Rail Baltica.

The Finnish container market is attributed to trade with Germany on a large scale. The majority of this flow could be traced to the Kotka-Hamina region (approximately 60 %), with the remaining cargo coming to and from Helsinki. Here, Rail Baltica shuttle trains could secure an additional share of the Finnish trade. This is also what the modelling of the current study confirmed.

Table 5. Generalisation of competitiveness of Muuga-related N-S/S-N-direction corridors

N-S/S-N-direction	Level of competitiveness	Explanation
Between Tallinn and Kaunas (both rail and road link)	High	Muuga Harbour has good connections with N-S road route (Via Baltica) and the future railway (RB); logical route for Finland-related goods
Western branch of RB-related corridor	Medium	Competitive for more time-sensitive goods and for German, Czech and Polish regions far from the sea
Adriatic branch of RB-related corridor	Medium	Competitive for more time-sensitive goods

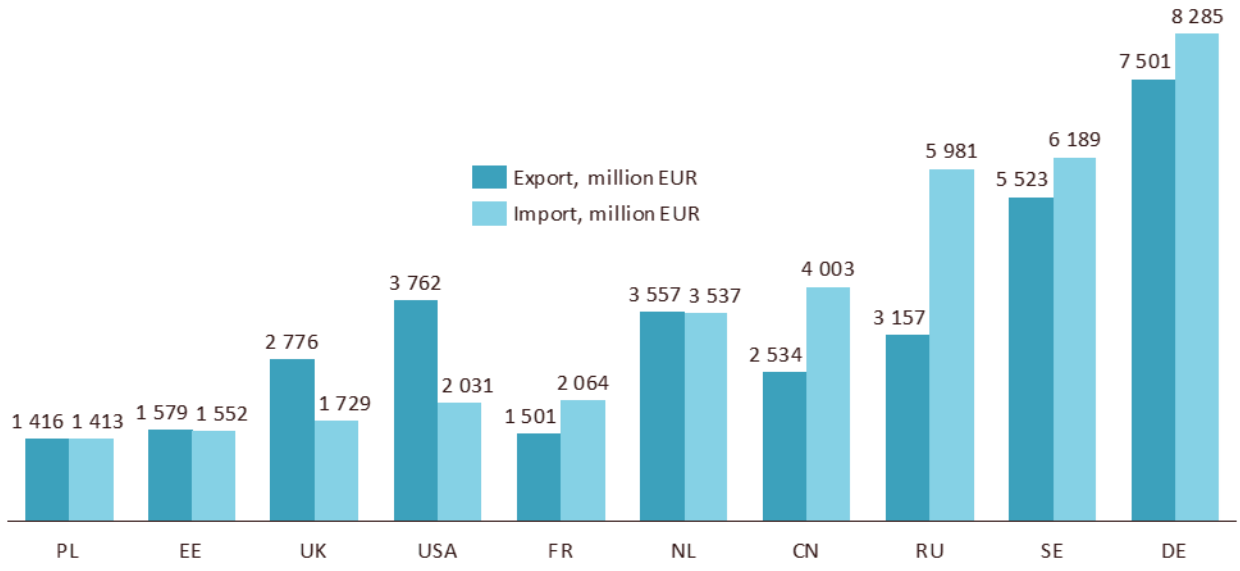
Source: Team analysis

4.1.3.1. Freight flows related to Germany

The prospect for the Muuga terminal to handle cargo flows related to Germany will largely depend on the conditions of the cargo flows between Finland and Germany. Estimating the probable volume of this cargo flow is of crucial importance for the future of the Muuga multimodal terminal.

Compared with other potential N-S/S-N cargo flows, **trade between Finland and Germany is** relatively **large**, at approximately **8.5 million tons** according to the 2015 data.[32]

Figure 14. Finland's trade partners in 2015; export and import



Source: Statistics Finland[33]

Ports in the German regions that are immediately adjacent to the Baltic (such as Rostock, Lübeck-Travemünde etc.) have a better advantage in terms of handling Finnish inbound-outbound cargo. The

[32] Finnish exports to Germany measure about 4 million tons per year: 2 million tons is moved in containers and 1.3 m tons is dry bulk. German exports to Finland are about 1.6 million tons per year: 0.7 million tons is moved in containers, 0.4 m tons is dry bulk, 0.3 m tons is mixed freight and 0.14 m tons is liquid bulk.

[33] http://uljas.tulli.fi/

advantages of rail increase when moving further from the Baltic coastline (towards the south and southwest), as indicated earlier.

The biggest share of Finnish-related cargo originates from states that are located further away from the Baltic coast. The states in Southern and Western Germany have the largest trade with Finland (see Table 6).

This supports the need to extend the Rail Baltica cargo link to Hannover, Frankfurt and even further afield. By taking into account the cargo volumes and geographic location of the different regions, it makes sense to consider **block trains between Muuga, Stuttgart** and **Munich**. Both destinations are about 800 km (approximately one day of truck driving) from Lübeck seaport. The estimated volume of trade with Finland could sustain at least two block trains per week.[34] Such a train would also have a market for cargo leaving from or arriving to St Petersburg and Stockholm.

Table 6. Foreign trade of Germany with Finland by state, thousand t

State	Imports from Finland	Exports to Finland
Baden-Württemberg	135	577
Bayern	229	268
Niedersachsen	510	775
Nordrhein-Westfalen	586	1 335
Sachsen-Anhalt	223	60

Source: German Regional Statistics[35]

The option to **use block trains between Nordrhein-Westfalen** (e.g. from Dortmund or Duisburg) **and Tallinn** also looks positive according to the cargo volumes - over 0.5 million tonnes of the Finnish-related imports and 1.3 million of Finnish-related exports.

Table 7. Top fifteen Finnish exported products and destinations in 2015, thousand tons

Product	Destination	Quantity (t)
Paper and paperboard	Germany	1 930.6
Mineral oil	Sweden	1 621.3
Mineral oil	Netherlands	1 202.1
Paper and paperboard	United Kingdom	1 130.8
Mineral oil	United Kingdom	956.0
Pulp of wood	China	878.4

[34] We here presume that block trains must be used to maintain competitive speed on the route. We proceed from the premise that a block train can carry 1 000 tons of freight in the future (admittedly, current average volume, considering the incomplete load of block trains, remains below 700 tons) and presume that Finnish-German trade at the moment of launching of Rail Baltica is 8 million tons. Presuming that we manage to secure 10 % of this volume with block trains (quite an optimistic premise), it means that 800 000 tons would be running in both directions along Rail Baltica, i.e. about 400 000 tons per direction. By taking block trains as a base for transportation, this means only 400 block trains per year will travel in each direction, i.e. 8 block trains per week. Considering that the adequate frequency of block trains would be 2-3 trains per week (in both directions), it means that we would have enough volume for 3-4 Muuga-related block train connections handling Finnish-German trade.

[35] https://www.destatis.de/EN/FactsFigures/CountriesRegions/RegionalStatistics/RegionalStatistics.html

Paper and paperboard	USA	845.3
Paper and paperboard	Belgium	821.3
Wood and wood charcoal	Sweden	798.6
Mineral oil	Latvia	631.7
Mineral oil	Belgium	623.9
Wood and wood charcoal	Japan	559.9
Pulp of wood	Germany	550.6
Wood and wood charcoal	United Kingdom	533.3
Paper and paperboard	Spain	523.0

Source: Statistics Finland[36]

With regard to Finnish trade with southern states in Germany, we indicated another competing route for Rail Baltica: the maritime route from Finland to the Netherlands, continued with inland waterways transport or road transport.

The port of Rotterdam is ideally located at the mouth of the Rhine and the Maas and provides high-frequency inland waterway connections to destinations throughout the whole of Europe.

From the terminals in Rotterdam, an extensive fleet of inland vessels transport cargo via the Maas and the Rhine directly to the major economic centres in the Netherlands, Germany, Belgium, France, Switzerland and Austria.

Delivery times vary from less than a day for destinations in the Netherlands, Germany and Belgium, to four days, such as from Rotterdam to Basel in Switzerland. Inland shipping is particularly strong in long-distance transport.

We tested several routes from Germany to Finland. The first option from Hannover to Helsinki consisted of the currently used route, carrying the cargo by road from Hannover to Travemünde and from there by sea with a ro-ro ship to Helsinki. For the second option, we assumed Rail Baltica as an alternative route. Experts estimated the price of carrying cargo over 1 000 kilometres on rail: 1 000 EUR. In that case, the cargo would reach Helsinki approximately 1.5 times faster (24.4 hours instead of 37.3 hours), while the maritime option via Travemünde would be 30 % less costly. One hour gained by shipping via Muuga entailed 51 euros extra cost per cargo unit (40-ft container or trailer). The panel concluded that this kind of "speed bonus" can be paid for time-critical and expensive goods. There was consensus among the experts that in the long run, the North Sea ports would be overloaded and alternative routes would benefit from this. In a long-term perspective (20 years and beyond), Finland's structure of export will also change towards more value-added goods, such as bio-chemistry products, enhanced cellulose-based products, high-tech products, etc. This would require faster transport, and the fast shuttle train connection with Europe would be an argument for Finland in this instance.

[36] http://uljas.tulli.fi/

Table 8. Top fifteen imported products and origins in 2015, tons

Product	Origin	Quantity (t)
Wood and wood charcoal	Russia	6 272.7
Wood and wood charcoal	Estonia	775.6
Iron and steel	Netherlands	495.0
Wood and wood charcoal	Latvia	388.6
Iron and steel	Germany	248.6
Paper and paperboard	Sweden	241.8
Iron and steel	Sweden	192.7
Iron and steel	Norway	174.9
Wood and wood charcoal	Sweden	152.1
Misc. chemicals	Norway	137.3
Iron and steel	Russia	127.0
Nuclear reactors	Germany	97.6
Iron and steel	Poland	97.0
Enzymes etc.	France	95.2

** temporary indicator, related to high infrastructure project*

Source: Statistics Finland[37]

General cargo, including the container business in Germany, still experiences growth, and it outperforms other rail cargo types with an expected medium term annual growth rate of 2.5-3 %. This development is in line with the general trend moving from bulk cargo to general cargo which is still ongoing, so from 2025 it is expected that about 2/3 of the cargo volume will be general cargo with a high percentage of containerisation.

4.1.4. East-West/West-East direction corridors

This sub-section examines the transport corridors passing through Muuga Harbour in the East and West directions, evaluates their competitiveness compared to alternative transport corridors in the same direction and estimates the amount of cargo Muuga could receive from the E/W corridor.

Due to its geographic location, the E-W/W-E Muuga corridor's catchment area seems to be primarily Northwest Russia. However, mostly due to rail transport, it also competes with other corridors for the transport of Russia's more remote regions, primarily Central Russia (Moscow hinterland, see Annex 6.7.1.2).

Table 9. Summary of competitive corridors in the E-W/W-E direction

E-W/W-E direction	Level of competitiveness	Explanation
Connections with the St. Petersburg region	High	Geographically adjacent, convenient for road transport.
Connections with Moscow, far regions of Russia, Kazakhstan and Central Asia	Medium	Competitive, if trade between Russia and EU increases again and Russia does not politicise the transport business too much

[37] http://uljas.tulli.fi/

Source: Team analysis

The Western branch of the **E-W/W-E corridor passing through Muuga uses maritime** transport. Here, the cargo arrives via the Baltic Sea and the Gulf of Finland from a range of Western and Northern European ports. The Eastern branch mainly uses either rail or road transport.

It is possible to **redirect freight moved overland to Muuga or nearby from the E-W/W-E corridor to the N-S/S-N corridor** and vice versa. This becomes especially relevant with the launch of Rail Baltica. The redirecting does not merely involve rapid reloading (e.g. swiftly loading cargo arriving from the South by RB to trucks and dispatching them towards St. Petersburg), but it could relate to the emergence of a logistics/distribution centre at Muuga Harbour, where the cargo diverse value-adding operations before being carried further – repacking, assembling etc. This is the biggest potential for Muuga Port. Figure 15 illustrates modelled freight flows for 2035.

The prospects of handling the transit of Kazakhstan and Central Asian countries cannot be discussed in isolation from the protectionist nature of Russia's policies. One such example is Russia's geopolitical policy on railway tariffs that can substantially influence the choice of routes and bypass certain countries out of trade. Without political influence, Muuga is well positioned for transporting the above-mentioned cargo to Scandinavia.

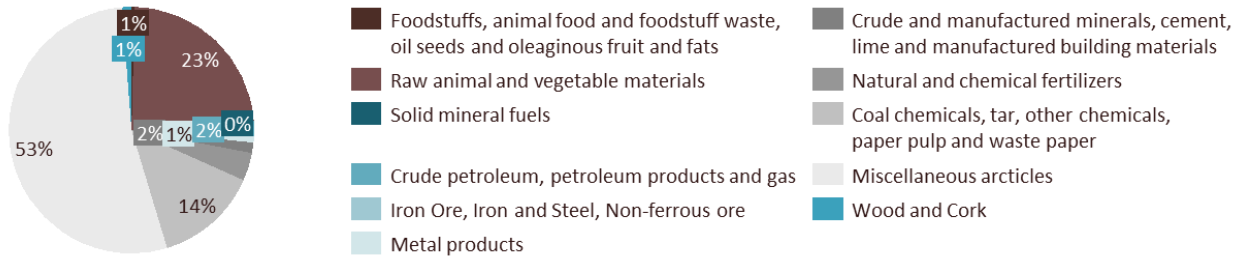
The growth opportunities for the Port of Muuga towards Russia are in containerised cargo. Muuga has shown itself to be strong in value-added services such as packaging, labelling and sorting.

Russian food industry

Muuga is beneficially located for Northwest Russia, but the renewal of Russian transit is questionable for several reasons. Estonia has the worst relationship with Russia of the Baltic states and is one of the keenest supporters of EU sanctions against Russia.

International logistics company

Figure 15. Rail Baltica freight flows to and from Russia in 2035



Source: Goudappel model

The situation concerning the E-W/W-E direction is substantially different from that of the N-S/S-N direction. While competition in the N-S/S-N corridors depends largely on the competition of various transportation modes and their combinations, the corridors competing in the **E-W/W-E direction predominantly use the same combination of transportation modes and carry the same types of goods** (e.g. consumer goods from the West to Russia, Russian natural resources to the West). The main factor influencing the situation's dynamic is the rapid development of Russia's own maritime corridor and new ports.

In Estonia and Latvia, the Tallinn and Riga ports along with the Paldiski, Ventspils and Liepaja ports hold the potential to handle the E-W/W-E traffic. The main advantage of these ports is their beneficial access from the Baltic Sea without entering the Gulf of Finland, which means that there can be possible locations for developing cargo terminals handling Russia-related traffic. Due to their geographic position, these locations have an advantage in handling traffic to and from Sweden.

Ports and logistics areas adjacent to the Russian border, like Kotka/Hamina in Finland or Sillamäe in Estonia, have certain advantages, as **certain Western companies prefer to keep their import goods for Russia in the EU** in the immediate vicinity of the border from where they can be rapidly transported to Russia when necessary. **After the launch of Rail Baltica, these will also be the locations where cargo can be switched from one rail gauge to another.**

Several interviewed respondents confirmed that Muuga could be used in the future as the preferred EU location for a warehousing and distribution centre for the greater St Petersburg area. Here they mean cargo that would first travel South-North on Rail Baltica and would then be transshipped towards Russia on rail or by road after warehousing, repacking or some other value added service. According to expert analysis, this emerging demand is translated to a total freight volume of 0.25 million tons by 2030, 0.75 million tons in 2035 and 1 million tons in 2045. The volume of containers could be between 180 000 and 262 000 TEU in 2035 and between 184 000 and 275 000 TEU in 2045.

The advantages of corridor passing through Muuga are the following: higher service quality than in Russian ports, the ability to handle specific goods (Muuga is well known as the main distributor of cocoa beans to the Russian market, for example) reasonable handling costs when compared to the Finnish ports and good access to the St. Petersburg area.

4.1.5. Asia-related corridors

When speaking about cargo volumes for Muuga terminal, especially in a longer perspective, one should consider the opportunities provided by corridors extending outside of the EU. This includes corridors connecting Europe with Asia. There are four principal corridors related to Asia:

- Directly by sea (without reloading) from Asia or by feeder ships from North Sea hubs;
- By rail connection from China or other East-Asian countries via Central Asian countries and Russia;
- Through the ports of the Adriatic Sea (the Adriatic Route);
- Through the Arctic Ocean ports via Finland (the Arctic Sea Route).

Limitations for rail transportation from Asia are that China has its own railway gauge size, which is changed at the border with Kazakhstan. The development of the Trans-Siberian corridor directly to Finland will reduce the role of the Baltic States.

Latvian logistics expert

Both the **Arctic Sea Route and the Adriatic Route represent opportunities to reduce long-distance haulage in the future.** Here, the sea will be replaced by rail. In the case of the **Adriatic Route**, the Asian goods from ships passing through the Suez Canal to the Port of Koper or some other nearby port could travel on Rail Baltica from the South towards Muuga.

In the case of the **Arctic Route**, Asia-related cargo would be transported through Finland from the North. Asian cargo would then arrive to Muuga Harbour from Helsinki (Vuosaari) and be dispatched further by rail or road. Both of these routes would not solely handle cargo related to Asia. The Adriatic corridor would also carry goods from the Adriatic countries and from Austria, while the Arctic route could attract quite a considerable amount of natural resources from the Arctic Ocean, e.g. fish from Norway. The volume of such goods could initially exceed that of Asia-related cargo.

Table 10. Summary of competitiveness of Muuga-related corridors in Asia-related trade

Asian direction	Level of competitiveness	Explanation
Adriatic Sea direction	High	Via RB and through Estonia, a geographically logical route for time-critical goods carried in that direction; Other routes are slower
Arctic route	Medium	Competitive in the long term; Precondition – Artic Rail in Finland

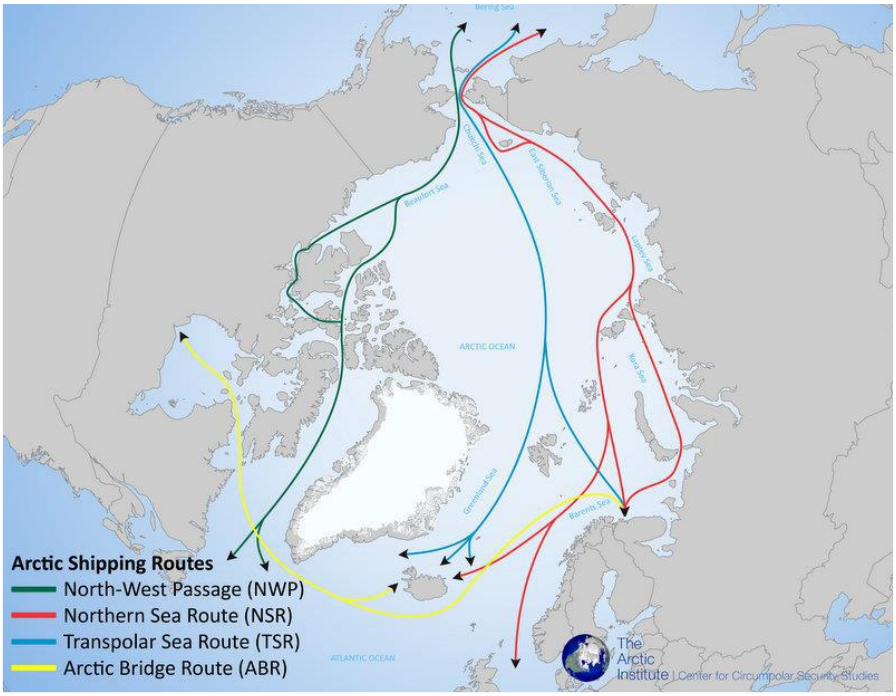
Asian direction	Level of competitiveness	Explanation
Container carriers (with Asia-related goods)	High	Muuga Harbour's advantages: depth, position as the starting point of Rail Baltica (for Southbound block trains)
Eastern Rail connections through Russia (With China)	Low	Strong competition from neighbouring countries in securing block trains from China and Estonia's small domestic market

Source: Team analysis

Arctic Sea Route

The Arctic Sea Route (ASR) or Northern Sea Route (NSR), as it is sometimes called, is a shipping route connecting Europe and Asia through Russia's Arctic regions (see Figure 16). The route is about 3 000 miles long, depending on ice conditions and other factors along the route. Currently, the navigation season for transit passages starts around the beginning of July and lasts until the second half of November.[38] At present, this does not sustain the full usage of the Arctic corridor. This however may change in the near future.

Figure 16. The Arctic shipping routes



Source: Humpert & Raspotnik (2012)[39]

The largest shipping potential on the Arctic Sea Route is related to dry bulk and offshore sectors. Dry bulk shipping on the NSR between Europe and Asia could be profitable and competitive against the Suez Canal Route under the right circumstances (extension of the navigation period and availability of reinforced-hull vessels suited for difficult ice conditions etc.). The most influential factors are origin-destination distance,

[38] http://www.arctic-lio.com/
[39] https://arcticyearbook.com/images/Articles_2012/Humpert_and_Raspotnik.pdf

bunker levels and freight levels. Based on different studies, large volume container shipping may become economically feasible by 2040 at the latest, if the ice cover continues to diminish at the present rate.[40]

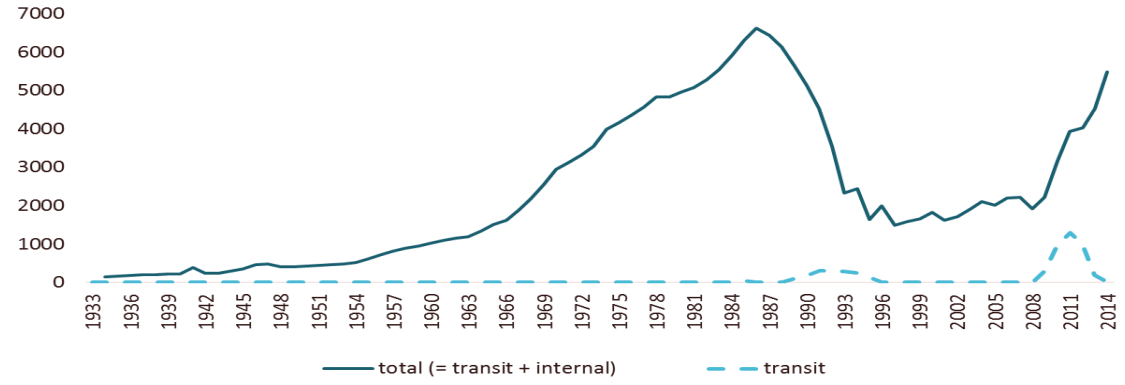
Competing corridors and possible Asia-related cargo volumes

The following assumptions are used in the analysis:

- By 2030 at the latest, the railway linking Kirkenes to the Finnish railway network is operational and the Kirkenes port is developed to handle up to 3 million tons of cargo. The railway will not initially carry Asia-related container goods, at least not in significant volumes, but rather Arctic resources (natural resources, minerals) and potentially LNG in containers.
- The Muuga-Vuosaari sea link will function frequently and reliably by that time, and RB will be operational. Cargo arriving in Muuga can be transported further to the Baltic states, and possibly also to Belarus and Ukraine. And if Russia has not yet improved its Arctic railway connections, possibly also to Northeast Russia. In case of fish transportation, the area may be wider southwards.
- Containers from China. Muuga is expected to become an attractive intermediary stop to bring cargo from China to Norway, Sweden, Finland and Russia, as it is regarded as being cheaper than the current transportation method through the Mediterranean Sea. This would substantially increase the use of containers.

The volume of the above cargo flow is modelled at about **0.5 million** tons in 2025, but the estimation greatly depends on the volume of natural resources exploited in the Arctic Ocean. The volume of potential cargo can steeply increase after large container carriers from Asia begin using the Arctic Route, especially from containers – 1 million tons in 2030. The Northern Sea Route will be navigable for year-round traffic, potentially by 2045. The cargo handling capacity of the Kirkenes port will have significantly increased by that time as well. In this case, if about 4-5 % from overall container flow of the Arctic Route will turn South in Kirkenes and enter Estonia by Muuga, **Muuga Harbour could receive up to 1.5 million tons cargo per year**.

Figure 17. Cargo volumes on the Northern Sea Route, thousand t



Source: University of Turku, Tuomas Kiiski[41]

Since the Suez Canal is located in a politically unstable region, and its closure or limitation of its usage cannot be ruled out, the number could be larger. The New Suez Canal will increase the canal capacity by allowing ships to sail in both directions at the same time for a greater proportion of the canal. However,

[40] https://services-webdav.cbs.dk/doc/CBS.dk/Arctic%20Shipping%20-%20Commercial%20Opportunities%20and%20Challenges.pdf
[41] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf

building a tunnel after 2050 between Tallinn and Helsinki would increase cargo volumes through Muuga by speeding up the crossing of the Gulf of Finland for freight from the Arctic Route.

Competing corridors in the Asian direction to be considered relevant for the Muuga multimodal terminal:

- All Southern maritime corridors carrying Asian cargo;
- Railway land bridge across Russia;
- Possible solution of container ships not stopping in Kirkenes but travelling to a North Sea hub (the goods would be shipped "back" Eastwards to the Baltic Sea from there);
- Southward transport link from Murmansk;
- Transport of goods South from Kirkenes through Sweden rather than Finland.

An alternative channel through Sweden would push the catchment area of the Arctic Route extension through Muuga eastward, while the extension Southward from Murmansk would in turn cut away Northwest Russia as a catchment area. If both alternatives were realised, it would mean that we could only consider the catchment area of the Arctic Route cargo through Vuosaari and Muuga, besides Estonia, as the Southbound routes: the transport of goods to Latvia and Lithuania (also included via RB)[42] and transport to Belarus and Ukraine via the 1520 mm gauge railway through Tartu.

We can generally conclude that the cargo flow potentially arriving in Muuga Harbour via the Arctic Route is certainly of considerable volume compared with the volumes of other routes. If the potential is realised, it would exceed the volume of cargo arriving by the Adriatic channel as well as the possible volume from German-Finnish trade. However, it is related to numerous uncertainties and can only be launched after the construction of the Arctic railway from Kirkenes and it can only provide larger cargo volumes further into the future.

Adriatic Route (intercontinental flows)

An important opportunity for **attracting additional cargo turnover to** Muuga Harbour **is the Adriatic corridor**. Rail Baltica intersects the Baltic Sea-Adriatic TEN-T corridor in Poland. That will improve rail access for Finland and the Baltic countries to countries like Slovakia, Austria, Slovenia and Italy as well as to the Adriatic ports and onwards to European and Turkish Mediterranean ports along with Asia.

The Northern Adriatic ports (Koper, Trieste, Rijeka, Venice and Ravenna) have remarkable potential for servicing **Asia-bound trade**. The Adriatic ports are located over 2 000 nautical miles closer to the Suez Canal than the North Sea ports (Rotterdam, Hamburg etc.). A combination of that geographical advantage and Rail Baltica can make the rail route from the Baltic states towards the Adriatic Sea in trade with Asia. Additionally, the Northern Adriatic ports may service flows in the Northern direction to/from the Eastern Mediterranean (Egypt, Israel and Turkey) and partly Northern Italy as well. This would save approximately one week in delivery time. Ports in Turkey, Israel and Egypt have recently been participating in the EU pilot project of Fresh Food Corridors with the aim of reducing the delivery time of fresh food products by using the Adriatic Corridor. A Rail Baltica shuttle train connection to the corridor could also bring fresh food faster to our region.

The Adriatic ports compete for transcontinental cargo with large North Sea ports. The largest container ships (14-16 000 TEUs) currently do not call at the Adriatic ports due to a number of limiting conditions – depth, capacity and hinterland connections.[43] However, the ports keep regular container and feeder lines (ships up to 6 000 TEUs) to the Far East and the Mediterranean. Their container throughput has grown on average 7 % per year in 1990-2014.[44] The 2016 registered throughput was 844 758 TEU, which was a record volume in the history of the Port of Koper. The ratio between empty and full containers was 15 % vs. 85 %. This ratio indicates that the economies from the hinterland markets increasingly recognise the advantages of the transport routes via Koper in terms of both the export and import of goods. The current railway

[42] We proceeded from the premise that the volume of consolidated trade from Estonia, Latvia and Lithuania with East Asia in tons compares with Finland's East Asia-related trade as one third vs two thirds or in a more remote future 40 % against 60 %.
[43] www.Southeast-europe.net/document.cmt?id=688
[44] http://imet.gr/Portals/0/Intranet/Proceedings/SIGA2/twrdy_batista_stojakovic[1].pdf

traffic with the European destinations from the Port of Koper is increasing: trains to Graz (Austria) 10 times, Munich (Germany) 8 times and Wroclaw (Poland) 2 times per week.

We proceed from the assumption that rail can compete with road transport when being included in the intermodal transport chain. Rail is competitive within the continental (rail + road) unaccompanied intermodal transport, namely in two cases:

- Fast moving long distance full trains between business centres for high-quality goods;
- Transport of solid and liquid bulk goods in bulk containers.

Generally, in the case of marine combined transport (ship + rail/road), rail dominates the continental part of the transport chain (up to 90 %).[45] As long as Rail Baltica will function as a part of marine combined transport **in the context of the Adriatic route, we consider it to be competitive with road transport**. This assumption is validated by the fact that the Baltic Rail company, which largely handles Asia-related cargo flows, is already now capable of successfully competing with road transport on the Koper-Wroclaw railway line, despite the relatively low speed of the trains (an average moving speed of 40-50 km).

Companies such as Transiidikeskus AS and Baltic Rail have considered starting container trains from Tallinn to the Adriatic ports.[46] These business plans heavily rely on remarkable freight from Finland. To date, these intentions have not been realised, primarily due to the insufficient compatibility of national railway systems (waiting at the borders, switching of engines). The situation may change after the launch of RB and implementation of the 4th Railway Package.

Some experts assessing the potential of the Adriatic Corridor are sceptical that it could handle Finland's Asia-related foreign trade. They use the example that carrying goods at present from Singapore to Hamburg on a large container ship and onwards to Helsinki on a feeder ship would be nearly twice as cheap in comparison with maritime combined transport from Singapore using train to an Adriatic port onwards to Tallinn and further shipping over the Finnish Gulf. The difference in cost would be too high to be compensated by the higher speed. They also expect the current relatively high feeder-ship fares to fall in the future.

Another and more important factor is that different cost and speed ratios will apply in the Finland-bound part of the Adriatic corridor following the launch of Rail Baltica. According to our calculations, the transport of goods between Finland and Asia via the Adriatic Route need not become more expensive than one third compared with transport via the North Sea hubs per TEU, while it would save approximately 7-8 days. This is a very significant economy of time, meaning that the corridor could catch a rather significant share of more time-sensitive goods moving between Finland and Asia. We based our calculations on the option of using high-speed full-length long-haul container trains for the transport of goods in the Adriatic corridor with the Rail Baltica extension.

Considering that it can attract cargo from the Port of Koper's Mediterranean catchment area after the launch of RB (incl. goods from Turkey's Mediterranean ports), together with a certain amount of cargo related to Northern Italy, we can realistically expect initially one and later two block trains per week quite soon after launching Rail Baltica. Based on expert modelling, the total RB cargo with Italy is estimated at 0.4 million tons per year – that should ensure the route's competitiveness. Further augmentation for the line should come from handling primarily East and South Asia-related cargo, which would allow for a significant increase in the weekly number of container trains and boost the volume of cargo by the end of the forecast period to up to 0.5 million tons per year, according to optimistic estimates. A particularly significant increase could come from handling goods from South Asia (e.g. link with the port of Mumbai in India), since the ratio of time saved and time consumed on covering the distance is better in the case of South Asia than that in regard to East Asia.

The possible launch of the Tallinn-Helsinki tunnel would increase the competitiveness of the route. However, this will not be significant in the context of Asia-related transport: the time and cost of covering

[45] www.Southeast-europe.net/document.cmt?id=688

[46] Even before the completion of RB by using the 1520-gauge railway across Tartu.

the distance between Tallinn and Helsinki is quite small compared with the entire route. We do have to consider that if a larger volume of traffic of Asian container goods via the Arctic Ocean is to be launched in 2040-2045, it would significantly reduce the Adriatic route's competitiveness of Finland-bound cargo. In this case, there is no basis for presuming that the volume of goods transported to Finland via the Adriatic route would exceed 0.4 million tons per year.

The above calculations were based on the assumption that the container train minimises stops en route to Muuga. If we presume that the train could stop for loading off and on in Austria (e.g. Vienna) and Poland (e.g. Slawkow), we could assume a much higher volume of goods. Under these conditions, experts are forecasting trade between Austria and Finland in 2035 of up to 0.7 million tons, of which 0.2 million is modelled as RB trade in 2035 – this will significantly increase the attractiveness of the Adriatic route.[47]

The Adriatic route can be launched at a considerable volume immediately after the completion of Rail Baltica. An increase in trade between Asia (incl. India) and Europe can also be forecasted with relatively high certainty. There are no competing North-South transport corridors for Asia.[48] The transport of Chinese goods via the transcontinental rail bridge poses competition, but this does not concern South Asian goods and is significantly more expensive than the Adriatic route. Therefore, the Adriatic corridor as an Asia-related transcontinental corridor should be certainly considered as having promising prospects for Muuga.

Figure 18. Baltic-Adriatic Rail Corridor according to the AS Baltic Rail vision

Source: Rail World, Inc.[49]

4.1.5.1. Forecast dynamics of Asia-related container transport in the Rail Baltica and Port of Muuga catchment area

UNCTAD estimates the current volume **of container traffic between Europe and Asia** to be around **22 million TEU[50],** with the share of **Asia-Europe traffic** being **15 million TEU** and **Europe-Asia traffic** being **7**

[47] It would be risky to reckon with a very high percentage here, since the competitiveness of Gdansk port in handling Austrian and Finnish trade is quite high.
[48] The planned transport link from Iran to Azerbaijan remains far too eastwards to offer serious competition in our catchment area.
[49] http://www.railworldinc.com/images/body_bg.gif
[50] http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx

million TEU. Most forecasts consider the realistic **growth rate of container traffic** in the long term to be roughly **4.5 to 6 % per year**. In the case of the higher growth rate of 6 %, it would mean that **European-Asian container turnover by 2040** would be approximately **100 million TEU.**

We use the presumption that Asia-related container turnover in the "belt" of countries related to Rail Baltica would not grow slower than the European average. We consider the following countries to be the "belt" of countries that are significant for the Arctic and Adriatic routes: Finland, Estonia, Latvia, Lithuania, Slovakia, Hungary and Slovenia. We proceeded from the views of the experts that, besides these countries, the catchment area of the transport corridor of interest to us also includes a certain part of the territory of neighbouring countries. These neighbouring countries would be Poland (with the exception of the country's Northern region serviced by Poland's own ports) and Belarus; to a lesser extent, it would also include Czech Republic, Germany (up to Berlin), eastern Austria and the northern Croatian coastline.

In 2040, we estimate there to be approximately 10 million TEU worth of Asian exports or imports. However, we have to keep in mind the high likelihood that a portion of the container traffic between Asia and the "belt" will travel directly, i.e. via the land-based transcontinental bridges (primarily the East-West railway traffic). Proceeding from an optimistic estimate of the capability of this transcontinental railway, we can presume that the volume of this transport flow deducted from intercontinental maritime transport could amount to up to 2 million TEU**.** Accordingly, approximately **8 million TEU worth of Asia-related container traffic will remain, for which three transport corridors will compete**:

- Transport via the Atlantic Ocean, including the reloading of cargo in the North Sea transcontinental ports to smaller feeder vessels, land transport or direct transport to the Baltic Sea by container carriers capable of passing through the Danish Straits;
- Transport via the Arctic Sea Route;
- Transport via the Adriatic Route.

It is estimated that approximately 80 % (around **6.4 million TEU)** of **Asia-related goods** may keep moving **via the Atlantic Ocean.**[51] Therefore, the volume of container flow both for the Arctic Route and the Adriatic Route would amount to approximately **1.6 million TEU**. If we consider the weight of one TEU to be approximately 10 tons, it would amount to roughly 16 million tons.

The largest share of this flow of goods passing through the North-South corridor would not remain in the Rail Baltica catchment area. Of the Southbound container flow arriving via the Arctic Sea Route, much more than half will remain in Finland and will not travel across the Gulf of Finland to Rail Baltica, and the Asia-bound Finnish export moving via the Arctic Sea Route will not concern Rail Baltica and Muuga either. In the case that large-scale container transport from Asia are launched via the Arctic corridor and port of Kirkenes, the ratio of containers remaining in Finland (or carried onwards to Russia or Sweden) and transported Southward is seen as 3-4:1.

4.1.5.2. Partnership networks

There is also cooperation between the ports and multimodal terminals aside from competition. No port can function in isolation. The most important cooperation partners for Muuga multimodal terminal are the ports and terminals listed below.

Potential partnering ports:

- Port of Vuosaari. This is the main link between Vuosaari and Muuga feeding the North-South/South-North direction. Both the city of Tallinn and the city of Helsinki divert traffic from congested city areas to these ports.
- Port of Koper and Port of Trieste. Especially if a block train is planned directly from Koper to Muuga to service Estonia, the Helsinki region and the St. Petersburg region.
- North Sea ports (Rotterdam, Amsterdam etc.). Potential cooperation partners for the East-West/West-East direction, as feeder lines connect these ports with Muuga.

[51] Estonian Institute for Futures Studies

- Ports in the Stockholm region – mainly to service East-West and rail transshipments to Sweden.

Potential partnering railway stations:

- Railway terminals near Moscow – to service the import and export potential of the Moscow region.
- Railway terminal in St Petersburg or nearby – to service St. Petersburg city by utilising Muuga's favourable geographic position.
- Alma-Ata in Kazakhstan. Here, partnering with a railway company, not a specific railway station, is necessary to attract Chinese block trains.
- Warsaw and railway stations in the industrial South Poland (on the Adriatic Route) – to connect southern manufacturing areas with northern consumption areas.
- Railway terminal in Berlin or nearby to obtain goods from the Adriatic route (including Vienna) or Munich, without using direct block trains. Also, the Port of Koper and/or Trieste as a starting point of the Adriatic Route related traffic in Europe.
- Other stations with substantial cargo origin-destination potential.

5. Modelling results – evaluation of freight and traffic flows

A comprehensive model of current and predicted European and transcontinental cargo flows was built in order to make informed decisions about the multimodal terminal's need and required capacities. The modelling results were verified through expert interviews and a comparative analysis of assumptions used in other similar studies.

The aim of the current section is to present freight flow prediction results for the 2025-2055 period.

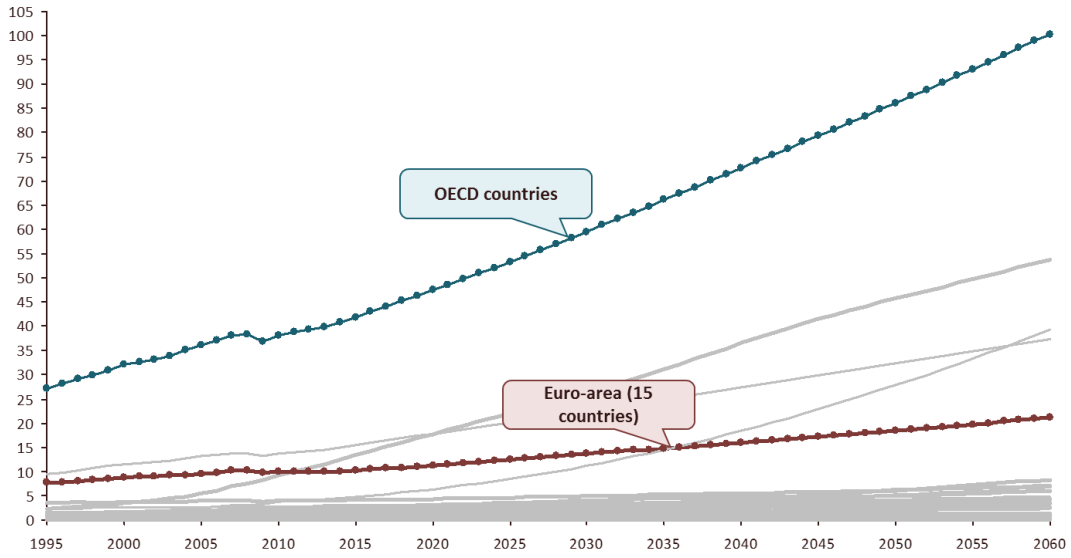
Two terminal locations were modelled:

- Rail Baltica is extended to Muuga Harbour and the terminal is built there – referred to as **RB Muuga**;
- Rail Baltica terminates 5-10 kilometres before the harbour, where a dry port facility can be constructed that is connected to Muuga harbour using the existing North-South rail line (referred to as **RB Dry port)**.

5.1. Description of the modelling methodology

In order to forecast freight flow for the 2025-2055 period, **correlation between world GDP and world trade growth** has been taken into consideration as part of a starting base of the methodology. The GDP growth of the Baltic states is forecasted at 2-3 % throughout the 2020s and between 1-2 % subsequently. Other advanced economies are expected to grow at a moderate rate, around 2 %, throughout the 2020s and around 1 % subsequently. For OECD, the overall expectations for economic growth are slightly more favourable than for the euro area countries (15 countries, see Figure 19).

Figure 19. Estimated GDP development in OECD and euro area countries, thousand billion USD



GDP long-term forecast (indicator); the blue curve represents the whole OECD area and the red curve the euro area (15 countries), while the grey curves represent other individual countries.

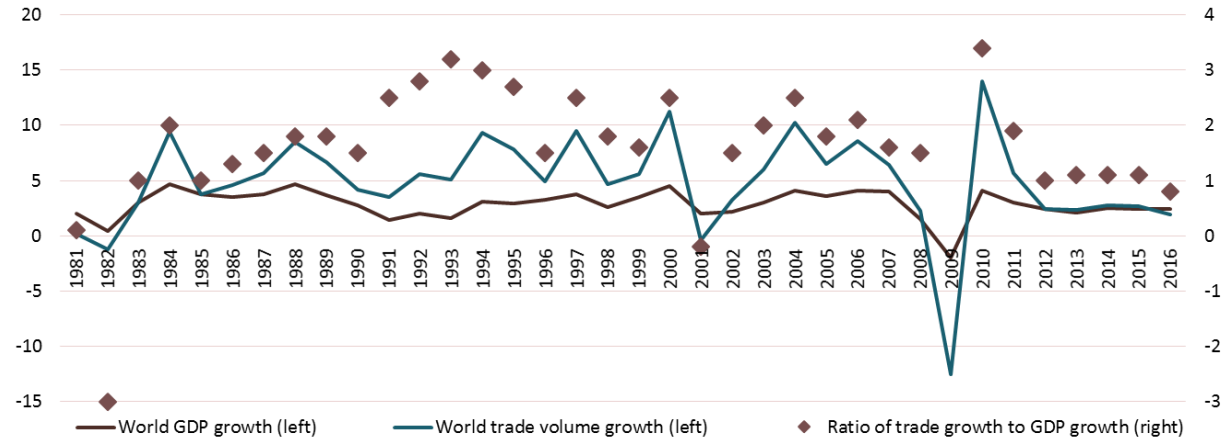
Source: OECD [52]

Judging by historic trends (see Figure 20), **world GDP and world trade growth are correlated**. Strong trade growth has always been a sign of strong economic growth, as trade export contributes to the growth of

[52] https://www.oecd-ilibrary.org/economics/gdp-long-term-forecast/indicator/english_d927bc18-en

developing and emerging economies, while strong import growth has been associated with faster growth in developed countries.

