

# LAIVA 2025

## Development and Change Factors of Finnish Maritime Dry Cargo Transport



CENTRE FOR MARITIME STUDIES  
UNIVERSITY OF TURKU

2013



TURUN YLIOPISTON  
MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUS

SJÖFARTSBRANSCHENS UTBILDNINGS- OCH  
FORSKNINGSCENTRAL VID ÅBO UNIVERSITET

THE CENTRE FOR MARITIME STUDIES  
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# **LAIVA 2025**

## **Development and Change Factors of Finnish Maritime Dry Cargo Transport**

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## FOREWORD

This report is produced as background material and part of "LAIVA 2025" project, which aims at generating alternative and optimal vessel concepts for future dry cargo transportations in Finnish foreign trade, considering development changes and factors affecting the operational environment. Based on industry and commercial induced transport requirements, environmental and energy aspects and marine technology related development factors of change, alternative scenarios were established as inspirational background material for maritime transport concept generation.

The research project was jointly carried out by the University of Turku (Centre for Maritime Studies) and Aalto University (Maritime Technology) yielding three Master's theses. The project has been co-funded by the Finnish Funding Agency for Technology and Innovations (TEKES) and the following companies: Cargotec Finland Oy, ESL Shipping Oy, Oy Langh Ship Ab, Outokumpu Stainless Oy, Stora Enso Oyj and Wärtsilä Finland Oy.

This report has been put together by Irina Wahlström, Sakari Kajander, Päivi Söderholm and Elisa Holma at the Centre for Maritime Studies.

The CMS would like to express its appreciation to the support, contribution and dedication all steering group members and other specialists have shown for the "LAIVA 2025" project.

Turku, February 2013

Sakari Kajander  
Head of Research and Consulting Services Unit  
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## ABSTRACT

Finland's future international competitiveness and economic success heavily relies on foreign trade and in particular that of export of industrial and service sectors. The absolute majority of both exports and imports is transported by sea and therefore it is imperative that Finland operates a merchant fleet that is optimally adapted to serve the Finnish foreign trade with regard to global change factors and circumstances in political, economic, sociological, environmental and technological scenes. Because of Finland's island-like geographic location and challenging seasonal winter navigation conditions, the competitiveness in logistics sets demanding requirements on different aspects of the supply chain including maritime transport and cargo handling. This in turn affects, and directs the design and conceptualisation of the best fitting dry cargo vessel intended to serve in Finnish foreign trade.

The Baltic Sea is one of the most heavily sailed seas in the world and the merchant traffic volumes are anticipated to grow further in the decades to come. From a historic perspective more than 800 million tonnes of goods has been annually handled by the ports surrounding the Baltic Sea coast, the biggest countries by volume representing Russia and Sweden. The transports in the Baltic Sea are dominated by export traffic, which to a large extent is a result of Russian oil exports.

During the last 5 years, container traffic has increased substantially in the Baltic Sea reaching closer to 9 million TEUs, in 2011. Container transports seem however sensitive to economic fluctuations as witnessed in 2009, when a quarter of volumes were lost. Trucks and trailers likewise saw a drop in volumes although the decline was not equally significant.

Finland's international maritime traffic has during the past decade, with the exception of 2005 and 2009, shown moderate yet steadily increasing transport volumes reaching 99 million tonnes, in 2011. Finland's major trading partner countries in maritime transports (both for import and export) are all found among European countries. The ports situated on the Baltic Sea coast have lately increased their share among all European ports.

During the last 10 years import volumes have exceeded export volumes, even if there has been a surplus in value measured trade exchange, until 2011. Finland's main export commodities comprise paper and paperboard, oil products and general cargo with biggest markets found in Germany and Sweden. Main import commodities consist of crude oil which to 90 per cent is imported from Russia. The next biggest import commodities consist of general cargo, the biggest volume being imported from Germany and coal and coke, mainly imported from Russia.

The general development in number and size of different types of dry cargo vessels sailing in Finnish foreign trade has been that the number of ship calls has reduced whilst the size of vessels on the other hand has increased. The capacity utilisation and balance of inbound and outbound commodity volumes vary between vessel types.

The volumes and value of transit traffic via Finland are considerable; transit volume representing more than 7 per cent of international seaborne cargo volumes handled by Finnish ports. The eastbound transit traffic passing via Finland to Russia consists predominantly of high value goods, whereas in westbound transit the volume is high and the value lower.

There are several comprehensive port projects in the Baltic Sea region, especially in Russia, Poland and Sweden, which have either recently been completed, in progress

or planned for execution. The Russian investment projects are expected to potentially reduce the Russian transit traffic via Finland to Russia and further to third country destinations. The Russian transport strategy aims at reaching an overall capacity of 346 million tonnes by 2030. Poland too, has invested heavily in ports with the objective to emphasise its role in container handling. Finnish port investments entail predominantly fairway dredging and deepening in order to increase the economics of scale and hence competitiveness in foreign trade.

The overall seaborne cargo volumes in international traffic are estimated to increase close to 230 million tonnes equaling a 30 per cent average growth within the Baltic Sea ports, by 2030. In absolute volumes, Russia, Sweden and Finland are forecasted to represent the biggest contributors in volume. In relative terms the biggest growth percentages in descending order are expected to be seen in Poland, Russia and Sweden, all exceeding the average growth rate of 30 per cent. The remaining countries are anticipated not to reach this growth rate. On cargo type level, containers are expected to show the most marked growth followed by Ro-Ro cargo and dry bulk. Although still the biggest single cargo type in 2030, liquid bulk is however the only type of cargo that is expected to decrease in share.

The aim of this report is to serve as background information covering historic and forecasted seaborne transport volumes, list factors of change affecting the characteristics of maritime transportation and describe alternative future scenarios portraying possible future settings and circumstances, in order to support the overall objective of producing optimal vessel concepts serving the Finnish foreign trade, in 2025. The scenario generation was led by a facilitator and carried out as a 1-day scenario workshop attended by steering group members of the “Laiva 2025” project, and other specialist with relevant expertise. Additionally, an electronic survey was conducted among the steering group members, interest organisations and shipping companies to support the output of aforementioned scenario workshop. As a result three alternative scenarios were created and chosen, those representing 1) scenario of dynamic and fast development, 2) scenario of predictable and manageable risks in business as usual, and 3) scenario of precaution in a threat reflected development. These chosen scenarios are to serve as inspiration for vessel design and concept creation.



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# 1 MARITIME TRAFFIC IN THE BALTIC SEA

## 1.1 Total volumes handled by Baltic Sea ports

The Baltic Sea region (BSR) ports, including the ports of Finland, Sweden, Estonia, Latvia, Lithuania, Poland and the ports of Denmark, Germany and Russia along the Baltic Sea coast have collectively handled during 2006-2011 some 800 million tonnes of goods annually including transit traffic. In 2011, the total volume handled rose to 839 million (+3.7%) tonnes compared with the total volume of 791 million tonnes in 2006.

in the Danish ports (~8 million tonnes or 11%). The total international volume handled was distributed between exports and imports in a 60:40 ratio in favour of exports.



## 1.2 International traffic volumes in the Baltic Sea region

When considering the international traffic only, i.e. excluding domestic traffic, the total cargo volume handled in 2011 was 767 million tonnes being 44 million tonnes more (+6%) than in 2006 when 723 million was loaded and discharged. In 2011, the biggest countries measured in total volumes were Russia with 183 million (22% share), Sweden 153 million (21% share) and Finland 99 million tonnes (14% share).

Compared with 2006, the most significant increases were experienced in Russia (+29 million tonnes or 19%), Lithuania (+16 million tonnes or 54%) and Latvia (+9 million tonnes or 16%) while the most marked falls took place

*Sweden is the biggest importer in BSR  
Russia stands out as the leading export country*

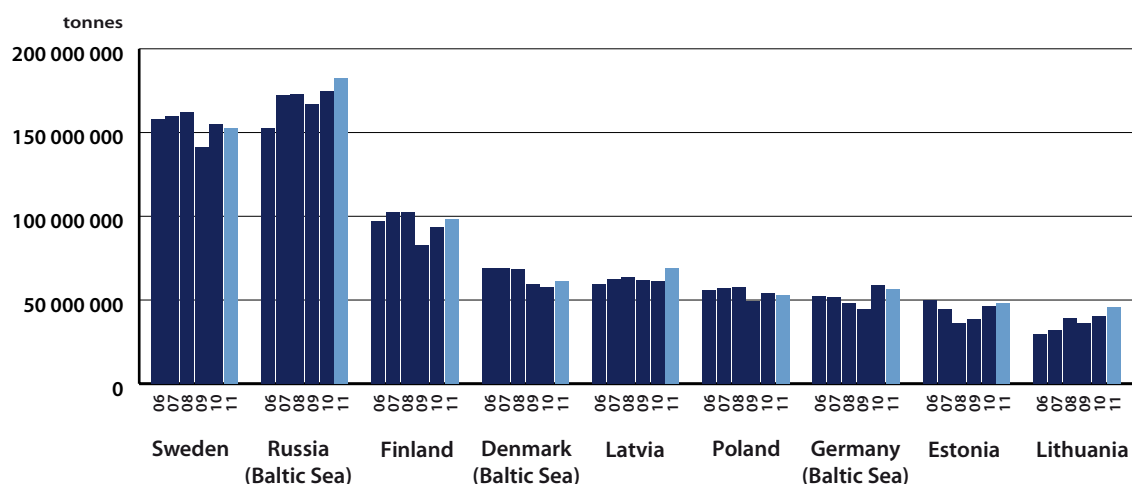


Figure 1. Foreign trade cargo volumes handled in the Baltic Sea ports by country in 2006-2011 (Holma et al., 2012).

### 1.3 Import

The import volume of the Baltic Sea region ports grew from 264 million to 296 million tonnes (+32 million tonnes or 12%) during 2006-2011. The most noteworthy build-ups in absolute terms took place in Poland (+14 million tonnes or 69%), Lithuania (+8 million or 81%) and Estonia (+7 million tonnes or 113%). Volume wise Sweden comprised the biggest

importing country among the Baltic Sea region ports with a total volume of 84 million tonnes, followed by Finland with 54 million tonnes. Russia on the other hand had very little imports compared with other countries or in relation to its export volumes. Apart from Germany, Denmark and Sweden the import grew under 2006-2011 in all countries.

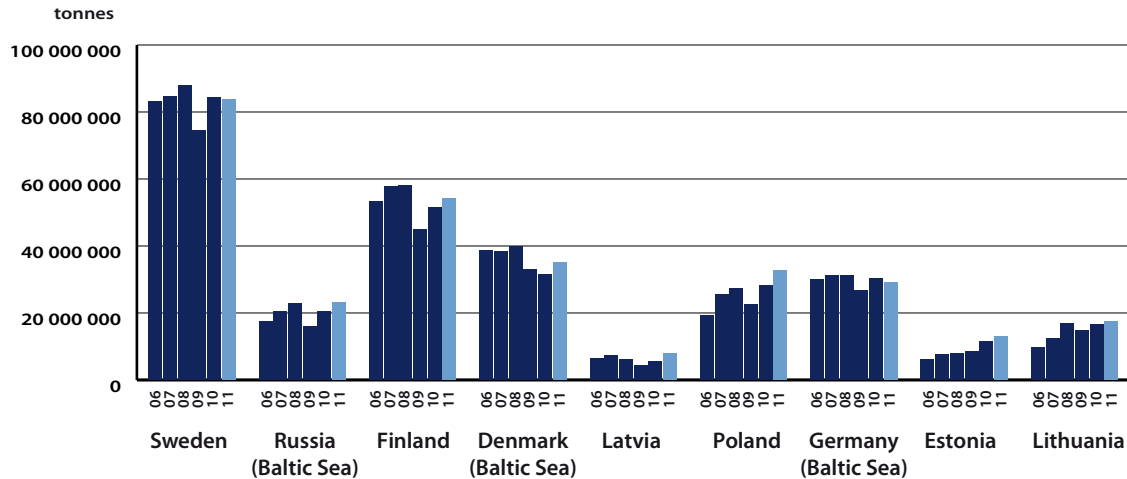


Figure 2. International imports in the Baltic Sea ports by country in 2006-2011 (Holma et al., 2012).