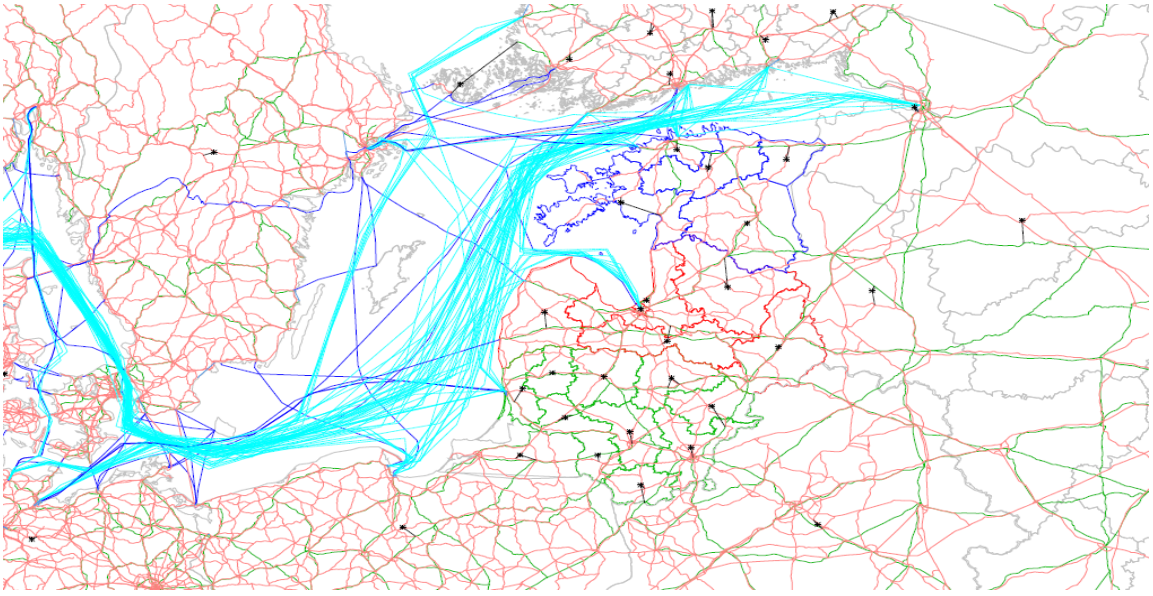
Figure 20. Ratio of world merchandise trade volume growth to world real GDP growth, 1981-2016



Source: WTO Secretariat for trade, consensus estimates for GDP[53]

In recent years, the relationship between trade and GDP growth has been weakening: while trade has typically grown in recent decades at 1.5 times faster than GDP, the ratio has slipped towards 1:1 and has remained stable for the last 4 years. In 2016, the ratio of trade growth to GDP growth was below 1 for the first time in the last 30 years.[54] The main modelling layers of the transport model used the Origin-destination matrix (further – OD table), which was established for 2015 (see Figure 21).

Figure 21. Main modelling layers used for the transport model



Source: Goudappel model

Since no transport model was available from earlier studies, a new transport model was constructed, based on the principles of the model used in the earlier AECOM (2011) study. A European-wide network of the

[53] https://www.wto.org/english/news_e/pres16_e/pr779_e.htm
[54] https://www.wto.org/english/news_e/pres16_e/pr779_e.htm

ETISplus Netter database was used for this purpose. The figure below shows the Baltic section of this network. The network has three transport layers: road (red), rail (green) and maritime (blue). The layers consist of links that all have transport characteristics (e.g. speed, distance etc.). For modelling purposes, relevant freight ferry links were added to the existing regular ferries. The model is operational in OmniTRANS software, a transport modelling software suite developed and used by Goudappel Coffeng.

OD flows by commodity and freight types were imported from the OD tables. An overview of the main flows is shown as a spin plot in Figure 22 below.

The objective of the modelling work is to determine the shares of the three main transport modes: road, rail and maritime transport. Maritime transport requires transport to and from the ports by rail or road, which is reflected in the model.

The share of each transport mode (Road, Rail or Sea) is determined for each separate OD flow by using a modal split function (see Annex 6.8.1), which is similar to the function used in the earlier AECOM study because cost components mirror the components in the AECOM study. However, the adjustments of parameters have been introduced depending on the distances of OD connections. For shorter distances, one dominant mode tends to be chosen over all the other modes. For longer distances, the choice of mode is more nuanced, as reliability and other factors become more important.

Bulk and non-bulk transport flows are treated separately using different cost parameters (see Annex 6.8.1). The model considers both the direct costs and components related to the transport time needed. Shippers will choose alternatives that have the lowest generalised costs.

For the transport mode Road, the model considers a maximum daily distance to be covered of 800 km including overnight costs, as well as the cost of using toll roads that are included in the ETISplus Netter network.

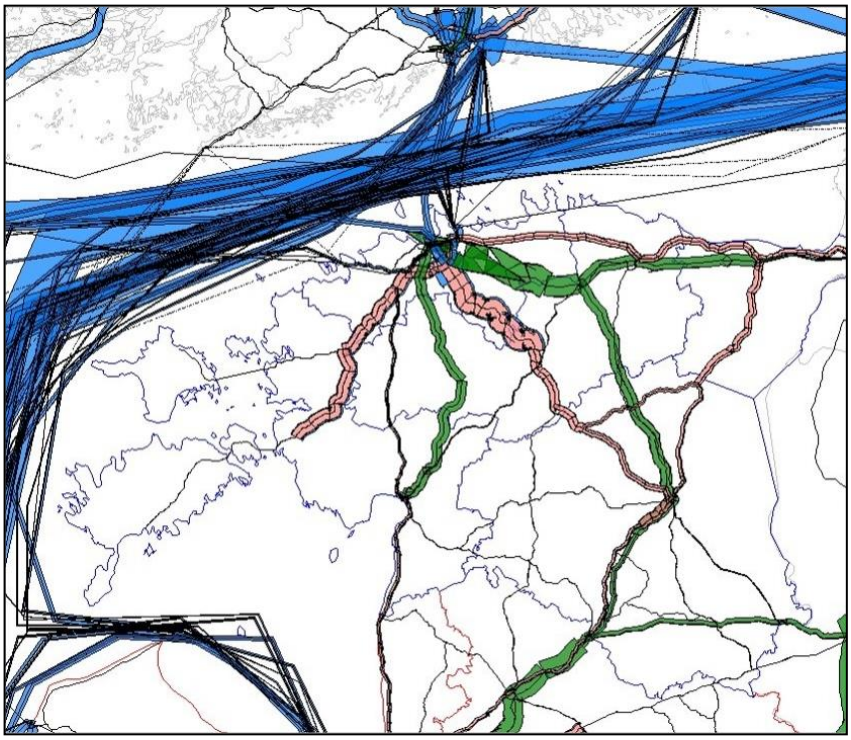
For the transport mode Rail, handling costs at each end of the journey are considered, along with the time and cost related to rail gauge change.

For the transport mode Sea (maritime), waiting time and the cost of port handling services to and from other modes are considered.

For both Road and Rail, country-to-country specific border penalties are included to reflect the time required for administrative issues.

After establishing the share of each transport mode, the flows are assigned to the routes and links that offer the shortest path between origin and destination as expressed in terms of generalised costs. An example of the results of assignments for all modes is included in the figure below (road=red, rail=green, sea=blue).

Figure 22. Illustration of a modal split (blue – maritime; green – railway; pink – road)



Source: Goudappel model

The model was checked for plausible modal split outcomes, e.g. the mode for which the lowest and second lowest generalised costs were calculated should reflect the expectations. In general, for shorter distances up to 400 km, road is deemed to involve the lowest costs, on middle-range distances (400-800 km) rail may have the lowest costs and on the longest distances (over 800 km) maritime transport will in many cases present the lowest cost. However, the model recognises that different modes may be chosen when differences in general cost between the modes are within a certain limited range. Another check on the model outcomes focused on total freight volumes in Tallinn harbour, this being the main purpose of the study.

5.2. Freight flow demand analysis

5.2.1. Total freight flows along the Estonian section of the 1435 mm gauge RB railway

The current sub-section focuses on identifying the best option for constructing the terminal (RB Muuga or RB Dry port) based on the modelling results. The total freight flows are analysed by commodity, origins and destinations of RB freight flows, and they consider different scenarios for the terminal up to 2055.

Three Rail Baltica sections were modelled:

- Border LV-Pärnu;
- Pärnu-Tallinn (connection to the existing East-West railway line near Lagedi);
- Tallinn (connection to the East-West railway line near Lagedi)-Muuga harbour.

Total freight flows

The project analyses two alternatives for building the multimodal terminal – RB Muuga and RB Dry port. The two alternatives focus on the territory of Muuga Harbour and adjacent development areas.

The flows were forecasted using the desk research of related studies macroeconomic context, competitive analysis of different ports in the region and the analysis of each country in the catchment area. The research was further calibrated with interviews from company representatives and other industry experts (detailed in Annex 6.1). A full explanation of modelling methodology is presented in section 6.8.

Table 11 and Table 12 show the total forecasted freight flows for 2025-2045 on the Estonian RB sections for both options.

Table 11. RB Muuga; total freight flows along the RB 1435 mm Estonian railway sections (thousand t, both directions, realistic scenario)

RB section	2025	2030	2035	2040	2045
Border LV-Pärnu	5 061	6 706	9 571	9 848	10 187
Pärnu-Tallinn (Lagedi)	4 620	6 082	8 676	8 902	9 198

Source: Goudappel model

Table 12. RB Dry port; total freight flows along the RB 1435 mm Estonian railway sections (thousand t, both directions, realistic scenario)

RB section	2025	2030	2035	2040	2045
Border LV-Pärnu	1 691	2 848	6 092	6 171	6 292
Pärnu-Tallinn (Dry port)	1 712	2 855	6 142	6 212	6 321

Source: Goudappel model

As seen from the modelling results, the option where the terminal is built in Muuga Harbour generates higher freight flows and is more viable than the alternative option where the terminal is built in the dry port, near Lagedi. The causes for lower freight flows in a dry port option are extra costs and time involved, due to the necessary rail gauge change from 1435 mm to 1520 mm and vice versa or additional loading/unloading of the truck at the dry port. Therefore, only results for the terminal built in Muuga Harbour are further presented and analysed.

Calculations consider limited growth during the start-up period (the first ten years), and market realisation (uptake) is assumed at the level of 60 % in 2025 and 75 % in 2030. Full growth is expected to start in 2035.

Table 11 and Table 12 both show a considerable use of RB from the beginning in 2025. However, the expected growth between 2035 (when full economic potential will be realised) and 2045 (before the Tallinn-Helsinki tunnel is modelled) is limited. Although a general increase in total freight volumes is expected, competition between RB and sea cargo will increase over time.

Table 13 below illustrates the representation of all commodity groups in RB. Overall, it is predicted that Rail Baltica will accommodate both bulk and non-bulk goods, with containerised cargo occupying an increasingly major role on the line. Most commodities in the 2025-2035 period are expected to grow at above 5 % annually, with less pronounced growth in the following years. The most important commodities will be miscellaneous articles, wood and cork, foodstuffs and building materials/minerals. The years of 2050-2055 show the effect of the Tallinn-Helsinki tunnel combined with the effect from the Arctic Corridor and trade with Asia with an increase of more than two-fold, mostly in containerised miscellaneous articles.

Table 13. Total freight flows by commodity along the RB 1435 mm Estonian railway section Pärnu-Tallinn (Lagedi), (thousand tons, both directions, realistic scenario)

Commodity group	2025	2030	2035	2040	2045	2050	2055
1. Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials	266	362	452	453	458	889	906
2. Foodstuffs, Animal food and Foodstuff waste, Oil seeds and Oleaginous fruit and Fats	506	684	869	892	912	1 414	1 464
3. Solid mineral fuels	425	540	704	699	693	1 774	1 788
4. Crude petroleum, petroleum products and gas	27	36	50	53	52	725	770
5. Iron ore, Iron and Steel, Non-ferrous Ore and Waste	17	23	33	33	34	87	90
6. Metal products	332	437	562	554	558	1 350	1 387
7. Crude and Manufactured minerals, Cement, Lime and Manufactured building materials	477	668	933	957	991	2 004	2 082
8. Natural and Chemical fertilisers	69	98	136	143	148	213	222
9. Coal chemicals, Tar, Other chemicals, Paper pulp and Waste paper	704	961	1 25	1 268	1 321	2 548	2 663
10. Miscellaneous articles	1 138	1 441	2 456	2 676	2 883	5 810	5 986
11. Wood and Cork	659	831	1 223	1 174	1 149	2 554	2 565
Total	**4 620**	**6 082**	**8 676**	**8 902**	**9 198**	**19 369**	**19 921**

Source: Goudappel model

Origins and destinations of RB freight flows

Domestic flows are limited in size, as most of the internal transport demand will be covered by road transport. Following existing trade patterns, Finland-bound freight flows and internal EU freight flows show major shares. Transshipment between East-West and North-South will be rather significant at around 1 million tons in 2030 (represented by rows 4 and 5 in Table 7). After the construction of the Tallinn-Helsinki tunnel, the flows to and from Finland are expected to be dominant on RB. Table 14 shows RB freight flows by type of origin and destination.

Table 14. Origins and destinations of freight flows on all Estonian RB sections (thousand tons, both directions, realistic scenario)

	2025	2030	2035	2040	2045	2050	2055
Domestic (within Estonia)	31	37	45	41	37	31	29
To and from Finland	2 143	2 782	4 157	4 351	4 653	13 851	14 262
Internal EU excluding domestic and Finland	2 158	2 910	4 063	4 147	4 201	4 788	4 842
EU excluding Finland <--> Third countries (excl. Russia)	179	254	361	388	411	403	426
Russia <--> other countries	556	730	950	927	890	1026	1 146

Source: Goudappel model

5.2.2. Total freight flows passing through Muuga Harbour

The current sub-section considers optimistic, realistic and pessimistic scenarios for total freight flows passing through Muuga Harbour by different transport modes. Table 15 below illustrates the representation of all commodity groups in Muuga port. Overall, Muuga port should retain all commodity groups that it had in 2015, with gradually more goods predicted to be shipped in containers (miscellaneous articles being the largest category). Most commodities will grow at above 5 % in 2025-2035, with less pronounced growth in the further periods and the growth in non-bulk goods predicted as being faster than bulk goods. Having said that, Muuga will remain an export port for bulk commodities (solid mineral fuels, crude petroleum and petroleum products, fertilisers, etc.) - good connections to 1520 mm gauge railways and its beneficial geographic position will hold their importance in the future.

Table 15. Total freight flows by commodity and freight type in Muuga Harbour, (thousand tons, single direction, realistic scenario)

Commodity group	2025	2030	2035	2040	2045	2050	2055
1. Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials	517	680	793	815	840	611	647
2. Foodstuffs, Animal food and Foodstuff waste, Oil seeds and Oleaginous fruit and Fats	998	1 321	1 494	1 548	1 593	1 282	1 373
3. Solid mineral fuels	811	989	1 177	1 204	1 235	833	882
4. Crude petroleum, petroleum products and gas	5 527	7 036	3 250	1 853	1 052	500	500
5. Iron ore, Iron and Steel, Non-ferrous Ore and Waste	59	83	95	99	103	62	65
6. Metal products	625	842	918	909	912	483	495
7. Crude and Manufactured minerals, Cement, Lime and Manufactured building materials,	1 160	1 608	1 858	1 927	1 976	1 112	1 166

Commodity group	2025	2030	2035	2040	2045	2050	2055
8. Natural and Chemical fertilisers	1 827	2 023	1 912	2 010	2 112	2 166	2 220
9. Coal chemicals, Tar, Other chemicals, Paper pulp and Waste paper	1 340	1 818	1 980	2 004	2 069	1 405	1 499
10. Miscellaneous articles	3 404	4 990	6 442	6 960	7 413	4 634	4 691
11. Wood and Cork	3 280	4 556	5 269	5 497	5 680	4 407	4 683
Total	**19 549**	**25 946**	**25 187**	**24 825**	**24 985**	**17 495**	**18 222**

Freight type	2025	2030	2035	2040	2045	2050	2055
1. Container	4 030	6 239	8 469	9 783	11 503	8 721	9 925
2. Liquid bulk	6 355	8 160	4 607	3 265	2 521	1 691	1 774
3. Dry bulk	5 117	6 227	6 774	6 723	6 258	3 889	3 568
4. Break bulk	3 612	4 790	4 591	4 303	3 953	2 714	2 459
5. Mixed freight	436	529	746	752	750	480	496
Total	**19 549**	**25 946**	**25 187**	**24 825**	**24 985**	**17 495**	**18 222**

Source: Goudappel model

Ro-ro transport, having been shifted from the Old City harbour to Muuga harbour, will increase in volume until 2045. The opening of the Helsinki-Tallinn tunnel in 2050 will lead to a decrease in ro-ro volumes, as they will bypass Muuga port. Rail Baltica feeding plays an important role for Muuga harbour, but RB will become less important for Muuga harbour once the Helsinki-Tallinn tunnel has been built. At that point, a significant amount of cargo would simply bypass Muuga Harbour. Ro-Ro freight flows are further elaborated in WP2-WP4 in terms of different commodities and distribution of different modes of transportation.

It is notable that outbound results for sea transportation are substantially larger than inbound flows in Muuga (2-4 times), thus making it primarily a vehicle for export. This is due to several factors. First, crude petroleum and related products, which by far account for the largest share of sea transportation early in the forecast period (up to 2040), are largely East-to-West export commodities. Second, Muuga is known as a port of export for natural and chemical fertilisers (with an approximate export-to-import ratio of 15:1); this is a trend that is predicted to remain during the forecast period. Both crude petroleum products and fertilisers are primarily carried using existing rail transportation. Lastly, wood and cork products are one of the main export commodities in the region and its flows are expected to increase substantially over time (5.5 times from 2015 to 2045). Most of this commodity will be imported by road and exported by sea.

Total freight flows to and from Muuga harbour are presented in Table 16.

Table 16. Total freight flows passing through Muuga Harbour (thousand tons, realistic scenario, different transport modes, inbound/outbound specific)

		2015	2025	2030	2035	2040	2045	2050	2055
Inbound	Rail (existing)	9 217	7 164	9 161	5 933	4 776	4 020	2 856	2 854
	Rail RB		2 059	2 746	3 798	3 857	4 044	1 749	1 786
	Road	2 209	5 327	7 193	7 900	8 287	8 569	7 481	7 936
	Ship	2 233	3 472	4 311	4 852	5 054	5 379	2 696	2 838
	Ro-ro		1 527	2 536	2 704	2 850	2 974	2 713	2 808
Outbound	Rail (existing)	509	411	598	1 021	981	1 089	505	505
	Rail RB		2 561	3 337	4 879	5 044	5 154	2 323	2 366
	Road	1 513	3 512	5 030	4 955	5 138	5 401	5 446	5 569
	Ship	11 636	11 204	13 790	10 918	10 061	9 597	7 215	7 686
	Ro-ro		1 861	3 191	3 414	3 601	3 744	2 007	2 097

Source: Goudappel model

5.2.3. Scenarios

The current sub-section focuses on explaining the modelling scenarios that were adapted to both RB and Muuga modelling results.

The optimistic scenario includes several commodity-specific added flows, such as oil products and miscellaneous articles. GDP growth is assumed to be similar to the realistic scenario. In particular, some added transport flows are estimated by experts:

- Koper (Slovenia) to Muuga line:
  - Additional 100 000 metric tons of miscellaneous container from 2025
  - Additional 300 000 metric tons of miscellaneous container from 2035
  - Additional 500 000 metric tons of miscellaneous container from 2050
- Future oil volumes in Muuga Harbour are assumed to be doubled compared to the realistic scenario, but they will decline from 2040 onwards, similar to the realistic market scenario.

The pessimistic scenario provides for an expected decline in GDP growth. As a result, this scenario sees a general decline in freight flows of 0.5 % per year relative to the realistic market scenario (OECD) as described above. From 2025 onwards, the decline is assumed to be 0.25 % per year. Additionally, it decreases the volumes of oil products and fertilisers by 50 % compared to realistic scenario. Flows of oil products are assumed to stop altogether from 2040.

Table 17 and Table 18 show the total freight flows passing through Muuga Harbour for all market scenarios. However, please note that this does not represent the total cargo flow in the case of Muuga port. The table instead shows the summed-up tonnages of both directions (inbound plus outbound) for the purposes of the comparison of different transportation types and simplicity of illustrating different scenarios. The tonnage of actual cargo at the port should be represented by half of these figures to avoid the double counting (see Table 17).

Table 17. RB Muuga option; Total freight flows along RB section Pärnu-Tallinn (Lagedi) by scenario (thousand tons, both directions)

Market scenario	2025	2030	2035	2040	2045	2050	2055
Optimistic	4 800	6 325	10 669	11 170	11 669	24 081	24 989
Realistic	4 620	6 082	8 676	8 902	9 198	19 369	19 921
Pessimistic	2 315	3 009	4 574	4 775	5 123	10 504	11 114

Source: Goudappel model

Table 18. Total freight flows passing through Muuga Harbour by scenario (thousand tons, both directions)

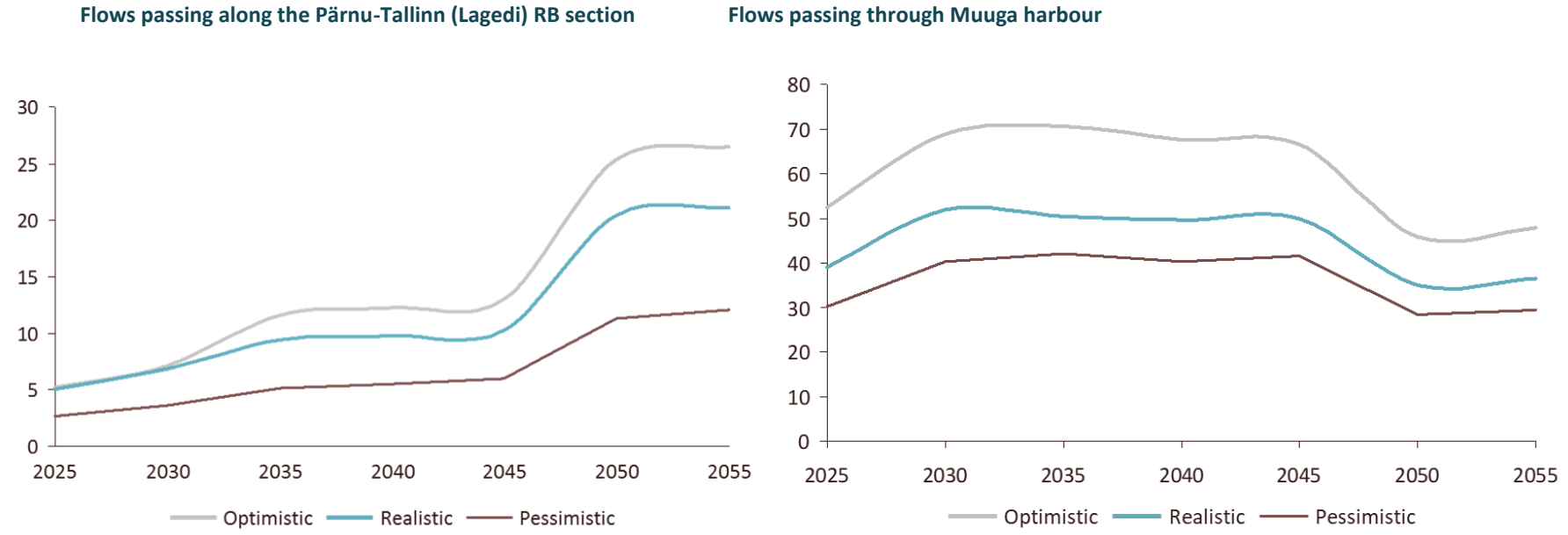
Market scenario	Mode	2015	2025	2030	2035	2040	2045	2050	2055
Optimistic	Rail (existing)	9 726	12 946	16 698	12 064	9 025	7 259	4 604	4 611
	Rail RB	-	4 862	6 391	10 845	11 351	11 851	5 149	5 289
	Road	3 722	9 266	12 797	15 988	17 023	17 899	16 385	17 252
	Ship	13 869	21 693	26 929	24 052	21 991	21 064	13 625	14 555
	Ro-ro	-	3 541	5 980	7 586	8 159	8 588	5 982	6 261
Realistic	Rail (existing)	9 726	7 575	9 760	6 955	5 757	5 109	3 361	3 359
	Rail RB	-	4 620	6 082	8 676	8 902	9 198	4 072	4 152

Market scenario	Mode	2015	2025	2030	2035	2040	2045	2050	2055
	Road	3 722	8 839	12 223	12 855	13 425	13 969	12 927	13 504
	Ship	13 869	14 676	18 101	15 770	15 115	14 976	9 910	10 523
	Ro-ro	-	3 388	5 727	6 117	6 452	6 718	4 720	4 905
Pessimistic	Rail (existing)	9 726	4 178	5 492	4 477	3 321	3 399	2 032	2 015
	Rail RB	-	4 348	5 650	7 962	8 041	8 207	3 590	3 613
	Road	3 722	8 250	11 258	11 721	12 066	12 398	11 356	11 705
	Ship	13 869	10 261	12 564	12 220	11 033	11 439	7 354	7 768
	Ro-ro	-	3 155	5 268	5 557	5 787	5 949	4 100	4 202

Source: Goudappel model

Figure 23 illustrates a graphic comparison of scenarios in terms of the total freight flows passing through RB section Pärnu-Tallinn (Lagedi) and Muuga Harbour, based on the data provided above.

Figure 23. Total freight flows comparison by scenario (million tons, both directions)



Source: Goudappel model

5.3. Terminal facilities expectations

We spoke with representatives of different companies who either own cargo or deliver cargo in order to establish the basis for analysis in the work packages to be followed in freight demand analysis.

A significant number of companies do not have specific requirements for the terminal. Around 60 % of Estonian companies and 30 % of companies in other countries expressed some specific expectations for the terminal. Logistics and industry companies expressed specific expectations for the terminal based on their experience, business line, freight type and facilities, which should be considered depending on the overall development of the freight flows.

The most common expectations from interviewees (around 50 % of the companies that expressed expectations) for Muuga multimodal terminal are terminal changing freight from road to rail, from sea to rail and from/to 1435 mm rail and 1520 mm gauges (convenient link between different gauges), sufficient warehousing facilities, loading/unloading equipment and customs facilities.

As Muuga terminal is mainly seen as a gateway to Finland, both according to interviews and freight forecast, a ro-ro terminal is a must as a prerequisite for the multimodal Muuga terminal. What is more, one logistics company representative even claimed that without the possibility of transporting trailers on train platforms there is no future for Rail Baltica.

Industrial companies mostly expect the terminal to be like other multimodal terminals (e.g. such as Kaunas intermodal terminal). Other expectations for the terminal differ, mainly depending on the cargo handling facilities that the companies have now. Those who do not have sufficient in-house facilities (and comparatively smaller companies) would like to see a full-service provision: loading, unloading, packing, unpacking, sorting, labelling, weighing-machine, specialist warehousing (e.g. temperature-controlled), etc. With a full range of services in the terminal, they would not need to transport freight to some other facility and, therefore, could save time and possibly money.

Those companies that have their own facilities and can perform some functions there expect less technical equipment and functions from the terminal: loading, unloading and sorting services are required, but they do not require packing, unpacking and labelling as these tasks are undertaken at their own facilities.

Expectations for the terminal partially differ depending on the nature of the products (weight, dimensions, fragility, temperature sensitivity, etc.). Chemical industry representatives mentioned that they would expect the terminal to have warehouses that have heating. Most electronics and machinery companies stressed the need for technical equipment that is suitable for handling large, heavy and/or fragile products.

Estonian logistics companies expressed a strong need for equipment handling all wagon-types (including containers that are loaded from the top, which require special and more expensive equipment), as multimodality cannot be achieved with one handling solution. They also stressed that the need for a multifunctional terminal is sustained by a lack of necessary volumes for operating trains with one only commodity – a train will need to carry different freight types (container, dry bulk etc.). However, all types of wagons and cargo that can be handled in Muuga have to be suitable for further handling at other terminals in destination and origin countries (compatibility on both ends of the route).

Logistics companies and terminal operators suggested launching train ferries, possibly between Muuga and Vuosaari. In addition, according to several logistics companies, the terminal should be a universal solution that is not only dependent on the harbour activities and interests. It means that the terminal should not exclusively serve the companies operating within Muuga Harbour; instead, road and rail multimodality and cargo movements from other ports in Estonia (most notably Paldiski) to the terminal should also be considered.

Based on the interviews, basic model results and standard practice, the essential facilities and services that are necessary from the beginning of the terminal operations are the following (basic phase):

- Container Terminal 1435 mm/1520 mm rail-rail, road-rail, sea-rail (MCTRB shall be in direct proximity to ship-to-shore gantry cranes to minimise transport distances). Transshipment equipment: RMG crane, reach stacker, shuttle carriers;
- Container depot;
- Ro-ro terminal;
- Electrical connection for reefer containers;
- Parking capabilities for trucks and semi-trailers;
- Office building;
- Customs facilities;
- Weighing system, radiation monitoring;
- Gate for trucks;
- Simple warehousing facilities.
- Facilities that will depend on rail, ship, road and logistics product and service development, as well as on the overall development of the traffic and freight volumes are as follows (extended phase):
- Extended warehousing options – closed storage, temperature-controlled storage (that depend on the freight volumes and on the already existing warehousing capabilities in Muuga);
- Container terminal – extension by further tracks, additional transshipment equipment, extension of the container depot area, extension of parking capabilities;
- Value-added services: packing, unpacking, sorting.

The outcomes of the WP 1 concerning forecasted economic development, freight volumes and structure, as well as insights from the interviews, are used to define the exact technical and other special needs of multimodal Muuga terminal, and these are further elaborated in WP2-WP4.

6. Annexes

6.1. Data used

A combination of desk research, literature review, expert interviews, analysis of statistical data and modelling of freight flows was used in this study.

List of literature used

Table 19. The list of literature for WP 1.1

No	Name of the study	Year	Authors
1.	A Feasibility Study for a standard gauge separate railway line in Estonia, Latvia and Lithuania	2011	AECOM
2.	Helsinki and Tallinn on the move	2012	Ulla Tapaninen
3.	North Sea–Baltic Core Network Corridor Study	2014	Proximare
4.	Development of a multimodal port freight transportation model for estimating container throughput	2010	Franklin Ekoue Gbologah
5.	Pre-feasibility study of Helsinki-Tallinn fixed link	2015	Sweco
6.	Feasibility study of further development of public logistics centres in Lithuania	2014	Smart continent
7.	Intermodal freight terminals: In search of efficiency to support intermodality growth	2006	Marco Valerio Salucci
8.	Terminal Study on the Freight Corridor Rotterdam-Genoa	2008	A.A. Roest Crollius
9.	Deregulation's impact on the railway freight transport sector's future in the Baltic sea region	2013	Milla Laisi
10.	Feasibility Study on Rail Baltic Railways	2007	COWI
11.	Improving cost-efficiency and reducing environmental impacts of intermodal transportation with dry port concept – major rail transport corridor in Baltic sea region	2015	Ville Henttu
12.	Rail Baltic Intermodal Logistics Centre in Latvia	2015	AECOM
13.	Public-private partnership investments in dry ports – Russian logistics markets and risks	2016	Yulia Panova
14.	Rail Baltic Feasibility Study Amendment – Analysis of Vilnius Extension	2014	AECOM
15	Survey of people travelling between Tallinn and Helsinki – air passengers	2011	Turu-uuringute AS
16.	Cargo Traffic on the Helsinki-Tallinn route	2011	Pekka Sundberg, Antti Posti, Ulla Tapaninen
17.	Competing Transportation Chains in Helsinki-Tallinn Route: Multi-Dimensional Evaluation	2012	Olli-Pekka Hilmola
18.	Competitive Position of the Baltic States Ports	2013	KPMG
19.	Development of public logistics centre (PLC) and infrastructure in the area under its influence	2013	NPR, Kelprojektas

No	Name of the study	Year	Authors
20.	Economic Development Perspectives of the Elbe/Oder Chamber Union (KEO)	2013	Michael Bräuninger, Silvia Stiller, Mark-Oliver Teuber, Jan Wedemeier
21.	Economic flows between Helsinki-Uusimaa and Tallinn-Harju regions	2013	Seppo Laakso, Eeva Kostiainen, Tarmo Kalvet, Keio Velström
22.	Enhancing Accessibility of Rail Baltic Influence Area: Standpoints of Public Sector	2011	Milla Laisi, Ville Henttu and Olli-Pekka Hilmola
23.	Freight on road – Why EU shippers prefer truck to train	2015	Francesco Dionori et al.
24.	Freight Transport Industry: Latvia	2011	KPMG
25.	Joint Barents Transport Plan: Proposals for development of transport corridors for further studies	2013	The Barents region expert group
26.	Level of service on passenger railway connections between European metropolises	2013	Attila Lüttmerding, Matthias Gather
27.	Logistics of North-West Russia and Rail Baltic: Standpoints of Private Sector	2013	Marina Karamysheva, Ville Henttu and Olli-Pekka Hilmola
28.	Operational Challenges to Port Interfaces in the Multi-modal Transport Chain (Maritime and Hinterland Connections)	2013	Amber coast logistics
29.	Private transport market stakeholders in the area of Rail Baltic	2007	EU-CONSULT
30.	Promoting information exchange with a port community system – case Finland	2011	Antti Posti, Jani Häkkinen, Ulla Tapaninen
31.	Baltic transport outlook 2030	2011	Morten S. Petersen et al.
32.	Public Sector Actors' Views on Rail Baltic	2011	Juha Saranen, Olli-Pekka Hilmola, Milla Laisi
33.	Rail Baltic Growth Corridor Work Package 4 Final Report	2012	Michał Beim, Jakub Majewski
34.	Rail Baltic Growth Corridor. Analysis of growth potential and governance model	2013	KPMG
35.	Rail Baltic growth strategy	2013	Olli Keinänen, Malla Paajanen
36.	Rail Baltic Influence Area: State of Operating Environment	2011	Olli-Pekka Hilmola
37.	Should Czech Republic and Slovakia Have Rail Baltic Strategy?	2011	Olli-Pekka Hilmola
38.	Spatial Mobility between Tallinn and Helsinki in Mobile Positioning Datasets. Statistical overview.	2012	Siiri Silm, Rein Ahas, Margus Tiru
39.	The operation of the transport market and the new solutions recommended under the RBGC project	2012	INDICATOR centre of marketing and research
40.	Why Do Open Rail Freight Markets Fail to Attract Competition? Analysis on Finnish Transport Policy	2011	Miika Mäkitalo
41.	Project development of infrastructure for Kaunas public logistics centre and its influence	2013	NPR

No	Name of the study	Year	Authors
42.	Feasibility study on the development of the railway infrastructure of the Rail Baltic section PL/LT state border – Kaunas RRT to the traffic speed	2016	Lietuvos geležinkeliai
43.	Twin-city in making: integration scenarios for Tallinn and Helsinki capital regions	2012	Erik Terk
44.	Estonian exporters competitiveness survey	2015	EY

Interviews

The list of interviews was compiled in cooperation with the client to represent the main stakeholders, as defined in the Terms of References: importing/exporting companies, transport operators and other service providers, experts and umbrella organisations.

The interview questionnaires were translated into local languages and conducted by local teams, who were organised to carry out the interviews.

Table 20. Number of interviews conducted

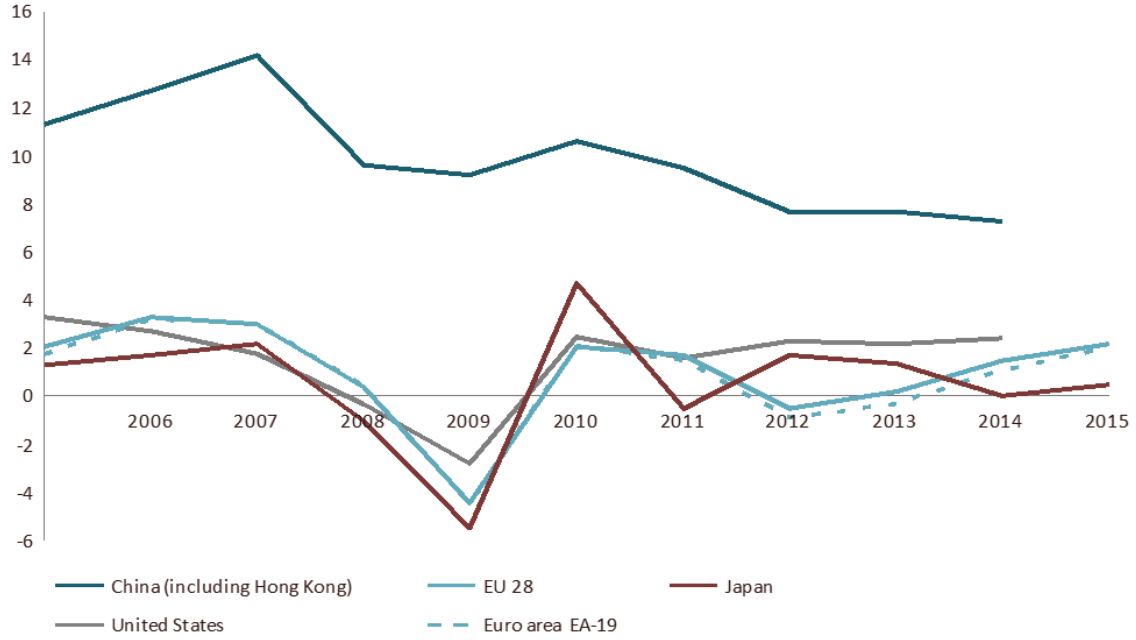
Country	Number of interviews
Estonia	65
Latvia	12
Lithuania	17
Finland	18
Russia	6
Other	5
TOTAL	**123**
…out of which independent experts	29

6.2. Global macroeconomic overview

This section provides an overview of the situation in the global economy, and it primarily focuses on the historical, current and future development of growth in various groups of countries such as the EU-28, euro area and OECD. It also evaluates the correlation between growth in the transport sector and economic growth as a whole.

The world economy is gradually stabilising, and positive signs of economic growth have been detected in emerging economies since the 2008-09 financial crisis. The impact of the recession is shown in Figure 24, illustrating the change in GDP compared to the previous year. Since 2009, the **EU countries** (both EU-28 and euro area) have struggled to keep the growth rate above 0 %; due to the debt crisis, the growth was negative in 2012-13, therefore making recovery after the recession slow. Overall, the growth rate for all EU countries has been slightly higher than that for the euro area.

Figure 24. GDP development in EU-28 and euro area in comparison with the USA, China and Japan in 2005-2015, % change compared with the previous year

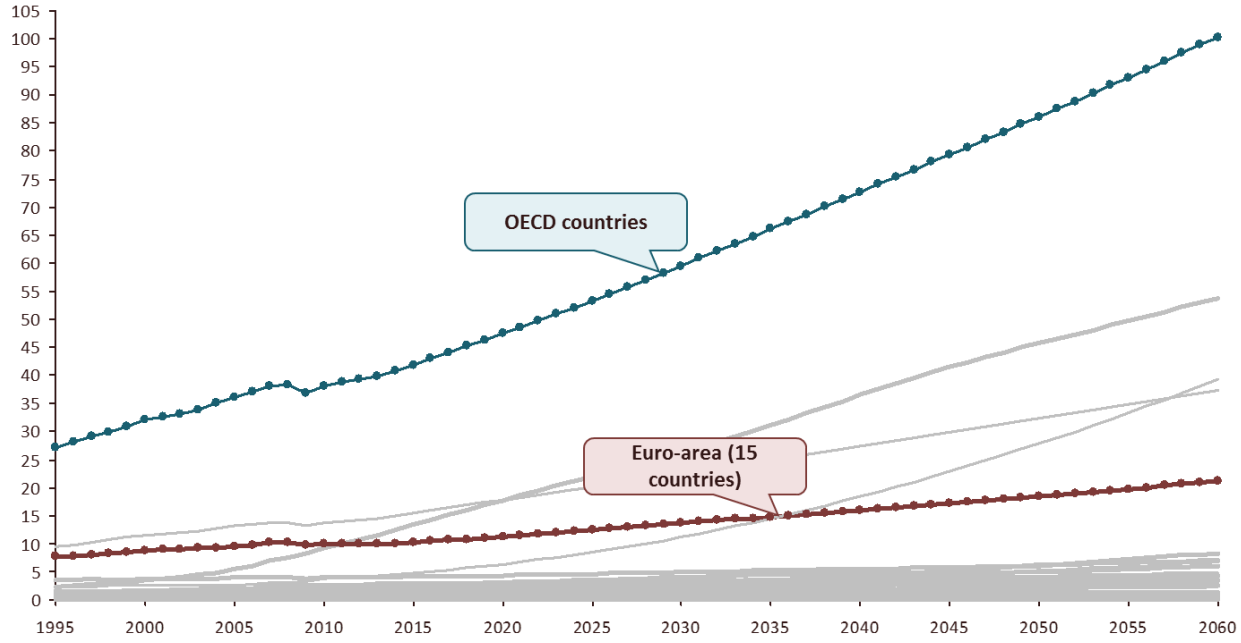


Source: Eurostat[55]

Since 2014, the major world economies have been showing signs of recovery. The GDP growth of the Baltic states is forecasted at 2-3 % through the 2020s and between 1-2 % subsequently. Other advanced economies are expected to grow at a moderate rate, around 2 %, throughout the 2020s and around 1 % subsequently. For OECD, overall expectations for economic growth are slightly more favourable than for the euro area countries (15 countries, see Figure 25).

[55] http://ec.europa.eu/eurostat/statistics-explained/index.php/National_accounts_and_GDP

Figure 25. Estimated GDP development in OECD and euro area countries, thousand billion USD

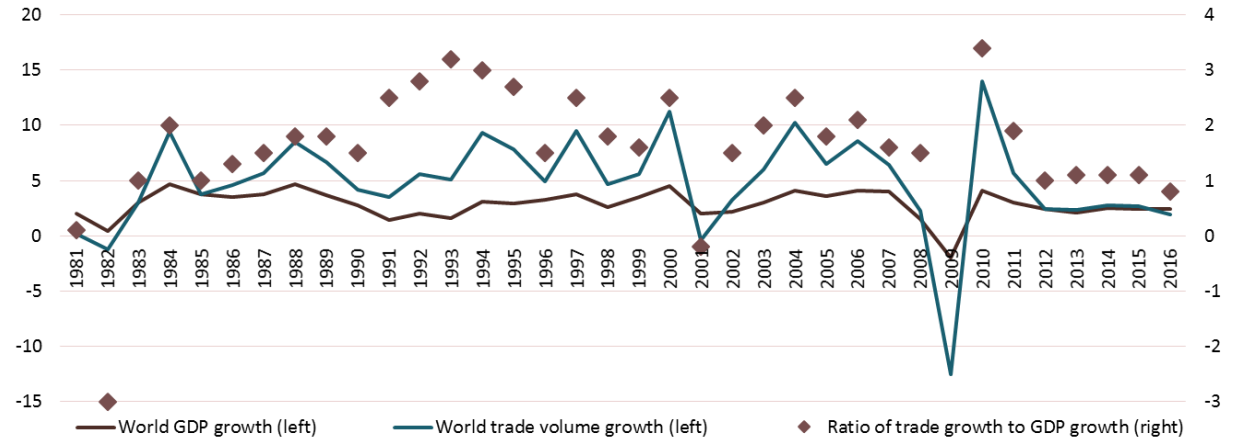


GDP long-term forecast (indicator); the blue curve represents the whole OECD area and red curve Euro area (15 countries), grey curves represent separate countries in the world.

Source: OECD[56]

Judging by historical trends (see Figure 26), **world GDP and world trade growth are correlated**. Strong trade growth has always been a sign of strong economic growth, as trade export contributes to the growth of developing and emerging economies, while strong import growth has been associated with faster growth in developed countries.