### 1.4 Export

The export of the Baltic Sea region ports grew from 459 million tonnes to 470 million tonnes (+11 million tonnes or 2.5%) during 2006-2011. In a class of its own, when export volumes are concerned, was Russia with an export volume of 159 million representing a 24 million tonne increase (+17%) when compared with 2006 volumes.

Lithuania with 8 million (+41%), Latvia with 8 million (+15%) and Finland with less than 1 million ton growth (+1%) respectively. All other countries saw their export volumes drop.

The export volume dominance among Baltic Sea region countries is explained by substantial Russian oil exports. Lithuania, Latvia and Finland were the other countries seeing increasing volumes during the same period;

*Sweden and Russia leading countries in BSR international maritime transport*  
*Significant growth in Russia based on oil exports*

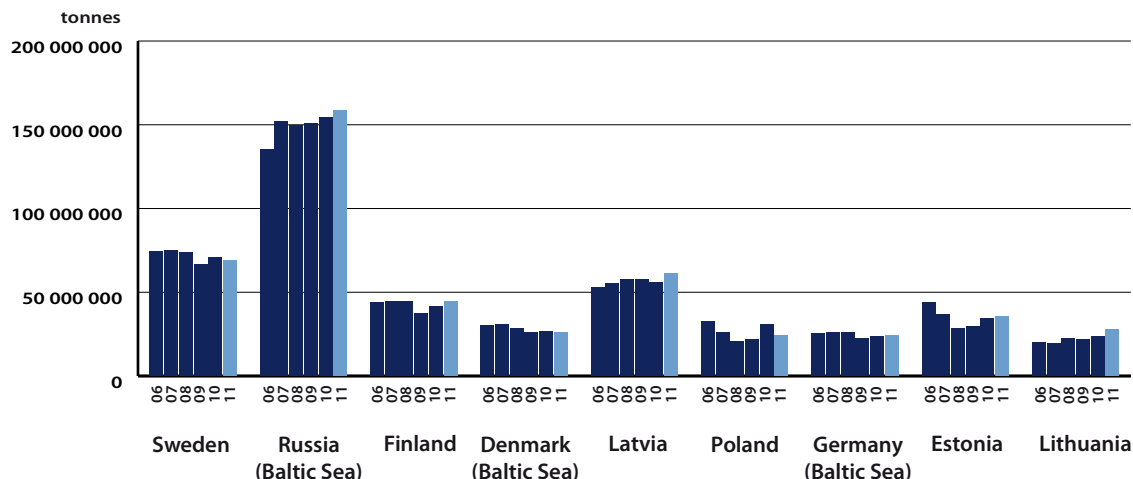


Figure 3. International exports in the Baltic Sea ports by country in 2006-2011 (Holma et al., 2012).

## 1.5 Distribution of cargo types

In 2011, among three main cargo types in international traffic, namely liquid bulk, dry bulk and other dry cargo, liquid bulk constituted the biggest cargo type handled by Baltic Sea ports representing a share of 40 per cent. Other dry cargo accounted for 34 per cent and dry bulk for 26 per cent, respectively. In absolute volume terms the amount of liquid bulk has grown 20 million tonnes from 281 to 301 million tonnes (+7%), other dry cargo 13 million tonnes from 242 million to 255 million (+5%) and dry bulk 16 million tonnes from 188 million to 204 million tonnes (+8%) during 2006-2011.

Despite the growth of all cargo types the relative shares out of total volume have remained unchanged. The only cargo type not affected by the global downturn in the end

*2/3 of transport volumes are bulk cargoes in BSR*

## 1.6 Transport units

### Containers

During 2006-2011, container traffic in the Baltic Sea region ports has increased by 2.4 million TEUs from 6.4 million to 8.8 million TEUs representing a relative growth of 37 per cent. In 2011, the biggest container volumes were handled in Russia (2.7 million TEUs), Sweden (1.6 million TEUs), Finland (1.4 million TEUs) and Poland (1.3 million TEUs).

The global economic downturn hit container handling hard reducing the number by a quarter or 2 million TEUs, from 7.8 million in 2008 to 5.8 million TEUs in 2009. Equally dynamic was the bounce-back in 2010 when most of the lost volumes were regained. The most substantial

of the first decade of the 21st century was liquid bulk. Both dry bulk and other dry cargo dropped in volumes two consecutive years in 2008-2009 whereas an upswing has taken place again from 2010 forward.

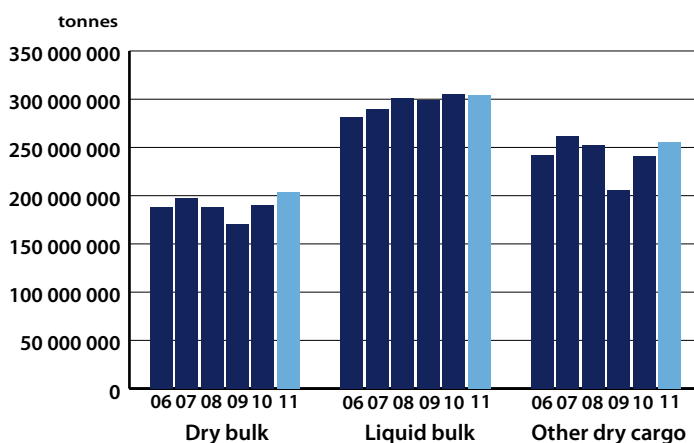


Figure 4. Cargo type distribution in the Baltic Sea ports in 2006-2011 (Holma et al., 2012).

relative growths during 2006-2011 have been witnessed in Poland (+129%) and Russia (+68%) having lately actively invested in their container handling capacities. All in all, seven out of nine countries showed impressive relative container handling growth figures. 2011 comprised the peak year in container volumes during 2006-2011.

*Container traffic development is closely associated with the general economic climate*

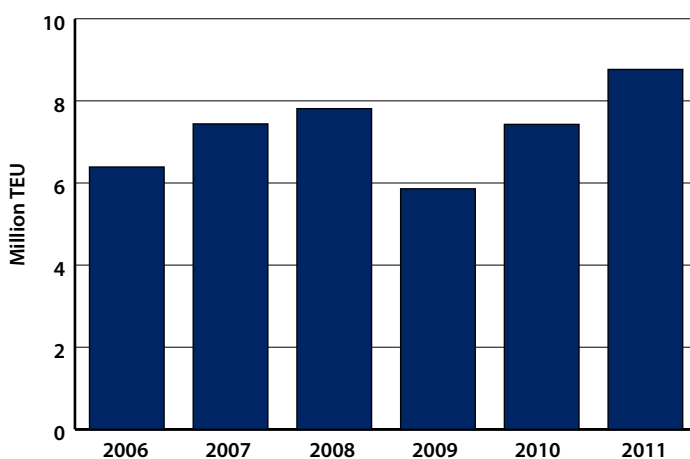


Figure 5. Containers handled in the Baltic Sea ports in 2006-2011 (Holma et al., 2012).



### Trucks and trailers

The number of trucks and trailers passing through the ports within the Baltic Sea region has shown a moderate growth pattern during 2006-2011. The number of trucks and trailers has increased with 350 000 (+5%) units from 7.1 million in 2006 to 7.4 million units in 2011. The ports of Sweden and Germany each had over 2 million trucks and trailers passing through their ports in 2011 followed by Denmark and Finland with approximately 1 million trucks and trailers each. The truck and trailer traffic reacted to the economic downturn too, but the fall was not as dramatic as for containers discussed earlier. The likely reason for a more moderate decline is that a fair amount of daily consumer goods are transported by trucks and trailers thereby not affecting the truck and trailer traffic in that extent.

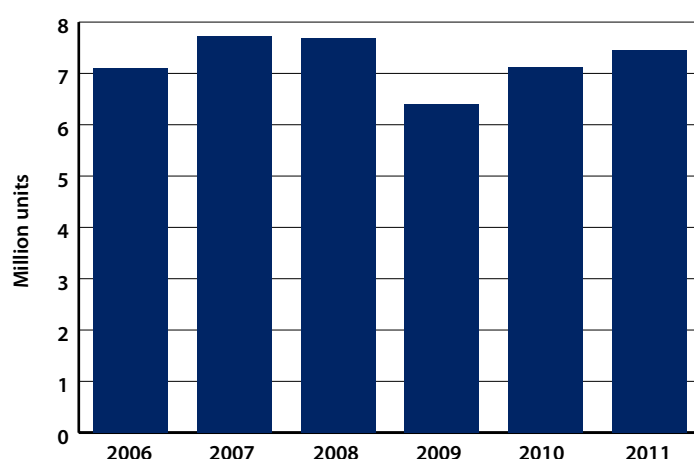


Figure 6. Trucks and trailers handled in the Baltic Sea ports in 2006-2011 (Holma et al., 2012).

### Train wagons

The development of train wagons has been rather dramatic over the period of 2006-2011, although strategies for promoting intermodalism have been set up to support an opposite development. The number of train wagons carried on vessels has dropped from 255 000 in 2006 to 130 000 in 2011, which equals a relative reduction of 49 per cent. The most noteworthy fall has been witnessed in Finland where 14 600 train wagons were transported in 2006, whereas the corresponding figure in 2011 was almost 3 150 equalling a relative reduction of 79 per cent. In Sweden the total of approximately 111 000 train wagons in 2006 has likewise dropped significantly i.e. by 52 per cent. The trend has been identical in all other countries too, although the declining trend has been somewhat more moderate.

*Train-ferry transports have halved during 2006-2011*

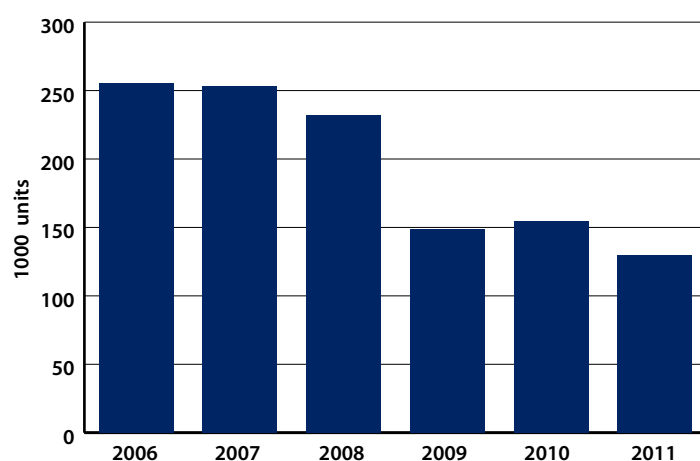
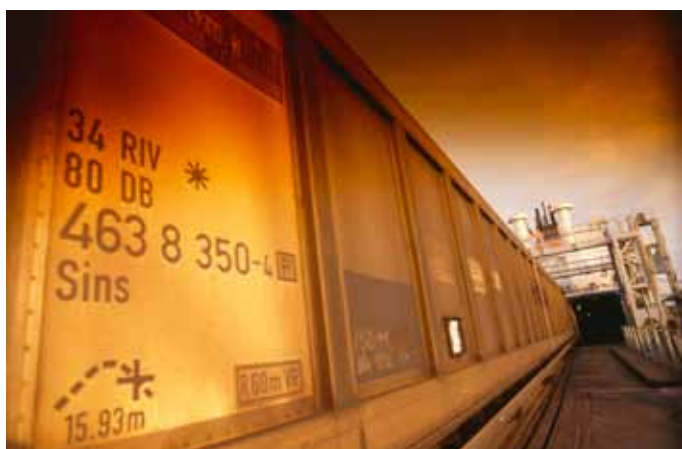


Figure 7. Train wagons handled in the Baltic Sea ports in 2006-2011 (Holma et al., 2012).



## 2 DEVELOPMENT FORECAST OF MARITIME TRANSPORTS IN THE BALTIC SEA REGION UNTIL 2030

According to Baltic Transport Outlook 2030, a comprehensive EU funded project entailing future maritime volumes, the total cargo volumes of the Baltic Sea ports are expected to increase with 228 million tonnes (+30%), during 2010-2030. Therefore the average annual growth is 1.3 per cent, which indicates a slower growth than before, although there are significant differences among cargo types. In 1997-2008, total cargo volumes increased with 224 million tonnes, which equals an average annual growth of 3.25 per cent.

It is anticipated that there will be several future growth areas within the Baltic Sea area, however without a clear single geographic concentration. If excluding liquid bulk, some level of accumulation in maritime cargo volumes is believed to take place in Russia (in eastern Gulf of Finland ports), Poland (Gdynia-Gdansk) and in the southern and mid-part of Sweden (Skåne and Gävleborg). The eastern part of the Baltic Sea (Finland, Russia, Estonia, Latvia and Lithuania) is anticipated to cover over half, i.e. 53 per cent of the future total cargo volume development in the Baltic Sea area. The ports in the eastern area of the Gulf of Finland are forecasted to contribute to the volume development the most (Baltic Transport Outlook 2030).

### 2.1 Future cargo type development in the Baltic Sea region

The structure of cargo type distribution comprising liquid bulk, dry bulk, Ro-Ro cargo, containers and other cargo, is forecasted to alter by 2030. In 2010, the 41 per cent share of liquid bulk was predominant in relation to the overall volume. However, in 2030 the share of liquid bulk is estimated to drop to 29 per cent. Containers, on the other hand are expected to increase their share from 8 per cent to 14 per cent. Ro-Ro cargo is expected to grow its share of 16 per cent to 18 per cent, and other cargo from 10 per cent to 11 per cent, in 2010-2030.

Among individual cargo types, container transports are expected to grow the most in the Baltic Sea ports i.e. by +138 per cent (77 million tonnes) up to 138 million tonnes by 2030. The second biggest type comprises Ro-Ro cargo, which is estimated to grow by 51 per cent (68 million tonnes) up to 197 million tonnes. Dry bulk is expected to increase by 42 per cent (67 million tonnes) up to 256 million tonnes and other cargo by 32 per cent (28 million tonnes) up to 103 million tonnes. Liquid bulk constitutes the only cargo type which is forecasted to show a negative development i.e. to

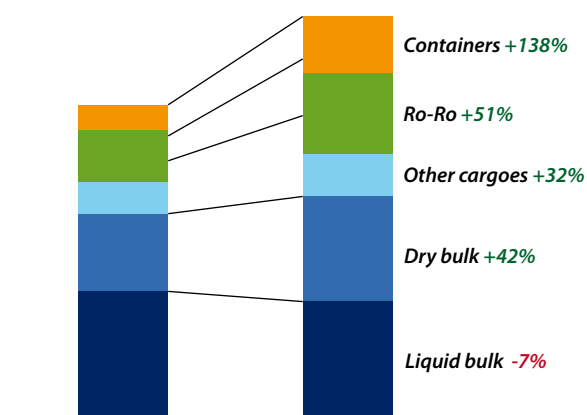


Figure 8. Maritime transport forecast by cargo types in the Baltic Sea region in 2010-2030.

drop by 7 per cent (-25 million tonnes) settling at a level of 286 million tonnes, in 2030 (Baltic Transport Outlook 2030).

### 2.2 Country specific development of future maritime cargo volumes

The maritime cargo volumes are forecasted to grow by 228 million tonnes among the ports along the Baltic Sea coast from a total 757 million tonnes in 2010 to 985 million tonnes in 2030, equaling a relative growth of 30 per cent.

Out of the estimated 228 million volume increase, Russia is expected to occupy the biggest share with an increase of 72 million tonnes (+42%). The Swedish cargo volumes are expected to increase by 47 million tonnes (+30%). The forecasted growth for Finland is 27 million tonnes (+27%), Poland 24 million tonnes (+50%), Denmark 17 million tonnes (+24%), Latvia 14 million tonnes (+23%), and Germany (Baltic Sea) 12 million tonnes (+22%). Countries with growth less than 10 million include Lithuania 7 million tonnes (+18%), Norway (South coast) 6 million tonnes (+28%) and Estonia 2 million tonnes (+4%).

Only three Baltic Sea countries out of ten exceed the average relative growth of 30 per cent for the entire Baltic Sea region, in 2030. The strongest relative growth is expected in Poland with a growth of close to 50 per cent followed by Russia with 42 per cent. Sweden is the third country rising above the average overall growth of 30 per cent. The relative increase in Finland is anticipated to be 27 per cent (Baltic Transport Outlook 2030 Forecast).



Table 1. Estimated total port volumes per country in international seaborne traffic (Baltic Transport Outlook 2030).

Country	Volume 2010 (Mt.)	Volume 2030 (Mt)	Volume change, 2010-2030 (Mt)	Volume change, 2010-2030 (%)
Finland	98.4	125.3	26.9	27.4
Estonia	37.1	38.7	1.6	4.4
Latvia	61.5	75.4	13.8	22.5
Lithuania	38.0	44.7	6.8	17.9
Russia	171.6	243.8	72.2	42.0
Poland	48.8	73.0	24.3	49.9
Germany (Baltic Sea)	56.0	68.1	12.1	21.6
Denmark	69.6	86.4	16.8	24.2
Sweden	154.8	201.9	47.0	30.4
South Norway	21.5	27.5	6.0	27.9
<b>Total</b>	<b>757.1</b>	<b>984.8</b>	<b>227.5</b>	<b>30.1</b>



## 3 MAJOR PORT INVESTMENTS IN THE BALTIC SEA REGION

### 3.1 Russia

The objective of the Russian traffic strategy is to increase and direct its trade flows instead of foreign ports through own ports. Russia is seeking for the highest possible degree of self-sufficiency in logistics by investing in the development of its ports, shipbuilding industry and other infrastructure. The development of rail links to ports is strongly emphasised too. Today, three quarters of Russian international goods flow is handled by Russian ports but the goal is to increase the share to 90-95 per cent, by 2020 (Sundberg et al., 2010). The Russian port investments are bound to affect especially the level of eastbound Finnish transit traffic to Russia.

Augmentation of port capacity on the Russian coast of the Gulf of Finland, as well as focus on transport and logistics development, are priority areas of transport infrastructure modernisation in the Northwest region of the Russian Federation.

The Russian port investments have been and are considerable and the aim is predominantly to secure the export of oil to the world market. According to Russian forecasts, the volume of the Gulf of Finland ports is expected to double from 174 million tons in 2007 to 346 million tons, in 2030. According to the transport strategy, the total volume is anticipated to be about 266 million tons as early as in 2015 (Sundberg et al., 2010). The growth is mainly based on increasing goods volume of Primorsk and Ust-Luga. The port investments in St. Petersburg area are carried out to increase the handling capacity of unitised goods.

#### *Bronka*

The Port of Bronka is located on the southern coast of the Gulf of Finland in Lomonosov (administrative district of Saint-Petersburg), near Saint-Petersburg flood protection system.

Bronka will become one of the leading container and Ro-Ro cargo areas of Port of Saint-Petersburg, the construction of which will take place in three stages. In the first phase, stretching from 2013 to 2015, a container and Ro-Ro terminal will be constructed. The container terminal has an annual throughput capacity of 1.45 million TEUs and the Ro-Ro terminal 260 000 Ro-Ro units. In the second phase by 2017, the container terminal will be enlarged enabling the



*The Russian transport strategy materialises in major port investments aiming to increase the use of own ports to 90-95% in seaborne trade. Especially unitised cargo handling capacity is being developed.*

annual throughput of 1.9 million TEUs. A logistics centre is simultaneously taken into operation. By the final phase in 2022, the capacity of Port of Bronka will reach 3 million TEUs. By the time of the completion, the port land area will cover altogether 207 hectares and have 1 900 quay metres. In total, the port investment will amount to 60 billion ruble equalling 1.4 billion euros (Port of Bronka).

The port declares that the maintainable ship sizes handled in Bronka comprise Panamax size container vessels (Wan Hai 501, 4 252 TEU) and Finnstar class Ro-Paxes (4 200 lane metres).



*Port plan of Bronka (Port of Bronka)*

### *Ust-Luga*

The multipurpose Ust-Luga merchant sea port is under construction in the Luga Bay of the Gulf of Finland, approximately 150 kilometres west of St. Petersburg and 40 kilometres from the EU border.

The port investments are massive and when completed Ust-Luga will become the biggest Russian container port covering 140 hectares with a throughput capacity of 3 million TEUs.

Currently, there are eight terminals operating in Ust-Luga port; a coal terminal, universal cargo terminal, sulphur terminal, car/railway ferry complex, multipurpose transloading complex «Yug-2», container terminal and timber terminal. The port will additionally have a terminal for oil products, crude oil and containers built.

The annual capacities of the various terminals will be as follows: bulk terminal complex for oil and marine fuels (25 million tonnes), coal terminal (12 million tonnes), universal cargo terminal (3 million tonnes) and sulphur terminal (9 million tonnes). The car/train ferry complex, part of the West-East transport corridor, handles goods transported by rail, car carriers and passenger ferries. The annual capacity of the complex is 2.9 million tonnes. By 2018, the capacity of Ust-Luga is to amount to 180 million annual tonnes of various goods.

The activity of the Yug-2 multipurpose terminal is specialised in the handling of self-loading goods, such as cars, containers and general cargo. The annual throughput of the terminal is 4.7 million tonnes of cargo and 500 000 cars.

The aimed capacity of Ust-Luga compared to the Finnish port of Vuosaari (Helsinki) is tenfold. In 2011, the port of Ust-Luga handled 22.7 million tonnes of cargo and approximately 133 800 vehicles. From January to September 2012 the port of Ust-Luga handled 33.3 million tonnes of cargo which is twice as much compared to the same period in 2011. The aim is to reach a handling capability of a 6 000 TEU vessel (Port of Ust-Luga).

### *Lomonosov*

The port of Lomonosov is located at the southern shore of the Nevskaya Bay by the Gulf of Finland, 40 kilometres west of St. Petersburg. The port of Lomonosov currently operates on the verge of its full capacity and therefore the port area and services will be expanded to meet the criteria of a high-capacity maritime cargo centre.

Within the framework of the building project, transshipment complexes will be built in 2016-2020. The planned car terminal will, when completed in 2016, handle at least 250 000 cars annually. By the end of the second construction phase in 2020 three more transshipment complexes for handling of containers, metal and refrigerated cargo have been completed. The port is able to handle 1 million TEUs when completed (Port Baltimor).