Figure 26. Ratio of world merchandise trade volume growth to world real GDP growth, 1981-2016



Source: WTO Secretariat for trade, consensus estimates for GDP[57]

[56] https://www.oecd-ilibrary.org/economics/gdp-long-term-forecast/indicator/english_d927bc18-en
[57] https://www.wto.org/english/news_e/pres17_e/pr791_e.htm

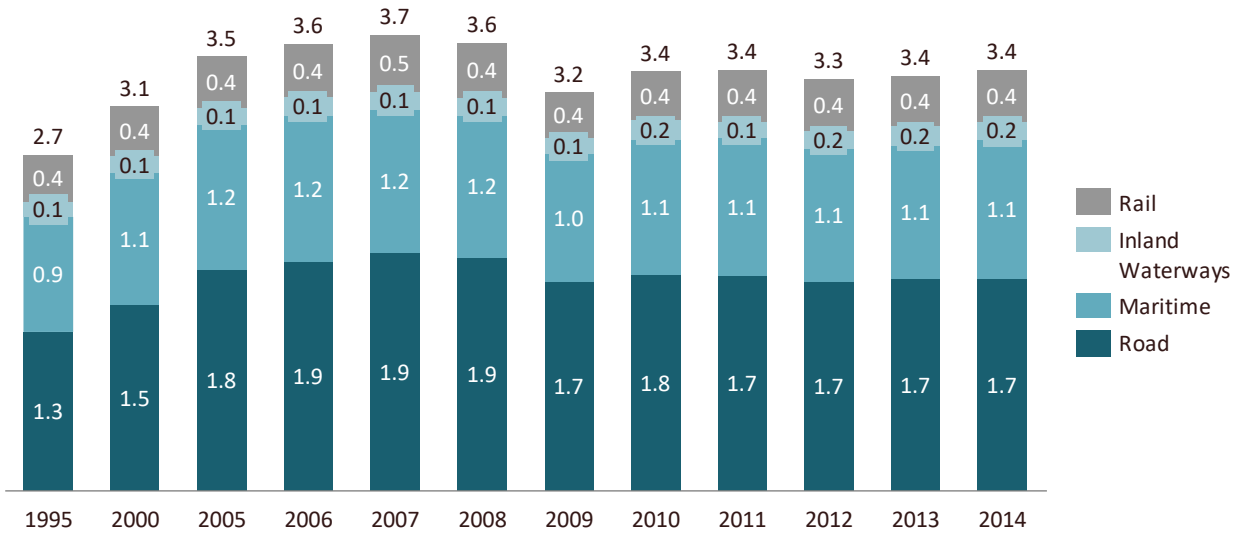
In recent years, the relationship between trade and GDP growth has been weakening: while trade has typically grown in recent decades at 1.5 times faster than GDP, the ratio has slipped towards 1:1 and has remained stable for the last 4 years. In 2016, the ratio of trade growth to GDP growth was below 1 for the first time in the last 30 years.[58]

Despite the fact that the growth rates are gradually showing stability, the world economy is vulnerable to political turmoil in several parts of the world, which have a direct impact on the economy, investments, military and transport. The political uncertainty concerning the EU and several of its Member States, questions on the enlargement and/or presence of NATO and immigration as the significant human and political challenges set the most vulnerable conditions for transport development and the investment environment.[59]

6.3. Role of transport in economic development

The split between modes of transport consistently shows a **high dependence on road transport** (see Figure 27). Due to an increasing strength of political measures, the share of road transport is expected to diminish. **Rail transport** is a **high priority in the EU** TEN-T Regulation (2013); however, priority position has little significance when rail infrastructure, rail operations and facilitating measures are managed in each country independently.

Figure 27. Freight transport volume and modal split in the EU 1995-2014, billion thousand ton-kilometres

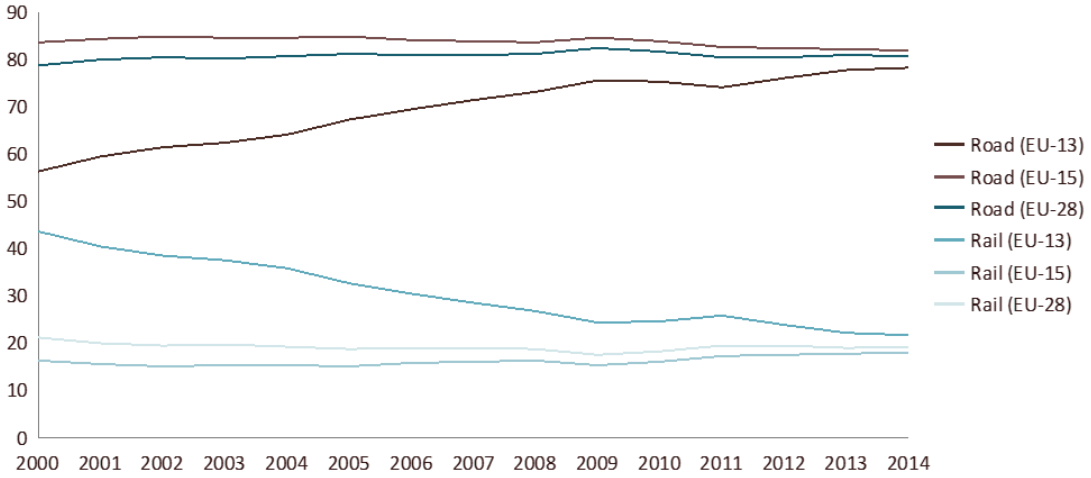


Source: European Environmental Agency[60]

Comparison between road and rail transport in the EU-28, EU-15 and EU-13 countries highlights the main trend of the loss of the railway sector in the new EU Member States compared to the road sector. This results from the overall growth and diversification of the economies of newer Member States, which has increased both the numbers of vehicles and the volumes of goods on road infrastructure, while the role of railways has remained to primarily serve international trade and transit. The long-dominating East-West transport still exists, but trade within the EU has increased considerably, a large portion of which is in road transport.

[58] https://www.wto.org/english/news_e/pres16_e/pr779_e.htm
[59] https://www.univaasa.fi/materiaali/pdf/isbn_978-952-476-520-6.pdf
[60] https://www.eea.europa.eu/data-and-maps/daviz/freight-transport-volume-4#tab-chart_1

Figure 28. Modal split between rail and road in the EU (EU-13, EU-15, EU-28) in 1995-2014, share of freight transported in %



Source: Eurostat[61]

6.4. Potential logistics infrastructure and factors affecting demand

This section describes the existing and planned logistics and goods handling infrastructure in the catchment area of MCTRB in terms of competition and cooperation. The existing and potential multimodal, intermodal and container terminals in the St. Petersburg and Finland area are described, as well as all the terminals along the entire RB railway line between Helsinki and Warsaw, such as Pärnu freight terminal, Riga intermodal terminal and Kaunas intermodal terminal. Additionally, the future rail network relevant for MCTRB is examined, specifically the Tallinn-Helsinki permanent connection through a tunnel.

Freight terminals

This sub-section describes the current, planned and potential freight (container, intermodal and multimodal) terminals that are within the catchment area of MCTRB: Southern Finland, Northwest Russia and along the entire RB railway line (Estonia, Latvia, Lithuania and Poland).

Estonia

One potential freight terminal location on the Rail Baltic route in Estonia, in addition to Muuga, is Pärnu. However, it is not yet certain where and how the terminal will be built, if at all. Currently, the project is at the proposal stage with the feasibility study scheduled for implementation by the end of 2018. Moreover, there are no existing terminals in Estonia that are officially defined as either multimodal or intermodal.

The **only significant container terminal is operated by Transiidikeskuse AS** at Muuga Harbour, which has, in effect, a monopoly position. Its current capacity is 600 000 TEUs[62], which could be extended to 2 million TEUs with further investments.

Sillamäe harbour began regular container shipping lines in autumn 2016 and is, therefore, demonstrating interest in expanding its handling of containers. As the project is still in its infancy, it is not yet known whether Sillamäe will become the other significant container terminal in Estonia. The characteristics and services of both terminals are described in the table below.

[61] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=tran_hv_frmod&lang=en
[62] http://www.tk.ee/en/terminals/container-terminal/

Table 21. Existing container terminals in Estonia

Terminal characteristics	Transiidikeskuse container terminal	Silsteve multifunctional terminal (port of Sillamäe)
Length of berths (m)	1 096	1 550
Depth at berths (m)	12.5-14.5	15.5
Storage capacity at the area (m^2)	130 000	870 000
Terminal capacity per year (TEU)	600 000	200 000
Number of plugs for reefer containers	404	n/a
Services	Loading/unloading of goods (containers, general goods, refrigerated goods, scrap metal) Free zone storage services Picking of goods and re-loading Forwarding services Changing ownership in free zone Purchase and sales of goods Value-added services Renting, maintenance and repair of loading equipment	Loading and discharge of bulk, general, ro-ro, project cargo and containers transported by sea, road and railway transport Storage of cargo Customs and shipping documentation services Forwarding services Cargo packing, sorting, marking and other additional services

Source: Transiidikeskuse AS, Port of Sillamäe[63]

Finland

On the core network corridors in Finland, there is only one railway terminal – **Kouvola** (Tehola-Kullasvaara region) –, which has the highest cargo flow and volume in Finland. In diversifying its logistical offering, Kouvola launched the ambitious Rail-Road Terminal Project in 2015. The aim of the project is to create Finland's first large-scale intermodal terminal, complete with state-of-the-art Logistics Park services. By 2030, Kouvola wants to be one of the most important logistical hubs in Northern Europe, driven by cutting-edge Smart Logistics. For instance, the project aims to facilitate container trains of maximum length from Russia and Asia, along with other concepts that will improve the cost-efficiency of logistics.

The major container ports in Finland are Hamina-Kotka, Helsinki and Rauma, which handle 88 % of all containers combined. Each port has several terminals handling containers, but the largest container terminals are Mussalo, Vuosaari and Euroports Rauma, respectively (see table below). These figures are slightly more optimistic in comparison to the experts' estimates from two international container specialists, who have projected container flow to be around 430 000 TEU in Hamina-Kotka (of which 200 000 TEU are empty containers) and 370 000 TEU in Helsinki (empty – 190 000 TEU); however, this still confirms them as the major container ports in the MCTRB area.

[63] http://www.tk.ee/en/terminals/container-terminal/; http://www.silport.ee/infrastructure.html

Table 22. Largest container terminals in Finnish ports

Port	Largest terminals	Services	Capacity (TEU)	Handled (TEU)[64]
Hamina-Kotka	Mussalo	Container loading/unloading. Full service - cargo handling, warehousing, forwarding, customs terminal.	1 000 000	554 578
Helsinki	Vuosaari		1 200 000	435 424
Rauma	Euroports Rauma		500 000	259 827

Source: Websites of the terminals, Port of Hamina-Kotka[65], Port of Helsinki[66], Port of Rauma[67]

Latvia

Ports in Latvia are in direct competition with Muuga for cargo moving on the East-West axis. However, these terminals can be partners to accommodate trade within the Baltic countries.

With the development of Rail Baltic, several intermodal logistic centres are planned to be built in the Baltic states. The **Rail Baltic Intermodal Logistics centre (RBILC) in Latvia** is planned to be built in Salaspils (20 km from Riga), and it should be operational by 2025 and reach full capacity by 2040. According to a study conducted by Aecom, 1.6 million tons (approx. 162 thousand TEUs) could be handled annually by 2040 (base scenario), which would equate to 5 trains per day (assuming 100 TEU per train, operational 6 days a week). The terminal would be medium-sized with a handling capacity of 4-9 trains a day that would be mainly focused on containerised freight. The terminal would include both a 1 435 mm gauge Rail Baltic line and the existing 1 520 mm gauge network. In total, the terminal is suggested to include five tracks (two 1 435 mm, two 1 520 mm gauge only, and two dual gauge) that are capable of handling and servicing 1 050 m long freight trains. 4 rail mounted gantry cranes (RMGs) would be used for loading and unloading freight. The terminal would provide a wide range of services – intermodal (rail-rail, road-rail, rail-warehouse), customs, value-added services, warehousing, repair, etc. The size of the terminal will be around 30 ha, but further extensions to the logistics village could be developed to around 400 ha.

Riga has three of the five container terminals (see Table 23) that handle almost all containers transported through Latvia. The least amount is handled in Liepaja, while Ventspils terminal has switched to service other types of cargo rather than containers.

Table 23. Current container terminals in Latvia

Name	Location	Services	Capacity (TEU)	Handled (TEU)
Baltic Container terminal	Freeport of Riga	Container loading/unloading	450 000	n/a
Rīgas konteineru terminmāls (Riga container terminal)	Freeport of Riga		110 000	71 145 (2014)
Rīgas Centrālais terminmāls (Riga central terminal)	Freeport of Riga	Container loading/ unloading; storage and customs services Forwarding services	100 000	n/a

[64] http://www.finnishports.fi/eng/statistics/monthly-statistics/?stats=monthly&T=2&year=2016&month=1&changes=rolling
[65] http://harboursreview.com/port-kotka.html
[66] http://www.portofhelsinki.fi/sites/default/files/attachments/vuosaari %20harbour %20- %20forward %20together.pdf
[67] http://www.portofrauma.com/sites/default/files/raumansatama_kasikirja2016_web120216_0.pdf

Name	Location	Services	Capacity (TEU)	Handled (TEU)
Noord Natie Ventspils terminal	Freeport of Ventspils	Container and ro-ro loading/unloading	150 000	-
Liepājas osta LM (Liepaja port LM)	Port of Liepaja	Container loading/unloading	n/a	3 668 (2015)

Source: Websites of the terminals[68], Freeport of Riga[69], Freeport of Ventspils[70], Port of Liepaja[71]

Lithuania

Much like in Latvia, Lithuanian terminals are competing with Muuga terminal on the East-West axis.

Lithuania has several intermodal terminals already operating and several that are being developed. Opened since 2015, Kaunas intermodal terminal (KIT) distributes containers to the West and to the North, which come through Rail Baltic, while the Vilnius intermodal terminal (VIT) is more oriented to Eastern trade routes.[72] Klaipeda intermodal terminal is yet to be built. In terms of private terminals, Kazakhstan Railways, the national railway company of Kazakhstan, has been planning to build a 1 million TEU container terminal in Klaipeda. In 2015, the company opened their first intermodal container terminal known as Klaipeda West Gate, and it has a capacity of 100 000 TEUs per year.[73]

Table 24. Current and future intermodal terminals in Lithuania

Characteristics	VIT (part of public logistics centre)	KIT (part of public logistics centre)	Klaipeda intermodal terminal (part of public logistics centre)	Klaipeda West Gate intermodal terminal
Storage (TEU)	1 500	550	1 200	NA
Loading capacity per year (TEU)	100 000	55 000	100 000	100 000

Source: Websites of the terminals, Port of Klaipeda

Apart from official intermodal terminals, there are two container terminals located in the **port of Klaipeda** that provide multimodal transport services: Klaipeda Container Terminal and Klaipeda's Smelte container terminal. About 15 % of containers arrive and depart from Klaipeda Container Terminal by rail. The terminal uses a modern RTG crane to handle containers from/to rail platforms. Also, the territory of the terminal has 4 railway tracks (88 wagons). Expansion of the container terminal lies in Klaipeda's Smelte development programme for the 2015-2023 period. Implementation of the company's development programme would result in annual throughput capacity of over 900 000 TEU. More than 90 % of the volume is expected to be moved in and out by sea.

[68] http://www.bct.lv/lv/info/infrastruktura; http://www.rigact.lv/lv/; http://www.rto.lv/en/about-rto/company-profile/; http://www.nnvt.lv/lat/
[69] http://rop.lv/en/about-port/mission-and-vision.html
[70] http://www.portofventspils.lv/en/port-in-general/port-in-numbers/
[71] http://www.liepaja-sez.lv/lv/port/tehniskie-parametri
[72] http://sc.billions.lt/view/item/184342
[73] http://www.portofklaipeda.lt/news/5018/578/Lietuvos-ir-Kazachstano-pokalbiu-rezultatas-naujas-terminalas/d,press

Table 25. Container terminals in Lithuania

Terminal characteristics	Klaipeda's Smelte container terminal	Klaipeda Container Terminal
Length of berths (m)	1 088	820
Depth at berths (m)	14	n/a
Storage capacity at the area (TEU)	20 000	18 000
Terminal capacity per year (TEU)	600 000	450 000
Number of plugs for reefer containers	657	n/a
Maximum length of ships (m)	337	230
Maximum draught of container ships at berths and the channel	13.2	10
Services	Discharging/loading and storage of all container types Servicing of containers transported by Viking, Mercury, Sun and TransBaltica shuttle trains Weighing, washing, repairing of containers and other related services Handling of heavy lift and project cargo Container Freight Station (CFS) services	Discharging and loading all types of containers Services to reefer containers Pre-trip inspection (PTI) CFS services (stripping & stuffing) Depot services (repairs, cleaning, washing, neutralisation) Weighing containers and goods EDI services, reporting to clients VGM weighing and certification

Source: Websites of the terminals[74]

Tallinn-Helsinki fixed line

The Helsinki-Tallinn twin cities concept is the fastest growing cross-border economic region on the North Sea-Baltic core network corridor. The economic interaction between the two cities has grown so large and intensive that the economic prosperity, labour market and trade of both cities have become largely dependent on it. Outside the current national transport strategy, the possibility to build a fixed link (tunnel) between Helsinki and Tallinn has been actively debated in Finland and Estonia for some time and has attracted international media attention. In 2018, a feasibility study was published,[75] which concluded that the fixed link with a cost estimate of 13-20 billion EUR would be economically feasible with a grant of at least 40 % from the EU. According to the study, the construction phase could start in 2025 and last 15 years. With this in mind, the tunnel would become operational in 2040.

In 2050 the demand in freight transport is assumed to be 8 million (scenario with tunnel), 4 million tons is via tunnel and 4 million on ferries; freight in the tunnel represents an above average value/ton.[76] The cost-

[74] http://www.smelte.lt/en/services/container-terminalservices/; http://www.terminalas.lt/en/terminals/
[75] http://www.finestlink.fi/wp-content/uploads/2018/02/FinEst-link-REPORT-FINAL-7.2.2018.pdf
[76] http://www.finestlink.fi/wp-content/uploads/2018/02/final-conference-handout.pdf

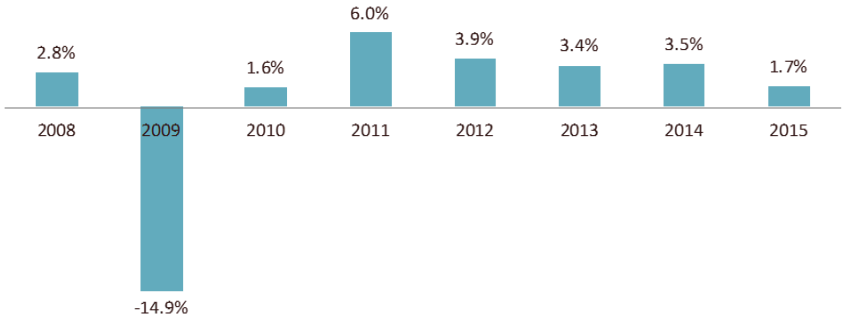
benefit analysis concluded that the tunnel scenario has low economic feasibility (0.45 B/C ratio) due to its large investment costs.

6.5. Profiles of catchment area countries: economic development and trade

6.5.1. Estonia

Estonia has one of the higher GDP per capita in Central Europe and among the Baltic states. According to the Doing Business Index[77] Estonia holds 12th place out of 190 countries.[78] In 2009, the Estonian economy contracted by 14.7 %, but it has recovered since.[79]

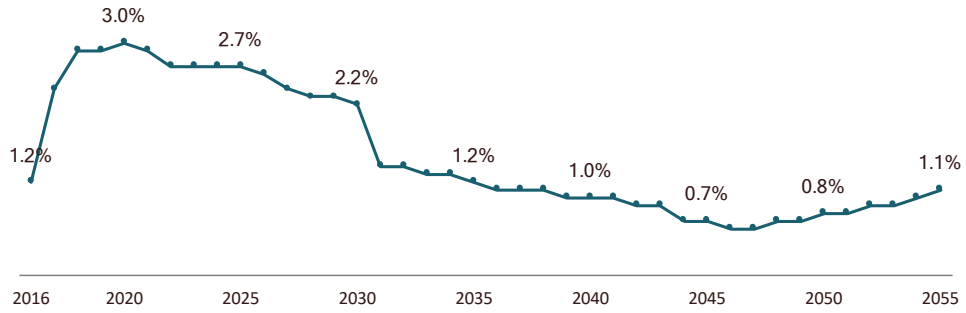
Figure 29. Estonian real GPD growth 2008-2015



Source: Statistics Estonia[80]

In the long term, the Estonian economy will develop at a moderate pace with inflation rates within the European Central Bank threshold of a 2 % annual increase. The forecasted growth of Estonian GDP until 2055 is presented in Figure 30 below.

Figure 30. Estonian GDP forecast 2016-2055, constant 2010 prices



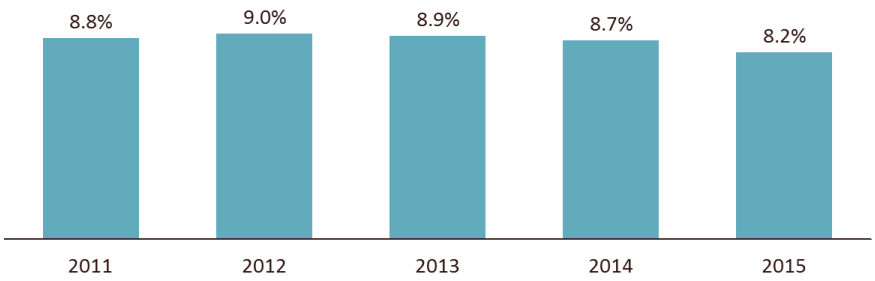
Source: Goudappel model, Estonian Ministry of Finance[81], OECD forecast[82]

[77] Index includes: ease of starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency.
[78] http://www.doingbusiness.org/rankings
[79] https://www.mkm.ee/sites/default/files/konjunktuur_nr_1_196_marts_2016.pdf
[80] https://www.mkm.ee/sites/default/files/konjunktuur_nr_1_196_marts_2016.pdf
[81] https://www.rahandusministeerium.ee/et/system/files_force/document_files/mof-forecast-summer-2016.pdf?download=1
[82] https://www.oecd-ilibrary.org/economics/gdp-long-term-forecast/indicator/english_d927bc18-en

Transport sector

Transport and logistics play a vital role in the Estonian economy. As of 2015, the transport sector employed around 45 000 people (over 7 % of the working population) and accounted for around **8 % of Estonian GDP.** However, in recent years, the transport sector has been in decline. The main reason behind this is the **decrease in East-West directional transit freight through Estonia**.

Figure 31. Share of Estonia's transport sector in GDP, %



Source: Statistics Estonia[83]

Analysis of trade

Export and import proportion have been **stable in recent** years and accounted for **47 % and 53 %** respectively. Larger negative balances of trade were observed in relation to chemical products, transport, machinery and equipment. The biggest surplus was registered in the sectors of wood and wood products along with furniture, pillows, blankets and wooden buildings.[84]

The import of goods has been increasing most years. The increase has been facilitated by the rapid inflow of foreign direct investment and the development of private consumption. The volume of imports in 2014 was 13.8 billion EUR while in 2015 it was 13.1 billion EUR.[85]

Table 26. Geographical distribution of Estonian import and export in 2015

Total	% of total import	% of total export
Europe total	**90.9 %**	**89.2 %**
EU28	82.5 %	75.1 %
Euro area	58.7 %	46.9 %
Finland	14.5 %	15.7 %
Latvia	8.5 %	10.4 %
Rest of EU28 (non-Euro area)	23.8 %	28.2 %
Sweden	8.5 %	18.8 %
United Kingdom	2.7 %	2.8 %
Rest of Europe (non-EU28)	8.4 %	14.1 %

[83] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=NAA0045&ti=VALUE+ADDED+BY+ECONOMIC+ACTIVITY+%28EMTAK+2008%29+%28ESA+2010%29&path=../I_databas/Economy/23National_accounts/01Gross_domestic_product_%28GDP%29/11gross_domestic_product_by_production_approach/&search=GROWTH&lang=1

[84] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf

[85] https://www.mkm.ee/sites/default/files/konjunktuur_nr_1_196_marts_2016.pdf

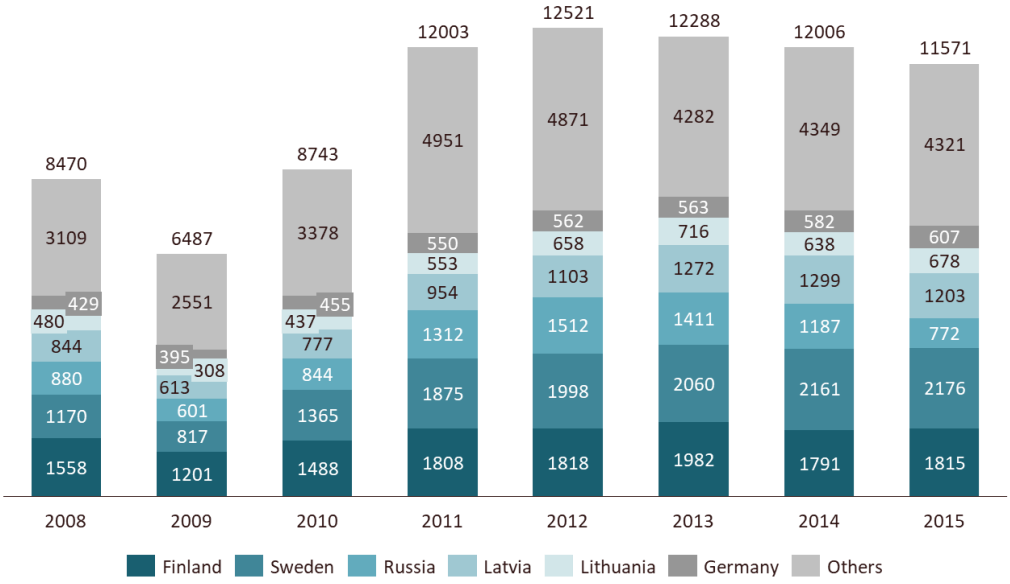
Total	% of total import	% of total export
Russia	6.0 %	6.7 %
Other	**9.1 %**	**10.8 %**

Source: Statistics Estonia[86]

The main Estonian trading partner in 2015 was Sweden (19 % of total Estonian exports), followed by Finland and Latvia. In recent years, trade with Russia has dropped dramatically and has been steadily decreasing ever since.

The share of goods of Estonian origin in total exports has been stable in recent years at a value around 68 %. The main consumers have been Finland, Sweden and Latvia (see Figure 32). The main commodity groups are wood and its articles (93 % of exported wood and wooden articles were of Estonian origin), miscellaneous manufactured articles (90 %), as well as optical, photographic, cinematographic, measuring instruments and apparatus (88 %).[87]

Figure 32. Main export partners of Estonia, million EUR



Source: Statistics Estonia[88]

Although the volume of exports shows a decrease, the number of exporters has increased over the last few years. In Estonia, there are approximately 14 500 exporters, 20 % of the total number of companies in Estonia. Based on export volumes, the largest export sectors are wholesale trade, manufacturing of computer, electronic and optical products, wood processing, warehousing and support activities for transportation, and the manufacturing of electrical equipment. Estonian exporters are most likely to focus on the Baltic states and Scandinavia.[89] In 2015, imports fell by 17 %, which was caused by a decrease in the value of mineral products. One of the largest import commodity groups – agricultural products and

[86] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=FT09&ti=EXPORTS+AND+IMPORTS+BY+COUNTRY+%28MONTHS%29&path=../I_databas/Economy/11Foreign_trade/03Foreign_trade_since_2004/&search=IMPORT&lang=1

[87] http://www.stat.ee/publication-download-pdf?publication_id=42573

[88] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=FT09&ti=EXPORTS+AND+IMPORTS+BY+COUNTRY+%28MONTHS%29&path=../I_databas/Economy/11Foreign_trade/03Foreign_trade_since_2004/&search=IMPORT&lang=1

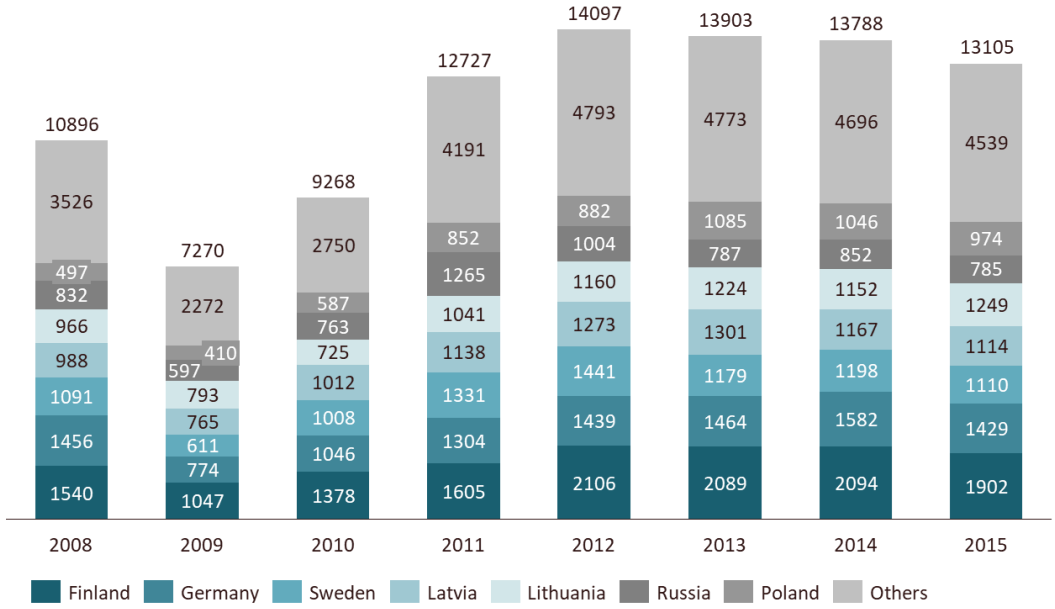
[89] https://www.mkm.ee/sites/default/files/2015-11-26_-_mkm_eksportooride_konkurentsivoime_uuringu_lopparuanne.pdf

food – also showed a decrease of 6 %. Only transport equipment, miscellaneous manufactured articles and paper products have shown a slight growth in imports.

The largest share in total imports was occupied by electrical machinery and equipment, especially electrical equipment, which amounted to 18 % of the total value. Mineral products (11 %) were second followed by agricultural products and food preparations (11 %).

In 2015, the largest share of imported goods came from Finland (14 % of total Estonian imports), with 11 % from Germany and 9 % from Latvia and Lithuania (see Figure 33). Imports from NAFTA countries increased significantly (18 %). The main commodities were machinery and equipment, base metals and jewellery (coins) along with medical and measurement apparatus, which together accounted for 67 % of total imports.[90]

Figure 33. Main import partners of Estonia 2008-2015, million EUR



Source: Statistics Estonia[91]

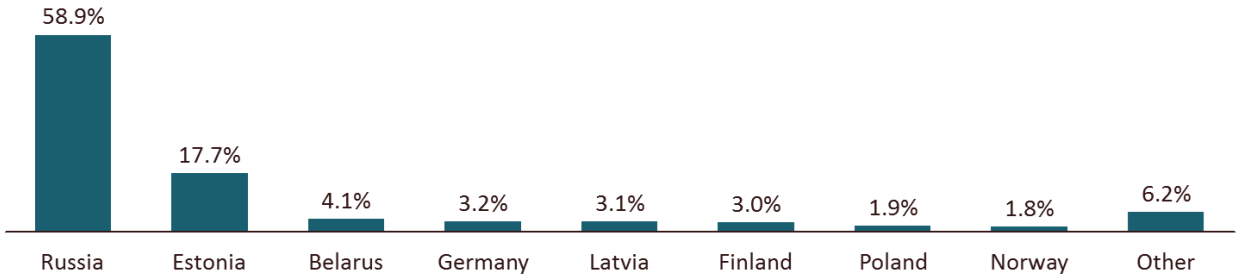
Compared to 2014, the **biggest increase in the values of import flows** was recorded from **Lithuania** (7 %) and **China** (7 %). The most remarkable **decrease** appeared in imports from **Finland** (10 %), **Germany** (8 %) and **Russia** (11 %).[92]

The role of Muuga Harbour in serving Estonian international trade

The major transport flows through Muuga have always been connected with Russia, mainly due to the transit of oil products. Even despite the recent decline, Russia still occupies the main place, accounting for almost 60 % (9 m tons) of Muuga cargo freight (see Figure 34).

[90] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf
[91] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=FT09&ti=EXPORTS+AND+IMPORTS+BY+COUNTRY+%28MONTHS%29&path=../I_databas/Economy/11Foreign_trade/03Foreign_trade_since_2004/&search=IMPORT&lang=1
[92] http://www.stat.ee/publication-download-pdf?publication_id=42573

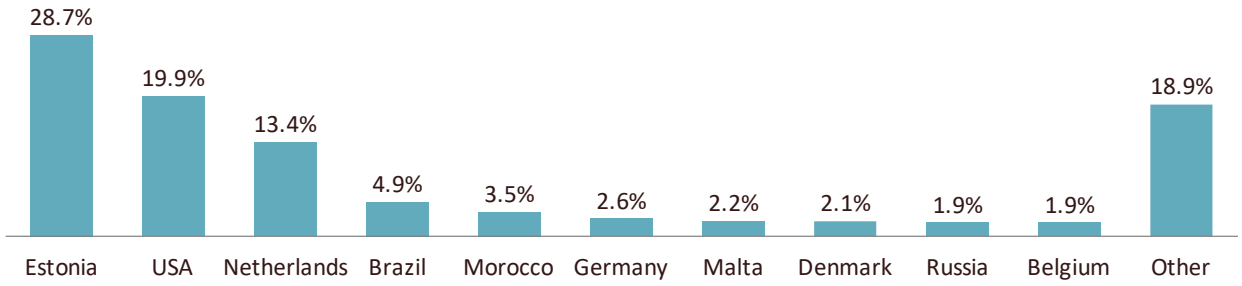
Figure 34. Structure of freight flows through Muuga Harbour by origin country in 2015



Source: Port of Muuga statistics

The international destinations of goods transported through Muuga are more diverse and include the USA (mainly oil products), the Netherlands (oil products and products in containers) and Brazil (fertilisers) (see Figure 35).

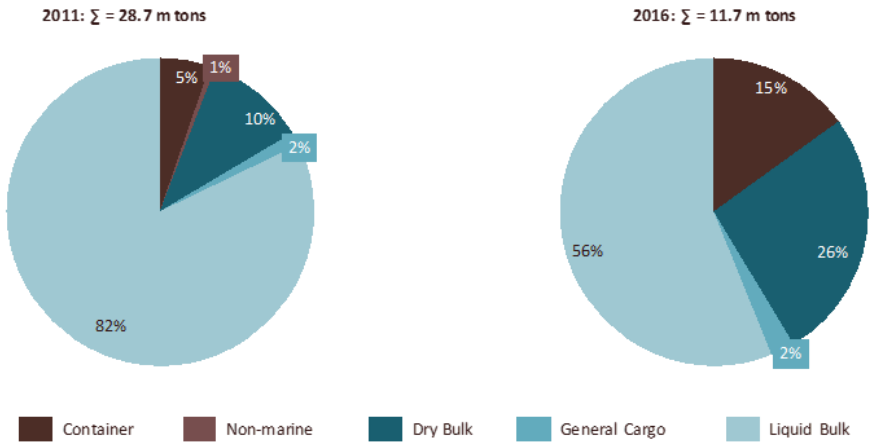
Figure 35. Structure of freight flows through Muuga Harbour by destination country in 2015



Source: Port of Muugastatistics

In terms of commodity structure, Muuga specialises in the transportation of oil and fertilisers, which respectively account for 69 % and 11 % of all cargo volumes through Muuga, while products in containers occupy 12 % (see Figure 36). The main international partner in container cargo transportation for Muuga is Germany: in 2015, Germany accounted for 26 % of all containers that were delivered to Muuga Harbour (445.6 thousand tonnes).

Figure 36. Structure of freight flows through Muuga Harbour



Source: Port of Muuga statistics

Transit flows

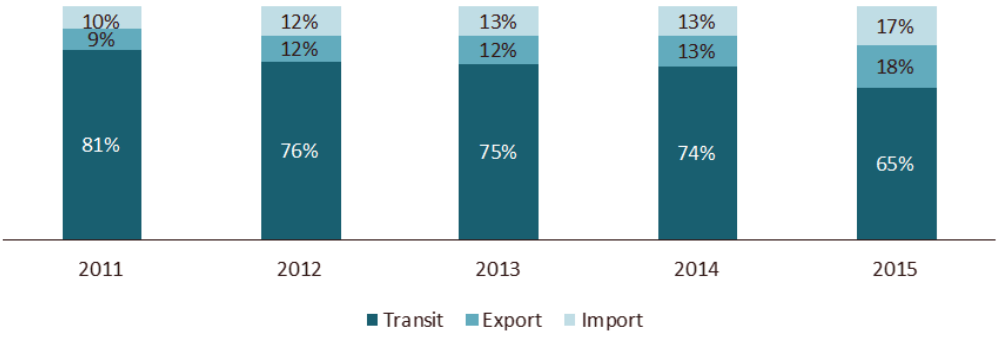
Prior to 2007, Muuga port was in a good position to handle Russian transit flows, primarily because of its good geographical position and the insufficient port capacities and infrastructure within Russia. Since 2007, Russia began to actively develop its transport infrastructure and shift cargo flows to internal ports. As a consequence, over the last decade transit through Estonia has declined significantly.[93] This decline is primarily due to a decrease in oil flows and could be mitigated by replacing this flow with other types of cargo – expert estimations and modelling show that the largest increase in cargo from Russia could be in the form of containerised goods.

Figure 37. Estonian transit freight by transport mode, million t

Source: Statistics Estonia[94]

Despite the significant decline, transit goods still dominate**.** Muuga has an advantageous position in comparison with Russian ports due to its favourable location (further west in the Gulf of Finland than St. Petersburg). Multiple interviews confirmed that Muuga port services are more refined and reliable than those in Russian ports, though the gap has been steadily decreasing.

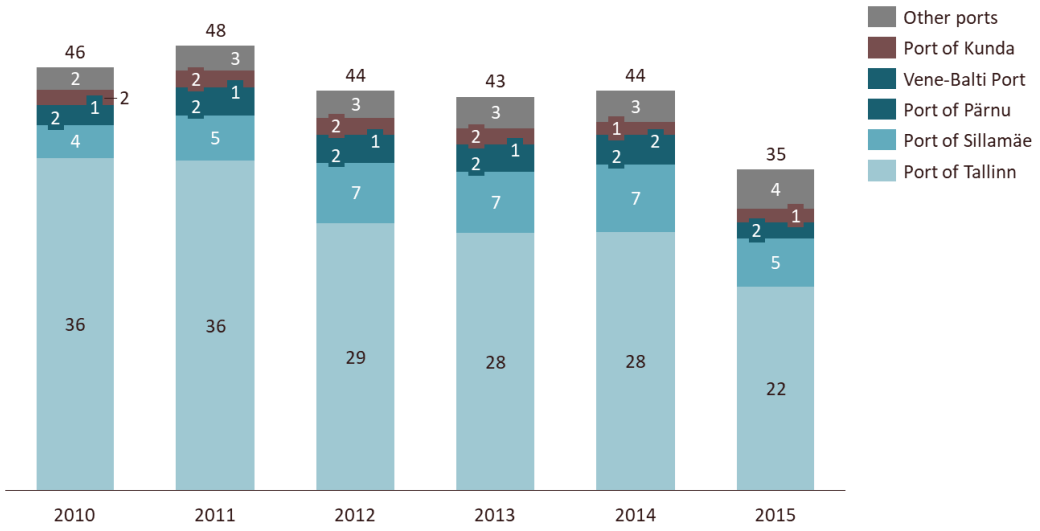
Figure 38. Freight flows through Port of Tallinn



Source: Port of Tallinn annual report 2017[95]

[93] https://www.riigikogu.ee/wpcms/wp-content/uploads/2014/11/Eesti_transiit_ja_logistika_II_osa.pdf
[94] https://www.stat.ee/389969
[95] http://www.portoftallinn.com/annual-reports

Figure 39. Freight volumes through the main ports of Estonia, million t



"Other ports" category includes ports handling less than 1 million t of goods annually.

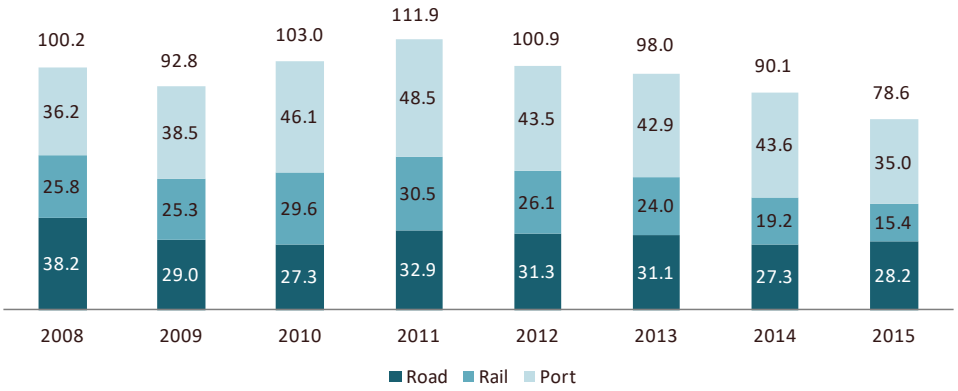
Source: Statistics Estonia[96]

By implementing the measures listed in the "Estonian transport development plan 2014-2020",[97] which stipulates the development of infrastructure, in 2020, Estonia should have a capacity to serve at least 86 million tons of cargo, out of which 60 million tons will be handled by ports, 21 million tons by railway and 5 million tons by road. The infrastructure development measures include cooperation with the maritime network, promoting the development of port infrastructure and support for the development of international maritime freight transport.

Freight by means of transport

In 2015, 78.6 million tons of goods were transported through or on Estonian ports, railways and roads (see Figure 40). Compared to the previous year, the cargo volumes decreased by almost 13 %, which has been the largest decrease in years. Despite the overall decline in the volume of cargo, the volumes of road transport slightly increased. The biggest decline was in goods handled by ports.

Figure 40. Estonian freight transport by mode 2008-2015, million t



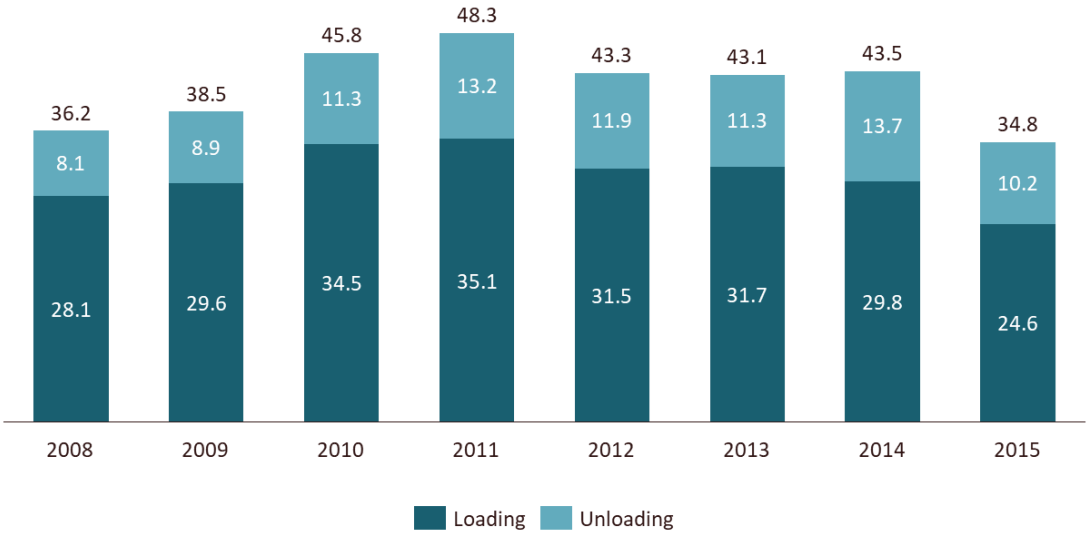
Source: Statistics Estonia[98], Internal data of Estonian railway operators

Maritime transport

In 2015, **35 million tons of cargo passed through Estonian ports**, which was the lowest volume of the last ten years. A year before, the growth of goods was supported by the unloading of freight, while in 2015, volumes of freight loading and unloading declined compared to the previous year. Ship loading accounted for 24.6 million tons and unloading for 10.2 million tons of total cargo volume. Compared to 2014, the loading of goods decreased by 18 % and unloading by 25 %. The loading of goods was influenced by the transport of goods on the public railway, where transit goods are mostly transported (see Figure 41).[99]

The proportion of Russian goods fell to its lowest level in recent years. Of Russian cargo volumes, 87 % accounted for liquid cargo and 12 % for fertilisers. The biggest risk and competition for cargo volumes in Estonian ports is Ust-Luga, which still has underused capacities.[100] Moreover, in 2016 Ust-Luga has become the most important port in the region for exporting fuel oil.[101] Port of Bronka is also developing, and it is gaining a foothold in container transportation and ro-ro in particular.