### *St. Petersburg*

The development programme of port infrastructure in St. Petersburg up to 2015 envisages a terminal for ferrous metals with an annual capacity of 2 million tonnes, multipurpose handling facilities with an annual capacity of 3 million tonnes, the second stage of the container terminal with an annual capacity of 1.2 million TEUs and a second phase of the car terminals with the annual capacity of 170 000 units. The modernisation programme enables double throughput capacity of the port (Sea Port of Saint-Petersburg).

## **3.2 Poland**

### *Gdansk*

After massive investments Gdansk Deepwater Container Terminal became operational 1st of June 2007. Phase one of the terminal construction was completed in October 2007. As a result, the terminal reached an annual throughput capacity of 500 000 TEUs. In 2011, the terminal handled over 641 000 TEUs. Gdansk is the fastest growing container hub in the Baltic Sea, holding a share of more than 57 per cent of Poland's container shipping market. Its throughput capacity, which recently has been expanded by a new storage facility, enables an annual handling of approximately 1.25 million TEUs. The project is being finalised with the object to expand the capacity of the deepwater container facility up to 4.5 million TEUs.

One of Gdansk's strategic goals is to develop its function as a Baltic container hub and to attain the position as fuel and dry bulk distribution port. Preparations are underway on expansion of the coal terminal and construction of the dry bulk terminal suited for handling cargo, such as export and import of coal, iron ore, aggregate and grain. Gdansk has a significant role in guaranteeing Poland's energy supply safety. Future growth of this potential represents a key element in the strategy. The immediate scope of activity in this regard includes the construction of a PERN Liquid Fuel and Oil Storage-Handling Base in the deep-water part of the port (Port of Gdansk).

## Gdynia

Baltic Container Terminal (BCT) in Gdynia has an investment program of PLN 153 million (EUR 37.3 million) thus increasing the container handling capacity from 750 000 TEUs to 1.2 million TEUs. One focus point of the investment is to help improve intermodal connectivity and this is to be done in co-operation with the Port Authority of Gdynia. The latter has decided to dredge the port's channels to 15.5 metres in depth, in order to build an appropriate turning basin for mega vessels and to reconstruct the quay wall at BCT. The investment should be completed in 2015 (Port of Gdynia).

*Poland strives to become the Baltic Sea container hub*

### 3.3 Sweden

#### Nynäshamn – Norvikudden

The services of Värtahamnen, the largest port member of Ports of Stockholm, will be relocated to Norvikudden in Nynäshamn, 60 kilometres south of Stockholm. As a result, Värtahamnen will be reconstructed to offer housing, commercial and office facilities, whereby the port will specialise in serving ferry and cruise traffic.

The Stockholm-Nynäshamn is planned to serve rolling goods and container traffic when fully completed. The new port will cover 44 hectares of land and accommodate seven quay-berths, with a total length of 1 400 meters. Four out of seven quays will serve container handling with a total quay length of 800 metres. In full capacity the port is able to handle 300 000 containers and 200 000 Ro-Ro units. A railway will lead to the port enabling also train-ferry traffic. A business park and logistics centre will be constructed in association with the port. The construction of the port will be initiated as soon as the terms and conditions of the construction permission have been established. The first vessel call is anticipated to

*Swedish port investments focus on containers, Ro-Ro and co-modalism*

take place in three years' time. The entire investment is estimated to amount to SEK 1.7 billion equalling EUR 194 million (Port of Stockholm).

#### Malmö

Norra hamnen of Malmö came into operation in 2011. All container and Ro-Ro activities have been shifted to new terminals. The port development entailed also the construction of a combi-terminal allowing the handling of goods transported by trains. The port believes in strongly increasing future co-modalism. The port anticipates the number of trailers and containers transported to and from the port by rail to grow by 30-40 per cent. The City of Malmö has invested SEK 1 billion (EUR 114 million) on terminals and facilities making it the biggest Swedish port investment in decades. The port development programme includes also the construction of a new logistics centre operating in full capacity in 2015-2016 (Copenhagen-Malmö Port).



*Architect view of rebuilt Värtahamnen after removal of port functions to Nynäshamn (WSP/Stockholms Hamnar).*

### 3.4 Estonia

#### *Sillamäe*

The Port of Sillamäe, situated in the north-eastern part of Estonia, is constructing a new container terminal with access roads which should be in operation in mid-2013. The land area of the container terminal covers 40 hectares. The port investment includes the construction of 900 quay metres with quay-side water depth of 14.5 metres (Port of Sillamäe).

#### *Paldiski*

The harbours of Paldiski and Muuga are part of Port of Tallinn which consists of a cluster of five individual harbours including also the harbours of the Old City, Paljassaare and Saaremaa.

A remarkable proportion of Port of Tallinn's investments are allocated to Paldiski harbour and surrounding areas to construct a business park. The core activity of the harbour is focused on handling Estonian export and import cargo and transit cargo. Mainly Ro-Ro cargo, scrap metal, timber, peat and oil products are handled there. Developing fields of activity include transit of new cars for neighboring markets and pre-sale service (Port of Tallinn).

#### *Muuga*

Rail Garant has initiated the construction of a new container terminal in Muuga. The terminal is intended for operation in the first quarter of 2013 with an annual capacity of 120 000 TEUs. In full capacity, by the end of year 2016, the port is able to handle up to 400 000 TEUs annually, more than twofold compared with the present-day capacity. Land areas will be reclaimed for the use of the port and transit terminal for process production of the surrounding industrial park (Port of Tallinn).



*Paldiski harbour (Port of Tallinn).*



## 4 MARITIME TRANSPORT IN FINLAND 2001-2011

Finland's overall maritime transport volume trend was moderately positive and even until 2008, followed by a significant fall and subsequent recovery in volumes. The difference between traditionally higher import levels compared with export levels, narrowed until 1999, where after the imports started to develop stronger in comparison to exports.

The total maritime transport volumes including domestic coastal traffic have increased by 16.6 million tonnes from 90.3 million tonnes in 2001 to 107 million tonnes in 2011, representing a relative growth of 18 per cent (Finnish Transport Agency). Of the 16.6 million tonne growth, 14 million came from international volumes and the remaining 2.6 million from domestic coastal volumes. The overall international transport volumes have grown by 17 per cent and the domestic traffic by 46 per cent during 2001-2011. The share of domestic traffic volumes in relation to overall transport volumes has accounted for 5-8 per cent during 2001-2011.

When comparing 2011 to 2006 volumes, the overall volumes transported have increased by 2.1 million tonnes (+2%), which has been supported by the growth of 2.7 million tonnes (+49%) in domestic traffic volumes whilst international volumes simultaneously have seen a 643 000 tonne loss (-0.6%).

### 4.1 International maritime transport

The overall Finnish maritime transport volume<sup>1</sup> in foreign trade, thus excluding domestic traffic, has grown from 84.5 million to 98.5 million tonnes during 2001-2011, which represents a relative growth of 16.5 per cent (Finnish Transport Agency). The total volumes reached their peak years in 2007 and 2008, when the overall volumes exceeded 100 million tonnes. During 2001-2006 the relative volume growth was 17.3 per cent, whereas during 2006-2011 the development was reverse representing a decline of 0.6 per cent.

Exports constituted 47 per cent and imports 53 per cent out of total volumes shipped in 2001. The corresponding ratios for 2006 and 2011 were 45 and 55 per cent, demonstrating a shrinking export volume share. This trend was even more notable during the peak years of 2007 and 2008, when the share additionally dropped with a few percentage points to 44 and 43 per cent.

<sup>1</sup> International volumes include both Finnish import and export volumes as well as transit traffic volumes.

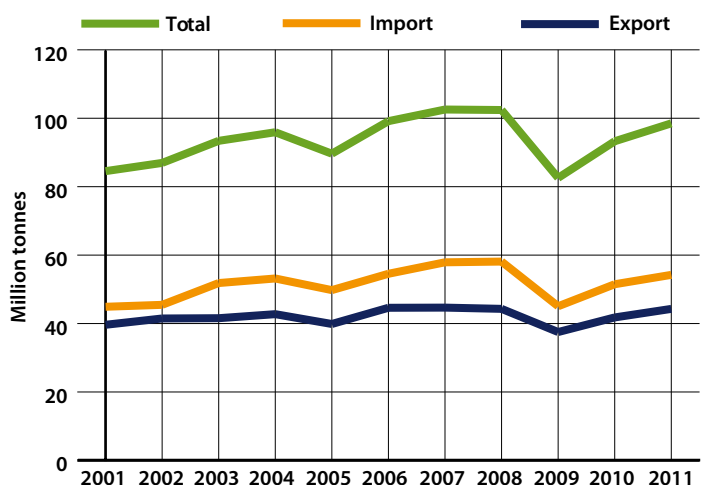


Figure 9. Finnish seaborne import, export and total cargo volumes handled in foreign trade in 2001-2011 (Finnish Transport Agency).

## Import

Import volumes in international seaborne trade have grown from 44.9 million tonnes in 2001 to 54.2 million in 2011 i.e. +9.3 million tonnes or 21% (Finnish Transport Agency). During this period import in comparison to export has shown a more dynamic development with a growth of 21 per cent versus 12 per cent.

Apart from 2009, the Finnish seaborne import has exceeded 50 million tonnes during 2006-2011 being close to 60 million tonnes before the global economic downturn. The 2011 import volumes were still 0.3 million tonnes (-0.6%) below the 2006 volume of 54.5 million tonnes.

The interdependence of import volume and total import value development<sup>2</sup> is presented in Figure 10. In 2001-2011, the import volume fell by 2 per cent from 40.3 million tonnes to 39.6 million tonnes, while the value on the other hand grew by impressive 51 per cent from 32.5 billion euros to 49.0 billion euros (Finnish Customs).

The import value increased steadily during 2001-2008 from 32 billion to 52 billion euros (+61%), while the volume development was more irregular (+6%). Both volume and value dropped by 30 per cent in 2009, where after growth was regained. The positive development in 2009-2011 has been somewhat stronger for the value development (+34%) compared to volume development (+28%).

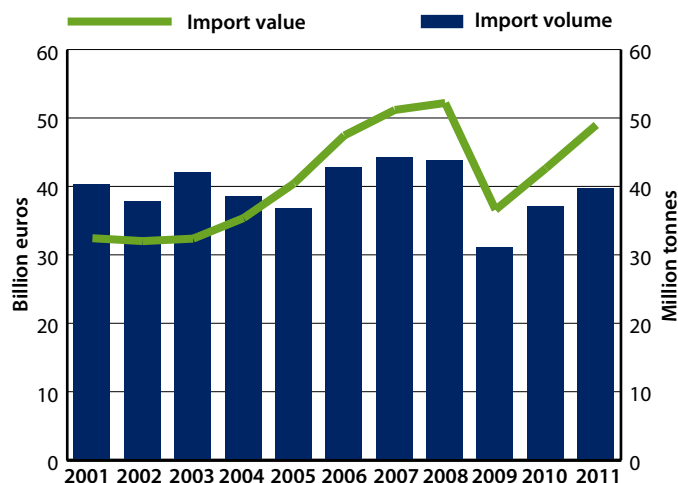


Figure 10. Import volume and value development in 2001-2011.

<sup>2</sup> Volume data covers maritime import in tonnes whereas value covers the overall value of Finnish imports in euros. Russian import volumes and value are excluded due to a large share of land based transport.

## Export

The Finnish seaborne export has grown by 4.6 million tonnes (+12%) from 39.6 million tonnes in 2001 to 44.3 million tonnes, in 2011. The peak years during this period were experienced in 2006 and 2007 both years representing volumes in excess of 44.3 million tonnes.

The Finnish export has remained during 2006-2011, apart from the 2009 set-back down to 37.5 million tonnes, above 40 million tonnes. In 2006-2011, the export decreased by 0.7 per cent. Compared to import, export has developed slower from 39.6 million tonnes in 2001 to 44.3 million tonnes in 2011, which equals a growth of 4.6 million tonnes or a relative growth of 12 per cent.