Figure 41. Loading and unloading of goods in Estonian ports 2008-2015, million t

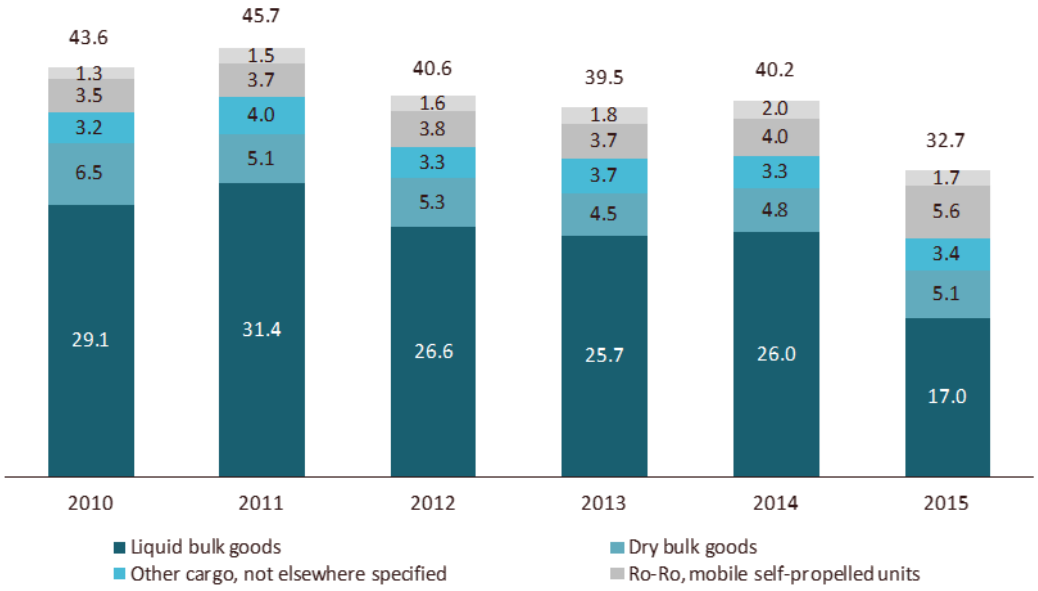


Source: Statistics Estonia[102]

In 2015, the main commodities handled by Estonian ports were refined petroleum products, forestry and logging products (see Figure 42).[103]

[96] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC175&ti=GOODS+TRANSPORT+THROUGH+MAIN+ESTONIAN+PORTS+BY+CARGO+TYPE+%28QUARTERS%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=TC175&lang=1
[97] https://www.riigiteataja.ee/aktilisa/3210/2201/4001/arengukava.pdf
[98] http://pub.stat.ee/px-web.2001/dialog/searchpx2.asp
[99] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf
[100] http://www.portoftallinn.com/?dl=612
[101] http://www.platts.com/latest-news/oil/london/feature-ust-luga-cements-its-role-as-russias-26656494
[102] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC185&ti=LOADING+AND+UNLOADING+OF+GOODS+IN+ESTONIAN+PORTS+%28MONTHS%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=PORT&lang=1
[103] http://www.stat.ee/publication-download-pdf?publication_id=42573

Figure 42. Estonian maritime transport of goods through main ports by cargo type 2010-2015, million t

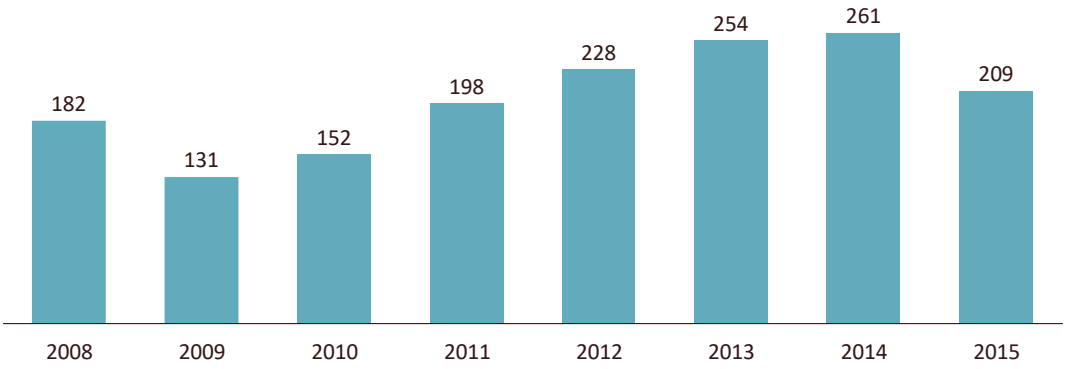


Excludes data on ports handling less than 1 million t of goods annually.

Source: Statistics Estonia[104]

In 2015, container transport volumes in ports fell from 261 thousand TEU to 209 thousand TEU, in line with the general decrease in freight flows. The volume of container goods decreased by 1.74 million tons, or 12 % (see Figure 43).[105]

Figure 43. Container transport via Estonian ports (thousand TEU)



Source: Statistics Estonia[106]

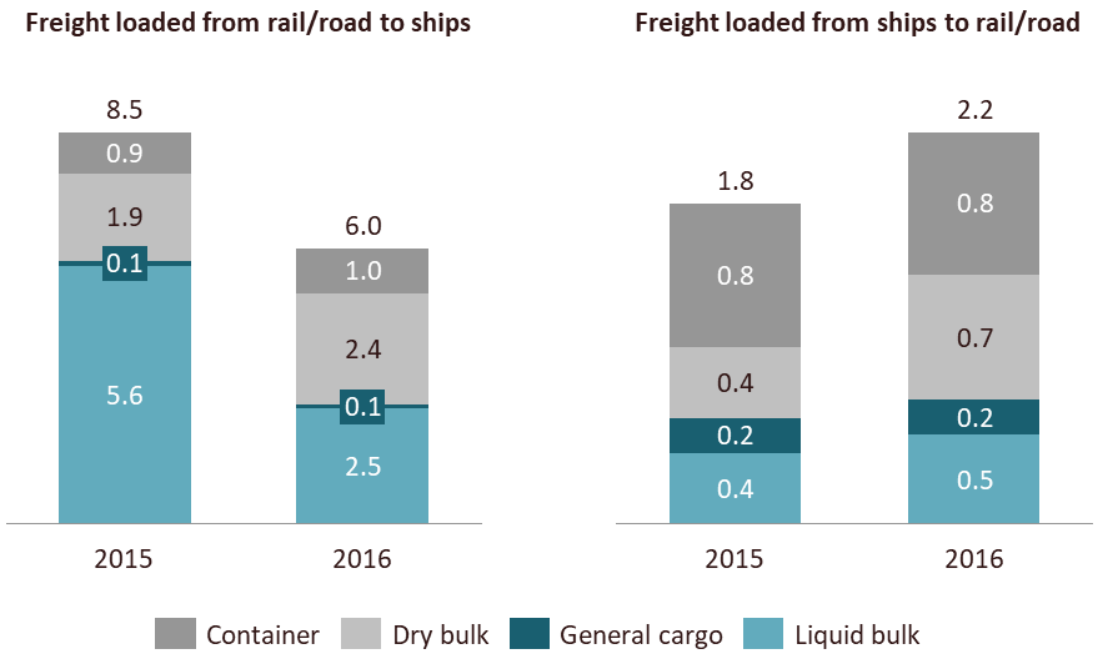
Muuga accommodated **34 % of the total volume of cargo** that was loaded in Estonian ports. The largest increase is observed in dry bulk (approx. 35 %). A slight increase is observed in handling containers (from 1.71 million tons to 1.76 million tons of 40 ft. containers) (see Figure 44).

[104] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC175&ti=GOODS+TRANSPORT+THROUGH+MAIN+ESTONIAN+PORTS+BY+CARGO+TYPE+%28QUARTERS%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=PORT&lang=1

[105] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf

[106] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=Tc1812&ti=TRANSPORT+OF+SEA+CONTAINERS+THROUGH+PORTS&path=../I_databas/Economy/34Transport/16Water_transport/&search=PORT&lang=1

Figure 44. Freight flows through Muuga Harbour by cargo type, million t[107]



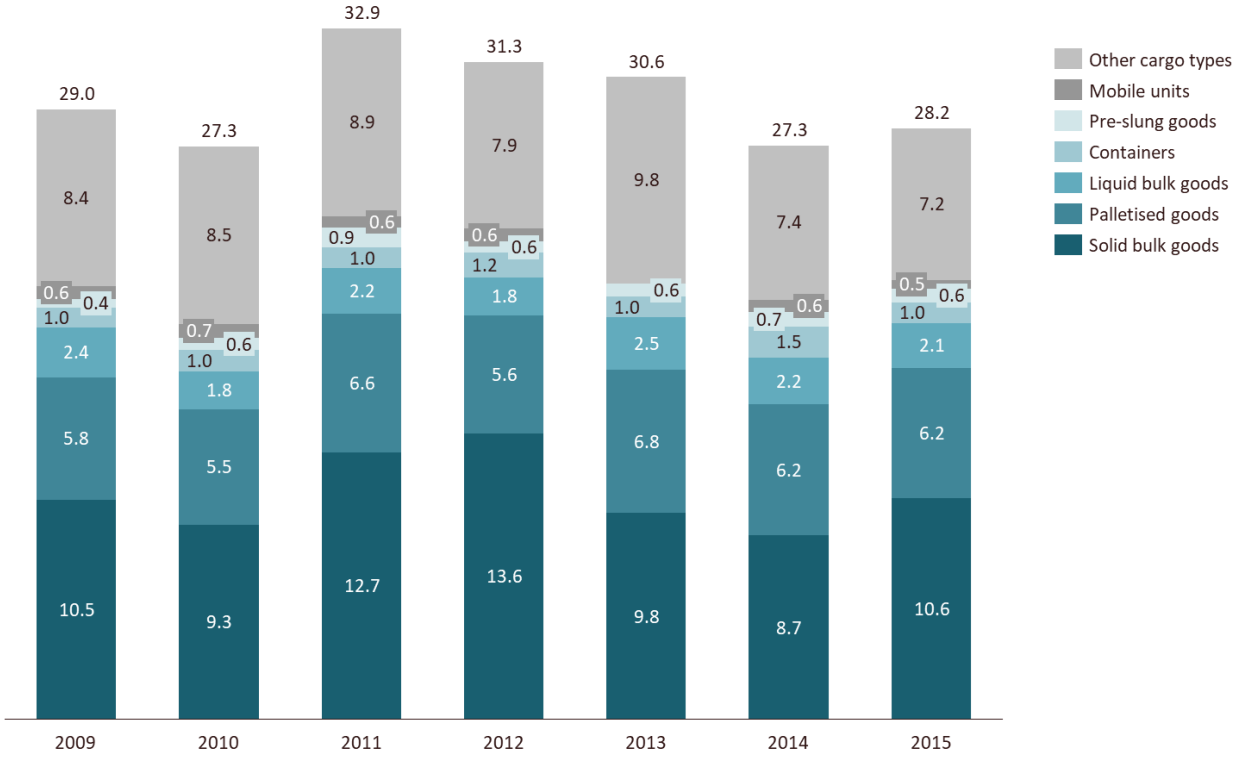
Source: Port of Muuga statistics

Road transport

Estonia is a relatively compact country – with less than 350 km between any two inland towns – and, as a result, the road transport is irreplaceable. Estonia transports approximately 25 million tonnes of cargo domestically, and the majority of this is transported by road.[108] Estonia is one of the main transit countries for Finnish inbound/outbound cargo. This has considerably increased heavy traffic on the Via Baltica road from Tallinn to the Latvian border.

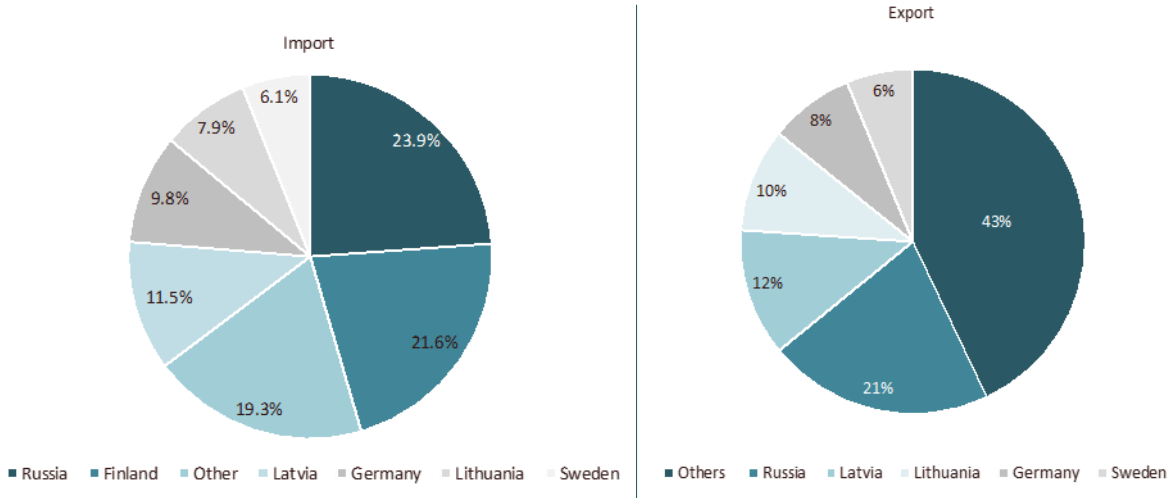
[107] Loading is from rail/road to ship, unloading is from ship to rail/road, does not include loading from/to storage
[108] https://www.riigiteataja.ee/aktilisa/3210/2201/4001/arengukava.pdf

Figure 45. Estonian freight flows by road transport by cargo type 2009-2015, million t



Source: Statistics Estonia[109]

Figure 46. Main Estonian import and export countries in road transport 2008-2015



Source: Eurostat[110]

Since 2008, the **main** Estonian **import countries in terms of road transport** were its closest neighbours – **Russia, Finland and Latvia**. A smaller share in imports was contributed by Germany, Lithuania, Sweden and other countries. The respective shares of Russia and Finland in imports were significantly larger at 24 % and 22 % than those of the other countries.

The main trade commodity type with **Finland** is wood and wood products, with is the same as **Russia**. Over the years, the volumes have changed, but this commodity type has dominated imports overall. In 2012 and 2015, however, grouped goods volumes appeared bigger than wood volumes.

The main import commodity type is grouped goods in the case of **Latvia** (typically containers), with the product structure being more similar with Finland. However, even in Latvia, one of the most popular commodity types for several years has been wood and wood products. The third type of commodity in Latvia is other non-metallic mineral products.

The main **export destination** is Estonia's eastern neighbour, **Russia**, which accounts **for 21 % of total exports**. This is followed by Latvia and then Lithuania, at 12 % and 10 % respectively. Also, a smaller but still important part is constituted by Germany (8 %) and Sweden (6 %).

The main Estonian export commodity to **Russia** is chemicals and its products. Since 2010, the volumes have increased multiple times. The second most important commodity type is food, beverages and tobacco, which have also increased since 2010. The third commodity type is machinery and equipment, which has been stable.

The most dominant export commodity from Estonia to **Latvia** is wood and wood products. This is followed by grouped goods and then by agriculture, hunting and forestry products.

In regard to **Lithuania**, the most important commodity type is agricultural products, followed by food and its products. The smallest share in commodities is grouped goods, which have remained stable over the years.

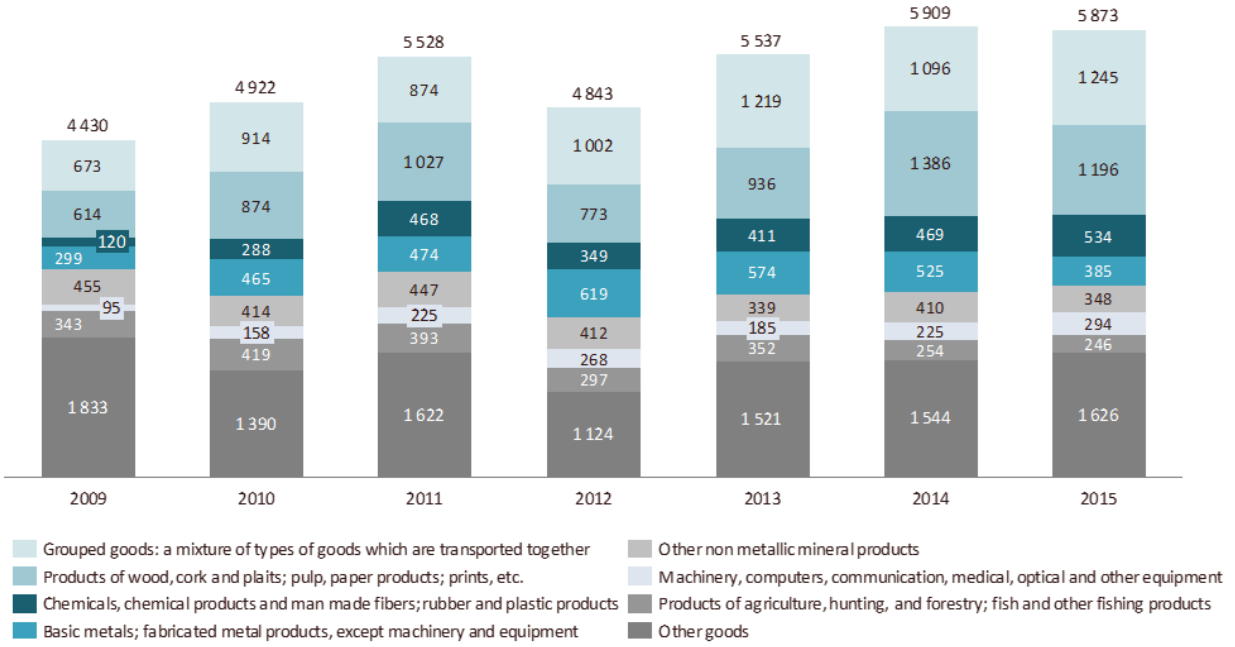
There is a significant difference in cargo types when comparing Estonian domestic and international road transport. In domestic road transport, the main cargo is mining and quarrying products, agricultural, hunting and forestry products, fish and fishing products, as well as wood products, food, beverages and tobacco. However, in international road transport, the major cargo types are wooden products, metal and metal products, food, beverages and tobacco (see Figure 47).[111]

[109] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC534&ti=GOODS+CARRIED+BY+ROAD+BY+TYPE+OF+CARGO&path=../I_databas/Economy/34Transport/08Road_transport/&search=PORT&lang=1

[110] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ext_tec03&lang=en

[111] https://statistikaamet.wordpress.com/2015/10/15/mullu-veosekaive-maanteedel-kasvas/

Figure 47. International road transport by type of goods, thousand t



Source: Statistics Estonia[112]

Following the intermodal transportation development trend in the EU, the carriage of containers by road is increasing (Table 27). Again, this trend is positive for Muuga port, as some of this container flow could be shifted to Rail Baltica.

Table 27. Sea containers moving in ports by Estonian road transport, thousand TEU

Year	Exported full containers	Exported empty containers	Imported full containers	Imported empty containers
2008	76.4	17.4	33.3	58.3
2009	49.6	25.0	38.5	36.1
2010	59.6	28.3	43.6	42.6
2011	76.9	30.9	46.8	59.9
2012	85.0	30.8	48.9	62.9
2013	87.1	35.5	55.6	63.8

Source: Statistics Estonia[113]

Railway transport

According to Statistics Estonia, in 2015 transit goods decreased by 20 % and amounted to 11.3 million tons (see Figure 48). In the wake of sanctions between the European Union and Russia, Russia has been

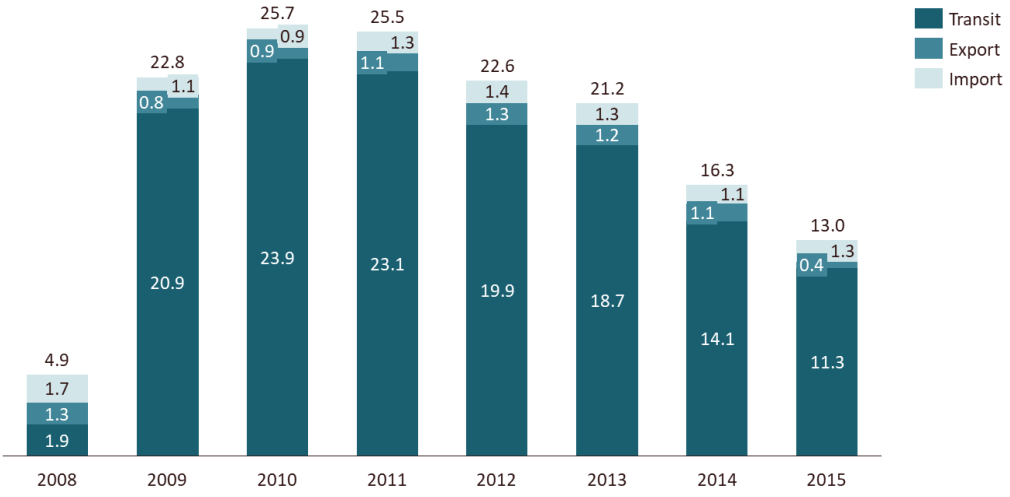
[112] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=TC528&ti=GOODS+CARRIED+BY+ROAD+BY+GROUP+OF+GOODS&path=../I_databas/Economy/34Transport/08Road_transport/&search=PORT&lang=1

[113] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=Tc1813&ti=SEA+CONTAINERS+MOVING+IN+PORTS+%281997-2014%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=CONTAINERS&lang=1

increasing the use of its own ports to transport transit goods, which has negatively influenced other neighbouring countries.

In rail transport, the main export goods were mineral products and the main import goods were petroleum products.[114]

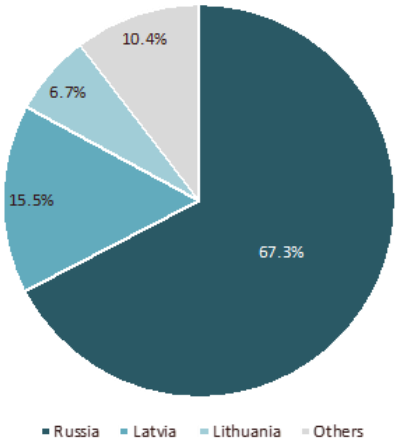
Figure 48. Freight transport by rail, thousand t, Estonia



Source: Statistics Estonia[115]

In 2008-2015, the main Estonian **export partners** in rail transport were **Russia, Latvia and Lithuania**. Russia constitutes the biggest share in export at 67 %. Latvia and Lithuania account for 15.5 % and 6.7 %, respectively (see Figure 49).

Figure 49. Estonia's main export countries in rail transport



Source: Eurostat[116]

[114] https://www.mkm.ee/sites/default/files/majandusulevaade_2015.pdf
[115] https://www.stat.ee/389969?highlight=kaubavedu%2Craudteel
[116] http://ec.europa.eu/eurostat/web/international-trade-in-goods/data/database

The largest partners are the same when comparing exports and imports in rail transport. However, in terms of **import partners,** Belarus had a 4 % share in 2016. Russia occupies a dominant part of Estonian import by rail at 83 %. The other important countries are Lithuania, Kazakhstan and Latvia.

The carriage of containers by rail is increasing in line with the intermodal transportation development trend in the EU (see Table 28).

Table 28. Sea containers moving in ports by rail transport 2008-2013 (TEU), Estonia

Year	Exported full containers	Exported empty containers	Imported full containers	Imported empty containers
2008	11 816	10	123	3 801
2009	11 869	1	26	2 243
2010	18 421	12	84	2 106
2011	23 306	90	200	8 363
2012	30 934	82	1 726	15 756
2013	34 035	31	1 562	26 564

Source: Statistics Estonia[117]

Cargo flows in the catchment area

The following tables summarise the inbound and outbound freight flows through Estonia in 2015. The values characterise export and import flows.

Table 29. Cargo flows from Estonia by destination country and type of cargo in 2015, thousand t

Destination country	Total	Break bulk	Container	Dry bulk	Liquid bulk	Mixed freight
Sweden	1 710.9	1 233.8	202.1	70.2	157.7	35.3
Finland	1 537.9	748.6	365.6	247.4	93.4	68.5
Latvia	1 187.8	186.3	433.6	325.9	219.7	10.2
Germany	1 164.0	478.0	169.8	430.7	71.1	8.3
The Netherlands	1 140.7	65.5	80.9	405.8	581.3	2.6
Denmark	712.8	554.7	107.4	18.1	29.5	2.5
Lithuania	543.4	30.6	243.6	136.7	112.7	9.2
United Kingdom	471.1	246.5	146.9	21.8	53.1	1.4
USA	414.8	13.7	15.0	14.0	367.9	3.6
Russia	381.2	5.0	80.6	104.6	162.3	20.6
Belgium	244.0	18.3	31.4	74.7	115.4	0.7
Norway	220.3	49.1	127.9	19.5	2.2	13.6
Poland	205.7	11.0	72.5	92.2	20.1	7.2
France	189.0	2.5	54.0	118.9	8.2	1.7

[117] http://pub.stat.ee/px-web.2001/dialog/varval.asp?ma=Tc1813&ti=SEA+CONTAINERS+MOVING+IN+PORTS+%281997-2014%29&path=../I_databas/Economy/34Transport/16Water_transport/&search=CONTAINERS&lang=1

Destination country	Total	Break bulk	Container	Dry bulk	Liquid bulk	Mixed freight
China	140.3	82.7	23.8	26.0	5.5	1.8
Italy	114.3	31.4	24.6	51.6	5.2	1.4
Spain	107.4	0.8	18.0	82.4	2.0	2.2
Ukraine	63.6	0.7	43.5	4.6	13.5	0.7
Czech Rep.	34.5	3.1	16.6	11.2	1.3	1.3
Hungary	22.8	0.9	6.6	12.2	0.7	1.0
Austria	22.5	1.3	11.1	6.5	1.6	1.0
Belarus	20.0	0.2	14.3	0.8	3.8	0.7
Slovenia	4.9	-	1.9	1.8	0.9	0.2

Source: Goudappel model

Table 30. Cargo flows to Estonia by origin country and type of cargo in 2015, t

Origin country	Total	Break bulk	Container	Dry bulk	Liquid bulk	Mixed freight
Russia	2 117.5	109.5	435.9	295.4	1 268.7	3.4
Finland	1 478.7	45.3	316.5	606.4	492.6	15.5
Lithuania	1 112.2	25.1	186.2	106.5	788.6	4.8
Latvia	672.9	260.4	225.9	129.4	52.7	3.7
Sweden	456.6	10.3	93.7	253.6	78.8	12.3
Norway	423.8	0.3	20.9	378.6	22.4	1.1
Germany	324.7	15.1	110.2	69.8	92.0	20.4
Poland	301.2	58.9	141.9	47.8	42.4	7.7
Belarus	195.0	20.8	46.8	55.4	70.1	1.4
The Netherlands	130.9	1.8	38.4	40.3	45.2	3.0
Belgium	117.7	0.4	28.4	55.3	30.9	1.0
China	116.4	8.2	56.2	5.3	14.3	27.6
Denmark	107.1	33.6	36.6	14.6	19.2	2.0
Spain	69.0	5.4	14.5	41.0	2.7	2.0
United Kingdom	68.0	1.9	21.5	16.3	12.1	6.0
Ukraine	60.9	12.9	21.3	22.6	2.9	0.9
Italy	58.9	13.9	17.8	13.2	6.4	5.6
France	48.1	1.6	17.2	11.6	7.8	1.8
Czech Rep.	39.5	8.7	12.4	4.5	5.5	4.1
USA	38.8	0.2	13.5	0.9	19.3	2.4
Hungary	27.8	0.2	10.9	2.6	6.9	5.9
Austria	18.3	0.5	10.9	1.7	2.9	0.9

Origin country	Total	Break bulk	Container	Dry bulk	Liquid bulk	Mixed freight
Slovenia	2.5	0.0	2.0	0.0	0.3	0.2

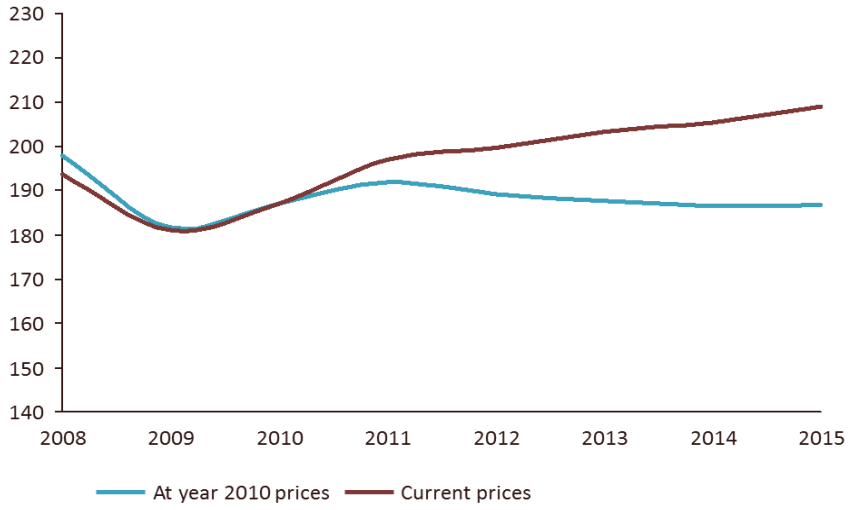
Source: Goudappel model

6.5.2. Finland

Economic development

The recovery of the Finnish economy since the recession has been remarkably slow in both a historical and international comparison. Several structural problems in the economy, both sectoral and population related, have hindered the political measures, e.g. light fiscal policy. The aging of the population and weak development of productivity have added to the challenge. The GDP growth rate in Finland has been slower than in the Euro countries in general.[118]

Figure 50. GDP in Finland in 2008-2015, billion EUR



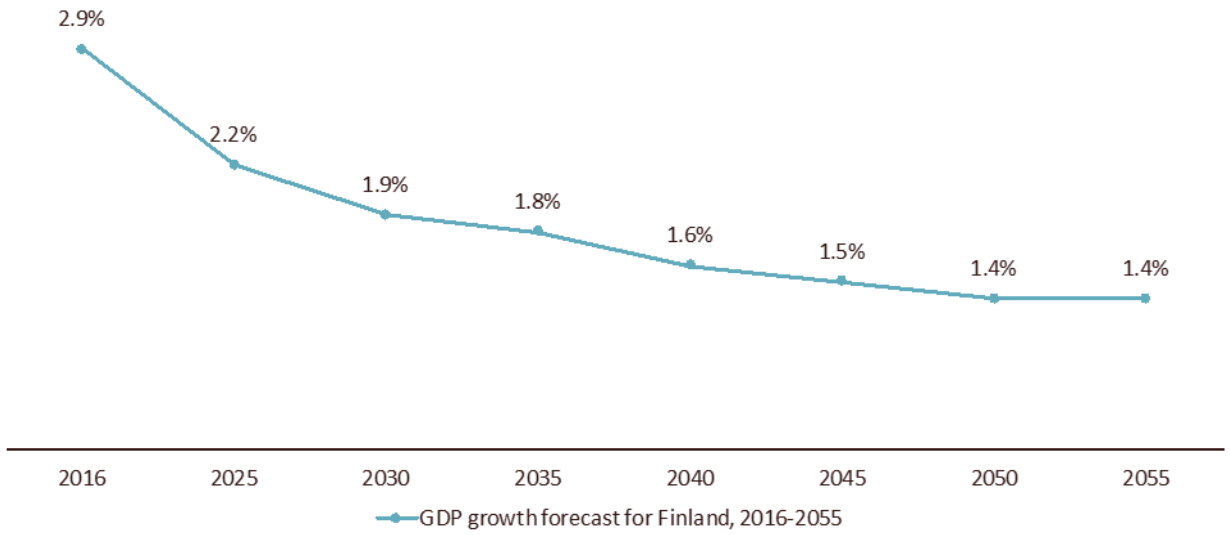
Source: Statistics Finland[119]

Since 2009, the Finnish export sector has severely lost its market share; as a consequence, its international competitiveness has been weakened, specifically in the paper, pulp and electronics industries.

The OECD's GDP forecast for Finland for 2017-2055 shows steady growth ranging from +3 % (2018/17) and shrinking down to +1.4 % by the mid-2050s, which does not fluctuate too much from the global GDP long term forecast (see Figure 51).

[118] http://www.eurojatalous.fi/fi/2015/3/suomi-jaa-yha-kauemmas-euroalueen-kasvusta/
[119] http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__kan__vtp/statfin_vtp_pxt_001.px/?rxid=63311cf6-e4cf-4379-9516-c813a2e7df37

Figure 51. Finnish GDP forecast



Source: OECD[120]

The Ministry of Finance gives a carefully optimistic perspective on the growth of the Finnish economy towards 2020. The purchasing power of the private sector is finally, after several consecutive years of decline, expected to turn positive. This has been supported by moderate inflation and slightly lowered tax levels. On the other hand, an increase in the employer's social security payments and a cut in bonus holiday pay in the public sector have weakened this development. The cost of a work unit in Finland has increased but less than the EU average. The cost of a work unit is expected to decrease in the near future, while the expectation for the rest of the EU is +2.5 %, which should help improve the competitiveness of Finnish export industries in particular.[121]

In the early 2020s, several industries are expected to show weaker growth due to the diminishing effective work input, which would result in a reduction in the work force due to the aging population. The development of exports is not expected to reach its pre-crisis levels, yet the biggest growth in the economy is expected to draw on domestic demand, especially in the service sector. The comprehensive strengthening of the service sector, in comparison to production, would lead to a great change in demand patterns.[122]

Severe structural imbalances in the economy that have kept the country stagnant for a decade remain as the major challenge for Finland: high unemployment, high deficit in the public sector, weak purchasing power of the private sector and private debt. In the long-term perspective, Finland is expected to show slower growth than the OECD countries in general.

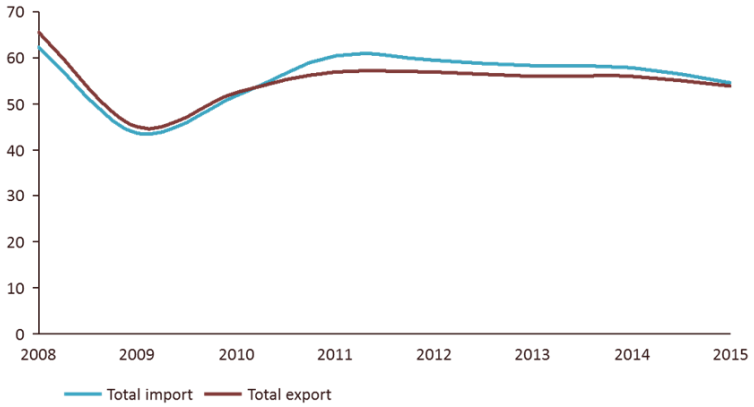
Analysis of internal and external trade

The long-term perspective reveals that Finland was a strong exporter from 1991 to 2008 and it had a positive trade balance from 1993 to 2011. During the recession, Finnish exports dropped from 65.5 billion EUR (2008) to 45 billion EUR (2009), and since then exports have not recovered to the same pre-recession levels. Since 2010, the total exports have remained steady at around 55 billion EUR[123]. The situation is more

[120] https://data.oecd.org/gdp/gdp-long-term-forecast.htm#indicator-chart
[121] http://vm.fi/artikkeli/-/asset_publisher/tyovoimakustannukset-laskevat-kustannuskilpailukyky-suhteessa-euroalueeseen-paranemassa
[122] http://vatt.fi/documents/2956369/3012225/t176.pdf
[123] https://ek.fi/mita-teemme/talous/perustietoja-suomen-taloudesta/ulkomaankauppa/

positive if we look at export volumes in tons. From 2008 to 2009, export volumes decreased by 16 % (from almost 42 million tons to over 35 million tons), but they have increased since then, reaching almost 44 million tons in 2016.[124]

Figure 52. Export and import in 2008-2015, billion EUR



Source: Finnish customs[125]

Geographically, trade within Europe is dominating. Europe in total represents 82 % of Finnish imports and 69 % of its exports. Within Europe, trade with the euro area countries dominates, specifically Germany, which represents almost 15 % of imports and over 10 % of exports. However, Sweden as a single trade partner is in an even stronger position with over 16 % of imports and over 11 % of exports. The non-EU countries in Europe, including Russia, represent over 11 % of imports and over 12 % of exports. Trade flows with America and Asia show a clear surplus for Finland.

Table 31. Geographical distribution of import and export in 2015, all goods and services

Total	% of total import (2015)	% of total export (2015)
Europe total	82.1 %	69.0 %
EU28	70.5 %	56.8 %
Euro area	41.6 %	34.3 %
The Netherlands	7.5 %	5.6 %
Germany	14.8 %	10.4 %
Rest of EU28 (non-Euro area)	28.9 %	22.5 %
United Kingdom	4.2 %	5.6 %
Sweden	16.3 %	11.8 %
Rest of Europe (non EU28)	11.6 %	12.3 %
Russia	8.1 %	5.8 %
Americas total	6.5 %	11.5 %
Africa total	1.0 %	2.6 %
Asia total	8.6 %	15.6 %

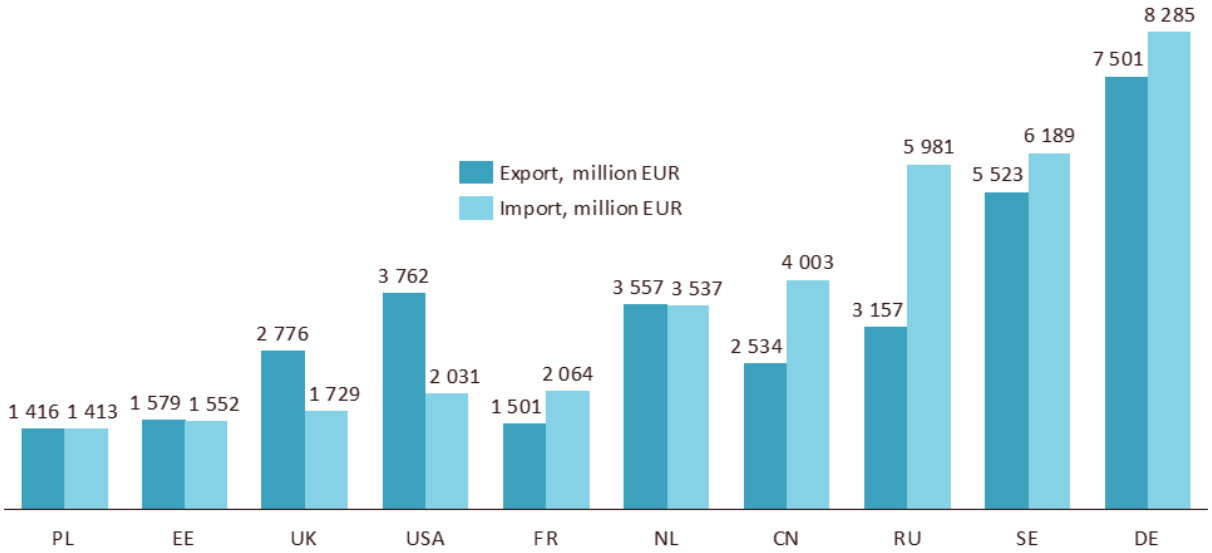
[124] http://uljas.tulli.fi/
[125] http://uljas.tulli.fi/

Total	% of total import (2015)	% of total export (2015)
Other and unknown, total	1.9 %	1.3 %

Source: Statistics Finland[126]

Germany, Russia, Sweden and the Netherlands hold the strongest positions in international trade with Finland. The trade balance is negative with the leading trade partners, especially with Russia and China.

Figure 53. Finland's trade partners in 2015; export and import



Source: Statistics Finland[127]

In terms of exports, paper products, pulp, wood products and mineral oil dominate the list of top fifteen products and destinations. The list of destinations consists of the strong trade partners in Western Europe. Of the top fifteen positions, only about a half is destined to Euro countries. The non-Euro countries represented on the list are Sweden, UK, China, USA and Japan.

Table 32. Top fifteen Finnish exported products and destinations in 2015, thousand tons

Product	Destination	Quantity (t)
Paper and paperboard	Germany	1 930.6
Mineral oil	Sweden	1 621.3
Mineral oil	The Netherlands	1 202.1
Paper and paperboard	United Kingdom	1 130.8
Mineral oil	United Kingdom	956.0
Pulp of wood	China	878.4
Paper and paperboard	USA	845.3
Paper and paperboard	Belgium	821.3

[126] http://tilastokeskus.fi/tup/suoluk/suoluk_kotimaankauppa.html
[127] http://tilastokeskus.fi/tup/suoluk/suoluk_kotimaankauppa.html

Wood and wood charcoal	Sweden	798.6
Mineral oil	Latvia	631.7
Mineral oil	Belgium	623.9
Wood and wood charcoal	Japan	559.9
Pulp of wood	Germany	550.6
Wood and wood charcoal	United Kingdom	533.3
Paper and paperboard	Spain	523.0

Source: Statistics Finland[128]

In regard to imports, wood products, iron, steel and various chemicals dominate the list of top fifteen products. The role of Russia in wood imports is paramount. Unlike exports, import products are entirely European.

Table 33. Top fifteen Finnish imported products and origins in 2015, tons

Product	Origin	Quantity (t)
Wood and wood charcoal	Russia	6 272.7
Wood and wood charcoal	Estonia	775.6
Iron and steel	The Netherlands	495.0
Wood and wood charcoal	Latvia	388.6
Iron and steel	Germany	248.6
Paper and paperboard	Sweden	241.8
Iron and steel	Sweden	192.7
Iron and steel	Norway	174.9
Wood and wood charcoal	Sweden	152.1
Misc. chemicals	Norway	137.3
Iron and steel	Russia	127.0
Nuclear reactors	Germany	97.6
Iron and steel	Poland	97.0
Enzymes etc.	France	95.2

Source: Statistics Finland[129]

By product types, the overall distribution of export in 2015 was as follows (% of total 53.8 billion EUR)[130]:

- Chemical industry 18.8 %
- Pulp, paper and paper products 16.8 %
- Metal and metal products 14.7 %
- Machines and equipment 13.5 %
- Electronics industry 12.1 %

[128] http://uljas.tulli.fi/
[129] http://uljas.tulli.fi/
[130]https://ek.fi/mita-teemme/talous/perustietoja-suomen-taloudesta/ulkomaankauppa/

- Vehicles 7.5 %
- Wood products 4.6 %
- Food and beverages 2.3 %
- Other products 9.7 %

Maritime transport (short sea shipping) is by far the most predominant mode of transport in international trade and carried 90 % of exports and 77 % of imports in 2015 (of tonnage).[131]

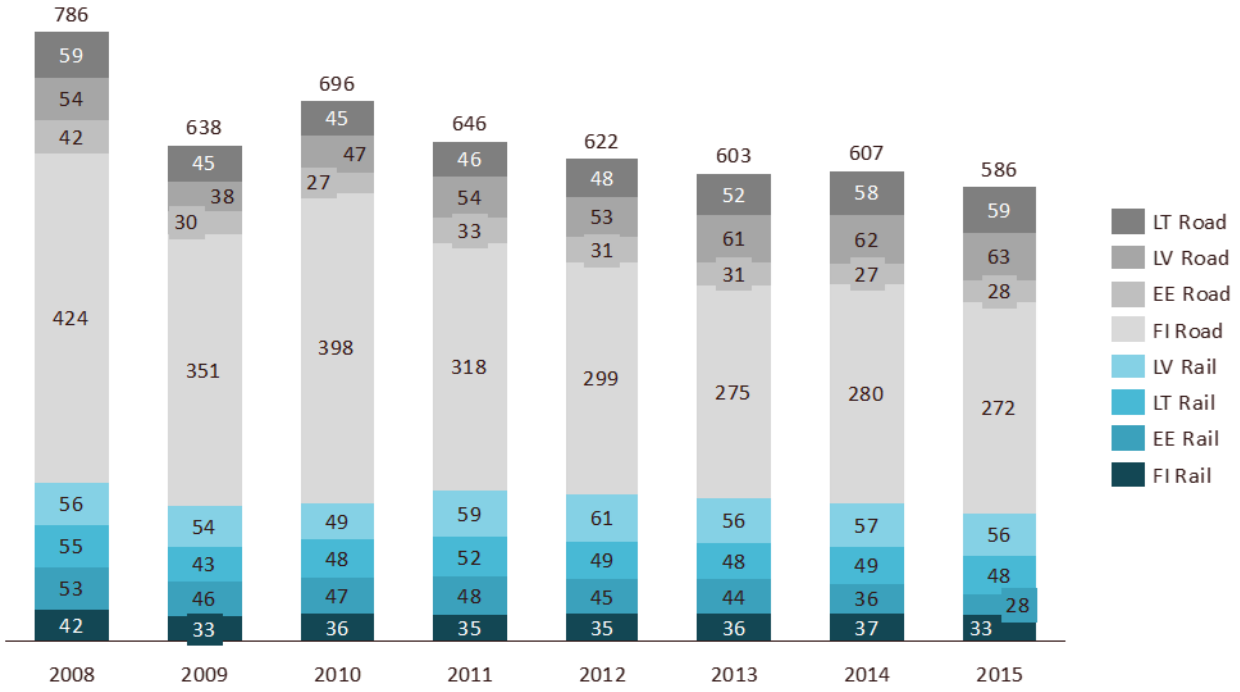
The export and import volumes through the Finnish seaports (in 2010) show the profile of both bulk and unitised cargo. There are a total of 21 seaports that belong to the TEN-T comprehensive and core networks on the Finnish coast and many ports are specialised by product type or customer. The dominant products in export include paper, oil products, sawn wood and wood pulp. In import, crude oil leads the way, followed by oil products, sawn wood and wood pulp. General cargo, ores and concentrates are strong in both export and import. The list of origins and destinations of the Finnish seaports is wide. The Port of Helsinki for instance has regular transport to several destination ports in Russia, the Baltic states, Sweden, Poland, Germany, Denmark, The Netherlands, Belgium, France, the UK and Spain. All major seaports have a large list of destination ports with the emphasis on, but not limited to, the Baltic Sea.