The interdependence of export volume and total export value development<sup>3</sup> is presented in Figure 11. In 2001-2011, the export volume grew by 12 per cent from 39.2 million tonnes to 44.1 million tonnes, while the value on the other hand grew by 14 per cent from 45.0

billion euros to 51.3 billion euros (Finnish Customs). The export value increased during 2001-2008 from 45 billion to 58 billion euros (+29%), while the volume development was more modest (+12%). Both volume and value dropped in 2009; value by 29 per cent and volume by 15 per cent, where after growth was regained. The positive development in 2009-2011 has been stronger for the value development (+25%) compared to volume development (+18%).

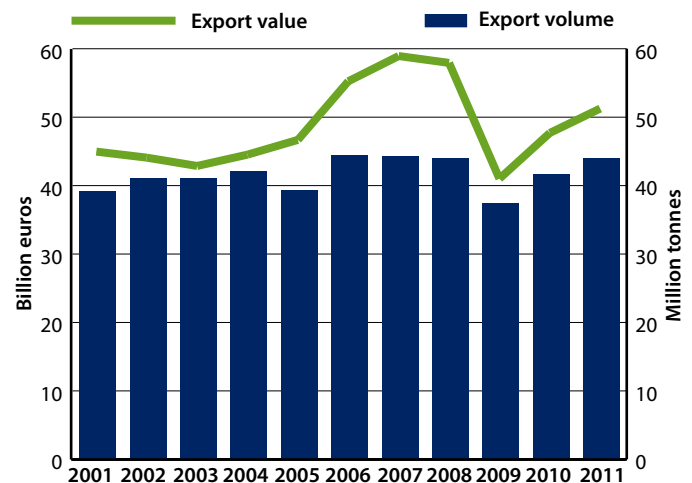


Figure 11. Export volume and value development in 2001-2011.

<sup>3</sup> Volume data covers maritime export in tonnes whereas value covers the overall value of Finnish exports in euros. Russian export volumes and value are excluded due to a large share of land based transport.

## Distribution of cargo types

The seaborne commodities presented in Figure 12 can be grouped into three main categories; dry bulk, liquid bulk and other dry cargo. Other dry cargo forms the biggest cargo type in Finnish international maritime traffic (39%) followed by dry bulk (32%) and liquid bulk (29%), in 2011 (Finnish Transport Agency).

Other dry cargo, still being the biggest cargo type transported in 2011, has experienced shrinkage in terms of percentage share among all cargo types over the past years. For liquid bulk and dry bulk the development has been the opposite. In 2001, a total of 37.6 million tonnes of other dry cargo was transported, which in absolute volumes was 1 million tonne less than in 2011. During the same period dry bulk has grown with 6.9 million tonnes from 24.7 million in 2001 to 31.6 million or 28 per cent, in 2011. The transportation of liquid bulk has grown by 6.1 million tonnes from 22.1 million in 2001 to 28.3 million in 2011, also representing an increase of 28 per cent.

The transportation of other dry cargo is export dominated if compared with imports. In 2001, the share of exports accounted for 70 per cent, whereas in 2011 the share had diminished with 5 per cent to 65 per cent. The export of other dry cargo has diminished by 2 million tonnes (-8%) from 27 million to 25 million, whereas import on the contrary has increased by 3.1 million tonnes (+29%) from 10.6 million to 13.7 million tonnes during 2001-2011.

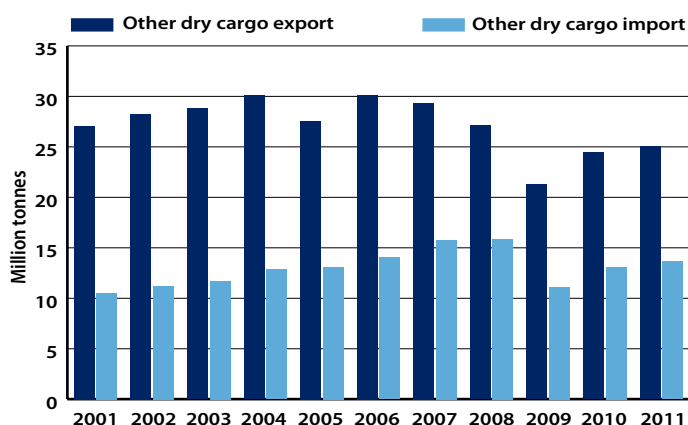


Figure 13. Balance of other dry cargo export and import in 2001-2011.

Dry bulk transportations are concentrated to commodity import. In 2001, the share of imports covered 80 per cent of all volumes transported. In 2011, the share of exports increased taking down the share of imports to 72 per cent. The export of dry bulk has shown the strongest relative growth among different cargo types (+75%), although the absolute amounts transported simultaneously are the lowest. Dry bulk export has grown from 5.0 million tonnes in 2001 to 8.8 million tonnes, in 2011. Imports on the other hand have grown by

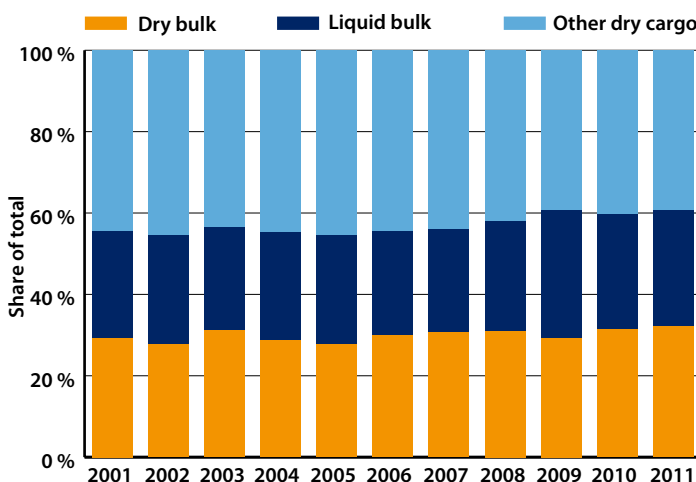


Figure 12. Finnish cargo type distribution in 2001-2011.

3.1 million tonnes (+16%) from 19.7 million tonnes in 2001 to 22.8 million tonnes, in 2011.

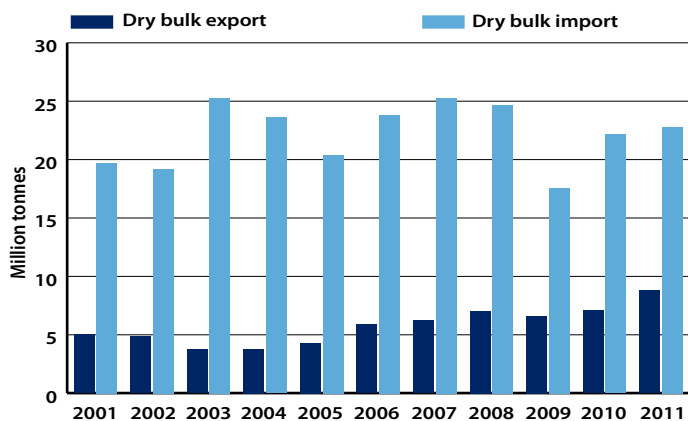


Figure 14. Balance of dry bulk export and import in 2001-2011.

The balance between liquid bulk import and export in 2001 was 65:35, in favour for import. In 2011, the ratio was 63:37, respectively. The export of liquid bulk has increased with 2.9 million tonnes (+39%) during 2001-2011 from 7.5 million tonnes to 10.5 million tonnes. Correspondingly, import of liquid bulk has grown from 14.6 million tonnes to 17.8 million tonnes (+3.1 million tonnes or 22%).

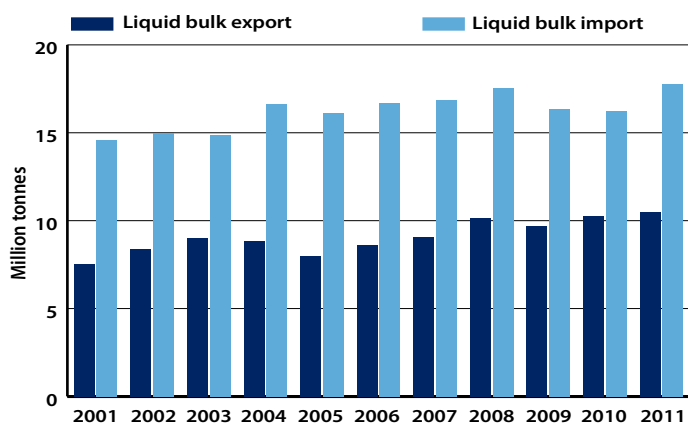


Figure 15. Balance of liquid bulk export and import in 2001-2011.

## 4.2 Transport units

### Containers

The development of containers measured in TEUs has been relatively strong during 2001-2011, growing from 975 000 handled TEUs in 2001 to 1.4 million TEUs in 2011, representing an absolute growth of 420 000 TEUs (+43%). After the major drop and a loss of almost a third in 2009, the number of containers have again started to show a growth trend, which seems even steeper than before 2009. In 2011, the level of 2006 was regained i.e. a volume of 1.4 million TEUs.

### Trucks and trailers

The number of trucks and trailers passing through the Finnish ports amounted to 516 000 units, in 2001. In 2011, the corresponding figure was 889 000 units which is 373 000 more (+72%) than in 2001 (Finnish Transport Agency). Compared with 2006 the number of trailers and trucks have increased by 34 000 units (+4%).

The peak year for trucks and trailers were in 2008, where after the volumes dropped with 20 per cent, in 2009. The aforementioned reduction of trucks and trailers was much more moderate compared to the drop experienced in container handling. Truck and trailer traffic also recovered quicker, thereby showing less sensitivity for economic fluctuations.

### Train wagons

The general development in train wagons has been sad. Still in 2001, more than 26 000 train wagons passed through the Finnish ports whereas only 3 150 wagons were handled in 2011, representing a dramatic decline of 88 per cent (Finnish Transport Agency). In 2006, the number of train wagons had almost halved to 14 700 from the 2001 figure.

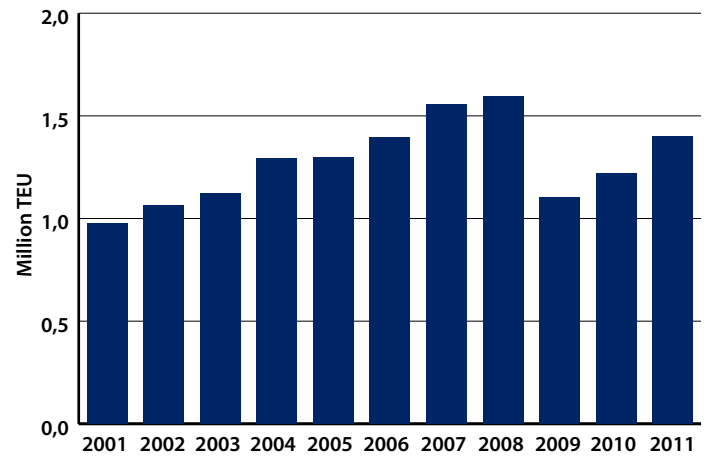


Figure 16. Container handling development in 2001-2011 (Finnish Transport Agency).