In 2016, both the import and export volumes through the Finnish seaports increased, with imports by +6.8 % and exports by +4.7 %. The development of transit transport was weak at only +3.1 % in total. Transport on Saimaa inland waterways fell by 12.2 %.[132]

The transport of goods by rail in Finland has declined from 42 000 in 2008to 33 000 thousand tons in 2015. Approximately one third of this is international transport. The modal shift is not developing favourably for railways, as road transport still has a dominant role in internal transport (Eurostat). Rail only has an integral role in trade with Russia. However, freight tariffs and wagon handling time have been found as factors that also discourage the use of railways in trade with Russia.[133] Considering the total volume of Finland's international trade, the role of railways is almost minimal when compared to the situation in Estonia, Latvia and Lithuania. The comparison between Finland and the Baltic states in road and rail transport reveals the structural change. The dominance of road transport in Finland is overwhelming.

[131] http://www.logistiikanmaailma.fi/wiki/Merikuljetukset_Suomessa
[132] http://www.finnishports.fi/eng/
[133] https://www.theseus.fi/bitstream/handle/10024/65414/partanen_ville.pdf?sequence=1&isAllowed=y 3

Figure 54. Goods transportation on rail and road in Finland, Estonia, Latvia and Lithuania, million t (m tons)



Source: Eurostat[134]

The development of freight transport on railways concentrates on the largest exporting sectors in wood, the paper and pulp industries, and the chemicals and metal industries. Freight on railways is transported to the chain of seaports for export to destination markets through seaports around the Baltic Sea and North Sea. Due to the monopoly structure of railways, which are dominated by the state-owned VR railway company, a large share of the industrial production remains to be transported from its origin by road. The current railway concept predominantly serves clients that have enough freight to fill a complete train. Clients with smaller freight volumes, instead, find more cost- and time-competitive solutions offered by road transport, despite the fact that the distance from the industrial plant to the next point of loading (for instance a seaport) may be long. The opening of the monopoly railway business may alter the situation in the longer run, assuming that the new operators are able to develop commercially-viable business concepts.

In terms of import, a similar pattern prevails, which favours road transport over railways. The Port of Helsinki alone receives 60 % of consumer goods, which continue onwards to the large warehouses in and around the capital region from where they are transported to their end destinations throughout the Southern part of the country. The logistics hot spot of transported and stored consumer goods for retail, however, seeks space to grow. The strong development of the Helsinki-Tallinn twin cities offers a scenario in which Northern Estonia could gain a competitive position in the logistics network of Finland, especially given the lower price level of Estonia in terms of transport and workforce. In this scenario, towards the mid 2020s, Rail Baltic serving as an efficient North-South connection and Muuga as its developing intermodal start/end point possess strong potential to serve the Finnish logistics market.

6.5.3. Latvia

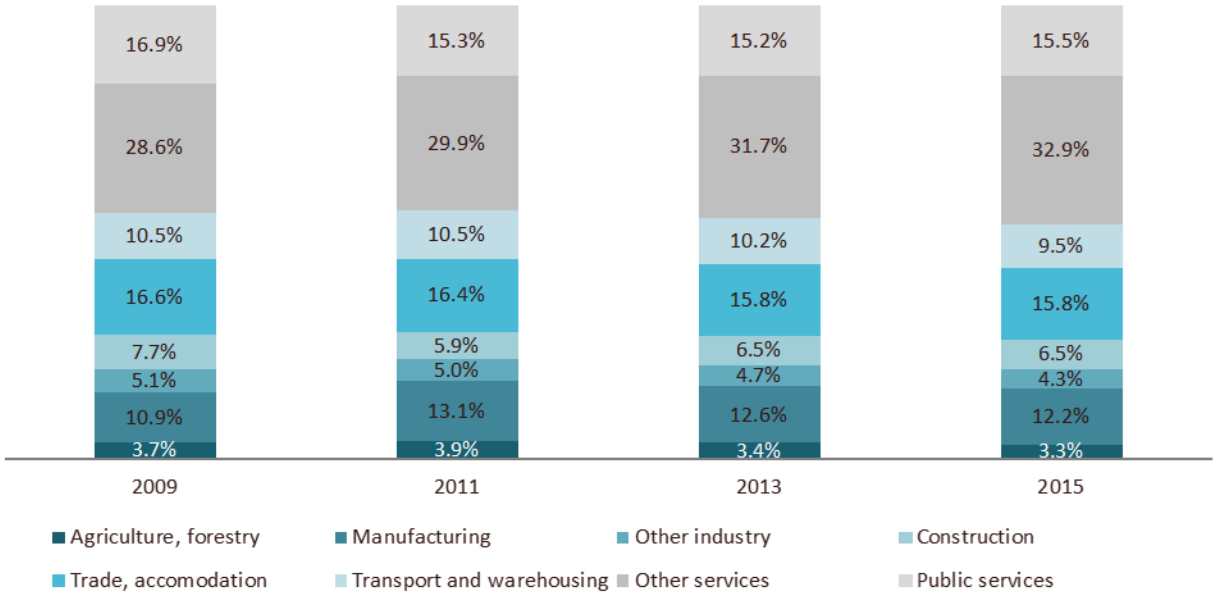
In recent years, the Latvian economy has seen moderate economic growth levels, which were mainly influenced by economic sanctions between the European Union and Russia. Exports to Russia decreased

[134] http://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics

by 24 % in 2015, but Latvian exporters were able to switch to other export markets in Europe and third countries mainly – where export volumes increased by 1.5 % and 23.5 %, respectively.

Latvia was 44th in the Global Competitiveness Index in 2015, 2 places lower than the year previous. The ranking scale showed Estonia in 30th place and Lithuania in 36th, while Russia, despite the economic sanctions, was just one place behind Latvia.

Figure 55. Structure of Latvian economy 2009-2015



Source: Ministry of Economics[135]

In 2015, the largest exporter in Latvia was URALCHEM trading – a Russian-based company that exports fertilisers and other chemicals for agriculture. The second largest exporter was TransBaltic Oil, which is the subsidiary of CJSC Belarusian Oil Company – a Belarus state-owned company that uses Baltic state infrastructure to export its oil products. This was followed by Samsung Electronics Baltics, the internationally-renowned manufacturer of electronics. In regard to companies with origins in Latvia, the largest exporter is Mikrotīkls, which manufactures routers and wireless ISP systems.

Table 34. Main Latvian exporters in 2015

Company	Export	Turnover	Industry
URALCHEM Trading	1097	1133	Trade: industrial goods
TransBaltic Oil	317	318	Trade: consumer goods
Samsung Electronics Baltics	232	291	Trade: consumer goods
Severstal Distribution	228	251	Trade: industrial goods
Mikrotīkls	199	202	Manufacturing: industrial goods
Latvijas finieris	155	194	Manufacturing: industrial goods
Tolmets	139	145	Trade: industrial goods
Ourea	123	123	Trade: consumer goods

[135] https://www.em.gov.lv/files/tautsaimniecibas_attistiba/2016_jun.pdf

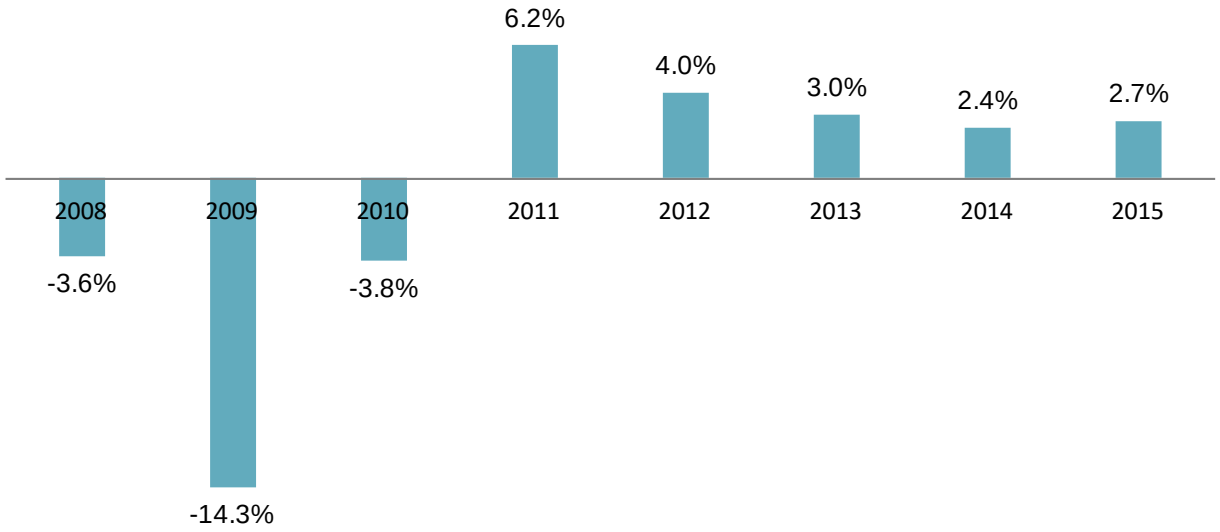
Kreiss	116	134	Transport, transit, logistics
Valmieras Stiklšķiedra	103	103	Manufacturing: industrial goods

Source: SIA Firmas.lv[136]

Economic development

In terms of Latvian economic trends, the period of 2008-2015 can be divided into two parts: 2008-2010, when GDP decreased significantly due to the global recession, and 2011-2015, Latvia's recovery period, although the country only reached its pre-crisis GDP level in 2016 (see Figure 51).

Figure 56. Latvia's real GDP growth for period 2008-2015



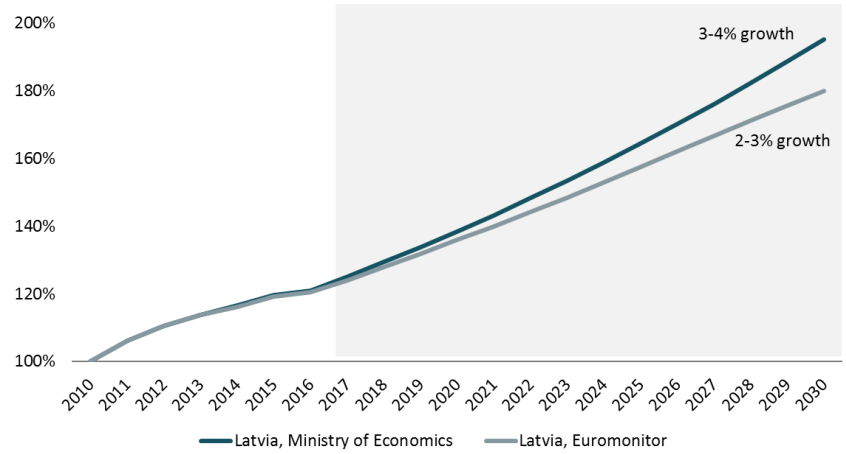
Source: Ministry of Economics of Latvia[137]

As Latvian economy stagnated due to decreasing investments, exports and delays in the implementation of EU-funded projects, which have been a major factor in economic development in Latvia in recent years, Bank of Latvia estimates that GDP growth in 2016 will be 1 %. Although, GDP forecasts for 2017 show improvements – the European Commission forecast 2.8 % growth while Bank of Latvia and Ministry of Finance are even more optimistic (3.0 % and 3.5 %, respectively).

The Ministry of Economics of Latvia estimates that medium-term GDP growth in 2017-2030 will be 3-4 % a year, while Euromonitor's GDP growth forecast is more conservative at 2-3 % a year (see Figure 57).

[136] https://www.firmas.lv/lbgpp/2016/articles/eksportetaji
[137] https://www.em.gov.lv/files/tautsaimniecibas_attistiba/2016_jun.pdf

Figure 57. GDP growth forecasts for Latvia 2017-2030

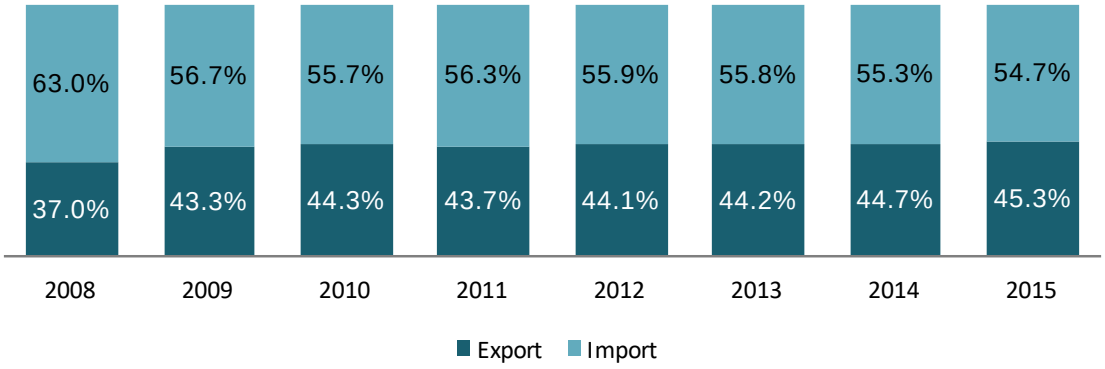


Source: Ministry of Economics of Latvia[138], Euromonitor

Analysis of external trade

Latvia is a net importer country and imports on average constituted 56.7 % of external trade in 2008-2015. However, export volumes are consistently growing, and exports reached 45.3 % in 2015 compared to 37.0 % in 2008. In total, the volume of external trade in 2015 amounted to 22.9 billion EUR.

Figure 58. Export and import proportion of foreign trade 2008-2015

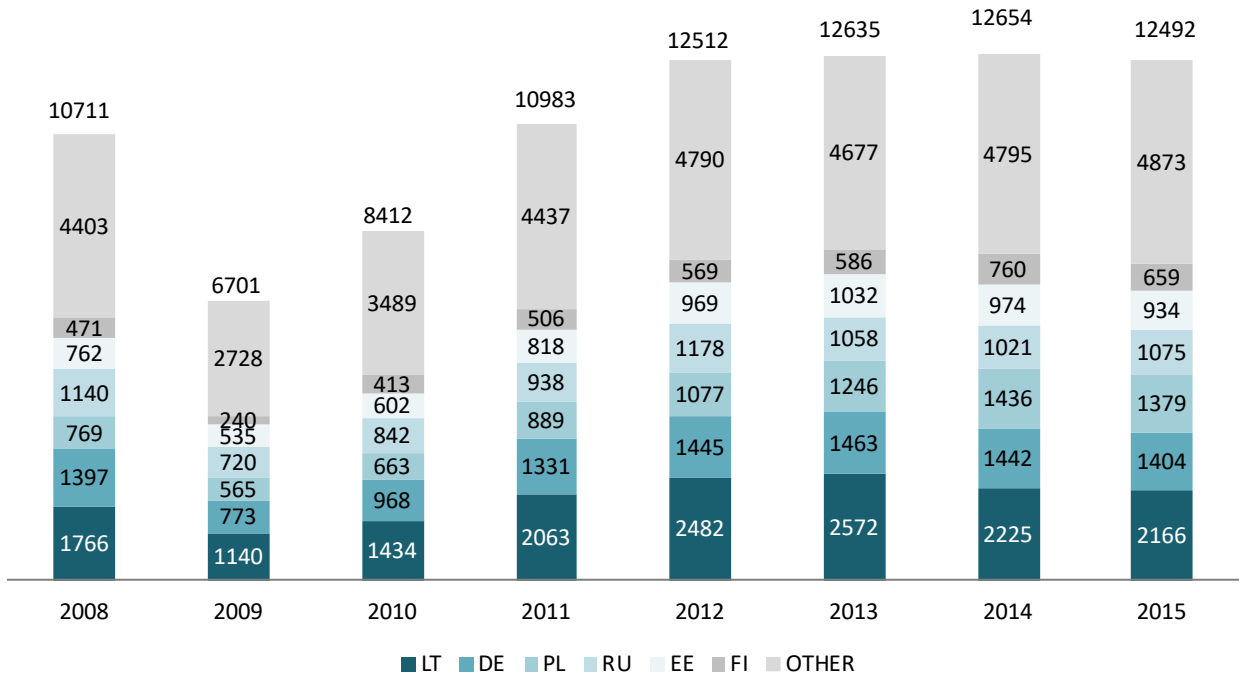


Source: Central Statistics Bureau of Latvia[139]

The total import value of Latvia in 2015 was 12.5 billion EUR. The main import origin countries were Lithuania, Germany, Poland, Russia, Estonia and Finland, which accounted for 61 % of all imports, with Lithuania accounting for 17 % (2.1 billion EUR), Germany 11.2 % and Poland 11.0 %. Imports from Estonia reached over 0.9 billion EUR (7.5 % total imports). On average between 2008-2015, 93 % of imports came from EU countries, with 5.8 % being from Asian countries (of which 2.7 % were from China).

[138] https://www.em.gov.lv/files/tautsaimniecibas_attistiba/2016_jun.pdf
[139] http://data.csb.gov.lv/pxweb/lv/atirdz/atirdz__ikgad__atirdz/AT0010_euro.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

Figure 59. Main import origin countries, million EUR

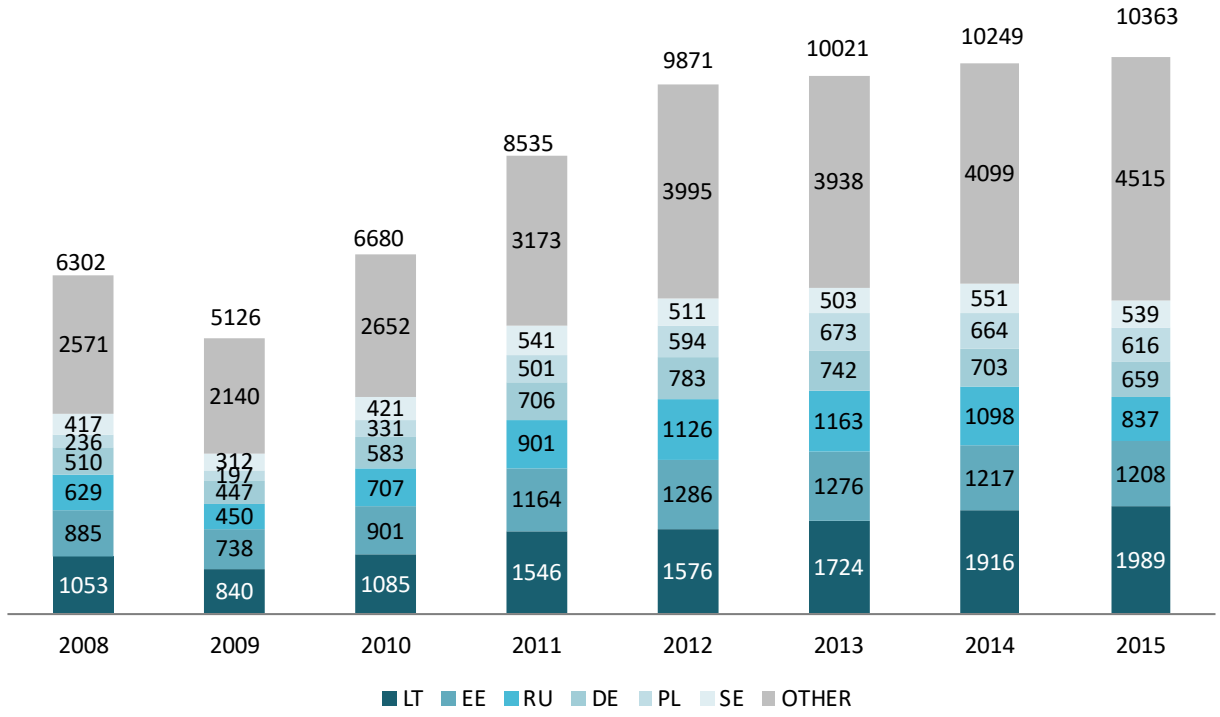


Source: Central Statistics Bureau of Latvia[140]

The total export value of Latvia in 2015 was 10.4 billion EUR. The main export destinations were Lithuania, Estonia, Russia, Germany, Poland and Sweden, which together accounted for 56.5 % of all exports. Around 19 % of exports went to Lithuania (1.9 billion EUR), 11.7 % to Estonia (1.2 billion EUR) and more than 0.8 billion EUR went to Russia. On average, 88 % of exports went to EU countries in 2008-2015 with 6.6 % going to Asian countries (of which 0.6 % went to China).

[140] http://data.csb.gov.lv/pxweb/lv/atirdz/atirdz__ikgad__atirdz/AT0020_euro.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

Figure 60. Main export destination countries of Latvia, million EUR



Source: Central Statistics Bureau of Latvia[141]

The most exported commodities from Latvia to Estonia were food products, non-metallic mineral products and agricultural products. The most imported commodities were wood and products of wood, food products and metal ores. About 75 % of exports and 60 % of imports with Estonia were made via road transport.[142]

Table 35. Export and import with Estonia by road by commodity groups 2015, million EUR

Commodity	Export	Import
Total	**912**	**566**
Food products, beverages and tobacco	207	106
Other non-metallic mineral products	192	56
Products of agriculture, hunting, and forestry; fish and other fishing products	184	49
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials; pulp, paper and paper products; printed matter and recorded media	114	125
Grouped goods: a mixture of types of goods which are transported together	90	50
Coke and refined petroleum products	44	30
Basic metals; fabricated metal products, except machinery and equipment	36	26
Metal ores and other mining and quarrying products; peat	25	68

[141] http://data.csb.gov.lv/pxweb/lv/atirdz/atirdz__ikgad__atirdz/AT0020_euro.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

[142] http://data.csb.gov.lv/pxweb/lv/atirdz/atirdz__ikgad__atirdz/AT0020_euro.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

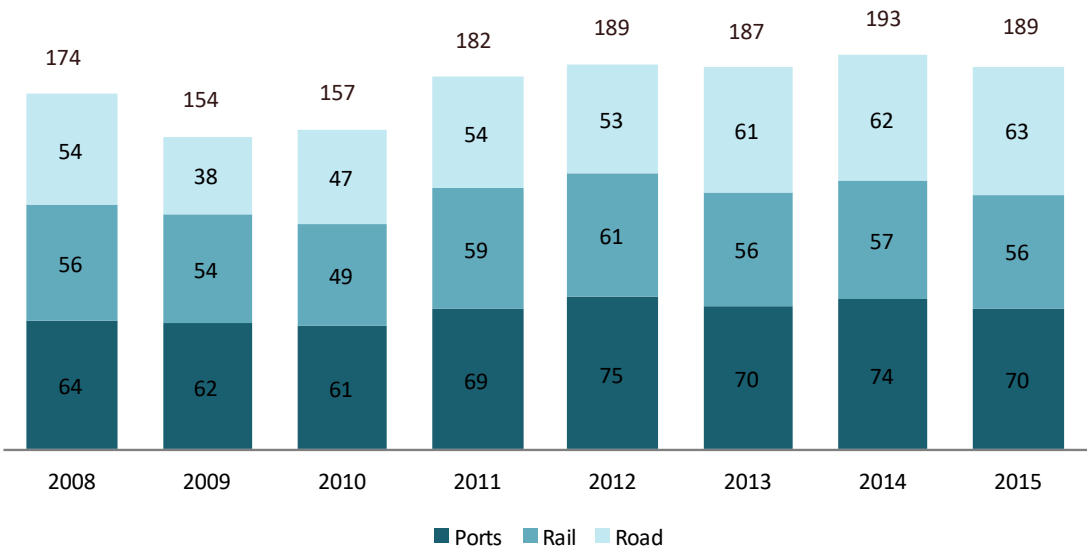
Commodity	Export	Import
Coke and refined petroleum products	13	13
Other	7	43

Source: Central Statistics Bureau of Latvia[143]

Freight transportation by mode of transport

In 2015, a total of 189 million tons of freight were transported in Latvia, which is 8.6 % more compared to 2008. Of these, 63 million tons were transported via roads, 56 million via railways and 70 million through ports. In particular, 80 % (45 million tons) of railway cargo was further transported through ports (see Figure 61).

Figure 61. Cargo transported via different modes of transport, million tons



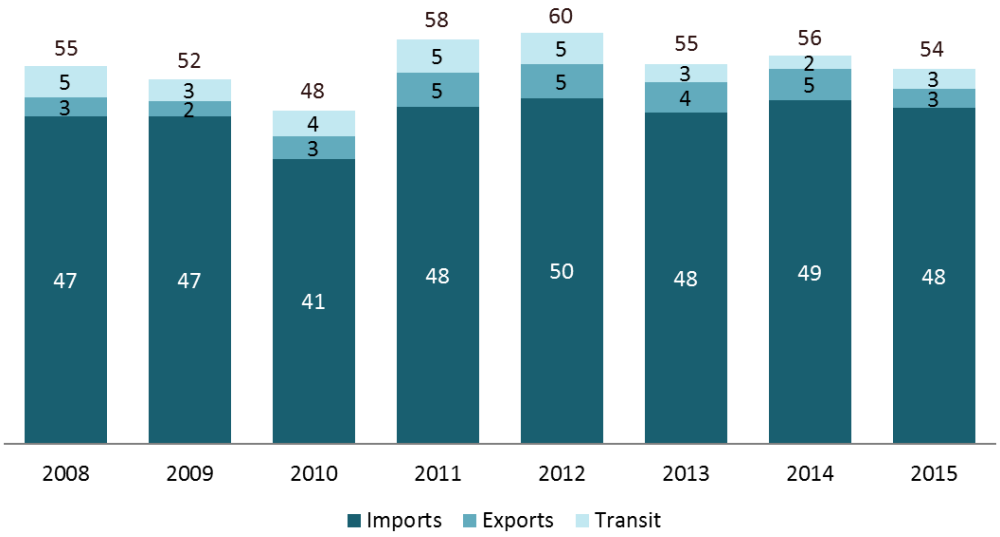
Source: Central Statistics Bureau of Latvia[144]

In 2015, 56 million tons in total were transported by railways, of which almost 54 million constituted international transportation. The majority of international rail transport consisted of import transportation (88 %), while export and transit transportation comprised around 3 % each (see Figure 62).

[143] http://data.csb.gov.lv/pxweb/lv/atirdz/atirdz__ikgad__atirdz/AT0051_euro.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

[144] http://data.csb.gov.lv/pxweb/lv/transp/transp__ikgad__transp/?tablelist=true&rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

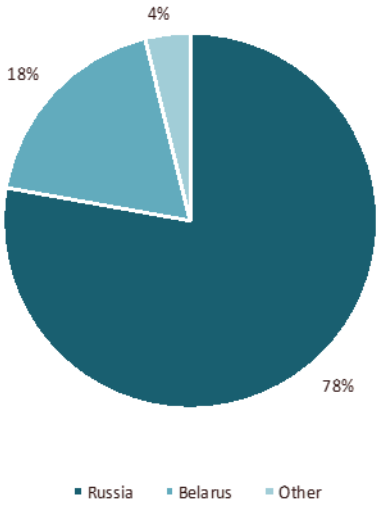
Figure 62. Division of international rail transport, million tons



Source: Central Statistics Bureau of Latvia[145]

The majority of goods imported into Latvia came from two countries – Russia and Belarus, constituting 78 % and 18 %, respectively (see Figure 63). Expressed in volume, this consisted of more than 46 million tons.

Figure 63. Origins of imported goods by rail, 2015



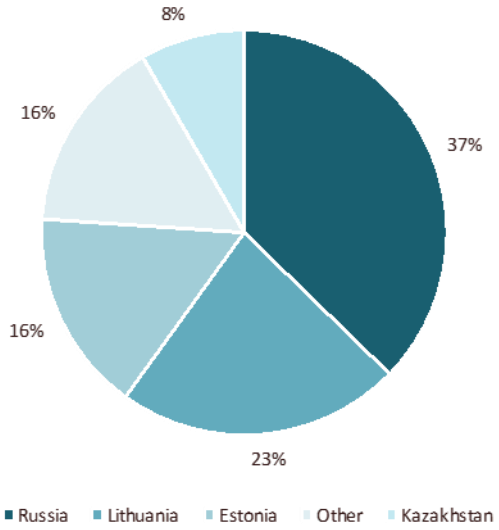
Source: Eurostat[146]

Export destinations were more diversified than import origins. Even though Russia was also the number one export destination with more than 1 million tons of freight, it was followed by Lithuania with 0.65 m

[145] http://data.csb.gov.lv/pxweb/lv/transp/transp__ikgad__transp/TR0150.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0
[146]http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ext_tec03&lang=en

tons and Estonia with 0.46 million tons. Other countries constituted less than 10 % of exported goods (see Figure 64).

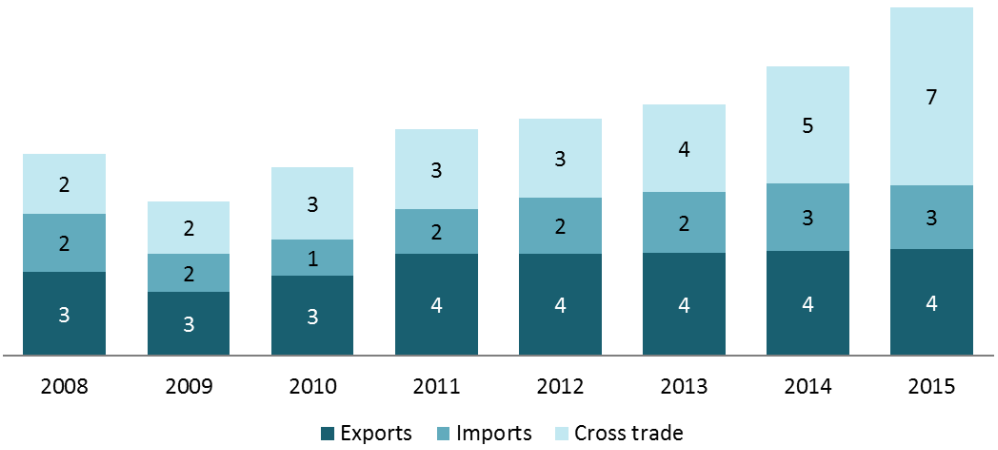
Figure 64. Destination of exported goods by rail, 2015



Source: Eurostat[147]

In 2015, the total volume of freights transported by roads was 63 million tons, of which only 14 million tons were international transportation. Of this, half of international transportation (7.1 million tons) was cross-trade and cabotage; export accounted for 31 % and imports for 18 % (see Figure 65).

Figure 65. Division of international road transport, million tons

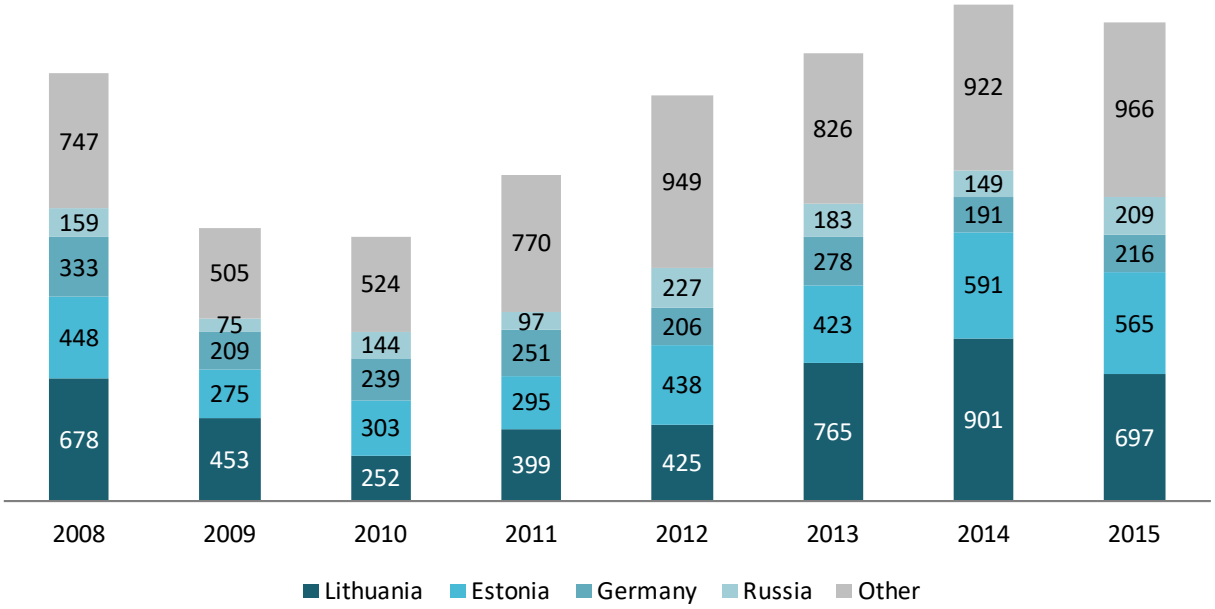


Source: Central Statistics Bureau of Latvia[148]

[147] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ext_tec03&lang=en
[148] http://data.csb.gov.lv/pxweb/lv/transp/transp__ikgad__transp/TR0230.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0

The majority of goods imported into Latvia came from two other Baltic states – Lithuania and Estonia (26 % and 21 %, respectively). The other two significant origins of imported goods were Russia and Germany (8 % each). All other countries contributed 36 %, or 966 million tons (see Figure 66).

Figure 66. Origins of imported goods by road 2015, million tons

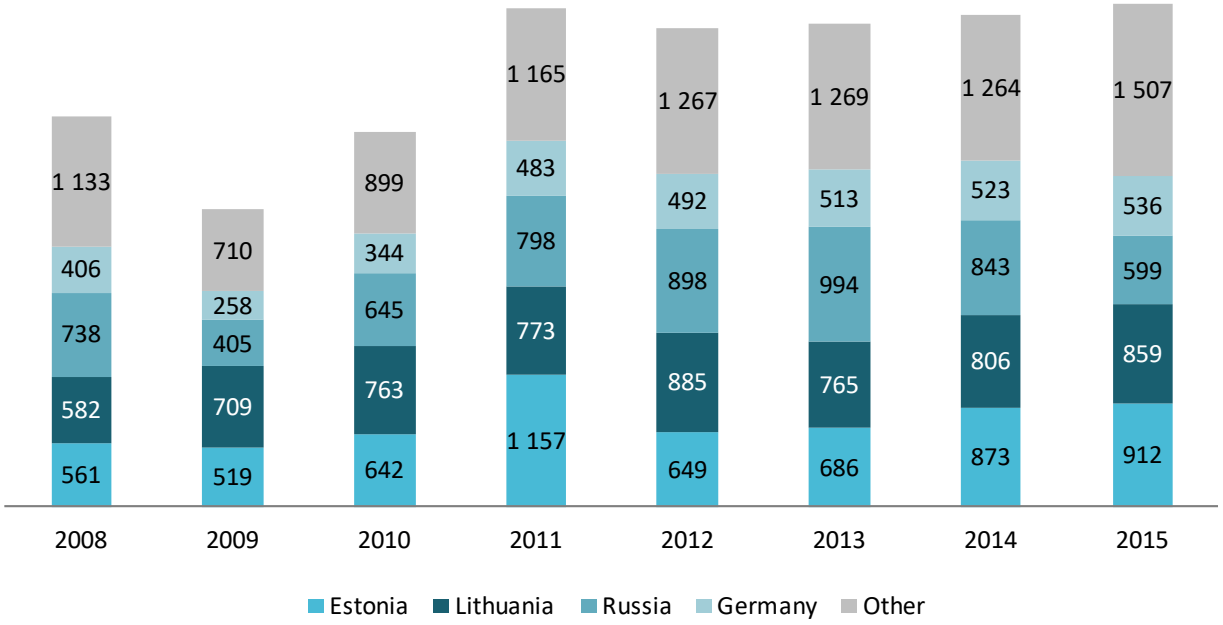


Source: Eurostat[149]

The top four destinations for both imports and exports were Lithuania, Estonia, Russia and Germany. Estonia was the main export destination with 21 % of all exports by road in 2015; Lithuania came second with 19 %. Russia followed with 14 %, which is the lowest amount over the 8-year period, but export volumes to Germany, although remaining at 10-12 % of all exports, increased in value in the same period.

[149] http://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics

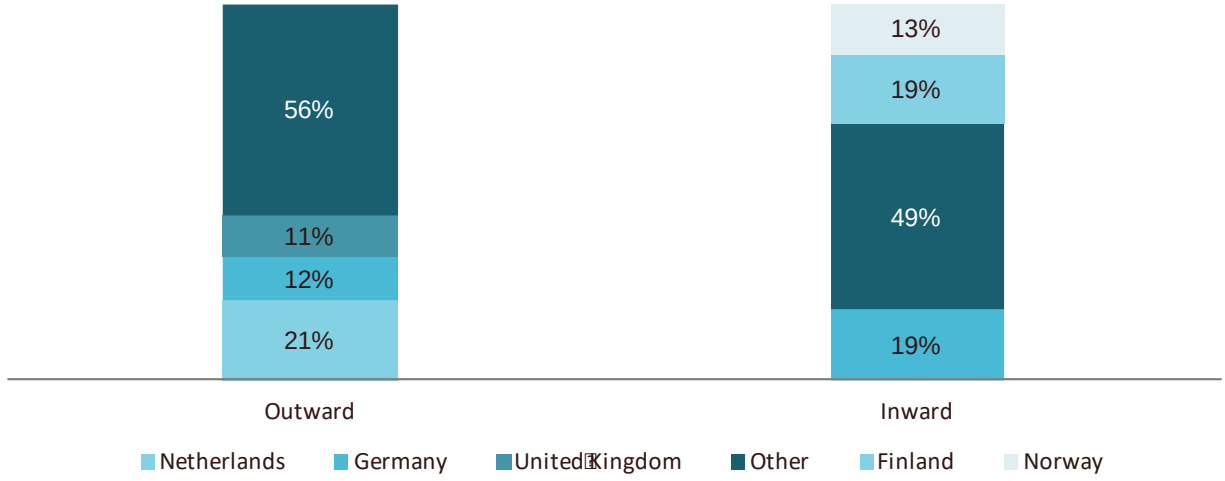
Figure 67. Destinations of exported goods by road 2015, million tons



Source: Eurostat[150]

The main origins of cargo handled in the Freeport of Riga were Germany, Finland and Norway, while the main destination countries were the Netherlands, Germany and the United Kingdom (see Figure 68).

Figure 68. Main inward and outward countries of cargo shipped through Riga, 2015

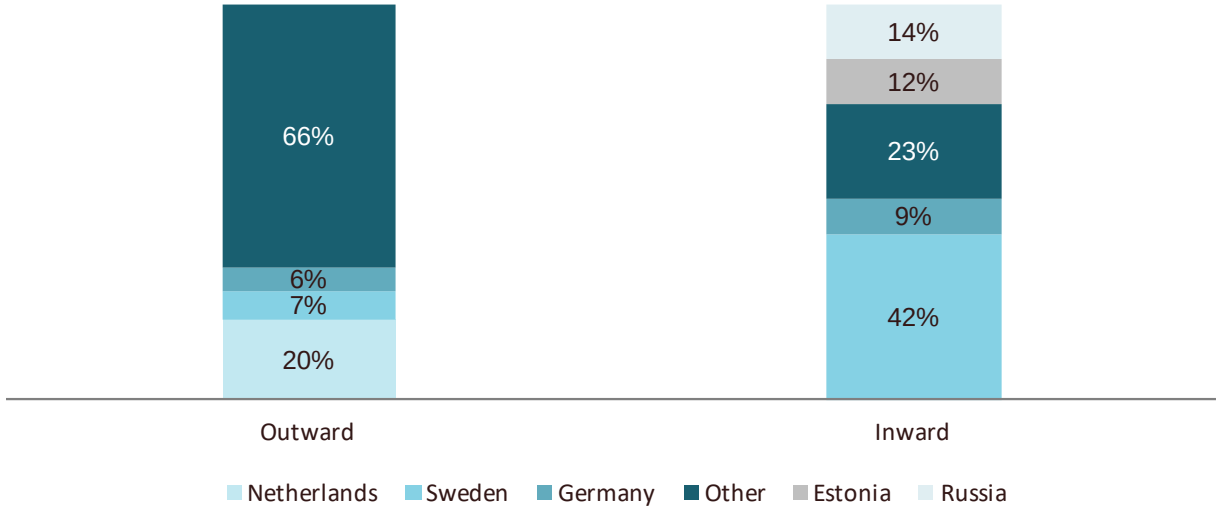


Source: Central Statistics Bureau of Latvia[151]

The main origins of cargo handled in the Port of Ventspils were Sweden, Russia and Estonia, while the main destination countries were the Netherlands, Sweden and Germany (see Figure 69).

[150] http://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics
[151] http://www.csb.gov.lv/sites/default/files/nr_29_transports_latvija_2016_16_00_lv_en.pdf

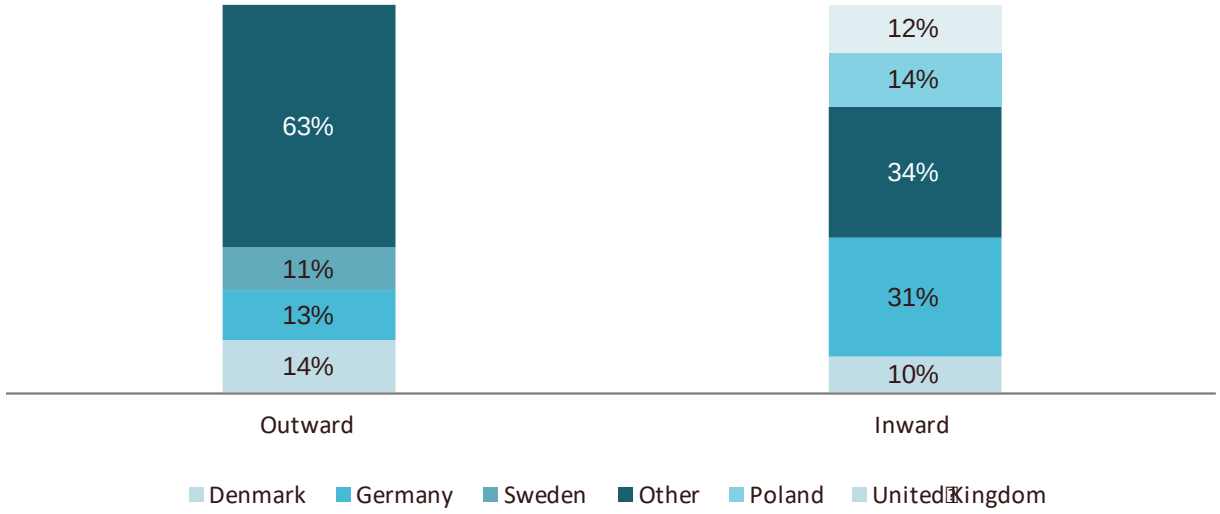
Figure 69. Main inward and outward countries of cargo shipped through Ventspils, 2015



Source: Central Statistics Bureau of Latvia[152]

The main origins of cargo handled in the Port of Liepaja were Germany, Poland and the United Kingdom, while the main destination countries were Denmark, Sweden and Germany (see Figure 70).