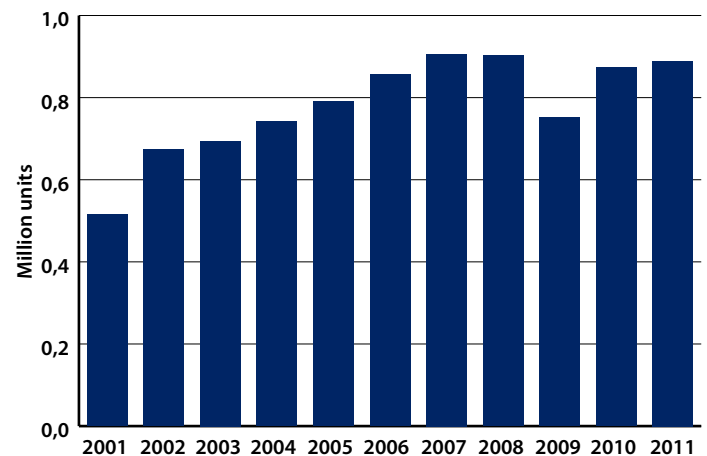


Figure 17. Development of trucks and trailer units in 2001-2011 (Finnish Transport Agency).

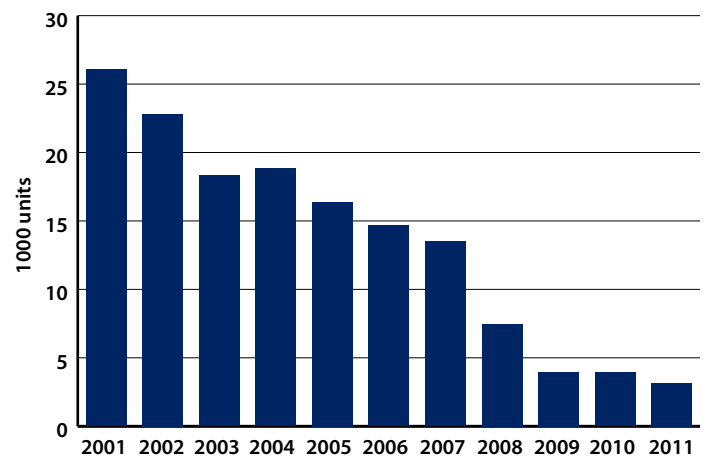


Figure 18. Development of train wagons in 2001-2011 (Finnish Transport Agency).



### 4.3 Finland's main trading partner countries by maritime traffic volumes

A good share of goods transported in Finnish international maritime traffic entails transshipment in European hub ports and should thereof be taken into consideration when analysing volumes and shares of direct connections from/to Finnish ports presented hereinafter. The total volume of Finnish maritime exports in 2001 was 39.6 million tonnes, while in 2011 the corresponding figure was 44.3 million tonnes (+4.6 million tonnes or 12%). In 2001, Europe's (including the EU countries and the rest of Europe) share of total seaborne exports was 86 per cent being 34.2

million tonnes and in 2011 84 per cent amounting to 37.1 million tonnes. Despite a volume growth of about 3 million tonnes (+8%), Europe's share of Finland's total maritime exports declined by 2.6 percentage points. The significance of the Baltic Sea ports as ports of destination on the other hand increased during this time, both by total volume and share. Total exports to Baltic Sea ports were 14.6 million tonnes in 2001 and 17.7 million tonnes in 2011, in percentage terms 37 and 40 per cent of Finnish total exports by sea. For Baltic Sea ports the growth was 21 per cent.

Table 2. Maritime transport volumes to/from Finland by origin/destination areas

		2001		2011	
		Million tonnes	% of total	Million tonnes	% of total
<b>From</b>					
	All European ports	42.5	95 %	50.9	94 %
	Baltic Sea ports	28.2	63 %	36.8	68 %
	Inbound total	44.9	100 %	54.2	100 %
<b>To</b>					
	All European ports	34.2	86 %	37.1	84 %
	Baltic Sea ports	14.6	37 %	17.7	40 %
	Outbound total	39.6	100 %	44.3	100 %
<b>Inbound and outbound</b>					
	All European ports	76.7	91 %	88	89 %
	Baltic Sea ports	42.8	51 %	54.5	55 %
	Total	84.5	100 %	98.5	100 %

Seaborne imports to Finland grew by 20.8 per cent, during 2001-2011. In 2001, the volume was 44.9 million tonnes and 54.2 million tonnes in 2011, marking a 9.3 million tonne growth. European ports increased in importance as ports of origin when comparing the volumes of 2001 (42.5 million tonnes) and 2011 (50.9 million tonnes), an increase of 20 per cent. Europe's share of all import shipments declined slightly during this period, from 95 per cent to 94 per cent. The import volumes from the Baltic Sea ports to Finland increased from 28.2 million tonnes to 36.8 million tonnes (+8.5 million tonnes or 30%). The Baltic Sea ports' share of total seaborne imports was 63 per cent in 2001 and 68 per cent in 2011.

Finland's main trading partners measured in total volumes and shares per total volumes in 2011 were Sweden (15.5 million tonnes, 15.8% share), Germany (15.7 million tonnes, 15.6% share), Russia (14.8 million tonnes, 15.0% share), the Netherlands (8.7 million tonnes, 8.8 % share) and Estonia (6.1 million tonnes, 6.2% share). The joint share of these five countries has grown from 50.5 and 60.6 per cent in 2001 and 2006, to 61.5 per cent in 2011 (Finnish Transport Agency).

All countries, except for Germany, have gained volumes during 2001-2011. The highest volume increases are represented by Russia (+9.8 million tonnes or 195%), the Netherlands (+3.6 million tonnes or 73%) and Sweden (+3.2 million tonnes or 26%). Relatively measured Estonia surpasses Sweden with a 45 per cent growth, which equals an absolute increase of 1.9 million tonnes (Finnish Transport Agency).

*Major growth in volume between Finland and Russia is based on increasing oil imports*

#### *Finland's main trading partner countries by seaborne import*

Finland's major import trading partners consisted in 2011 of Russia (27% share), Sweden (16% share), Germany (11% share), Latvia (8% share) and Estonia (7% share). Over the period 2001-2011, all main trading partners have increased their volumes shipped to Finland. Russia has increased its volumes with 10.0 million tonnes from 4.6 million in 2001 to 14.6 million (+219%) in 2011 due to increasing transportation of oil.

Finland imported from Sweden 8.8 million tonnes of goods, which was 1.4 million tonnes more (+19%) than in 2001. Commodity volumes from Germany have increased by 0.8 million tonnes (+16%), Latvia by 0.3 million tonnes (+8%) and Estonia by 0.7 million tonnes (+23%). However, Sweden, Germany and Estonia were in 2011 below the volumes of 2006; Sweden (-0.5 million tonnes or 6%), Germany (-1.5 million tonnes or 21%) and Estonia (-0.15 million tonnes or 4%). In 2011, the TOP5 import countries jointly accounted for 69 per cent of all import volumes in foreign seaborne traffic, whereas in 2001 the TOP5 countries accounted for 57 per cent.

#### *Finland's main trading partner countries by seaborne export*

In 2011, Finland's major export trading partners consisted of Germany (21% share), Sweden (15% share), the Netherlands (13% share), Great Britain (7% share) and Belgium (7% share). Over the period 2001-2011, Finland has managed to increase its exports to Sweden and the Netherlands only (Finnish Transport Agency).

Export to Sweden has grown by 1.8 million tonnes (+37%) from 4.9 million tonnes in 2001 to 6.7 million tonnes in 2011 and the volumes to the Netherlands have grown by 2.8 million tonnes (+98%) from 2.8 million tonnes to 5.6 million tonnes. Simultaneously, export volumes to Germany have dropped by 1.4 million tonnes (-13%) from 10.8 million tonnes to 9.4 million tonnes. Correspondingly, the export to Great Britain fell by 1.5 million tonnes from 4.8 million to 3.2

million tonnes (-32%). Belgium has shown a minor decline of 50 thousand tonnes (-2%) from 3.07 million tonnes to 3.02 million tonnes. Germany and Great Britain are the only two countries that have showed negative volume development both during the periods 2001-2006 and 2006-2011.

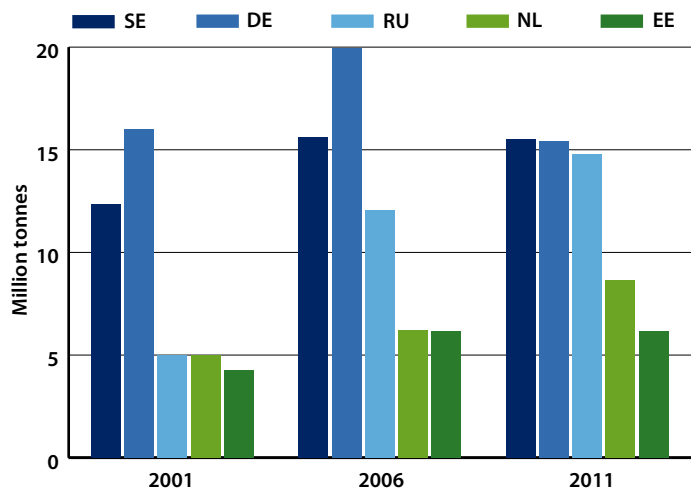


Figure 19. Volume development of TOP5 trading partners in 2001-2006-2011 (Finnish Transport Agency).

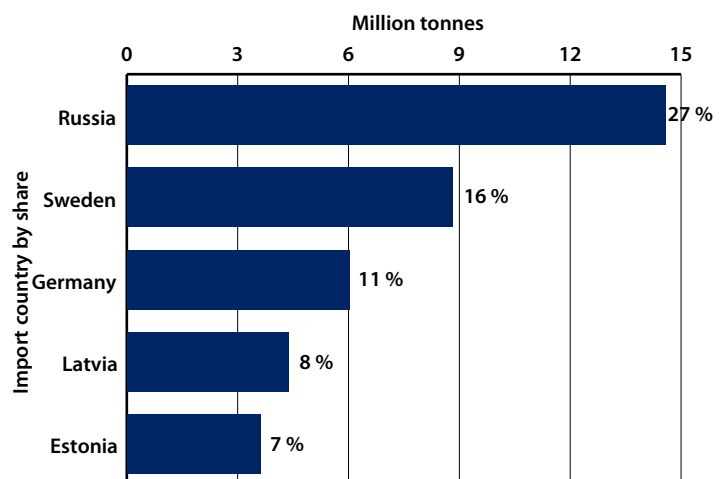


Figure 20. Shares of main import countries (ports of origin) in 2011 (Finnish Transport Agency).

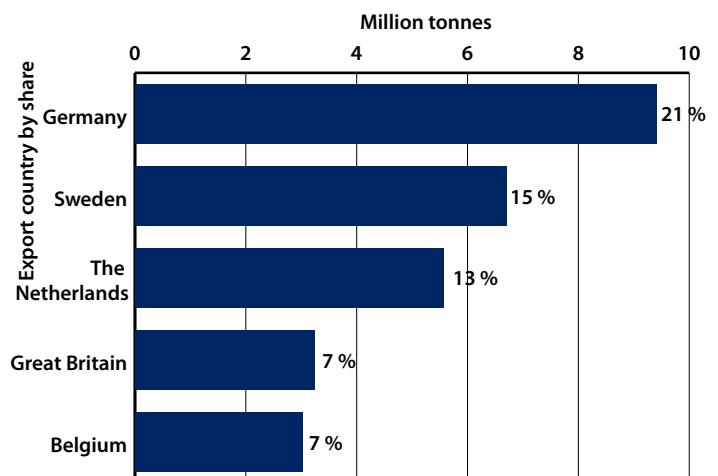


Figure 21. Shares of main export countries (ports of destination) in 2011 (Finnish Transport Agency).