Figure 70. Main inward and outward countries of cargo shipped through Liepaja, 2015

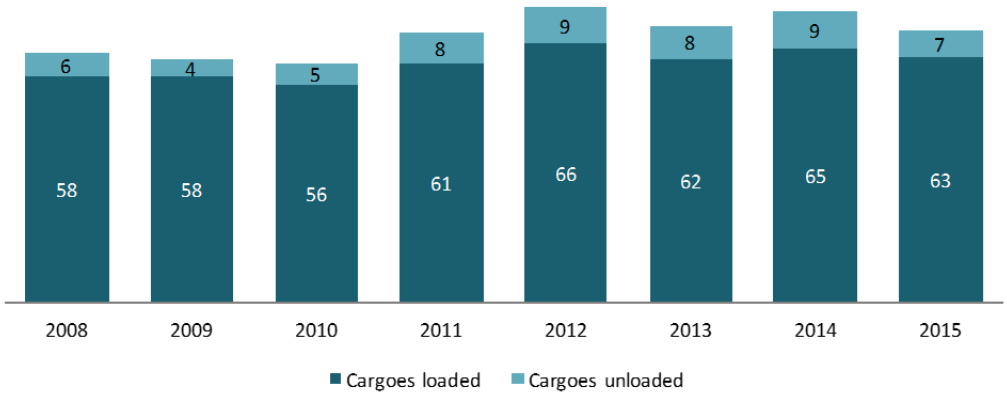


Source: Central Statistics Bureau of Latvia[153]

The volume of cargo loaded and unloaded in Latvia's ports had increased since 2008, reaching its peak in 2012 (more than 75 million tons). Since then, it has been declining and only reached 70 million tons in 2015 (see Figure 71).

[152] http://www.csb.gov.lv/sites/default/files/nr_29_transports_latvija_2016_16_00_lv_en.pdf
[153] http://www.csb.gov.lv/sites/default/files/nr_29_transports_latvija_2016_16_00_lv_en.pdf

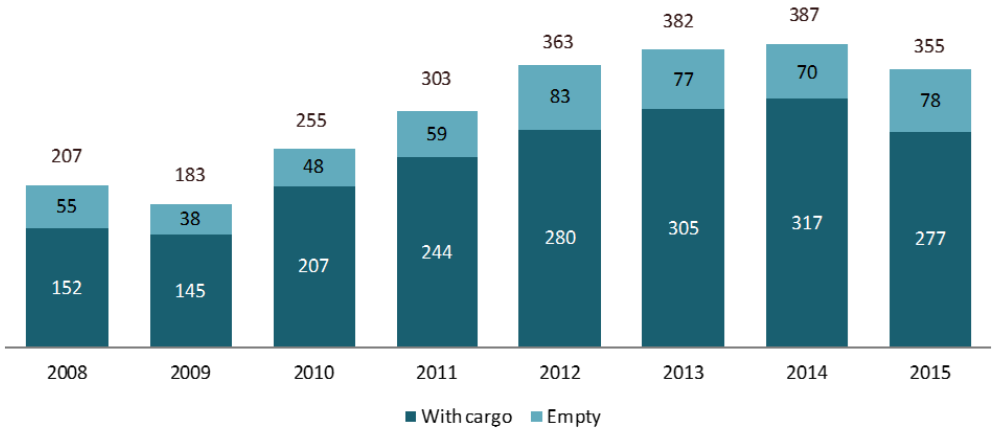
Figure 71. Cargo loaded and unloaded in ports, million tons



Source: Central Statistics Bureau of Latvia[154]

In 2015, Latvian ports handled 360 thousand TEU containers, with the majority passing through the Freeport of Riga (more than 355 thousand). 78 % of all containers handled in Riga were with cargo, and 22 % were empty. In comparison to other Baltic Sea ports, Tallinn and Klaipeda handled around 200 and 392 thousand TEU containers respectively.[155] Since 2008, the number of handled containers has increased by more than 70 %, which is due to a focus on attracting container cargo with higher value-added. A situation has emerged in this direction whereby the usual cargo flows of coal, oil etc. coming from Russia have been redirected to Russian ports though there has been an overall increase in the containerised transportation of goods. In order to seize the opportunity, the Freeport of Riga has undertaken several development projects in Kundzinsala, in addition to several private investments among companies operating in this area.

Figure 72. Containers handled in the port of Riga, thousand TEUs



Source: Freeport of Riga[156]

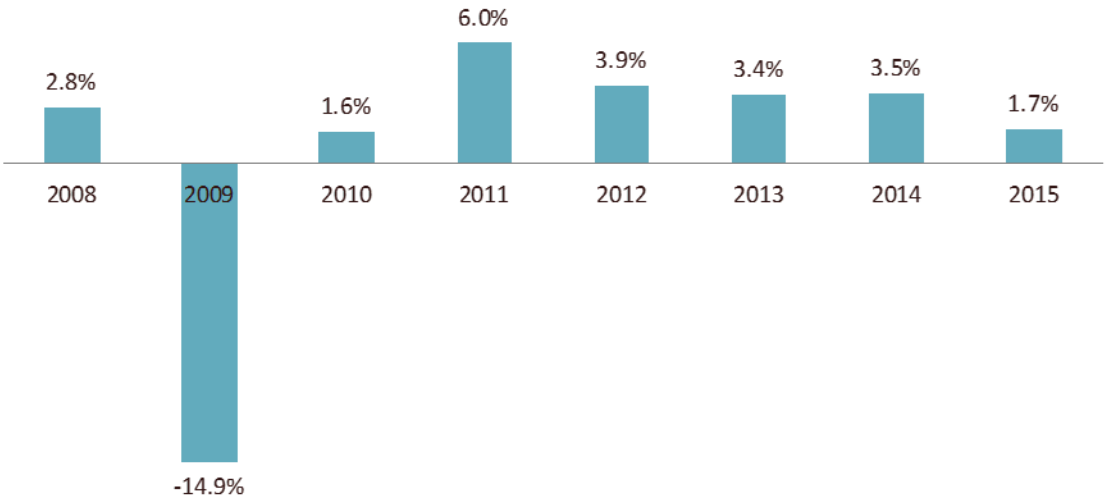
6.5.4. Lithuania

[154] http://data.csb.gov.lv/pxweb/lv/transp/transp__ikgad__transp/TR0170.px/?rxid=cdcb978c-22b0-416a-aacc-aa650d3e2ce0
[155] http://www.portofklaipeda.lt/port-statistics
[156] http://rop.lv/lv/par-ostu/statistika.html

Economic overview

During the period of 2008-2015, the Lithuanian economy grew by an average of 3.4 % per annum, compared with the EU average of 1.2 %. As a result of the global recession, which resulted in a sharp decrease in exports and internal consumption, the Lithuanian economy contracted by 14.9 % in 2009; however, positive growth of seasonally adjusted GDP resumed in the first quarter of 2010, mostly owing to growth in exports due to recovering foreign markets.

Figure 73. Lithuanian real GDP growth for 2008-2015

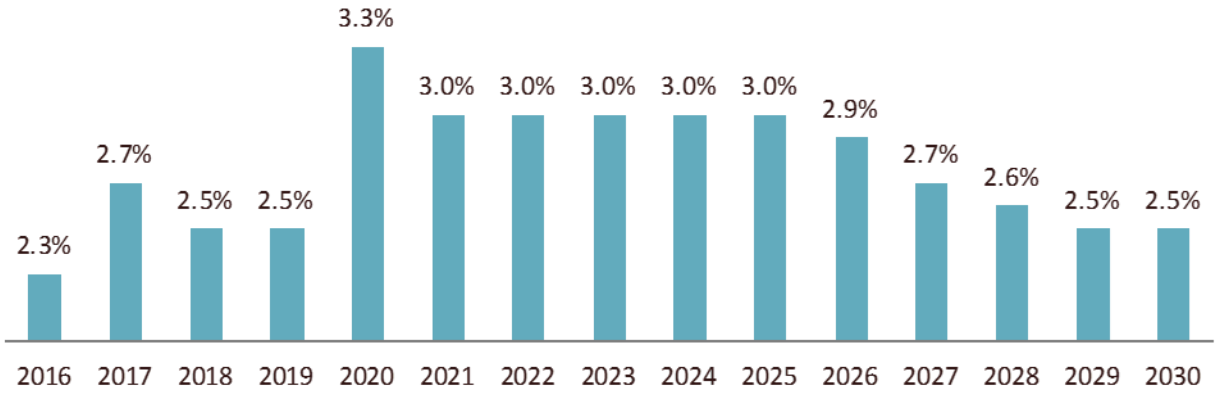


Source: Statistics Lithuania[157]

According to current projections from the Ministry of Finance of Lithuania, real GDP will be 2.3 % higher in 2016 than in 2015, in 2017 its growth rate will increase to 2.7 % and in 2018 and 2019 it will increase to 2.5 %. The Ministry believes that this growth will be achieved by increasing exports (around 3.5 % annually) and household consumption (around 4.4 % annually). Also, unemployment will decrease while salaries will increase faster than inflation; therefore, the purchasing power of citizens will remain strong. The central bank of the Republic of Lithuania predicts that GDP growth in 2016 will be 2.0 % and 2.4 % in 2017. According to the European Commission, real GDP growth will climb from 2.0 % in 2016 to 2.7 % in 2017 and to 2.8 % in 2018. Despite moderate growth, Lithuania's GDP will grow faster than GDP in both the EU and euro area, and the standard of living, during the period covered by the economic development scenario, will continue to improve (see Figure 74).

[157] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S7R183#/

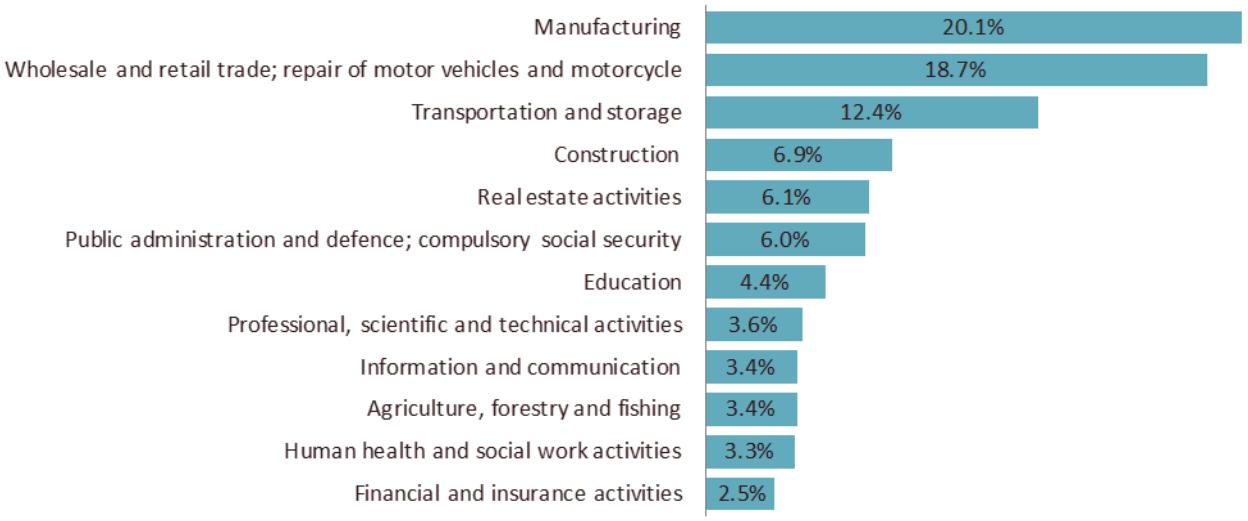
Figure 74. Lithuanian real GDP growth forecasts for 2016-2030



Source: Ministry of Finance of the Republic of Lithuania[158], Euromonitor International

The biggest part of Lithuanian GDP is created by the manufacturing sector at 20.1 % of total GDP, specifically food products, beverages and tobacco (4.4 % of GDP), textiles, wearing apparel, leather and related products (1.7 % of GDP), and chemicals and chemical products (1.7 % of GDP). The second largest sector, creating 18.7 % of GDP, is wholesale and retail; the repair of motor vehicles and the motorcycles sector, followed by the transportation sector.

Figure 75. Lithuanian GDP structure by sector, 2014



Source: Statistics Lithuania[159]

It is expected that manufacturing industry will grow further in the near future, as every third company expects production growth, and every fourth export growth, while the number of less optimistic companies is decreasing. Although economic activity in the construction sector is expected to slow down and possibly

[158] https://finmin.lrv.lt/en/actual-financial-data/economic-development-scenario
[159] https://osp.stat.gov.lt/paieska?q=gdp+structure

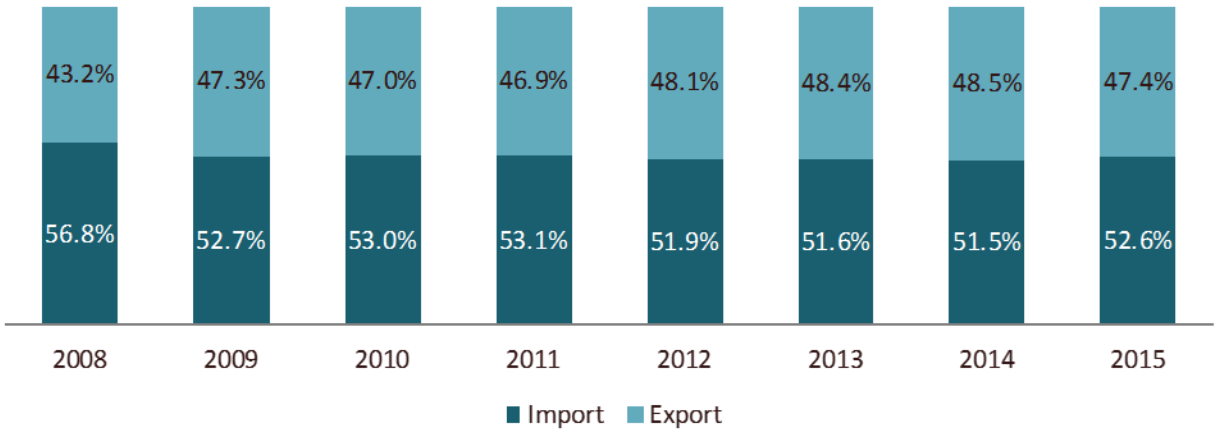
decrease, it is expected that the Lithuanian transportation sector will grow in the future. The growth is also expected for the wholesale and retail sector due to increasing wages and consumption.

Lithuanian largest companies by revenue are Orlen Lietuva (refined petroleum products), Maxima (retailer of food products, beverages and tobacco), Achema (producer of fertilisers and nitrogen compounds), Sanitex (wholesaler of food products, beverages and tobacco), Lukoil Baltija (retailer of automotive fuel), Lithuanian railways (rail transportation operator), Lina Agro (wholesaler of grain, unmanufactured tobacco, seeds and animal feeds) and Lifosa (producer of fertilisers and nitrogen compounds). Most of these companies are also the biggest exporters.

Analysis of internal and external trade

Lithuania is a net importer as imports on average constituted 52.9 % of external trade in 2008-2015. The value of the total exports in 2015 was 16.1 billion EUR, while imports were 21.1 billion EUR (see Figure 76).

Figure 76. Export and import value of total foreign trade in 2008-2015, % of total imports and exports in EUR

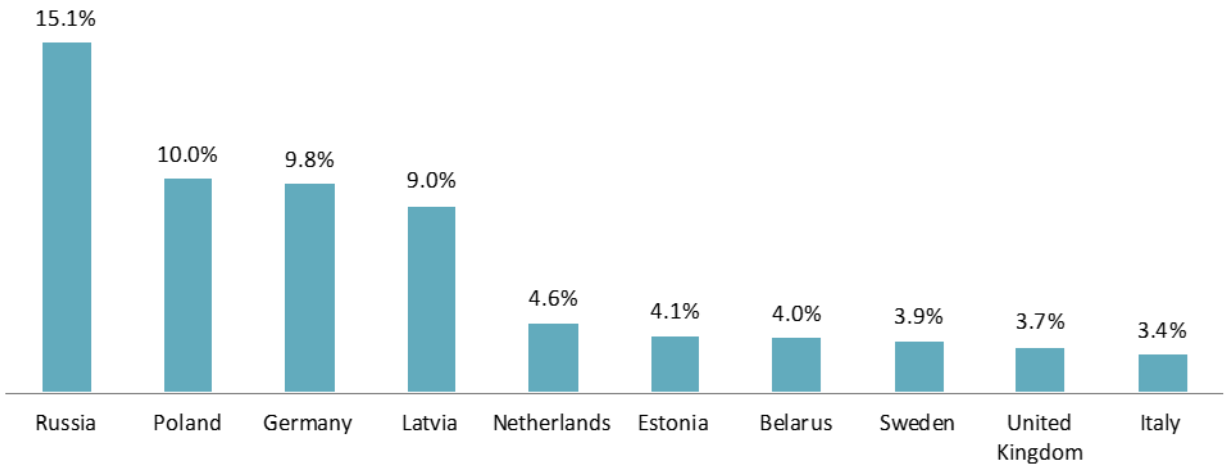


Source: Statistics Lithuania[160]

The main trading partners of Lithuania are Russia, Poland, Germany and Latvia. These four countries accounted for 44 % of the total value of foreign trade. In 2015, Estonia was ranked the 6th biggest Lithuanian trading partner.

[160] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S7R160#/

Figure 77. Main Lithuanian trading partners, % from total imports and exports in EUR

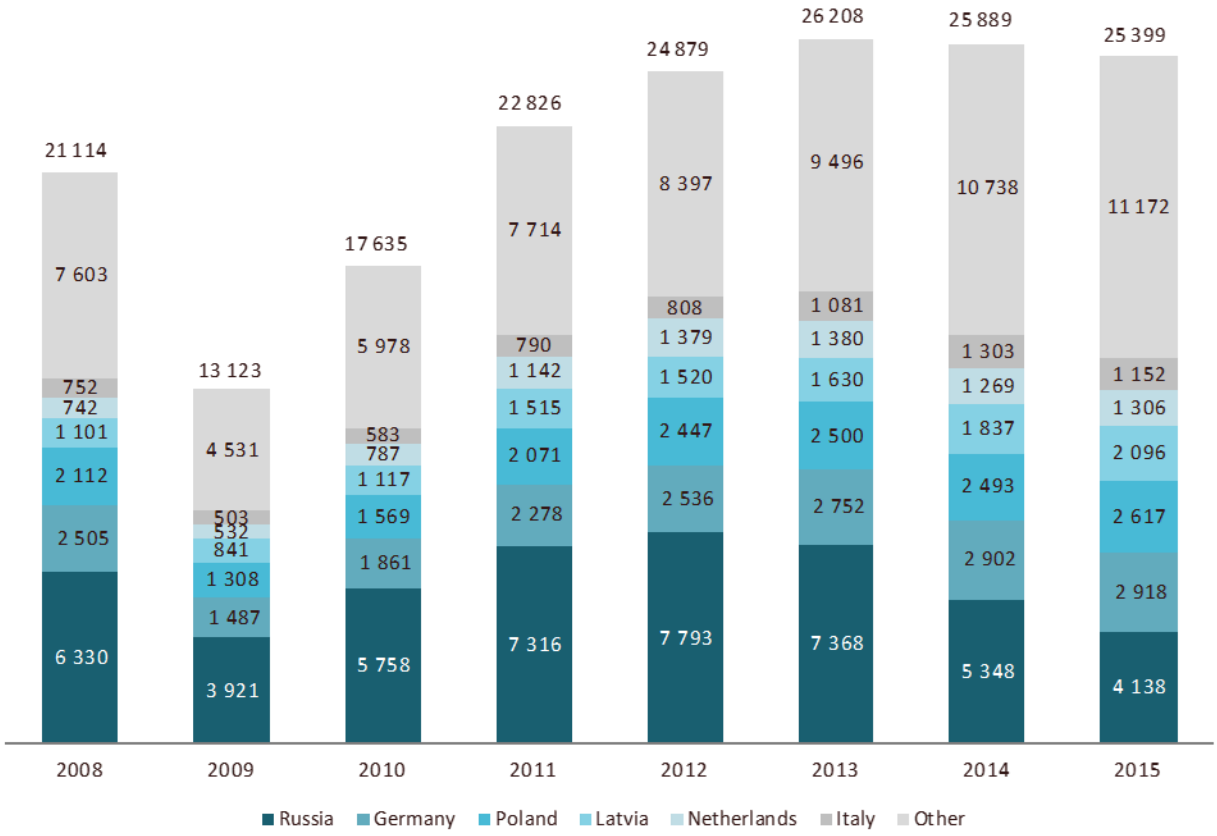


Source: Statistics Lithuania[161]

When looking at the import statistics separately, one can see that imports from Russia have decreased substantially since 2008. At first, imports from Russia decreased due to global economic recession in 2009 and then started to increase again, reaching a peak in 2012. However, since 2012, the amounts imported from Russia have decreased dramatically and in 2015 they amounted to 56 % of the value imported in 2012, primarily due to a decrease in the value of mineral fuels imported to Lithuania. However, imports from Germany, Poland and Italy steadily increased during the same period.

[161] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S7R160#/

Figure 78. Main import origin countries, m EUR



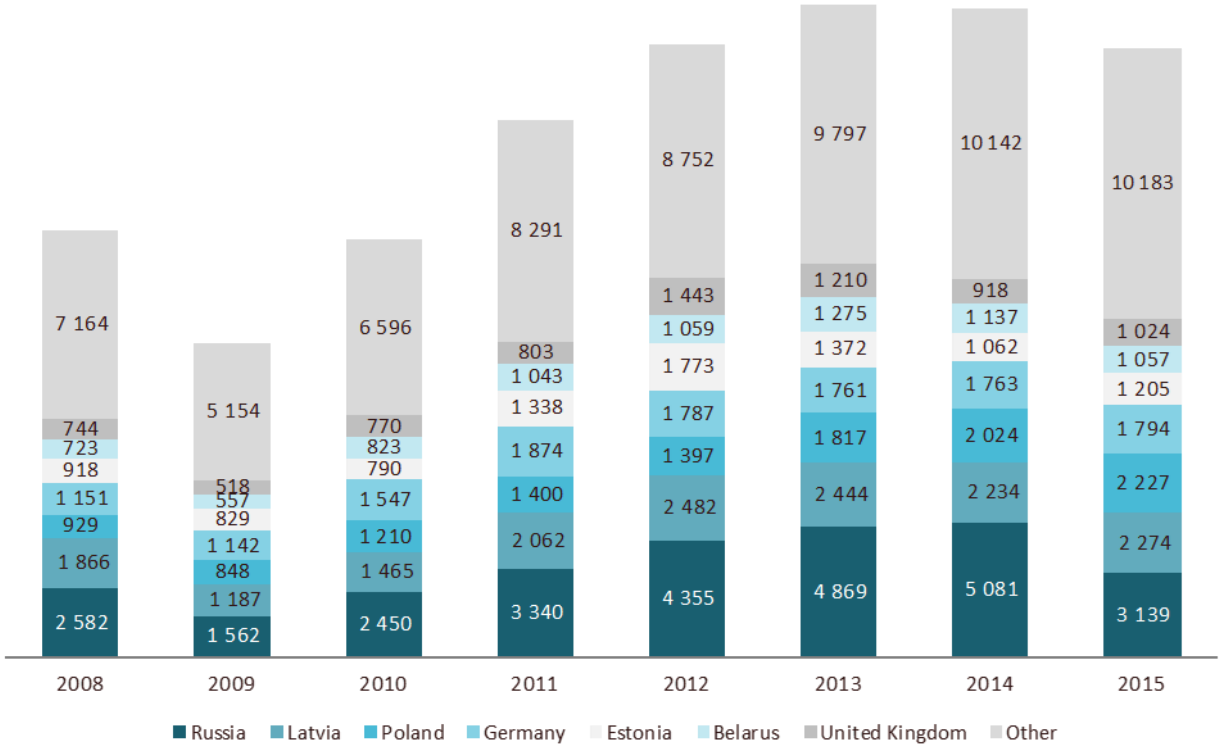
Source: Statistics Lithuania[162]

Lithuania's main export country is Russia. The value of goods exported to Russia had increased substantially since 2009. However, in 2015, compared to 2014, the value of exports decreased dramatically (by more than 38 %). The main reasons for this were the Russian embargo imposed on food products imported from Lithuania and many other European countries, devaluation of the rouble and bad economic conditions. Nevertheless, Lithuanian exports switched to other countries and grew fastest in European Union countries. Exporters switched to other European countries such as Latvia, Poland, Estonia, the United Kingdom and even the United States to compensate for the decrease in demand from Russia. Nevertheless, a general decrease in the value of exports occurred in 2015 due to a decrease in the prices of oil products (though the volume increased), in re-export (due to the Russian embargo and devaluation of the rouble in other Eastern countries) and the shift to other markets did not compensate for the full loss incurred to Lithuanian exports.

Estonia was Lithuania's 5th biggest exporting country in 2015 and in other years too. The largest value of goods exported to Estonia was in 2012; since then the value has been decreasing and only rose again in 2015.

[162] https://osp.stat.gov.lt/paieska?q=import+country

Figure 79. Main export origin countries, m EUR



Source: Statistics Lithuania[163]

The two main groups of goods exported from Lithuania to Estonia are mineral products and food products, beverages and tobacco. The main import category from Estonia to Lithuania is live animals and their products, specifically dairy products, eggs and honey.

Table 36. Export and import with Estonia by commodity group in 2015, million tm tons

Commodity	Export	Import
Total	**1 254.5**	**593.1**
5 Mineral products	706.8	82.1
4 Food products, beverages and tobacco	145.5	32.2
6 Products of chemical or allied industries	94.3	49.2
9 Wood and products of wood and cork (except furniture); articles of straw and plaiting materials; pulp, paper and paper products; printed matter and recorded media	79.5	41.0
15 Base metals and articles of base metals	51.2	36.8
2 Vegetable products	49.5	15.0
7 Plastic and rubber	30.6	26.1

[163] https://osp.stat.gov.lt/paieska?q=import+country

Commodity	Export	Import
13 Articles of stone, plaster, cement, asbestos, mica or similar materials, ceramic products; glass and glassware	28.6	66.6
1 Live animals; animal products	19.2	151.9
10 Pulp of wood or other fibrous cellulosic material	15.3	36.5
3 Animal or vegetable fats and oils; waxes and their cleavage products	6.1	25.4
Other	27.9	30.2

Source: Statistics Lithuania[164]

Generally, export growth is expected to be modest in both 2017 and 2018 due to the constantly rising real unit labour costs, which will make it increasingly hard to gain a market share on the back of weak external demand growth. According to current projections from the Ministry of Finance of Lithuania, the country's exports will grow by 4.9 % in 2016, 2.8 % in 2017, 3.1 % in 2018 and 3.4 % in 2019.

The table below represents annual growth rate for different commodity groups in the future.

Table 37. Expected annual production growth rate for different commodity groups until 2025

Commodity group	Expected annual growth until 2025
Wood and wood products (forestry products: incl. paper, pulp, carton boards etc.)	Forestry – 10 % Furniture – 6 %
Heavy industry products (e.g. production by metal industry and construction material industry)	5 %
Mineral liquid fuels	n/a
Chemical industry products (fertilisers)	5 % (fertilisers – 8.5 %)
Agricultural products (cereals)	n/a
Mining products (coal, oil shale)	n/a
Container products	n/a
Specific goods (e.g. cars etc.)	Cars and other vehicles – 4 %
Electronic goods	4.5 %
Ro-ro (e.g. cars, semi-trailers and trailers, trucks, heavy goods vehicles, etc.)	n/a
Possible "new types of goods", which may apply (e.g. drinking and fresh water etc.)	Food and drink industry – 4-5 %

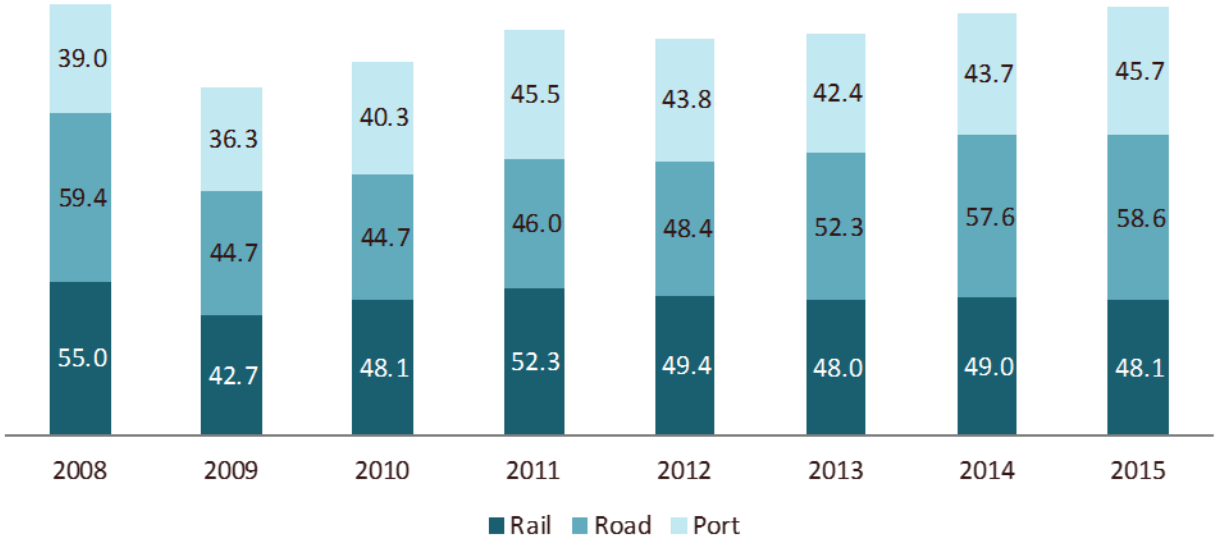
[164] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S7R164#/

Source: Statistics Lithuania[165]

According to Lithuanian enterprise, furniture exports in Lithuania grew by 7.8 %, while wood and wood products increased by 7.4 %. Representatives of furniture and wood companies claim that similar growth in exports is expected for several more years, but it is necessary to deal with issues in the Lithuanian wood material market. Otherwise, the increase in exports will cease.

The split between freight handled by road, sea and rail is almost equal, with road having the largest share. In 2015, 38 % of goods to/from and within the country were transported by road, 32 % by rail and 30 % of cargo was handled by the port of Klaipeda. Figure 75 shows the modal split of freight handled by road, rail and port in Lithuania in the period from 2008 to 2015.

Figure 80. Freight transportation by transport mode, million t



Source: Statistics Lithuania[166]

The majority of freight carried by rail entered the country. This type of traffic accounted for 43 % of rail transportation in 2015 and national transport accounted for 30 % of all freight carried by rail. The amount of freight that entered the country gradually increased from 2008 to 2015, while the transit through Lithuania decreased.

From 2008 to 2015, the amount of freight transited through the country by rail decreased by 104 %. Nearly all transit freight was transported in the direction of the Kaliningrad region. Due to the unstable situation in the neighbouring markets, the flow of freight transported in the route decreased significantly (by 13 %). Therefore, the total amount of freight carried by rail decreased in 2015. Of the three Baltic countries, the biggest decline in rail cargo volumes is observed in Estonia due to the redirection of Russian transit freight to their own ports. In terms of types, oil products accounted for the largest group of transit freight (24 %), followed by solid mineral fuel (24 %), food products (14 %), ferrous metals (12 %) and plant products (11 %).

In 2015, 55 % of the total imported freight were chemical and mineral fertilisers, 20 % were oil products, 10 % were ferrous metals and 6 % were mineral products. Also, there was a significant increase in the

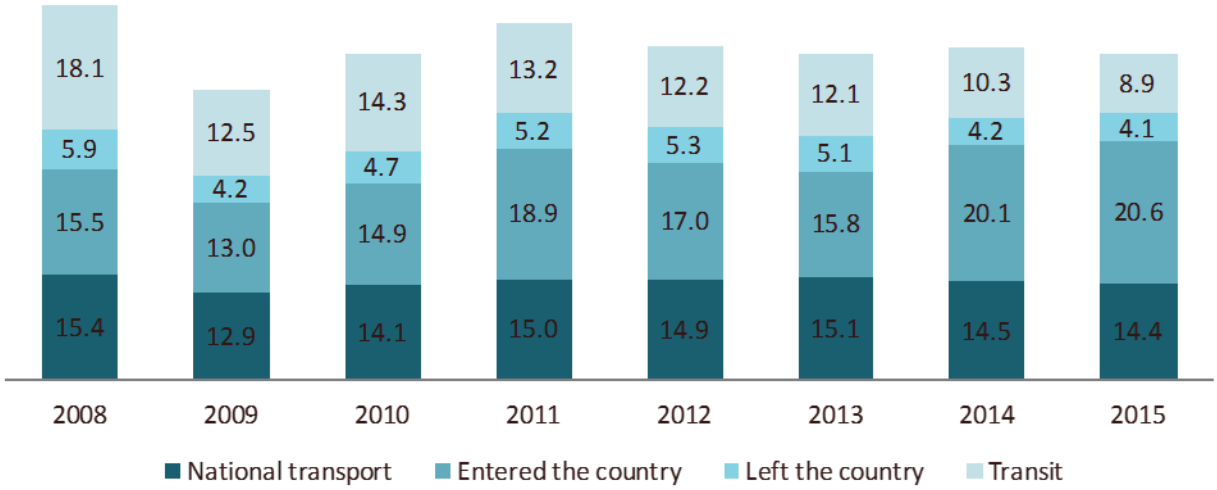
[165] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S9R187#/
[166] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S5R048#/

volumes of the transportation of fertilisers from Belarus via the port of Klaipeda. In 2015, the rail transportation of import freights via the port accounted for 14.8 million t (72 % of total imports).

Around 40 % of the local freight were oil products (Orlen Lietuva), 2 % were chemical and mineral fertilisers (principal customers Achema and Lifosa), 14 % were mineral products (mostly break stone) and 16 % were plant products (mostly grain).

As in previous years, more than half (about 58 %) of export freight flows were petroleum products transported from JSC Orlen Lietuva to Ukraine, Latvia and Estonia.

Figure 81. Rail transportation of freight by the type of traffic, million t

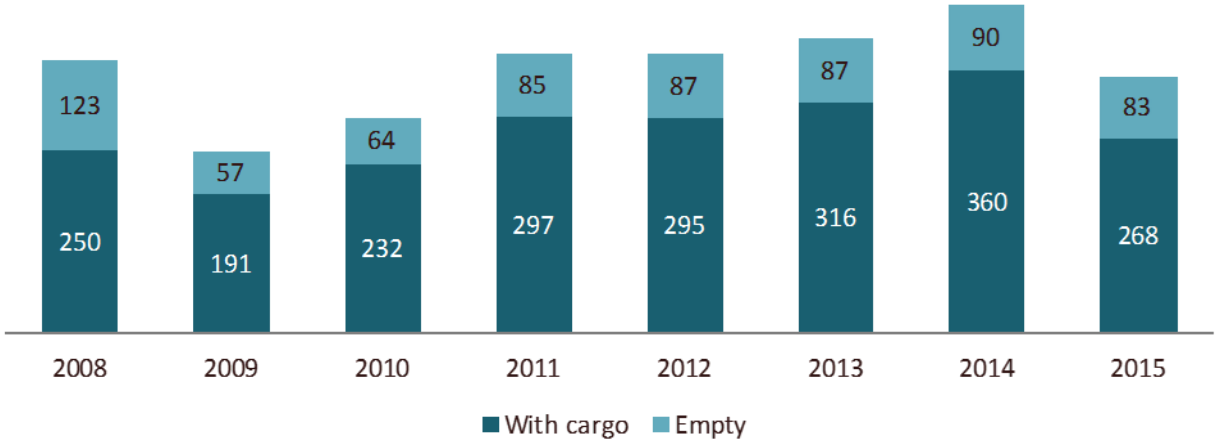


Source: Statistics Lithuania[167]

In 2015, the port of Klaipeda handled 350 thousand containers. Most of them were with cargo (77 %). Compared to the ports of Tallinn and Riga, the port of Klaipeda handles the most containers (twice more than the port of Tallinn), although the port of Riga is catching up fast. The main reasons are the active policy of the Latvian Ministry of Transport to attract cargo from Russia, Kazakhstan and Belarus, even by luring cargo from the Port of Klaipeda and actively offering Riga's port services to Klaipeda's port clients.

[167] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S5R048#/

Figure 82. Containers handled in the port of Klaipeda, thousand TEUs

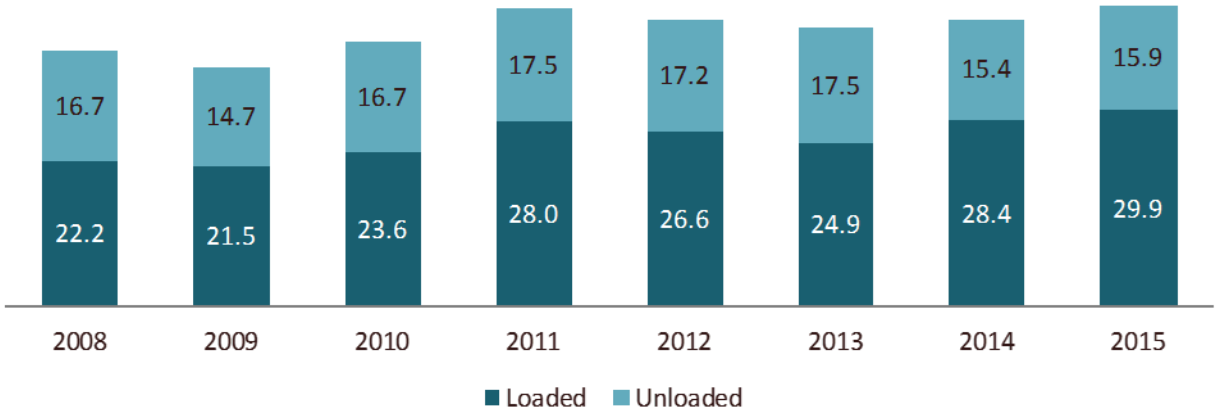


Source: Statistics Lithuania[168]

The number of cargo loaded and unloaded in the port of Klaipeda has increased by 17 % since 2008 and reached its record in 2015 (around 45.8 million t). 8.7 million t were handled by Butinge oil terminal and other cargo was handled by the port of Klaipeda. The port generally loads almost twice more goods than it unloads.

In 2015, the cargo handled in the port of Klaipeda grew. Unlike the Latvian and Estonian ports, which mainly handle Russian transit cargos of coal and oil, Klaipeda has diversified cargo flows (Russian transit cargo accounts for up to 60 % in the port of Riga, whereas in the port of Klaipeda it is 6 %).

Figure 83. Goods loaded and unloaded in the port of Klaipeda, million t



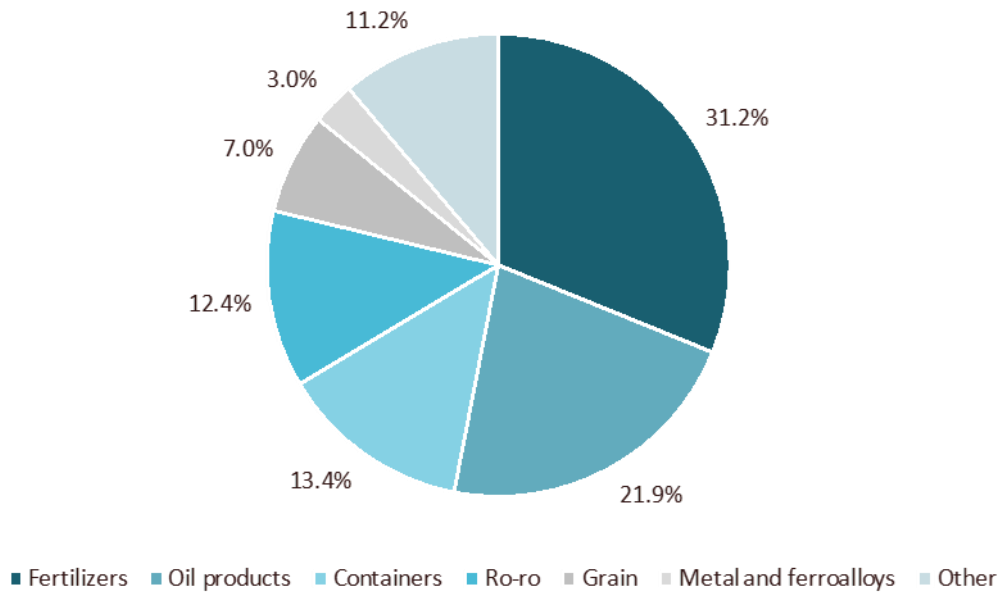
Source: Statistics Lithuania[169]

Fertilisers and oil products dominated the cargo handled in the port of Klaipeda in 2015 (excluding the information about Butinge oil terminal). Together fertilisers and oil products accounted for more than 50 %

[168] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S5R094#/
[169] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S5R094#/

of cargo handled in the port. The other two biggest groups were containers and ro-ro.

Figure 84. Structure of cargo handled in the port of Klaipeda in 2015



Source: Port of Klaipeda[170]

Lithuania's GDP will grow faster than the EU's and the euro area's GDP – on average by 2.5-3.0 % up to 2030. The biggest share of Lithuanian GDP is created by manufacturing (20.1 %), wholesale and retail, repair of motor vehicles and motorcycles sector (18.7 %) and transportation sectors (12.4 %).

The split between freight handled by road, sea and rail is almost equal, with road being the most important mode of transportation (38 % of goods to/from and within the country were carried by road in 2015).

Lithuanian, Latvian and Estonian ports are rather similar and neither of them has a strong competitive advantage; at the same time, the port of Klaipeda is the only ice-free port, is more diversified in terms of freight and therefore less dependent on Russia. It is estimated that the port of Klaipeda will reach its full capacity by 2025.

6.5.5. Northwest Russia

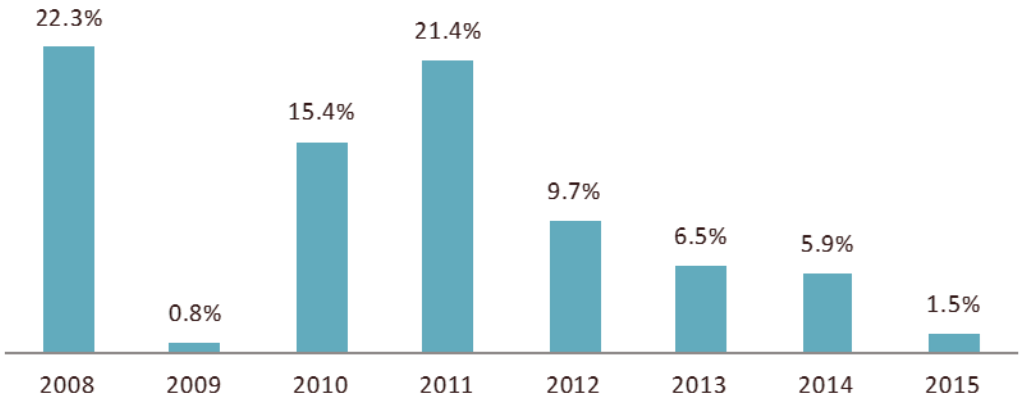
Economic overview

The Northwestern Federal District has a significant contribution in the overall economic potential of the Russian Federation. The district accounts for 10 % of total gross domestic product, 12 % of industrial production and 10 % of employment of the whole Russian economy.

According to the Federal State Statistics Service, the gross regional product of the Northwestern Federal District amounted to 6.04 trillion RUB (89 billion EUR) in 2015.

[170] https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S5R094#/

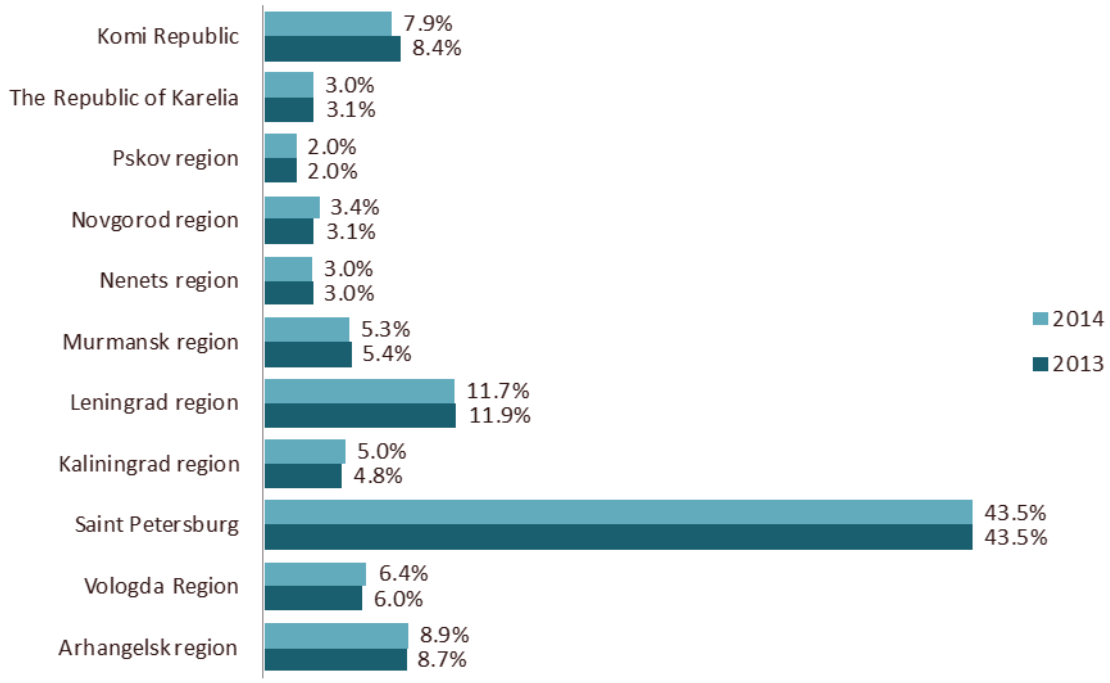
Figure 85. NW Russia real GDP growth for 2008-2015



Source: Russian Federation Federal State Statistics Service[171]

The four most developed regions of the Northwestern Federal District (St. Petersburg, Murmansk, Vologda Oblast and Komi Republic) produce 79 % of the gross regional product and 67 % of industrial production. The leading position in the economy of the district is occupied by the city of St. Petersburg, which accounts for about 43.5 % of GRP and 33 % of industrial production.

Figure 86. NW Russia real GDP structure by region, 2012-2014



Source: EMISS Database

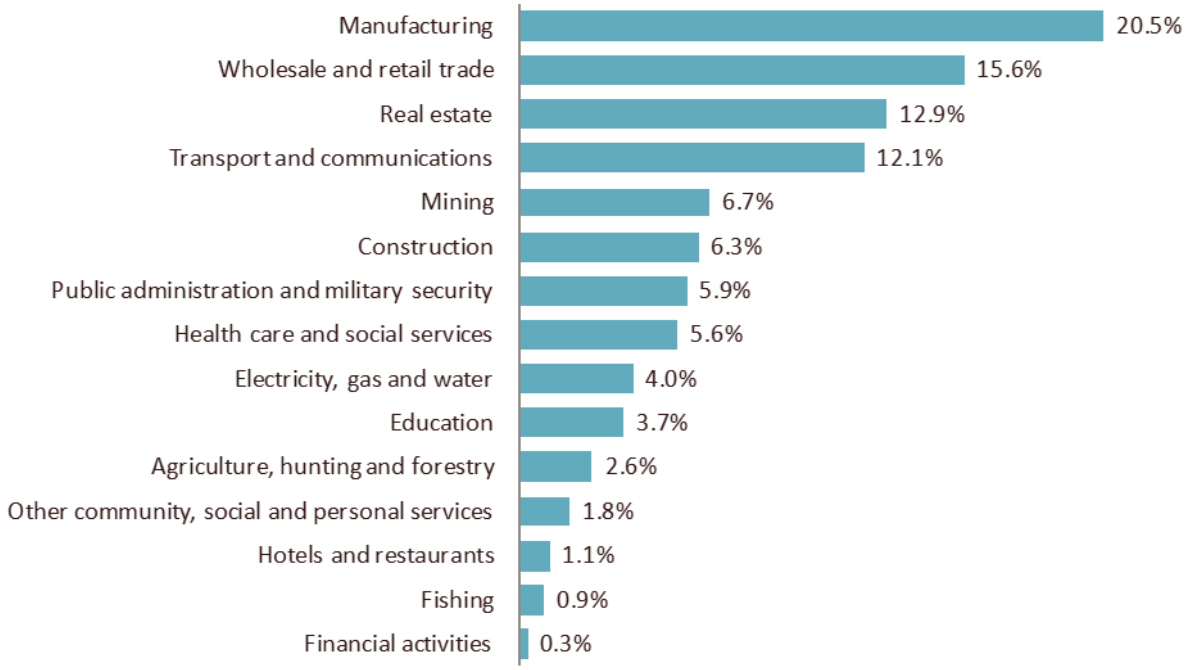
[171] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/domestic/

In the Northwestern Federal District, the growth rate in the index of physical volume of gross regional product is expected to increase from 2016: in 2016 by 0.4 %, in 2017 by 1.7 % and in 2018 by 1.9 %. Despite these positive trends in 2018 in comparison to 2014, the District shows low rates of GDP growth (0.6 %).

Manufacturing within the federal district includes electrical machinery and the manufacture of a wide range of equipment for agriculture, shipbuilding and defence engineering. The district assembly plants include major car brands such as BMW, Ford, Nissan, Toyota and Infiniti. The Northwestern Federal District ranks first in Russia for the construction of sea and river vessels.

The largest enterprises in the Northwest Federal District are JSC Severstal (steel and mining), JSC Power Machines (energy systems machine-building), JSC United Shipbuilding Corporation, JSC Ilim Pulp (pulp and paper mill), JSC Yantarenergo (electric grid company), OJSC Apatit (mining and processing enterprise, chemical manufacture), Kola Mining and Metallurgical Company, and JSC Sevkabel (cabling and wiring production). The region is second in Russia in terms of produced fish. Fish processing is carried out in Murmansk, St. Petersburg and Kaliningrad.

Figure 87. NW Russia real GDP structure by industry, 2014



Source: Russian Federation Federal State Statistics Service[172]

In the Northwestern Federal District, some of the lowest rates of industrial production growth index is predicted (down 2.7 %) in the medium term (in 2018 relative to 2014) due to a decline in mining (by 6.4 %) and in the volume of manufacturing industries (2.8 %). A reduction in the rate of growth of the index of physical volume of industrial production in 2018 is foreseen in the Nenets Autonomous District (2.5 %), the Republic of Karelia (0.5 %) and the Novgorod region (0.1 %). In the Nenets Autonomous District, decline is expected due to the natural digression of oil production on existing fields.

It is stated in the Strategy until 2020 development programme that due to modernisation and the innovative development of the region, the average annual growth rate of gross regional product by 2020 in NW Russia will be 6-7 % annually, while labour productivity will grow by 7-8 % per year.

[172] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/domestic/

In 2015, the Expert North-West analytical centre conducted a study of the Northwestern Russian region and it has conducted a regular annual rating of the "Top 250 largest companies in the Northwestern Federal District".

The highest rated companies are Gazprom Neft, VTB Group, PJSC Severstal and PJSC Rostelecom, accounted through consolidated financial statements for purposes of rating indicators, which includes operations in the whole Russia and thus few comparisons to other companies can be made.

The key growth drivers for the economy remain the same: public procurement and investment in infrastructure projects. The fastest growing companies in 2015 were Gazprom Invest OOO (growth of 7.6 times, part of the PJSC Gazprom), JSC Archangelskgeoldobycha (growth of 4.7 times, part of the PJSC LUKOIL) and Concern Sea underwater weapons – Gidropribor (growth of 4.0 times). The growth of these companies is primarily associated with increased state and private investments in the exploration of natural resources, their extraction, the activation of work in the Arctic and increased government spending on defence.

Table 38. NW Russia largest companies in 2015

Company	Region	Industry	Revenue in 2015, m EUR	Net Profit, m EUR	Trade priority
Gazprom-oil	St. Petersburg	Oil and gas industry	21 587	1 709	Export
VTB Group	St. Petersburg	Banking	17 640	25	Domestic market
Severstal	Vologda region	Siderurgy	5 621	506	Export
Rostelekom	St. Petersburg	Telecommunications	4 373	212	Domestic market
Lukoil – Komi	Komi	Oil and gas industry	4 290	354	Export
United shipbuilding company	St. Petersburg	Manufacturing	4 106	138	Export
Lenta	St. Petersburg	Retail trade	3 717	138	Domestic market
Agrotorg	St. Petersburg	Retail trade	3 366	7	Domestic market
NOVAT Ust Luga	Leningrad region	Oil and gas industry	2 099	197	Export
Fosagro Cherepovets	Vologda region	Chemicals	1 570	200	Export

Source: Russian Federation Federal State Statistics Service[173]

Analysis of internal and external trade

The Northwestern Federal District has a unique geographical position and it is the only district to have a direct border with the European Union, Northern Europe, through the Baltic Sea to the Federal Republic of Germany, the Kingdom of Sweden and the Kingdom of Denmark, and by sea route to other European countries. It has developed economic and cultural ties with foreign partners.

In 2015, the trade turnover of the Northwestern Federal District amounted to 65 122 m. EUR. The volume of exports amounted to 34 625 m EUR, and imports 30 497 m EUR.

The orientation of external trade of the Northwestern Federal District to non-CIS countries has remained unchanged for a long period of time. Their share in the turnover of the county is over 90 %. Trade with

[173] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/

neighbouring countries amounted to 11 % of the region's trade in 2016.

Table 39. NW Russia export statistics by destination country in 2015

Country	Export, thousand EUR	Share in total export	Key commodities
CIS	**1 052 640**	**3.0 %**	
Ukraine	464 731	1.3 %	tobacco, paper and equipment
Other CIS countries	587 909	1.7 %	
Other countries	**33 572 924**	**97.0 %**	
The Netherlands	7 507 071	21.7 %	fuel, fish, copper, nickel, ferrous metals
Germany	3 918 808	11.3 %	fuel, tires, wood, ferrous metal, paper
China	2 025 633	5.9 %	fuel, timber, manure, mineral products, copper
UK	1 646 703	4.8 %	fuel, timber, manure, mineral products, fertiliser
USA	1 632 529	4.7 %	fuel, fertiliser
Finland	1 378 077	4.0 %	fuel, timber, chemicals
Belgium	1 344 472	3.9 %	nickel, copper, fuel, fertiliser
India	1 080 025	3.1 %	fertiliser, equipment
Denmark	918 231	2.7 %	fuel, timber
Estonia	811 261	2.3 %	fuel, timber, fertiliser
Other non-CIS countries	**11 310 114**	**32.6 %**	

Source: Russian Federation Federal State Statistics Service[174]

Table 40. NW Russia import statistics by destination country in 2015

Country	Import, thousand EUR	Share in total import	Key commodities
CIS	**392 179**	**1.3 %**	
Ukraine	334 004	1.1 %	mechanical engineering products, ferrous metals
Other CIS countries	58 175	0.2 %	
Other countries	**30 104 813**	**98.7 %**	
China	6 504 744	21.3 %	mechanical engineering products, toys, vehicles, ferrous metals
Germany	3 177 667	10.4 %	mechanical engineering products, paper, ferrous metals
Korea	1 553 780	5.1 %	vehicles, equipment

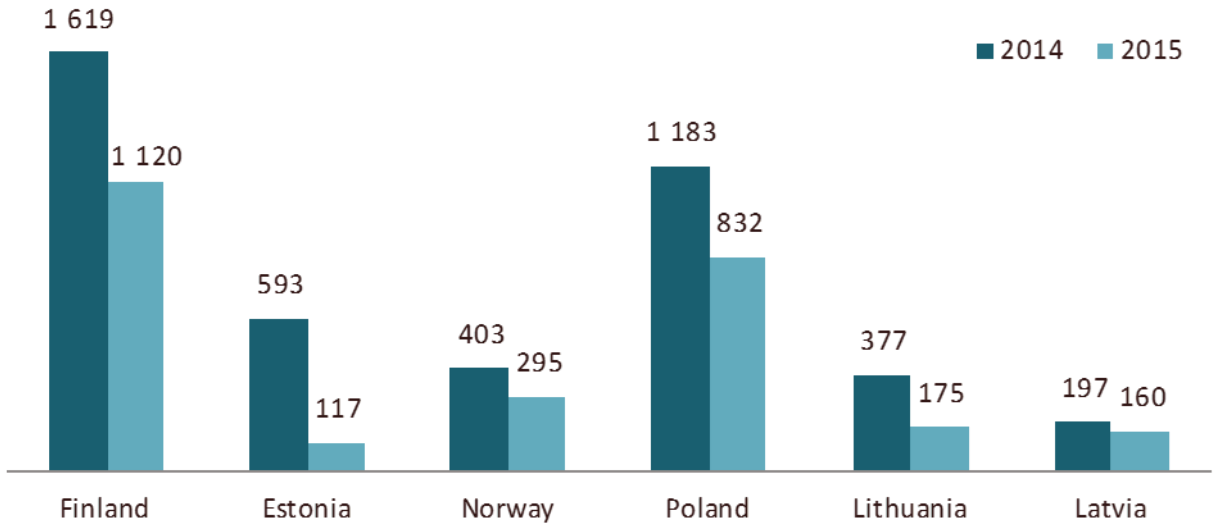
[174] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/

Country	Import, thousand EUR	Share in total import	Key commodities
USA	1 483 982	4.9 %	mechanical engineering products, vehicles, ferrous metals
Brazil	1 273 341	4.2 %	Food
Italy	1 143 985	3.8 %	mechanical engineering products, ferrous metals
Finland	1 120 089	3.7 %	mechanical engineering products, chemicals, paper
Japan	983 370	3.2 %	mechanical engineering products, vehicles
Poland	832 355	2.7 %	equipment, paper
France	810 798	2.7 %	mechanical engineering products, alcoholic beverages, plastic
Other non-CIS countries	11 220 701	36.8 %	

Source: Russian Federation Federal State Statistics Service[175]

Priority in cross-border trade is given to Finland. NW Russia exported mineral fuel, timber and wood products, and chemical products. Dairy products, paper and paperboard, machine-building products and plastic goods are supplied from Finland to NW Russia.

Figure 88. Export flows with NW Russia's main trading partners in 2014-2015, m. EUR



Source: Russian Federation Federal State Statistics Service[176]

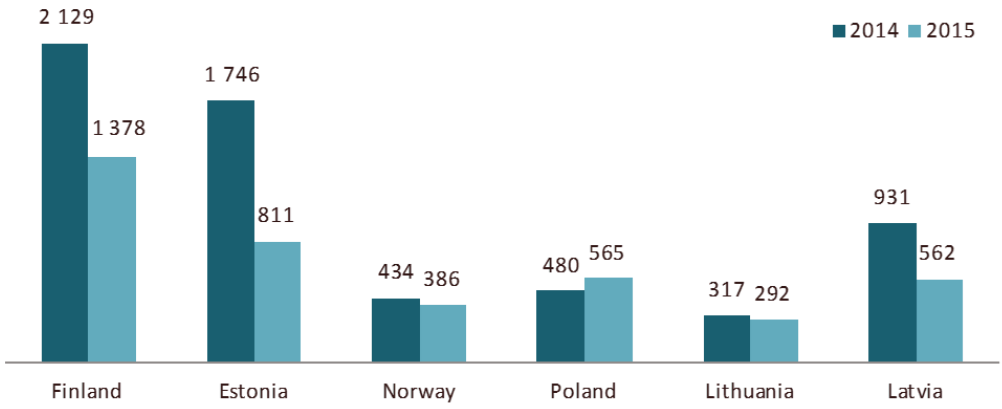
The second place in terms of the volumes of trade flows between bordering countries in 2015 was occupied by Poland. The main goods exported to Poland were fuel, ferrous metals and wood; imports consisted of electrical equipment, plastic goods, fruits and ground transportation vehicles.

Latvia was in 3rd place by trade volume. The most traded commodities with Latvia are mineral fuels, ferrous

[175] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/
[176] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/

metals, wood and chemical products, fish, crop production and engineering products.

Figure 89. Import flows with NW Russia's main trading partners in 2014-2015, million EUR

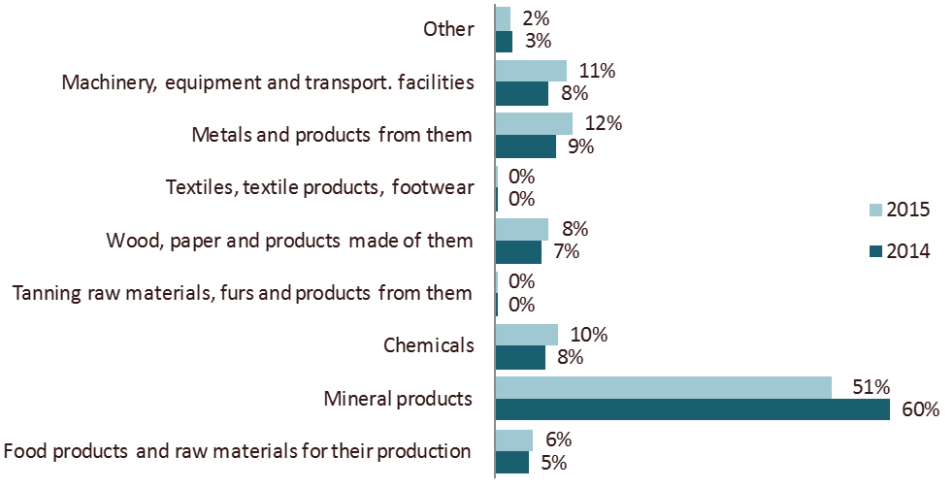


Source: Russian Federation Federal State Statistics Service[177]

In the Northwestern Federal District of the Russian Federation, the leaders in terms of volumes of export are St. Petersburg and the Leningrad region. The structure of imports is as follows: 1st place is occupied by St. Petersburg, 2nd place by the Kaliningrad region and 3rd place by the Leningrad region.

In the commodity structure of exports, 1st place is occupied by mineral products, 2nd place by metals and products from them, and 3rd place by wood and paper.

Figure 90. NW Russia export statistics by commodity group in 2014-2015, % of total export



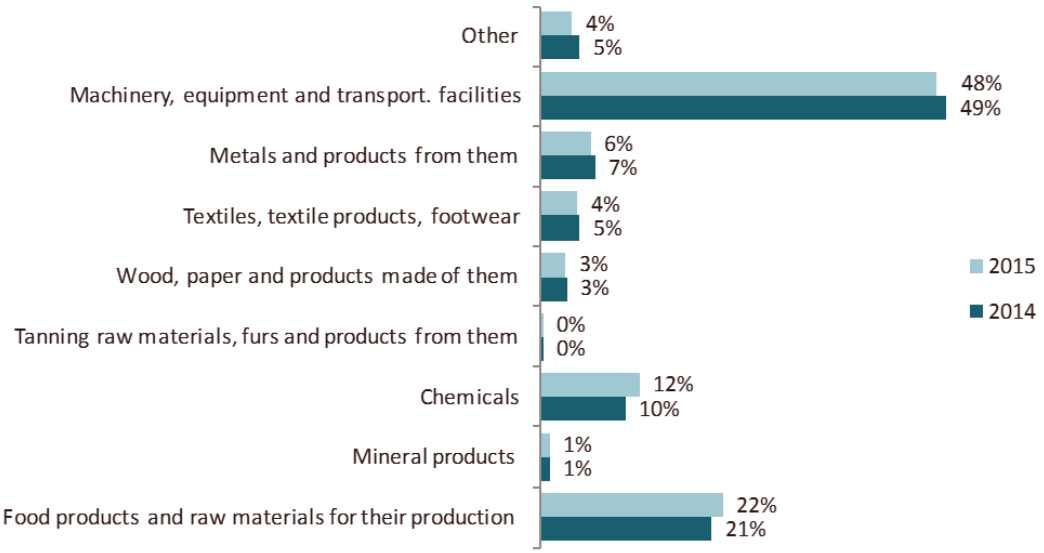
Source: Russian Federation Federal State Statistics Service[178]

In terms of the commodity structure of imports, 1st place was occupied by machinery, equipment and vehicles, 2nd place by food products and raw materials for their production, and 3rd place by chemical products.

[177] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/
[178] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/

The Northwestern Federal District participates in a number of regional cross-border cooperation programmes in the Baltic Sea region and with Northern Europe. These include the Arctic Council, the Barents Euro-Arctic Council, the Council of Baltic Sea States, the Northern Dimension partnership, which covers the territory of the co-operation of all the above-mentioned organisations.

Figure 91. NW Russia import statistics by commodity group in 2014-2015, % of total export



Source: Russian Federation Federal State Statistics Service[179]

The district's transportation system is highly developed. It includes all types of transport: sea, river, rail, air, road and pipeline. The transportation complex of the Northwestern Federal District plays an important role in the economy of the region and the entire Russian Federation. Due to its unique geographical location and relatively close proximity to the European Union and to the largest European ports, a significant proportion of the country's international cargo passes through the district.

Available ports, a well-developed network of railways and highways, an aviation system, the Northern Sea Route, and the Volga-Baltic waterway and pipeline transport serve both the internal needs of the region and the exports of oil, gas and products of their processing, and combined they make the Northwestern Federal District of strategic importance to the economy and national security.

The role of the transportation complex of the Northwestern Federal District is to ensure operation of the Russian transportation system and it is primarily determined by specialisation and transportation infrastructure capacity, which provides for the import and export of Russian goods, as well as the ability to create the necessary conditions for sustainable development of the county enterprises.

In recent years, there has been a significant increase in demand for the services of the transportation complex, which is in tandem with the development of international trade and the increased volume of production. The Northwestern Federal District is a leader in Russia in terms of the growth of container traffic (although in recent years this has declined significantly), as well as in terms of development of the trade network. Transport has a significant impact on improving the competitiveness of the region's economy.

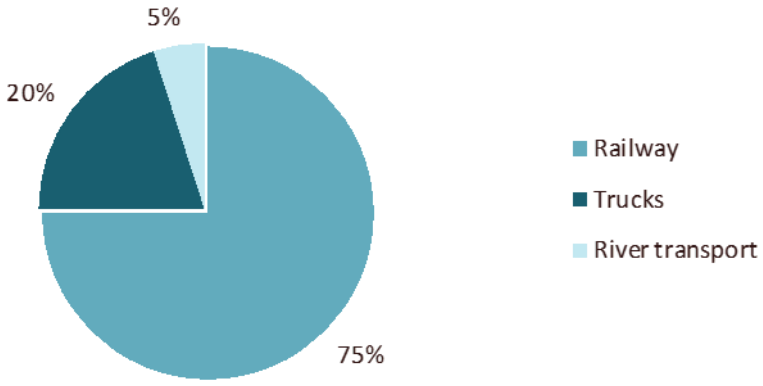
[179] http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/activities/

The district hosts the largest ports in Russia – the seaport of Saint Petersburg, Murmansk Sea trading port, port of Kaliningrad and Arkhangelsk. Murmansk port is mainly associated with the transportation of energy resources from Russia and from other countries (such as Norway) by the Northern Sea Route.

Maritime transport plays an important role in Russian foreign economic relations and the economic development of the North-West Federal District, carrying out export-import, transit and cabotage (including Arctic) sea transport. In remote areas of the Far North Sea, transport is often the only mode of transport that is capable of carrying large consignments, ensuring the livelihoods of indigenous people of the north and the development of the country's natural resources. This form of transport provides direct connections to the Kaliningrad Region without crossing the territory of other states.

Inland waterway transport, as an integral part of the transport complex of the district, provides regional and international transportation. The inland waterways are connected with strategically important sea basins (Baltic, North, Caspian, Azov and Black Sea).

Figure 92. JSC Sea Port of Saint-Petersburg turnover structure by transport mode in 2015



Source: Corporate brochure of JSC Sea Port of Saint-Petersburg[180]

One of the largest railway junctions is St. Petersburg, and numerous highways originate from here to Kaliningrad, Moscow, Helsinki, Minsk, Kiev and many other cities, which maintains economic relations with other federal districts of Russia and with other countries.

Road transport is leading in terms of freight and passenger traffic in the Northwestern Federal District and occupies a leading position in the foreign trade of motor transport of the Russian Federation. One third of the total volume of foreign trade of goods is transported by road.

The Northwestern Federal District held a number of international transport corridors, which are included in the major federal roads Scandinavia, Russia, Cola, Holmogory Vyatka and Kaliningrad-Chernyakhovsk-Nesterov, among others.

There is a significant differentiation in the Russian Federation in terms of availability of roads. Currently, more than one third of the rural areas of the Northwestern Federal District are not provided with permanent bond paved roads within the network of public roads. Due to the poor condition of the road network and the lack of paved roads in the countryside, there has been a decline in agricultural production and increased depopulation of these areas. Nenets autonomous district is cut off from the network of roads and railways of Russia. The major industrial centres of the Republic of Komi (Messrs. Pechora, Inta and Vorkuta) also have no road transport infrastructure.

[180] http://www.en.seaport.spb.ru/article/1/

6.5.6. Potential for catchment area development in the forecasting period (2025-2055)

This sub-chapter below aims to provide an outline of the further development prospects of the catchment area for Muuga Harbour in the context of the implementation of the TEN-T strategy: development in the Arctic region, the Northern Sea Route and the Asian region. The purpose of the sub-section is to give a thorough description of the potential routes and main factors shaping their development. The prospects for Muuga Harbour are estimated in more detail in section 4.1.

Arctic development

The Arctic region has become an integral part of EU policy-making due to its vast untapped resources in energy, mining, data storing, forest industry, tourism, food production and other industries that make use of the stable (yet harsh) weather conditions, fresh water and remoteness. The EU has taken on a policy-making initiative to build a strong strategy and improve connections to the Arctic region. With the present political attention by the EU internally and in international policy-making (Arctic Council, Northern Dimension Partnership in Transport and Logistics), the Arctic region forms an important growth potential especially to the Northeastern region of the EU. Even if the role and potential of the Arctic region are acknowledged, the question remains as to which transport corridors it should be linked to. In light of recent research, the Northern Sea Route does not appear as a commercially viable alternative.[181]

Muuga's position as a terminal for the Arctic Sea route is unlikely. If the route became operational, it would be difficult to imagine that any cargo going to Central Europe would use Muuga, instead of going directly to the North Sea ports.

Civitta interviews

Northern Sea Route

The Northern Sea Route is independent from Arctic development project. While Arctic development is an EU strategic goal of integration of the Arctic, the Northern Sea Route is a Russian transportation route.

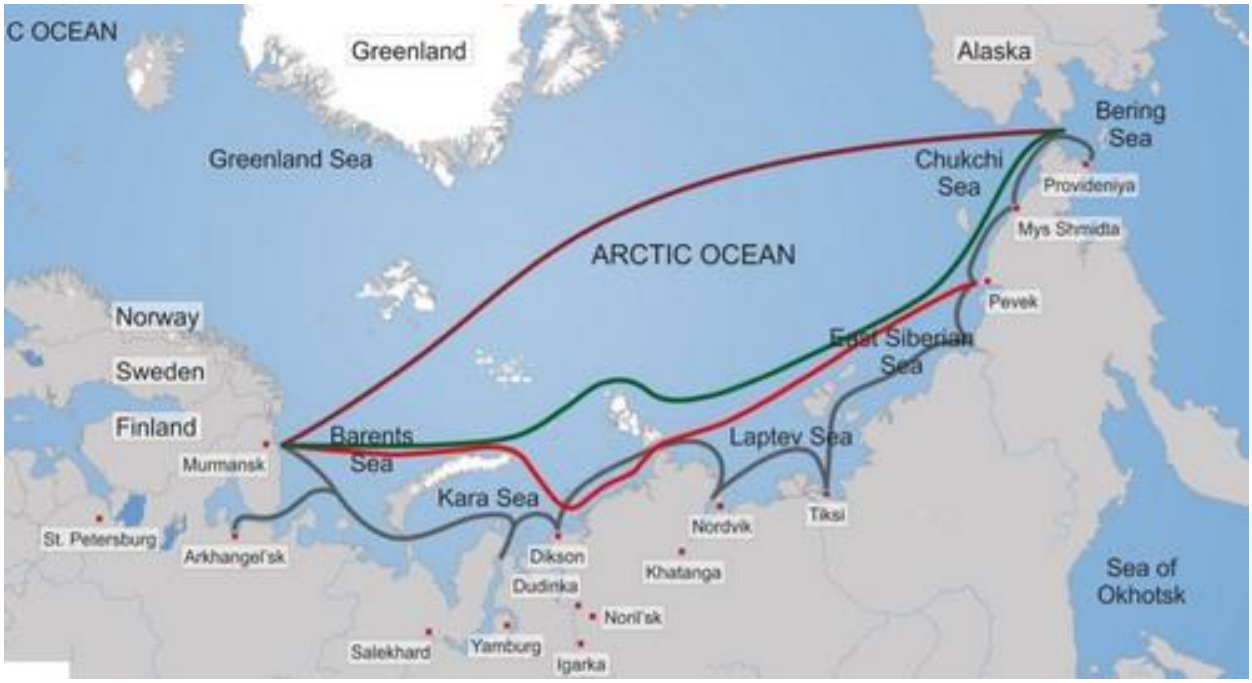
The Northern Sea Route goes through a water area adjacent to the Northern coast of the Russian Federation, covering the internal sea waters, the territorial sea and the exclusive economic zone of the Russian Federation, including tracks suitable for navigation.[182]

Climate change has raised the interest in exploring the possibility of the Northern Sea Route (NSR) as a commercially viable solution and intensive route for trade between Europe and Asia, as it offers a shorter route (both in mileage and days) compared to the existing routes, e.g. through the Suez Canal. The distance from Yokohama, Japan, to Rotterdam, The Netherlands, on the Northern Sea Route is 13 700 km vs. 20 900 km using the conventional route through the Suez Canal.[183]

The season has increased from 84 days in the 1980s to 114 in the first decade of 2000s and reached 146 days in 2012. However, the sea route remains frozen for a considerable part of the year and heavy icebreaking is needed most of the year. The ice conditions are extremely hard, the route itself is shallow – only 8 metres deep fairway vs. the standard of 13 metres – and traffic is completely dependent on the Russian icebreaking fleet. The quality of the fairway and high operational costs **do not support a viable vision of a marketable route.** Furthermore, the climate condition itself forms an unpredictable parameter because climate change is likely to introduce both warm and cold periods. A constant development of thawing is not guaranteed.[184]

[181] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf
[182] http://www.arctic-lio.com/NSR
[183] http://worldmaritimenews.com/archives/161360/study-Northern-sea-route-to-overpower-suez-canal/)
[184] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf

Figure 93. Map of the Northern Sea Route corridors



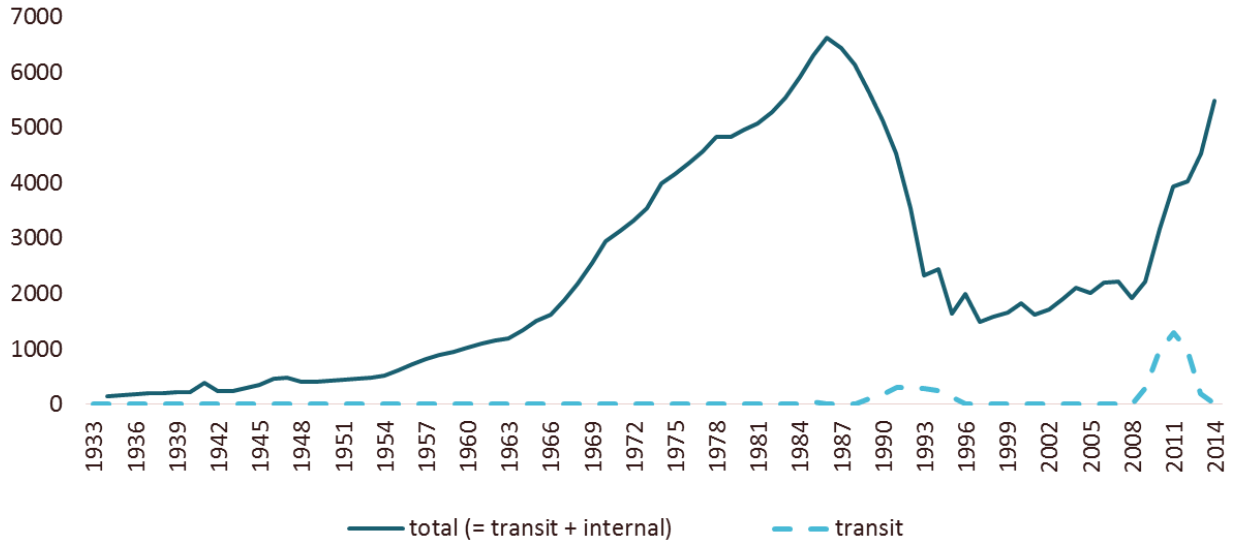
Source: Northern Sear Route[185]

The cargo volumes on the Northern Sea Route are illustrated in Figure 94. The use of the passage collapsed after the end of the Soviet Union. In 2007-13, there was an increase in transit, which consisted of general cargo, bulker and tanker categories, with only a few LNG-carriers and no container ships. In 2011-2013, between 20-30 international vessels used the passage annually, but the number dropped below ten vessels annually in 2014 due to the political situation and has remained low since. In 2015, the total cargo on the Northern Sea Route, including both domestic and international and transit, totalled 5.5 million tons. Three-thirds of the volumes is dry cargo, while oil products are the second largest product type at around 20 %.[186]

International interest towards the route appears low. The connection is mostly used in intra-Russian transit. The Asian operators have shown little interest towards the development of the NSR. As for operators in the EU, the high costs of the operation form the biggest obstacle.[187] Therefore, the Northern Sea Route only bears marginal potential for Estonia and Muuga Harbour in particular.

[185] http://www.Northern-sea-route.com/the-Northern-sea-route-map-is-the-way-to-success
[186] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf
[187] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf

Figure 94. Cargo volumes on the Northern Sea Route, thousand t



Source: University of Turku, Tuomas Kiiski[188]

Connections to Asia

There are several maritime routes from the EU to Asia through the Suez Canal. As trade flows between the EU and Asia are increasing, largely supported by the growth of the Asian market, prospects for new railway routes are emerging. Maritime transport has a price advantage compared to railways, and the capacity of railway connections is limited. However, a railway connection to Asia can offer a considerable time advantage. Therefore, there is a strong opportunity for ground-based container traffic to intensify in the long-term perspective.

China's vision for the **Silk Road Economic Belt and Maritime Silk Road**, collectively known as the 'Belt and Road' aims at bringing together China, Central Asia, Russia and Europe. The plan, also called as a new **Eurasian Land Bridge**, seeks through an aggressive investment programme to build transport routes with important cities as hubs. In the Belt and Road concept, both the investment and operations are Chinese, which leaves its European (or other) partners only with the role of trade partnership. Potential routes reach, for instance Latvia or Lithuania (or countries further south), from a third country and continue to the heart of continental Europe or across the Baltic Sea to Sweden. However, since the Chinese 'Belt and Road' project brings impressive road and rail infrastructure and the plan is to connect China deeper into the EU, these trade flows may also offer an opportunity to Muuga.

Investments in infrastructure foster international freight flows, as the effectiveness and flexibility of transportation increases. Inter-governmental agreements (e.g. a number of cooperation and trade agreements between Russia and China) are an important instrument to intensify regional trade, as they increase the usage of national infrastructure.

[188] https://www.utupub.fi/bitstream/handle/10024/130546/AnnalesE12Kiiski.pdf

6.6. Comparison of ports

Country	Port	Capacity (million t)	Max depth/draft(m)	Container terminals (number)	Container handling capacity (million TEU)	Competitive advantage
Estonia	Muuga Harbour	54.0	18.0/17.1	1	0.7	• Greatest development/expansion potential in the region • A large number of operators and additional services • Excellent port infrastructure and administration • Depth
Estonia	Sillamäe port	15.5	16.5/15.2	1	0.3	• Location (Eastern-most harbour in the EU) • Good business relationships with Russia
Estonia	Paldiski South harbour	10.0	14.5/14.0	-	-	• Ro-ro connection to a variety of countries • Large open area for new cars • Partnership with Port of Hanko • Good location for Estonia-Sweden cargo flows
Estonia	Old City harbour	12.0	11.0/10.3	-	-	• Frequent ro-ro connection between Tallinn and Helsinki
Estonia	Paljassaare Harbour	n/a	9.0/8.6	-	-	• n/a
Estonia	Paldiski North harbour	n/a	11.8/n/a	-	-	• Ro-ro connection to a variety of countries • Large open area for new cars • Good location for Estonia-Sweden cargo flows
Estonia	Pärnu port	4.0	7.2/6.9	-	-	• A large part of the Estonian wood and peat industry is located in its hinterland
Estonia	Kunda port	n/a	9.3/8.5	-	-	• Closeness to the industry in its vicinity and more widely in Northeastern Estonia

Country	Port	Capacity (million t)	Max depth/draft(m)	Container terminals (number)	Container handling capacity (million TEU)	Competitive advantage
Finland	Helsinki port	20.0	12.5/11.0	7	1.2	• Key location for cargo directed to the South in the event of building a railway system for cargo coming from Arctic seaway.
Finland	Hamina-Kotka port	n/a	15.3/13.5	3	1.0	• Location (proximity to Russia)
Finland	Naantali	10.0	15.3/13.0	-	-	• Good location for servicing cargo flows moving between Finland and continental Europe through Scandinavia • The shortest entry point to Finland in case of a direct maritime connection between Finland and Polish or German ports • Certain potential in servicing cargo flows between Russia and Sweden, though currently not used
Finland	Turku	n/a	10.0/n/a	2	n/a	
Finland	Rauma port	6.0	11.0/10.0	1	0.35 (0.5 in 2017)	
Finland	Hanko	n/a	13.0/n/a	n/a	n/a	
Latvia	Riga port	55.0	16.0/14.7	3	0.7	• Favourable location to Moscow compared to other Baltic state ports • Freeport status, tax reliefs • Expansion possibilities
Latvia	Venspils port	43.0	17.0/15.0	1	0.2	• Good location in servicing East-West cargo flows • Freeport status, tax reliefs • Expansion possibilities
Latvia	Liepaja	9.0	12.0/10.8	1	n/a	• Special economic zone status, tax reliefs • Expansion possibilities
Lithuania	Klaipeda port	65.0	14.5/13.4	2	1.1	• Shorter maritime routes to Danish Straits and North Sea hubs • Suitable port for servicing ocean-going container vessels sailing from Asia

Country	Port	Capacity (million t)	Max depth/draft(m)	Container terminals (number)	Container handling capacity (million TEU)	Competitive advantage
						• Better location for servicing Belarusian goods and the Moscow area • Container handling speed • The northernmost ice-free port in the Eastern Baltic Sea • Many international container trains
Northwest Russia	Ust-Luga port	120.0	n/a/15.0	1	n/a (3.0 in 2025)	• Favoured by Russian national policies • Proximity to the EU and central Russia (gate of Russian exports) • Avoids land border crossing for EU-related cargo • Big development potential (unused land) • Well-developed railway infrastructure
Northwest Russia	The big port of St. Petersburg	106.0	n/a/11.0	6	Around 4.0	• Favoured by Russian national policies • Avoids land border crossing for EU-related cargo • Shorter distance from Russian oil refineries than to other ports
Poland	Gdansk port	99.1	n/a/10.2 (inner port); 15.0 (outer port)	2	3.0	• Suitable port for servicing ocean-going container vessels sailing from Asia • Key link in the Trans-European Transport Corridor No. 1 connecting the Nordic countries with Southern and Eastern Europe

6.7. Multimodal transport corridors

It should be taken into consideration that the competitiveness of a transport corridor (including sub-corridors) in the case of using a specific combination of transport modes in the transportation sector is of primary importance. And the competitiveness of a port/terminal should only be viewed within the framework of the former.

Since the time period of the forecasts is more than 30 years, not only are the currently operational corridors considered as competitors but also those being launched, planned or potential. Regarding transport infrastructure, possible additional undertakings are also considered aside from the development projects already decided on.

The evaluation of competitiveness is complicated by the fact that one has to take the following into consideration due to the 30-year forecast period:

- Changing external environment of the transport sector (related to economic, political and ecological limitations);
- Changes in the structure and geography of cargo flows;
- Changes in the relative competitiveness of various transportation modes (external pressure and opportunities of improvement due to technological progress).

Such changes are only partly predictable. Therefore, the forecasts of competitiveness that cover such a long period of time can only be approximate.

In the current chapter, 'a corridor' refers to a direction along which a massive movement of goods can be predicted, usually combining different transportation modes (maritime, rail and road). These do not necessarily mean the TEN-T corridors determined by the European Commission: a corridor may combine rail, road and sea transport.

The competition of corridors passing through Muuga Harbour takes place in a broad geographical context, which can be considered even transcontinental. The following analysis concerns three groups of flows:

- North-South/South-North (N-S/S-N) cargo flows;
- East-West/West-East (E-W/W-E) cargo flows;
- Cargo flows related to Asia (East and South Asia).

As defined in Section 4.1.3, the N-S/S-N flows involve cargo transportation between the Northern, Western and South-European countries. The E-W/W-E flows refer to cargo flows related to Russia, Kazakhstan and the Central Asian countries (Ukraine and Belarus are addressed in N-S/S-N flows). Cargo flows related to China and the rest of East Asia, if they arrive to Estonia directly without reloading, are viewed as a separate category in this Chapter, designated as Asia-related transcontinental cargo flows (see sub-section 4.1.5). However, if cargo from China reaches Muuga by a feeder ship from Rotterdam, it is treated as part of the West-East cargo flow.

All these directions are not isolated but linked to each other and can mutually augment each other. The future of Muuga multimodal terminal depends on handling these three types of flows as well as on whether and to what extent augmentation can be achieved between them. There are at least seven currently existing and potential transport corridors passing through Muuga, with at least 17 competing corridors.

6.7.1. Competitive situation analysis

The sub-sections below describe the corridors running through the Muuga terminal, competing corridors and the type and level of competition. A brief assessment of the competing corridors attempts to show their level of threat to Muuga-related corridors. Assessment is descending from high to low threat, but it is expressed in a different form due to the characteristics of the competitive situation. The nature of the threat is also described.

6.7.1.1. Competing corridors for North-South/South-North traffic

Corridor through Muuga terminal

1.1. The transport connection between Finland and Estonia by sea via the ports of Helsinki and Tallinn (Vuosaari and Muuga), with the Southern stretch of the corridor by rail (in future predominantly by Rail Baltic towards Warsaw). The corridor has a wide catchment area and may be divided into sub-corridors:

1.A.1. The westward sub-corridor from Warsaw to Berlin and towards the German-Dutch border with Southward branching (from Berlin towards Prague plus several branches from the West Southward, towards Southern Germany).

1.A.2. The sub-corridor leading from Warsaw through Vienna to the Adriatic Sea with branches towards Budapest and Romania. Through the Adriatic ports the corridor extends to the sea (sea connections with Mediterranean ports as well as through the Suez Canal with Asian ports) (see the part of the table: Asia related transcontinental cargos).

Competing corridors

1.1.A. Southbound road traffic from Muuga, and to a lesser extent from other North Estonian ports (Paldiski, Tallinn Old Port, Kunda, Sillamäe) by road.

Moving cargo southward from Tallinn by road has a competitive advantage in the territories of Estonia, Latvia, Lithuania, and possibly also partly in Poland. In the territories of the three Baltic states, railway may only be competitive in the case of mass transport to larger cities near the railway line and for serving industrial enterprises (incl. intra-industrial trade). For longer distances, road transportation is not competitive with rail.

Figure 95. Southbound road traffic from Muuga

Source: Team analysis

In brief:

Since most of Finland-related cargo traffic by road southward will take place through Muuga terminal, the use of road transport besides rail transportation for short distances would not adversely affect Muuga terminal's competitiveness. The predictable southward road transport of cargo from other ports on Estonia's north coast is marginal in comparison with the cargo volumes of Muuga and it neither harms the port's nor the main corridor's competitiveness.

Remarks:

Transport of goods from Tallinn Old Port will be strongly restricted due to concerns about the welfare of residents. The majority of cargo transport will be directed to Muuga.

Advantage of Muuga – good access to major southbound roads and a frequent shipping link to Finland.

1.1.B. Traffic from other North Estonian ports southward via the 1520-gauge railway through Tartu.

Preferring this route may become practical in transporting Finland-related cargo in the direction of Ukraine and Belarus (incl. Odessa port and onwards to Turkey). This route can be used by Muuga itself as well as rivalling Estonian ports, above all Sillamäe. Muuga has an advantage in handling this cargo (e.g. Finnish pulp and paper) thanks to the density of its maritime traffic and presumable good connection to the 1520-gauge railway compared with Sillamäe, unless cargo arrives from Southwest Finland, as in this case Muuga is located in a more favourable position.

Figure 96. Traffic from other Estonia`s North coast ports Southward via the 1520-gauge railway through Tartu

Source: Team analysis

In brief:

This corridor is not the primary one for Muuga, but its competitiveness on that route may be high.

1.1.C. Direct traffic by sea from Finland to Polish or German Baltic Sea ports (Gdansk/Gdynia, Rostock, Travemünde and others).