#### 4.4 Import commodity development by country/ port of origin

Finland imported 54.2 million tonnes of commodities in 2011. The main commodities volume wise imported comprised crude oil, general cargo, and coal and coke. These commodities were followed by ores and concentrates, crude minerals and cement, oil products and timber and woodchips.

The top three commodities alone accounted for 49 per cent of the total import volumes out of which crude oil accounted for 19 per cent, general cargo 16 per cent and coal and coke 14 per cent. There have not been marked changes in the shares over the period 2001-2011.

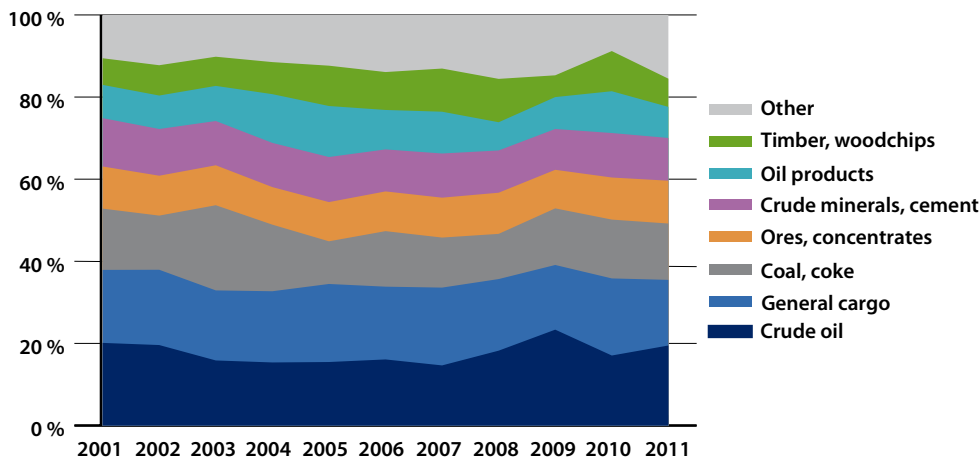


Figure 22. Distribution of main import commodities in 2001-2011 (Finnish Transport Agency).

Table 3. Main import commodities in 2001, 2006 and 2011 (Finnish Transport Agency).

	Types of commodities (tonnes)						
	Crude oil	General cargo	Coal, coke	Ores, concentrates	Crude minerals, cement	Oil products	Timber, woodchips
<b>2001</b>	9 036 072	7 983 394	6 701 851	4 608 876	5 286 286	3 637 722	2 911 657
<b>2006</b>	8 778 540	9 667 643	7 376 809	5 278 061	5 578 251	5 242 179	5 034 964
<b>2011</b>	10 567 786	8 666 500	7 442 669	5 657 022	5 640 505	4 106 092	3 725 278
<b>% change 2006-11</b>	20 %	-10 %	1 %	7 %	1 %	-22 %	-26 %
<b>% change 2001-11</b>	17 %	9 %	11 %	23 %	7 %	13 %	28 %

The total import volumes have risen during 2001-2011 with 9.3 million tonnes or by 21 per cent. The most noteworthy volume development expressed in absolute terms has taken place for crude oil (+1.5 million tonnes), ores and concentrates (+1.0 million tonne) and timber and woodchips (+0.8 million tonne). The strongest relative growth during 2001-2011 has occurred for timber and woodchips (+28%), ores and concentrates (+23%) and crude oil (+17%).

The origin and volumes of Finland's seven main import commodities in 2011 are listed in Table 4. The absolute majority (9.3 million tonnes) of imported crude oil originates from Primorsk in Russia followed by several Norwegian ports exporting even but significantly smaller quantities of crude oil each.

General cargo is shipped to Finland predominantly from Germany, Sweden and Estonia.

The import of coal and coke has within the Baltic Sea its origin in Russia, Latvia and Poland. Coal and coke is also transported to Finland from overseas origins including the United States and Canada.

A vast majority (3.6 million tonnes) of ores and concentrates is transported to Finland from Luleå and crude minerals from Storugn in Sweden. Oil products are mainly transported from Latvia, Russia and Sweden but also from the Netherlands and Great Britain.

Timber and woodchips come to Finland predominantly from the eastern parts of the Baltic Sea, namely Latvia, Estonia and Russia.

Table 4. Import countries and main ports of origin per commodity type in 2011.

Commodity <sup>[1]</sup>	Country <sup>[2]</sup> and port of origin <sup>[3]</sup> in descending volume order (1000 tonnes)				
Crude oil	RU 9 326	NO 1 242	-	-	-
	Primorsk	Several Norwegian ports			
General cargo	DE 3 096	SE 2 332	EE 1 350	BE 676	NL 511
	Hamburg, Travemünde, Lübeck, Bremenhaven	Stockholm, Kapellskär	Tallinn	Antwerpen	Rotterdam
Coal, coke	RU 3 507	LT 1 705	US 423	PL 354	CA 350
	Gulf of Finland ports	Riga	North Atlantic & Gulf of Mexico ports	Gdansk, Stettin	Pacific Ocean ports
Ores, concentrates	SE 3 596	NL 657	IE 225	CA 162	DE 153
	Luleå	Rotterdam	Dublin and others	Atlantic and Pacific Ocean ports	North Sea ports
Crude minerals, cement	SE 1 383	NO 577	EE 439	GB 435	DE 416
	Storugn and others	Verdal and others	Tallinn	Fowey, Plymouth	Wismar, River Rhein, North Sea ports
Oil products	LT 905	RU 734	SE 448	NL 302	GB 259
	Riga, Ventspils	Kaliningrad	Gothenburg, Nynäshamn	Rotterdam	Various North Sea ports
Timber, woodchips	LT 1 222	EE 1 147	RU 765	FR 173	SE 112
	Riga	Pärnu and others	St.Peterburg	Atlantic and Pacific Ocean ports	Various Swedish ports

<sup>[1]</sup> Commodity groups are presented in descending total volume order from top to bottom and the largest countries within a commodity group from left to right

<sup>[2]</sup> BE=Belgium, CA=Canada, DE=Germany, EE=Estonia, FR=France, GB=Great Britain, IE=Ireland, LT=Latvia, NL=The Netherlands, NO=Norway, RU=Russia, SE=Sweden and US=The United States of America

<sup>[3]</sup> The principal ports of origin are represented in descending volume order where possible by port or region

## 4.5 Export commodity development by country/ port of destination

Finland exported 44.3 million tonnes of commodities in 2011. The main commodities volume wise exported comprised paper and paperboard, oil products and general cargo. These commodities were followed by ores and concentrates, chemicals, sawn wood, wood pulp and metals and metal manufactures.

The top three commodities alone accounted for 50 per cent of total export volumes of which paper and paperboard accounted for 20 per cent, oil products 16 per cent and general cargo 14 per cent.

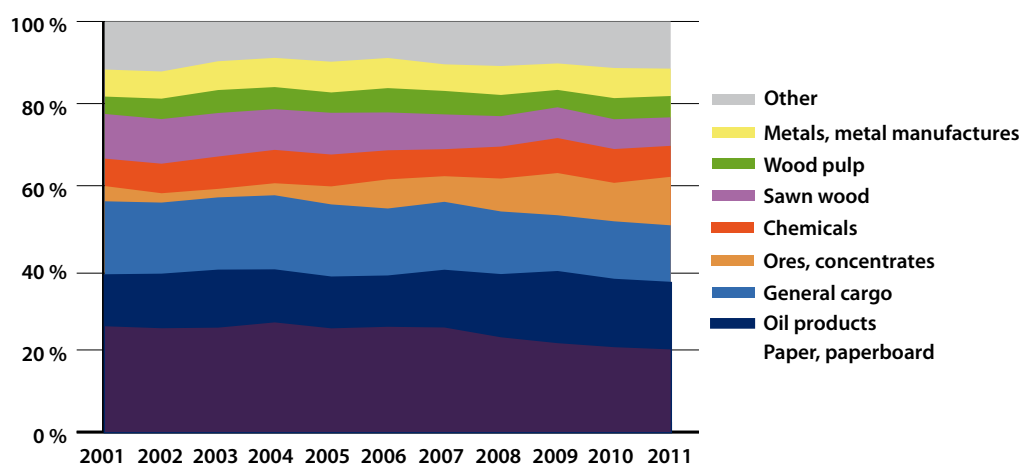


Figure 23. Distribution of main export commodities in 2001-2011 (Finnish Transport Agency).

Table 5. Development of the main export commodities in 2001-2011 (Finnish Transport Agency).

	Types of commodities (tonnes)						
	Paper, paperboard	Oil products	General cargo	Ores, concentrates	Chemicals	Sawn wood	Wood pulp
2001	10 212 917	4 891 017	7 174 903	1 467 059	2 650 288	4 310 757	1 679 987
2006	11 435 299	5 433 896	7 419 005	3 163 428	3 159 662	4 114 587	2 640 885
2011	8 914 227	7 147 538	6 234 460	5 233 612	3 338 368	3 075 684	2 299 236
% change 2006-11	-22 %	32 %	-16 %	65 %	6 %	-25 %	-13 %
% change 2001-11	-13 %	46 %	-13 %	257 %	26 %	-29 %	37 %

The total export volumes have risen during 2001-2011 no more than 4.6 million tonnes or 12 per cent. The most significant volume development expressed in absolute terms has taken place for ores and concentrates (+3.7 million tonnes), oil products (+2.3 million tonnes) and chemicals (+0.7 million tonnes). Correspondingly, the most substantial relative growths during 2001-2011 have been seen among ores and concentrates (+257%), oil products (+46%) and wood pulp (+37%). The export volumes have diminished for sawn wood (-1.2 million tonnes or 29%), paper and paperboard (-1.3 million tonnes or 13%) and general cargo (-0.9 million tonnes or -13%).

The destinations and volumes of Finland's main export commodities are presented in Table 6. The largest commodity by volume exported from Finland in 2011 comprised paper and paperboard, shipped above other to German ports of Lübeck, Bremenhaven and Hamburg entailing altogether 3.7 million tonnes. Finnish paper also had markets in Belgium, Sweden, Great Britain and the United States.

Oil products produced in Finland were exported to several ports in Sweden, but for the more part to the ports of Sundsvall and Stockholm. In Europe oil products were furthermore exported to Rotterdam and Amsterdam in the Netherlands and Antwerpen and Gent in Belgium. Overseas destinations included Montreal in Canada and New York in the United States. The export of general cargo found the same itinerary as commodity import; Sweden at the head.

Ores and concentrates had a more exotic grouping of destination countries with China in the lead with 2.5-times bigger volumes than the runner-up Great Britain. Not unexpectedly, oil products had their biggest markets in the Netherlands and Belgium. Sawn wood was, except for Germany and other European countries, widely transported to Northern African countries such as Egypt and Algeria. The three biggest wood pulp importers comprised Belgium, Great Britain and Germany.

Table 6. Export countries and main ports of destination per commodity type in 2011.