Maritime transport remains a strong competitor to the launching Rail Baltic due to lower costs. It will be able to retain a clear majority in Finland-Germany as well as Finland-Poland trade. There is very strong competition (see Section 0) with Muuga in cargo moving in the rail corridor section to the West of Warsaw. The advantage of direct maritime transport is strongest in the immediate Baltic Sea regions and weakens southward and southwest from the Baltic Sea. However, even there, Muuga and Rail Baltic can only claim cargo whose delivery speed and reliability are more important than the lower cost of transportation.

In terms of the rail corridor's southern branches (from Warsaw through Vienna towards the Adriatic etc., and the branch from Berlin towards Prague), the competitiveness of Southern Baltic ports is lower when compared with RB, although Prague and Vienna are apparently likely to continue using a considerable volume of the Rostock and Gdansk port services, respectively.

Figure 97. Direct traffic by sea from Finland to Polish or German Baltic Sea ports

Source: Team analysis

In brief:

The competitiveness of the Muuga- and RB-related corridor in the Western flank of the rail corridor is limited to a relatively small number of more time-critical groups of goods and territories remote from the Baltic Sea. However, securing even a small percentage of the cargo moving here would equal large volumes. Competitiveness is higher in the Southern branch area of the rail corridor (running towards the Adriatic Sea), as well as its branches towards Hungary and Romania. However, less Finland-related cargo is moved in these regions than in the western part of the rail corridor.

Remarks:

The competitive situation for Muuga may be relieved in the event of rising fuel price and ecological restrictions (somewhat favouring rail traffic compared with maritime traffic).

1.1.D. Direct traffic from Finland by sea to North Sea ports (e.g., Rotterdam) and transporting goods back eastwards (Germany's West).

Competition with Muuga here concerns quite a small area of Western Germany as a potential catchment area (mainly Nordrhein-Westfalen). The North Sea ports and their connections will probably be overloaded in the future as well, to make return traffic more efficient. Traffic via North Sea-Baltic Sea railway corridor and Muuga is much faster.

Figure 98. Direct traffic from Finland by sea to North Sea ports

Source: Team analysis

In brief:

The competitiveness of Muuga- and RB-related railway corridor with this option is satisfactory at least, though the problem may rather be whether this region's volume of trade with Finland will be sufficient to run several trains to Muuga every week.

1.1.E. Traffic between Finland and Germany via Sweden and Denmark using the Fehmarn tunnel (in use from about 2027) and Oresund bridge.

By railway (probably trailers on platforms) from Germany using the new tunnel and bridge to Sweden, from Stockholm by ro-ro to Turku, from Turku by road to Helsinki region.

According to foreign experts, there will be no impact on traffic between Germany and Finland, except perhaps in the case of the Turku region. The distance is much longer than by sea. The route is shorter by about 70 km (between Hannover and Helsinki) than the route via Rail Baltic, but there are serious drawbacks when compared with the RB-related corridor: the cost of using the tunnel, the cost of using the bridge, loss of time on sea between Stockholm and Turku (losing at least 6 hours more by sea compared with the trip between Muuga and Vuosaari).

Figure 99. Traffic between Finland and Germany via Sweden and Denmark

Source: Team analysis

In brief:

No serious competition to the RB- and Muuga-related route.

Remarks:

The Fehmarn project may be launched from about 2027. No calculations about the probable cost of using the Fehmarn tunnel are as yet available.

6.7.1.2. Competing corridors for East-West/West-East traffic

Corridor through Muuga terminal

2.1. Western stretch: maritime, cargo can arrive from many locations, especially Western European countries; Eastern stretch: railway.

The corridor includes transport connections with Kazakhstan and Central Asia

2.1.A. Finnish corridor with Russia by rail (linking several Finnish ports (from Turku and Hanko to Kotka/Hamina).

Figure 100. Finnish corridor with Russia by rail

Source: Team analysis

In brief:

According to several experts, there is not significant competition to the corridor passing through Muuga in relation to geographical and cost (extra expenses for covering longer distances).

There may be some competition concerning servicing transport between Sweden (Stockholm area) and Kazakhstan in future.

Remarks:

Current container traffic by rail is small. The competitiveness of the Finnish corridor can be increased by Finnish through efficient cooperation with RZhD, the Russian railway organisation, incl. transport of e.g. Kazakhstan-related cargo to the West.

2.1.B. Cargo traffic through Russia's own Gulf of Finland ports.

Very strong competitor especially due to the development of Ust-Luga port and its connections. Muuga's competitiveness can only be based on better service in ports, sufficiently low rail tariffs and better discipline. Muuga may have advantages in terms of Russia-based Western investor enterprises, which require a very high reliability of supply.

Since the Ust-Luga port's railway connection is considered a priority in Russia, it obstructs shipping Estonian cargo eastward by rail through Narva, which would use the same line for part of the distance. Estonian-Russian rail traffic is pushed to the southern route through the Koidula border station. This situation may continue in the future and will limit the competitiveness of Estonia's rail corridor in the St. Petersburg direction.

Figure 101. Cargo traffic through Russia's own Gulf of Finland ports

Source: Team analysis

In brief:

Very difficult competitive position against Russian ports considering the support of this corridor by the Russian government.

Remarks:

A positive indirect influence on the competitiveness of the Estonian railway corridor compared to the Russian corridor is the development of a distribution centre near the Muuga Harbour, where goods can also be redirected on to railway from one gauge to another.

2.1.C. Cargo traffic through Latvian and Lithuanian ports

Strong competition for the Muuga and Estonian corridor in the future from the Latvian corridor incl. handling traffic from Kazakhstan and Central Asia. Latvia has a geographical advantage in regard to the Moscow direction, but the time gap on shorter distances is not too large and can be in principle compensated for by higher-quality logistical services. The disadvantage of the Latvian channel is an overload of the Riga transport node, but the bottleneck can be overcome in the future.

Besides Riga port, the ports of Ventspils and Liepaja have some potential for handling Russian transit. The economy of time is possible thanks to the use of a longer rail stretch, but the absence of larger cities in the immediate vicinity of these ports reduces the attractiveness of expanding container terminals (the terminals would depend too much on transit).

Competition from the Lithuanian corridor through Klaipeda may strengthen in the future, but its pressure is relieved by the southern position of the Lithuanian corridor (possibly also the need to carry goods through Belarus).

Figure 102. Cargo traffic through Latvian and Lithuanian ports

Source: Team analysis

In brief:

The competitiveness of Muuga and its corridor against Latvian and Lithuanian corridors is satisfactory if the service will be well developed.

Remarks:

If Latvia loses its competitive position for other cargo, competition for handling container traffic is likely to increase to compensate for the lost revenue.

2.1.D. Russia's rail connections with Europe through Belarus.

Largely concerns Central Russian goods, but also goods related to Russia's Eastern regions.

Increasing competition with Muuga due to the improved rail connections to Russia and possible diversification of Russian export. A disadvantage of the competing corridor is the need to change gauge at the Polish border (or to use road transport for further Westward traffic).

In brief:

Pressure from this corridor increases, but its impact on the Estonian corridor and Muuga is indirect rather than direct.

Corridor through Muuga terminal

2.2. Western connection: by sea with different, mainly Western European countries, Eastwards connection with Russia: by road

2.2.A. Finnish corridor

Southeast Finland's region with the ports of Kotka and Hamina has a certain competitive advantage, especially in handling Russian imports (warehouses and distribution centres adjacent to the border for just-in-time-supply) but it is mainly competing with Sillamäe rather than Muuga Harbour for this business.

In brief:

Muuga's competitive position is probably satisfactory thanks to the high density of international shipping and probable strong logistics centre in the Muuga area.

Figure 103. Finnish corridor

Source: Team analysis

2.2.B. Transport through the port of Sillamäe

Sillamäe port has a small advantage thanks to its location adjacent to the border with Russia (St. Petersburg area) and possible cheaper storage territory, though it is offset by more frequent visits to Muuga Harbour by international shipping lines.

In brief:

Muuga Harbour is better connected with transport networks. Also, there is the network of inland terminals and logistics companies adjacent to Muuga Harbour. It makes sense to bring them to e.g. Freselle Container terminal, among others, which strengthens Muuga's position. Therefore, Sillamäe's competition does not pose a significant threat.

2.2.C. Latvian and Lithuanian corridors

In brief:

Muuga Harbour and its corridor are more competitive against southern neighbours in servicing St. Petersburg and the St. Petersburg region due to the geographical location.

6.7.1.3. Competing corridors for Asia-related transcontinental cargoes

Corridor through Muuga terminal

3.1. The Adriatic corridor: Finland's link to South and East Asia via the port of Koper (or some other Adriatic port) and the Suez Canal. Vuosaari-Muuga by sea, Muuga-Koper by rail, Koper-Asia (e.g. Mumbai or Shanghai) by sea.

The main competitor is the traffic of Asia-related cargo to Finland by sea through North Sea hubs (e.g. Rotterdam) and from there by feeder ship link to Vuosaari or other Finnish port.

To a lesser extent, the **competing routes are the transcontinental rail link from China via Russia (**especially if it reaches Finland directly) and maritime traffic via the Arctic route.

Compared with shipping across Europe, the Adriatic corridor is much faster and the possible future economy of time would be almost a week. The cost of an hour saved for the dispatcher/recipient of cargo is lower than in the case of other earlier discussed corridors using Muuga and RB.

Since the Adriatic corridor can be used for carrying goods other than those related to Asia, as well as intra-European traffic (from the Adriatic region, possibly from a limited number of way stations to Estonia and Finland), it allows for increasing the traffic density of route trains on the railway line, which improves the competitiveness of the corridor.

Figure 104. Traffic of Asia-related cargo to Finland by sea through North Sea hubs and from there by feeder ship link to Finnish ports

Source: Team analysis

In brief:

High competitiveness of the channel via Muuga for more expensive and time-sensitive goods, although not so for the most time-sensitive goods.

This route may face future competition from the Arctic maritime route. The Arctic Route and transcontinental rail link would not be alternatives for South Asia (e.g. India).

Remarks:

The transcontinental rail bridge from China has higher competitiveness if cargos are not carried from China's coastal regions (especially Southeast region), but rather from China's inland regions, since the overland distance would then be shorter. However, goods produced in the inland regions are largely cheaper. In the case of goods related to South Asia (e.g. trade with India), using the land bridge will not be possible at least with Finland as a partner.

According to some expert opinions, the volume of cargos handled by the transcontinental rail bridge will remain limited in the future and not constitute more than 10 % of maritime trade between China and Europe.

The large scale launching of the Arctic route would "gobble up" a share of cargo departing from China for Finland by sea, but certainly not the entire East Asia-Finland maritime cargo flow, since the Arctic route would probably use the ports on China's Northeast coast more (e.g. Dalian) or would carry Japanese and Korean cargos, while the Adriatic corridor would handle the goods from China's Southeast ports and those of Southeast Asian countries.

Corridor through Muuga terminal

3.2. The Arctic route. The flow of East Asia-related cargo across the Arctic Ocean through the port of Kirkenes, Finnish railway and the port of Vuosaari. From Vuosaari to Muuga by sea, further southward from Muuga by land (further distance dependent on the cargo). This is only possible after linking Kirkenes with Finland's rail network.

3.2.A. The corridor competes in principle with all the southern corridors that link East Asia with Europe, especially those using the maritime routes. The significance of the Adriatic corridor among competitors is probably not decisive (see comments in descriptions of Adriatic corridor).

3.2.B. Ships moving via the Arctic route need not use Kirkenes and send cargo for our region through the North Sea ports (e.g. Rotterdam).

3.2.C. It is possible that some competition could come from directing Asian cargo by the Arctic route southward through the port of Murmansk.

The Arctic route is shorter than the route using the Suez Canal by about 5 200-6 800 km (economy of route length depends on the choice of Asian departure point and the useable route in the Arctic Ocean). Furthermore, in the case of a non-extreme ice situation and the normal organisation of icebreaking, it remains faster by about 10-13 days. However, it is much more expensive at present (cost of icebreaking, insurance etc.) and depends on the length of the navigation period. It would probably become cheaper over time, but it is not currently possible to estimate by how much.

The impact on Estonia of the possible launching of the Arctic route depends on how far south the corridor's catchment area extends, i.e. how large a percentage of goods arriving in Finland via that route will move on to Estonia and southwards from here (the Baltic states, possibly also Northwest Russia and Belarus). This corridor can carry goods further southward related to the exploitation of Arctic Ocean's natural resources (Norwegian Sea fish, natural gas in containers), which can be described as intra-European cargos moving in a transcontinental corridor. The corridor may provide good opportunities for sending cargos to Asia (in order to achieve a return load, the cost of traffic in that direction is likely to be much lower).

The corridor's attractiveness increases steeply if there should be serious problems with using the Suez Canal (congestions, damage due to terrorism or other reasons).

Figure 105. Cargo by the Arctic route southward

Source: Team analysis

In brief:

The potential competitiveness of the Muuga channel primarily in the case of Asia-related goods of average time-sensitivity (not worth sending by rail, but faster delivery compared with the southern maritime route is preferred), which may significantly improve in the event of problems associated with using the Suez Canal.

The use of the corridor is related to several uncertainties and preconditions (primarily linking Kirkenes with the Finnish rail network) and is not likely before 2040 in terms of more massive transcontinental cargo flows.

Corridor through Muuga terminal

3.3. Handling ocean container carriers sailing from Asia in Muuga. Forwarding cargo to Estonia, Latvia and Northwest Russia by land and to Finland by sea.

Handling and forwarding Asian cargo coming on ocean container carriers in Gdansk, creation of competing hubs in the nearby ports with sufficient depth: Klaipeda, Ventspils, Ust-Luga.

The natural conditions of Muuga Harbour are favourable in realising such an idea, but competition is strong. Due to limited demand for such hubs, there is not going to be more than 2-3 hubs on the east coast of the Baltic Sea. The natural conditions of the port of Ust-Luga are not the best for such activity: the need for permanent dredging and worse ice conditions, but the Russian state may subsidise these activities. After the global economic recession, Estonia hasn't continued with developing the idea and with preliminary negotiations.

In brief:

Muuga position among strong competition: not too strong.

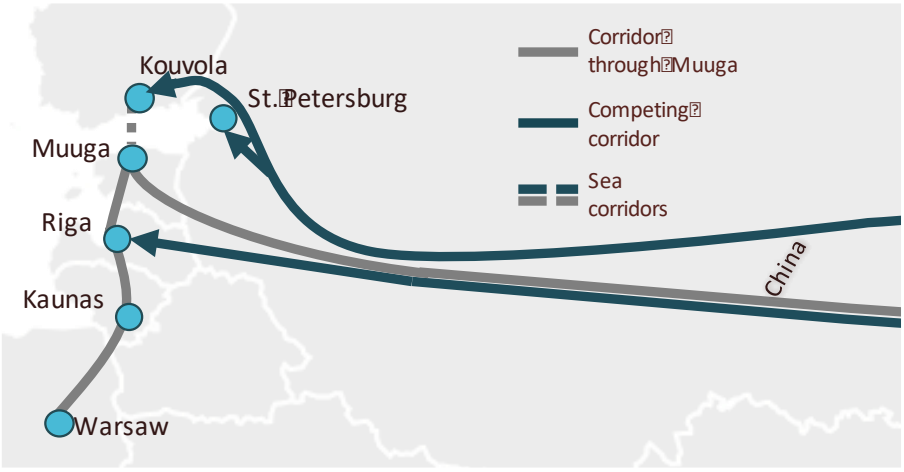
Corridor through Muuga terminal

3.4. Extending one intercontinental railway route from China through Central Asia and/or Russia to Muuga Harbour. Possibilities to forward cargo by land (incl. RB) and by sea.

Competing solutions for handling China bound trains in Kouvola (Finland), St. Petersburg and Riga.

The continental routes between Europe and Asia comprise a huge growth potential. In the current scenario, there is no foreseeable limit to trade growth with China. The question persists as to whether these new trade routes will be totally Chinese owned and operated or if Europeans will succeed in gaining a role in them.

Figure 106. Competing solutions for handling China bound trains in Kouvola, St Petersburg and Riga



Source: Team analysis

In brief:

High potential, though unclear capacities to realise the idea.

6.8. Methodology of freight flow and traffic evaluation

In this section, detailed methodology for forecasting freight flow for the period 2025-2055 is provided. First, an origin-destination matrix (further – OD table) was established for 2015. Second, a definition of the OD table was increased to reflect commodity types and type for freight flows. Third, OD tables were calculated for each year of the forecast horizon taking into account the GDP growth of individual countries and individual commodities. Fourth, a comprehensive transport model was used to predict the split between different types of transport for each year of the forecast horizon and for each origin-destination pair.

6.8.1. OD table for 2015

The OD tables cover the transport flows to and from all relevant countries for the Baltic countries. An analysis was conducted to identify these countries, based on total freight transport volumes. They are Estonia, Latvia, Lithuania, Finland, Sweden, Norway, Denmark, the UK, France, Spain, Italy, The Netherlands, Belgium, Germany, Switzerland, Austria, Slovenia, Hungary, Poland, the Czech Republic, Russia, Ukraine and China.

For Estonia, Latvia, Lithuania, Finland, Russia, Sweden and Germany, regions were specified in order to facilitate a more detailed level of modelling.

Three main data sources have been used to compile origin-destination matrix: AECOM Rail Baltica study (2011), national statistics databases, and ETISplus database:

1. **An important starting point for the analysis was an earlier study (Rail Baltica, Final report, Volume I, May 2011) by AECOM focusing on freight volumes on the Rail Baltic Corridor. As part of this analysis, an assessment was made of the total volumes of freight for road, rail and sea transport between and within the Baltic countries and several other countries. The volumes were divided into bulk and non-bulk and presented for the year 2008.**

The AECOM data has only been used as a verifying tool and to fill in any gaps. AECOM data was used, for example, to calculate the volumes of domestic freight transport within Estonia, Latvia and Lithuania.

To obtain the volumes for the base year 2015, the original 2008 values were updated using a factor derived from the development of total imports and exports between 2008 and 2015. It is thus assumed that 1) the development of domestic transport is in line with international transport development, and 2) the distribution of freight within each Baltic country remains the same.

2. **After an initial assessment in which AECOM data was compared with data obtained via the national statistics offices, the decision was made to shift the focus to more reliable national statistics data. In addition, the statistics offices have comprehensive and recent data available (usually accessible online) on import and export volumes as part of the economic indicators on foreign trade. The national data sources also include a classification of volumes into commodity categories (ranging in detail from commodity categories CN2 to CN8.**

The main downside of using national data, as opposed to the data available from the AECOM study, is the absence of domestic regional freight volumes. For example, Estonian statistics show the transported tonnage of a certain product group from Estonia to Latvia, but not how much of it relates to Northern Estonia and the Riga region. For that, we used the ETISplus data.

In cases where national statistics department data was conflicting between countries, priority was given to Estonian, Latvian and Lithuanian data. For example, trade flows between these states and Finland where taken from respective statistics offices rather than from Finland, as Finland data under-represents cargo flows.

3. **As explained above, to fill in the gaps, we also accessed an additional data source: ETISplus. This European database contains modelled data (base year 2010) for passenger and freight transport to and from EU Member States. Its main objective is to provide European transport policymakers with good quality input to support models, evaluation methodologies and indicator frameworks. It**

provides a common transport database, which overcomes the problems of the heterogeneous methodologies currently used for obtaining much of the data. ETISplus uses NSTR2 to classify the transported commodities and distinguishes between the transport modes road, rail, sea, inland waterways and air (the latter two modes are not included in this study).

The main reason for using ETISplus is that it identifies the freight flows between regions on a NUTS3 level, which is in line with the AECOM data. Hence, this source identifies the freight volumes between North Estonia and the Riga region.

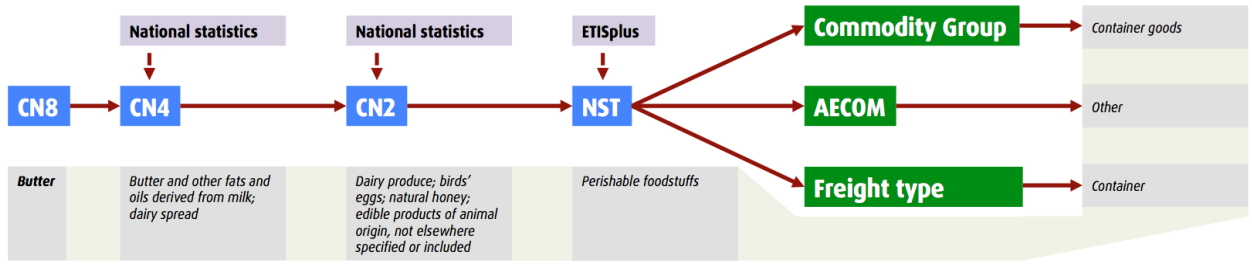
Because ETISplus uses modelled data for the base year 2010, the volumes presented differ, to a varying extent, from the national statistics for 2015. Based on an earlier study in the Netherlands, however, experience has shown that for a 5-year time gap, regional growth in a country is more or less in line with national growth.

ETISplus also shows the total freight flows to and from Finland. We found inconsistencies between the total flows from Finland when compared to Estonia, Latvia and Lithuania. The freight flows identified by national Finnish sources seemed to be rather low. ETISplus showed considerably higher ingoing freight flows to Finland and slightly higher outgoing flows. The decision was then made to increase all Finnish flows to ETISplus volume levels.

6.8.2. Commodities and freight types

The different sources accessed in order to construct an OD table use different commodity categories (CN8, CN4, CN2, NST), and different levels of detail. These commodity categories were converted in order to obtain comparable commodity and freight types. The example below shows the method used for the product 'butter'.

Figure 107. Conversion of commodity categories used in the Study



Source: Goudappel model

The OD tables eventually show the commodity groups and freight types. The commodity groups are based on the main NST classes used by ETISplus. The freight types reflect the categories as requested in the ToR. A conversion list for commodities and freight types was presented for comments during the early stages of the WP1.3 activities.

Both classifications were also cleared with the stakeholders of the other WPs, who will use the data resulting from WP1.3.

Commodity groups used for modelling:

1. Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials
2. Foodstuffs, Animal food and Foodstuff waste, Oil seeds and Oleaginous fruit and Fats
3. Solid mineral fuels
4. Crude petroleum, petroleum products and gas
5. Iron ore, Iron and Steel, Non-ferrous Ore and Waste
6. Metal products

7. Crude and Manufactured minerals, Cement, Lime and Manufactured building materials,
8. Natural and Chemical fertilisers
9. Coal chemicals, Tar, Other chemicals, Paper pulp and Waste paper
10. Miscellaneous articles
11. Wood and Cork

Freight types used for modelling:

1. Container
2. Liquid bulk
3. Dry bulk
4. Break bulk
5. Mixed freight
6. Ro-ro

Table 41. Classification of freight types

NST2/NSTR commodity class	Freight type	Description
0	Dry bulk	Live animals
1	Dry bulk	Cereals
2	Dry bulk	Potatoes
3	Dry bulk	Other fresh or frozen fruit and vegetables
4	Container	Textiles textile articles and man-made fibres
5	Break bulk	Wood and cork
6	Dry bulk	Sugar-beet
9	Dry bulk	Other raw animal and vegetable materials
11	Dry bulk	Sugars
12	Container	Beverages
13	Container	Stimulants and spices
14	Container	Perishable foodstuffs
16	Container	Other non-perishable foodstuffs and hops
17	Container	Animal food and foodstuff waste
18	Liquid bulk	Oil seeds and oleaginous fruit and fats
21	Dry bulk	Coal
22	Dry bulk	Lignite and peat
23	Dry bulk	Coke
31	Liquid bulk	Crude petroleum
32	Liquid bulk	Fuel derivatives
33	Liquid bulk	Gaseous hydrocarbons liquid or compressed
34	Dry bulk	Non-fuel derivatives
41	Dry bulk	Iron ore
45	Dry bulk	Non-ferrous ores and waste

NST2/NSTR commodity class	Freight type	Description
46	Dry bulk	Iron and steel waste and blast furnace dust
51	Dry bulk	Pig iron and crude steel
52	Break bulk	Semi-finished rolled steel products
53	Break bulk	Bars sections wire rod railway and tramway track construction material of iron or steel
54	Dry bulk	Steel sheets plates hoop and strip
55	Break bulk	Tubes pipes iron and steel castings and forgings
56	Dry bulk	Non-ferrous metals
61	Dry bulk	Sand gravel clay and slag
62	Dry bulk	Salt iron pyrites sulphur
63	Dry bulk	Other stone earths and minerals
64	Dry bulk	Cement lime
65	Dry bulk	Plasters
69	Break bulk	Other manufactured building materials
71	Dry bulk	Natural fertilisers
72	Dry bulk	Chemical fertilisers
81	Liquid bulk	Basic chemicals
82	Liquid bulk	Aluminium oxide and hydroxide
83	Liquid bulk	Coal chemicals
84	Dry bulk	Paper pulp and waste paper
89	Liquid bulk	Other chemical products
91	Ro-ro	Transport equipment
92	Ro-ro	Tractors
93	Mixed freight	Other machinery apparatus and appliances engines parts thereof
94	Container	Manufactures of material
95	Container	Glass glassware ceramic products
96	Container	Leather textiles and clothing
97	Container	Other manufactured articles
99	Mixed freight	Miscellaneous articles

6.8.3. Forecast of development trends (for 2025-2055) by freight groups

The forecast of development trends by commodity groups for 2025-2055 was made based on forecasted GDP growth by country and forecasted growth rates of commodities from Euromonitor, which were verified and adjusted based on information gathered in interviews with experts. The obtained forecasts of different commodity types were divided into several freight groups. The methodology was as follows:

1. Cargo flow data for Estonia, Latvia, Lithuania, Finland, Russia and their main trading partners for 2015 were gathered from local statistics bureaus, Eurostat and the EtisPlus database.

2. GDP growth forecast for countries included in research were gathered from national sources or international resources like the Euromonitor and OECD databases.
3. Forecasted growth rates of commodities were obtained from the Euromonitor database.
4. GDP and commodity growth rates were combined in commodity adjustment factors.
5. Commodity adjustment factors were double-checked in interviews with industry experts to increase the reliability of the data.
6. Commodity adjustment factors were applied to cargo flow data for 2015 and future cargo flows by country and commodity type were calculated.
7. GDP growth was adjusted to the commodity growth factor.

Yearly commodity growth relative to GDP is presented in the table below.

Table 42. Commodity growth relative to GDP (100 % = in line with GDP), 2015-2055

Commodity	Country	2015	2025	2030	2035	2040	2045	2050	2055
Cereals, fruit and vegetables, live animals, textiles, other raw animal and vegetable materials	Estonia	100 %	114 %	118 %	121 %	121 %	121 %	121 %	121 %
	Latvia	100 %	110 %	113 %	114 %	114 %	114 %	114 %	114 %
	Lithuania	100 %	93 %	91 %	89 %	89 %	89 %	89 %	89 %
	Average of other countries	100 %	97 %	96 %	95 %	95 %	95 %	95 %	95 %
Foodstuffs, animal food and foodstuff waste, oil seeds and oleaginous fruit and fats	Estonia	100 %	97 %	96 %	95 %	95 %	95 %	95 %	95 %
	Latvia	100 %	83 %	78 %	74 %	74 %	74 %	74 %	74 %
	Lithuania	100 %	98 %	98 %	97 %	97 %	97 %	97 %	97 %
	Average of other countries	100 %	97 %	96 %	96 %	96 %	96 %	96 %	96 %
Solid mineral fuels	Estonia	100 %	86 %	82 %	78 %	78 %	78 %	78 %	78 %
	Latvia	100 %	110 %	114 %	116 %	116 %	116 %	116 %	116 %
	Lithuania	100 %	91 %	88 %	86 %	86 %	86 %	86 %	86 %
	Average of other countries	100 %	95 %	93 %	92 %	92 %	92 %	92 %	92 %
Crude petroleum, petroleum products and gas[189]	Estonia and other countries								
	Latvia								
	Lithuania								
	Average of other countries								
Iron Ore, Iron and Steel, Non-ferrous ore and waste	Estonia	100 %	106 %	108 %	110 %	110 %	110 %	110 %	110 %
	Latvia	100 %	163 %	182 %	199 %	199 %	199 %	199 %	199 %
	Lithuania	100 %	115 %	120 %	124 %	124 %	124 %	124 %	124 %
	Average of other countries	100 %	88 %	83 %	79 %	79 %	79 %	79 %	79 %
Metal products	Estonia	100 %	109 %	112 %	115 %	115 %	115 %	115 %	115 %
	Latvia	100 %	127 %	136 %	143 %	143 %	143 %	143 %	143 %

[189] Crude petroleum, petroleum products and gas are assumed to remain at the same level as 2015 until 2045. After that, because of alternative energy sources, electric cars etc., the industry is expected to start shrinking.

Commodity	Country	2015	2025	2030	2035	2040	2045	2050	2055
	Lithuania	100 %	102 %	103 %	103 %	103 %	103 %	103 %	103 %
	Average of other countries	100 %	96 %	95 %	93 %	93 %	93 %	93 %	93 %
Crude and manufactured minerals, cement, lime and manufactured building materials	Estonia	100 %	106 %	108 %	110 %	110 %	110 %	110 %	110 %
	Latvia	100 %	163 %	182 %	199 %	199 %	199 %	199 %	199 %
	Lithuania	100 %	115 %	120 %	124 %	124 %	124 %	124 %	124 %
	Average of other countries	100 %	88 %	83 %	79 %	79 %	79 %	79 %	79 %
Natural and chemical fertilisers	Estonia	100 %	79 %	73 %	68 %	68 %	68 %	68 %	68 %
	Latvia	100 %	117 %	123 %	129 %	129 %	129 %	129 %	129 %
	Lithuania	100 %	111 %	115 %	119 %	119 %	119 %	119 %	119 %
	Average of other countries	100 %	102 %	102 %	102 %	102 %	102 %	102 %	102 %
Coal chemicals, tar, other chemicals, paper pulp and waste paper	Estonia	100 %	79 %	73 %	68 %	68 %	68 %	68 %	68 %
	Latvia	100 %	117 %	123 %	129 %	129 %	129 %	129 %	129 %
	Lithuania	100 %	111 %	115 %	119 %	119 %	119 %	119 %	119 %
	Average of other countries	100 %	102 %	102 %	102 %	102 %	102 %	102 %	102 %
Miscellaneous articles	Estonia	100 %	88 %	85 %	83 %	83 %	83 %	83 %	83 %
	Latvia	100 %	104 %	105 %	106 %	106 %	106 %	106 %	106 %
	Lithuania	100 %	101 %	102 %	102 %	102 %	102 %	102 %	102 %
	Average of other countries	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Wood and Cork	Estonia	100 %	121 %	128 %	133 %	133 %	133 %	133 %	133 %
	Latvia	100 %	86 %	80 %	75 %	75 %	75 %	75 %	75 %
	Lithuania	100 %	122 %	130 %	137 %	137 %	137 %	137 %	137 %
	Average of other countries	100 %	95 %	93 %	92 %	92 %	92 %	92 %	92 %

Source: Goudappel model

6.8.4. Methodology for OD tables for future years

In order to have future freight flows available for modelling, future OD tables for 5-year periods between 2025 and 2055 were constructed. The starting point is the OD table for 2015. The methodology applied to establish future freight flows follows a three-step approach for each OD flow and separately for each future year of forecasting:

- The freight growth is represented by an average of the growth of the GDPs in the country of origin and in the country of destination.
- A commodity-based adjustment factor is applied which represents the over-performance (factor>1.0) or under-performance (factor<1.0) of a specific business sector compared to GDP.
- If available, country-to-country and commodity-specific information was added.

GDP growth

In general, a strong correlation between GDP growth and changes in freight volumes was found in earlier studies and in other parts of WP1. We used the OECD data on GDP growth. This data represents the 'realistic' market scenario.

Commodity-based adjustment factor

The commodity-based adjustment factor is calculated based on the economic development by business sector compared with overall economic development. Only the information for the country of origin has been incorporated into the adjustment factor, because it represents the production performance level. Euromonitor Passport information from Transport Outlook was used as a source, which includes country-specific information; however, this information is only valid until 2025. To determine the commodity-adjustment factor for the years 2030-2055, growth between 2015 and 2025 was extrapolated to the years 2030 and 2035. For the years from 2035 onwards, the commodity-based adjustment factor is assumed to remain stable, i.e. no further commodity-specific changes are taken into consideration because the outlook for those years is increasingly uncertain.

Country-to-country and commodity-specific information

The commodity 'oil' is treated separately for two reasons: in recent years, freight volumes from Russia through ports in the Baltic countries have declined. It is uncertain how these flows will develop in the future. Second, we should be generally cautious in anticipating further growth in oil volumes because of the ongoing transition to more sustainable energy sources. For this reason, under the realistic market scenario, future oil volumes in the ports are limited to the volumes observed in 2015. For the Port of Muuga, this translates into a 7.9 Mt limit. From 2040 onwards, a further 20 % decline is assumed for each 5-year forecast period. By 2055, therefore, oil flows are expected to have fallen to 20 % of the flows seen in 2015.

6.8.5. Modal split formulas used in transport model

In this section, an overview of the modal split functions that have been used in the modelling is given.

In mathematical notation, the modal split function is:

$$GC_{m,g} = VoT_g * T_m + P_m$$

Where GC = Generalised Costs; VoT = Value of Time; T = Time; P = Price;

Subscripts: m = mode of transport; g = good (i.e. bulk or non-bulk)

The equation of the modal split function has the form:

$$P_{ij}^{x} = \frac{\exp(-\alpha C_{ij}^{x})}{\exp(-\alpha C_{ij}^{x}) + \exp\left(-\beta C_{ij}^{y}\right) + \exp(-\delta C_{ij}^{z})}$$

Where is P^{x}_{ij} is the probability of using mode x to go between i and j. C is the generalised cost and α, β and δ are fixed weighting parameters. In the model for Non-Bulk α=0.01, β=0.008 and δ=0.009 and α=0.01, β=0.009 and δ=0.009 for Bulk. These are the parameters for Road, Rail and Sea, respectively. Using these parameters, if the generalised cost of the modes for a particular non-bulk journey were equal at 100, then 30 % would use Road, 37 % Rail and 33 % Sea. As stated earlier, the parameters have been differentiated depending on the distance between origin and destination. High values for parameters have been used for shorter distances, and lower values for longer distances. However, the relative differences between α, β and δ have been kept constant.

6.8.6. Modelling assumptions

In this section, assumption and values are summed up, which have been used in the modelling.

The assumptions that have been made for cost components for the modes road, rail and maritime have been included in the table below. Cost values are being shown for 1 000 t.

For the mode road, one truck is assumed to carry net 20 t, which means that 50 trucks are needed to transport 1 000 t. For the mode rail, one train is assumed to carry net 1 500 t. In many cases, the cost values used in the AECOM study have been used for the modelling in this study as well, in order to achieve consistency. In other cases where other information was available being assumed to be more accurately and plausible, these sources have been used. Sources have been mentioned in the explanation column.

Table 43. Freight type specific assumptions used in modelling

	Cost component	Cost value	Explanation
Road	EU-border waiting time	Border penalties table	-
	Value-of-Time (VoT) Bulk	€2 387/h/1 000 t	HEATCO base; VoT Non-Bulk higher than Bulk as being applied in AECOM study 2011
	Value-of-Time (VoT) Non-Bulk	€4 900/h/1 000 t	HEATCO base; VoT Non-Bulk higher than Bulk as being applied in AECOM study 2011
	Cost per km	€45/km/1 000 t	Aecom €0.9/km/truck transporting 20 t
	Tollcost per 1 000 t	as given by ETISplus network added per link	ETISplus value *50 trucks of 20 t to obtain value for 1 000 t
	Distances larger than 800km	extra time penalty of 9 hours and extra cost of €2 500 for overnights	50 euro *50 trucks of 20 t to obtain value overnight costs for 1 000 t (similar AECOM)
Rail	Value-of-Time (VoT) Bulk	€980/h/1 000 t	HEATCO value rail relative to road used (factor 0.41)
	Value-of-Time (VoT) Non-Bulk	€2 940/h/1 000 t	Non-Bulk rail vs Bulk rail ratio for VoT taken from AECOM
	Cost per km Bulk	€30/1 000 t	Based on AECOM; Bulk more expensive operational costs due to handling and special requirements wagons
	Cost per km Non-Bulk	€8.20/1 000 t	Based on DB rates per train and 1 500 t per train
	Handling cost at each end of the journey	€6 963/1 000 t	Based on Aecom

	Cost component	Cost value	Explanation
	Extra time needed for rail gauge change	Included in Border penalties	-
	Extra handling costs related to rail gauge change	€15 700/1 000 t (Aecom: €220/container of 14 t)	Based on Aecom
	waiting time at border crossing with Russia	Border penalties table	-
Sea	Value-of-Time (VoT) Bulk	€624/h/1 000 t	VoT Sea substantially lower than road and rail, little difference Bulk vs Non-Bulk (source Dutch research)
	Value-of-Time (VoT) Non-Bulk	€570/h/1 000 t	VoT Sea substantially lower than road and rail, little difference Bulk vs Non-Bulk (source Dutch research)
	Base cost level Bulk	€15 400/1 000 t (distances < 200km), €18 700/1 000 t (distances > 200 km)	Based on web research freight ferry services
	Base cost level Non-Bulk	€15 922/1 000 t	Based on web research freight ferry services
	Extra cost per km Bulk	€3/km/1 000 t	Based on web research freight ferry services
	Extra cost per km Non-Bulk	€2.85/km/1 000 t	Based on web research freight ferry services
	Waiting time penalties at terminals freight sea services	8-24 h depending of service frequency	-
	Regular Ferry costs per 1 000 t	Specific price levels (*50 articulated lorry 20 t/16.5 m/4.5 m)	Based on web research regular ferry services
	Handling costs from/to road per 1 000 t	€3 250 (65*50 trucks)	Based on Aecom
	Handling costs from/to rail per 1 000 t	€2 000 (40*50 trucks)	Based on Aecom
	Handling costs from/to sea per 1 000 t	€1 500 (30*50 trucks)	Based on Aecom

Time penalties have been applied for border crossings for the modes road and rail. The penalties have been specified for country to country border crossings outside the EU. In the tables below, the border penalties (in hours) have been specified for road and rail, respectively. In the table for rail, the border crossings for which a rail gauge change is necessary have been indicated.

Road – border waiting times, hours								
	FI	EE	LV	LT	PL	BY	UA	RU
FI		0						8
EE	0		0					8
LV		0		0		4		8
LT			0		0	4		8

Road – border waiting times, hours								
PL				0		4	4	8
BY			4	4	4		2	2
UA					4	2		4
RU	8	8	8	8	8	2	4	
Rail – border waiting times, hours								
	FI	**EE**	**LV**	**LT**	**PL**	**BY**	**UA**	**RU**
FI		0						8
EE	0		0					8
LV		0		0		6		8
LT			0		3	6		8
PL				3		6	6	8
BY			6	6	6		2	0
UA					6	2		4
RU	8	8	8	8	8	0	4	

Price indices will be applied to all cost components for modelling future years. We have used price indices similar to those used in the AECOM study, as no new information has been made available.

	2015	2025	2030	2035	2040	2045	2050	2055
Road	100	113	120	127	134	141	148	155
Rail	100	107	112	117	122	127	132	137
Sea	100	104	107	109	111	113	115	117

General infrastructure assumptions on future developments have been included in the table below:

	2015	2025	2030	2035	2040	2045	2050	2055
RB becoming operational	No	Yes (2026)	Yes	Yes	Yes	Yes	Yes	Yes
Tunnel Helsinki-Tallinn operational	No	No	No	No	No	No	Yes	Yes
Ro-ro from Old City harbour to Muuga	No	No	No	Yes	Yes	Yes	Yes	Yes
Riga terminal operational	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kaunas terminal operational	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The cost components for RB are assumed to be the same as for the existing rail services. Extra gauge change penalties have been introduced on sections where exchange with the current rail network is possible. The cost for the use of the future Tallinn-Helsinki rail tunnel has been taken from the pre-feasibility study.

The model did not take induced demand into account; therefore, additional assumptions were made following the analysis of corridors and expert interviews.

Growth in Finland. A more significant increase in freight flow through Finland to several countries is anticipated than initially thought starting in the year 2035, because of Poland's intersection with the Baltic Sea-Adriatic TEN-T corridor in Poland, in particular:

- Total freight flow to and from Poland is expected to increase from 0.5 M tons to 0.65 M tons per year (from 2035);
- Total freight flow to and from Austria is expected to increase from 0.07 M tons to 0.2 M tons per year (from 2035);
- Total freight flow to and from Germany is expected to increase from 0.6 M tons to 1 M tons per year (from 2035).

Warehousing for the St. Petersburg area. It is believed that Muuga will be used in the future as a preferred EU warehousing and distribution location centre for the greater St. Petersburg area. Here we mean cargo that would first travel South-North on Rail Baltic and then be transhipped towards Russia on rail or on road after warehousing, repacking or other value-added service. This emerging demand is translated to total freight volume of 0.25 M tons by 2030, 0.75 M tons in 2035 and 1 M tons in 2045.

Containers from China. Muuga is expected to become an attractive intermediary stop to bring cargo from China to Norway, Sweden, Finland and Russia, as it is deemed to be cheaper than the current transportation method through the Mediterranean Sea. This would approximately increase the use of containers by 0.5 M tons in 2025, 1 M tons from 2030; 1.25 M tons in 2035 and 1.5 M tons in 2040. Here we mean containers arriving to Muuga on 1520 mm rail. We assume that at least 20 % of that volume will be value added in Muuga.

Containerisation. We additionally anticipate a larger use of containers at the expense of other freight types, following global trends of a 10 % annual increase in container traffic since 2009.[190] In our case, dry bulk volume is estimated to decrease annually by 0.5 % in 2025-2040 and 1.5 % in 2040-2055, while the volume of break bulk is expected to drop by 1.5 % for the whole forecast period.

Oil flow decline. A tense geopolitical situation has been causing freight flows through Estonia to decrease for a while and it is unlikely to change at this point. Russia is currently developing several ports, mainly in St. Petersburg and Ust-Luga, which should increasingly take flows away from Muuga for decades to come. This should hit crude petroleum and gas products especially hard, for which Russia is the primary provider in the region. As a result, the flow of these commodities through Muuga is now expected to drastically decline from 7 M EUR in 2030 to 0.5 M EUR in 2050.

[190] https://data.worldbank.org/indicator/IS.SHP.GOOD.TU

Abbreviations

ASR	Arctic Sea Route
AT	Austria
BE	Belgium
BY	Belarus
CEF	Connecting Europe Facility
CFS	Container freight station
CIS	Commonwealth of Independent States
CNC	Core network corridors
CT	Combined transport
CZ	Czech Republic
DB	Deutsche Bahn
DE	Germany
DK	Denmark
EC	European Commission
EDI	Electronic data interchange
EE	Estonia
ES	Spain
EU	European Union
E-W/W-E	East-West/West-East
FI	Finland
FTA	Finnish Transport Agency
GC	Generalised cost
GDP	Gross domestic product
GHG	Greenhouse gas emissions
GVA	Gross value added
HN	Hungary
IAE	International Energy Agency
ICT	Information and communication activities
IMO	International Maritime Organization
ISO	International Organization for Standardization
ISP	Internet service provider
IT	Italy
KIT	Kaunas intermodal terminal
LNG	Liquefied natural gas
LT	Lithuania
LV	Latvia
M	Million
NAFTA	North American Free Trade Agreement
NATO	North Atlantic Treaty Organization
NECA	NOx emission control area
NL	The Netherlands
NO	Norway
N-S/S-N	North-South/South-North
NSR	Northern Sea Route

NST	Standard goods classification for transport statistics
NW	North West
OD	Origin-destination
OECD	Organisation for Economic Co-operation and Development
PL	Poland
PTI	Pre-trip inspection
RB	Rail Baltic
RBILC	Rail Baltic intermodal logistics centre (Riga)
MCTRB	Rail Baltic Muuga multimodal cargo terminal
RF	Russian Federation
RMG	Rail mounted gantry
Ro-ro	Roll-on/roll-off
RTG	Rubber tired gantry
RU	Russia
SE	Sweden
T	Tons
TEN-T	Trans-European transport network
TEU	Twenty-foot Equivalent Unit
TTU	Tallinn Technical University
UA	Ukraine
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
USA, US	United States of America
VAT	Value added tax
VGM	Verified gross weight
VIT	Vilnius intermodal terminal
VoT	Value of time
WP	Work package

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