Commodity	Country <sup>[1]</sup> and port of destination <sup>[2]</sup> in descending volume order (1000 tonnes)				
Paper, paperboard	DE 3 719	BE 948	SE 803	GB 792	US 703
	Lübeck, Bremenhaven, Hamburg	Antwerpen	Gothenburg	Hull, Tillbury	Baltimore and N.&S. Atlantic ports
Oil products	SE 2 213	NL 1 076	CA 798	BE 448	US 442
	Sundsvall, Stockholm and others	Rotterdam, Amsterdam	Montreal	Antwerpen, Gent	New York
General cargo	SE 2 231	DE 1 611	EE 1 308	BE 365	NL 267
	Stockholm, Kapellskär	Hamburg, Bremenhaven, Travemünde	Tallinn	Antwerpen	Rotterdam
Ores, concentrates	CH 2 490	GB 982	IT 287	NL 274	EE 216
	Various Chinese ports	Immingham	Various Italian ports	Rotterdam, Ijmuiden	Tallinn
Chemicals	NL 791	BE 612	SE 500	DE 400	GB 275
	Rotterdam, Amsterdam	Antwerpen	Various Swedish ports	Travemünde, Lübeck	Teesport
Sawn wood	DE 653	EG 489	GB 394	NL 335	DZ 247
	Lübeck, Hamburg	Alexandria	Hull	Rotterdam	Bejaja
Wood pulp	BE 948	GB 792	DE 771	NL 392	IT 196
	Antwerpen	Hull, Tillbury	Emden and others	Rotterdam, Vlissingen	Genova

<sup>[1]</sup> BE=Belgium, CA=Canada, CH=China, DE=Germany, DZ=Algeria, EG=Egypt, EE=Estonia, GB=Great Britain, IT=Italy, NL=The Netherlands, SE=Sweden and US=The United States of America

<sup>[2]</sup> The principal ports of destination are represented in descending volume order where possible by port or region



#### 4.6 Leading Finnish ports by total foreign trade volumes

In 2011, Finland's biggest port by total volume of 18.4 million tonnes was Kilpilahti representing a 18 per cent share of all goods handled in Finnish foreign trade.

The two other ports exceeding 10 million tonnes were HaminaKotka with 13.1 million tonnes and Helsinki with 11.1 million tonnes representing an 11 per cent share of total volumes handled in Finnish ports.

Kokkola, Naantali, Rauma, Raahe and Pori followed the aforementioned ports in ranking with volumes of 5.0 to 7.3 million tonnes representing total volume shares of 5-7 per cent.

The ports of Hanko and Oulu comprised a 3 per cent volume share each.

All ports, except for Helsinki and Pori have seen their volumes grow during 2001-2011; the biggest growths taking place in Kokkola (+4.4 million tonnes or 149%) and Raahe (+2.8 million tonnes or 129%), whereas Helsinki has experienced the biggest drop of 1.15 million tonnes (-9%).

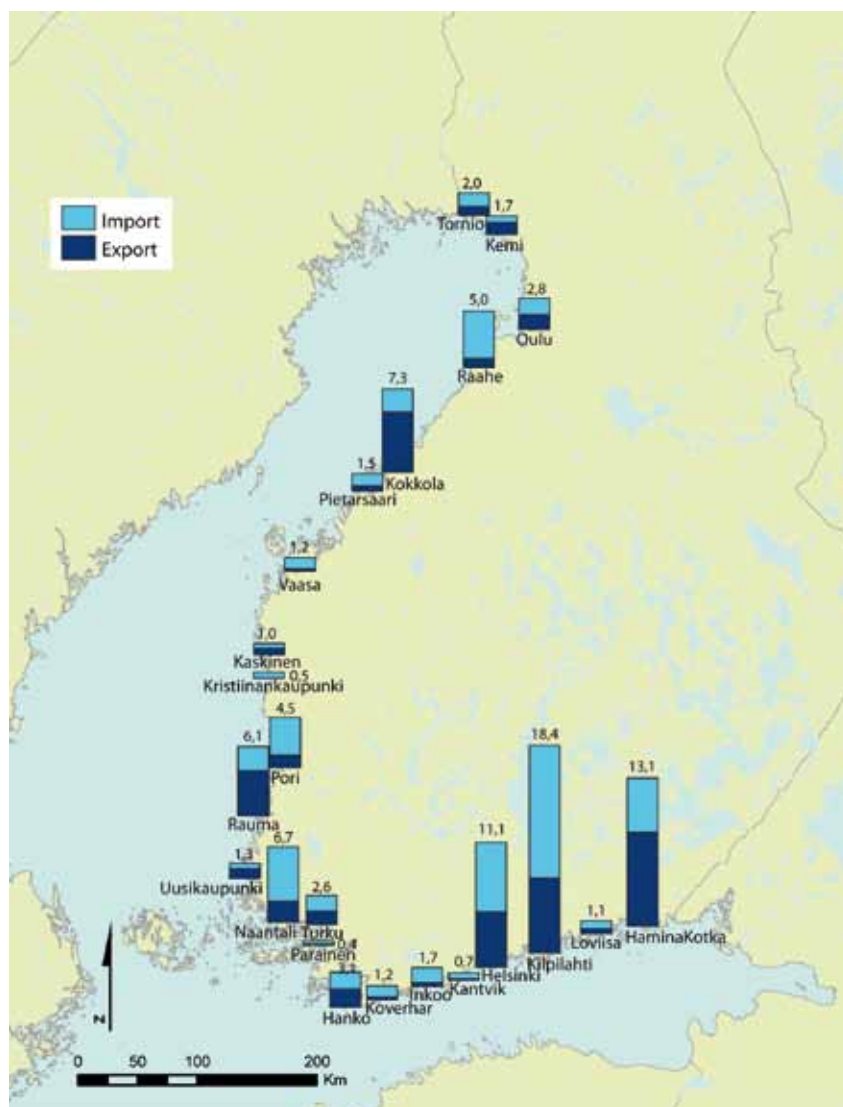


Figure 24. Map of leading Finnish ports.

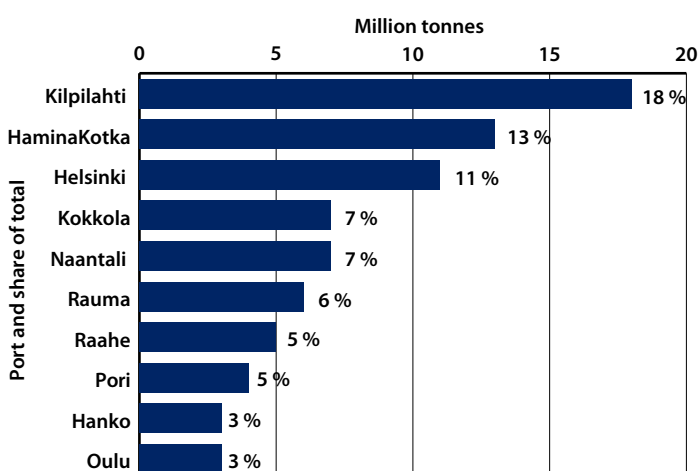


Figure 25. TOP10 Finnish ports by total volume in 2011 (Finnish Transport Agency).

#### Leading importing ports and commodity distribution

In 2011, Finland's biggest importing port was Kilpilahti with a volume of 11.8 million tonnes representing a 22 per cent share of all import goods handled in Finnish foreign trade. Kilpilahti is the major crude oil importing port in Finland serving the Neste refinery. Kilpilahti has seen its volumes grow by 3.3 million tonnes (+39%) since 2001, whereby it also has increased its share among all Finnish main importing ports from 19 per cent in 2001.

The second biggest importing port was Helsinki with only half of Kilpilahti's volumes i.e. 6.2 million tonnes, which represents an 11 per cent share of all Finnish import volumes. Over half of Helsinki's imported commodities comprise general cargo.

HaminaKotka, Naantali and Raahe formed a group of ports with above 4 million tonnes imported and shares of

8-9 per cent. Pori had import volumes of 3.3 million, which accounted for 6 per cent of all imported goods to Finland in 2011. HaminaKotka has increased its volumes by 1.7 million tonnes (+55%) from 3.1 million tonnes in 2001 to 4.8 million tonnes in 2011, thus increasing also its share with two percentage points from 7 to 9 per cent. The commodity distribution of HaminaKotka is broad and apart from crude oil all other major commodities are imported, general cargo at the head.

Raahe has doubled its import volumes from 2.0 million tonnes in 2001 to 4.2 million tonnes in 2011 (+110%) thus expanding its share from 4 to 8 per cent. Over two thirds of Raahe's import commodities come from ore and concentrate imports.

Rankings 6-10 among Finnish importing ports are occupied by the ports of Pori, Rauma, Kokkola, Hanko and Oulu, which represent import volumes of 1.4-3.3 million tonnes.

Table 7. Main commodity distribution of TOP10 Finnish importing ports in 2011 (Finnish Transport Agency).

Port	Main commodity groups of TOP10 Finnish importing ports in 2011
Kilpilahti	Crude oil (71%); Oil products (25%)
Helsinki	General cargo (55%); Other goods (17%); Coal & coke (14%)
HaminaKotka	General cargo (38%); Timber (21%); Crude minerals & cement (13%)
Naantali	Crude oil (47%); General cargo (21%); Coal & coke (17%)
Raahe	Ores & concentrates (65%); Coal & coke (20%); Crude minerals and cement (13%)
Pori	Coal and coke (25%); Ores & concentrates (13%); Crude minerals & cement (7%)
Rauma	Timber (36%); Crude mineral & cement (26%); General cargo (23%)
Kokkola	Crude minerals & cement (14%); Ores & concentrates (11%)
Hanko	General cargo (49%); Metals & metal manufactures (24%)
Oulu	Chemicals (50%); Wood pulp (23%)

#### Leading exporting ports and commodity distribution

Finland's leading exporting port in 2011 was HaminaKotka with a volume of 8.3 million tonnes. Compared to 2001 volumes of 9.1 million tonnes, HaminaKotka has lost 807 000 tonnes (-9%) of its volumes and 4 percentage points of its share among all ports from 23 per cent in 2001 to 19 per cent in 2011. As in imports HaminaKotka has a broad base of various commodities being exported. The biggest commodities exported in 2011 consisted of paper and paperboard and chemicals.

Kilpilahti, Kokkola and Helsinki follow HaminaKotka with shares over 10 per cent each and volumes extending from 4.9 million to 6.6 million tonnes. Kilpilahti has increased its volumes by 2.1 million tonnes (+45%) and Kokkola with 3.5 million tonnes (+203%) in 2001-2011. Helsinki on the other hand has lost 132 000 tonnes (-3%) during the same time. Kilpilahti has increased its percentage share among all ports from 12 to 15 per cent, Kokkola from 4 to 12 per cent, whereas Helsinki has lost 2 percentage points from 13 to 11 per cent share in 2001-2011. Almost all

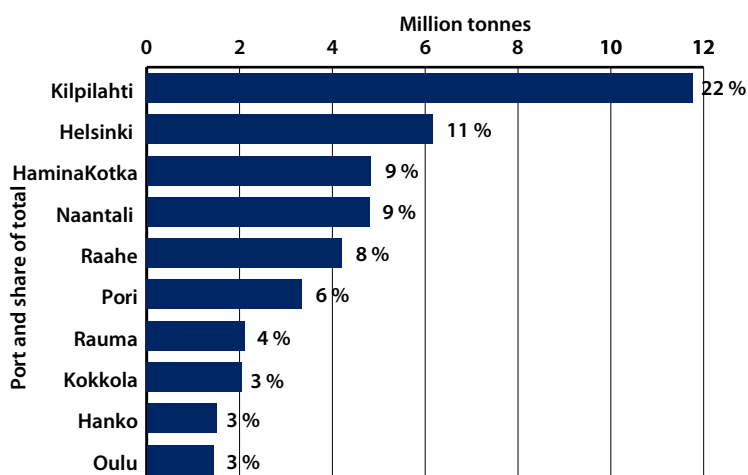


Figure 26. TOP10 Finnish ports by import volume in 2011 (Finnish Transport Agency).

commodity volumes shipped out from Kilpilahti consist of refined oil products. Kokkola on the other hand is specialised in export of ores and concentrates originating from the mines in the northern part of Finland. Over half of Helsinki's outward commodity volumes comprise general cargo.

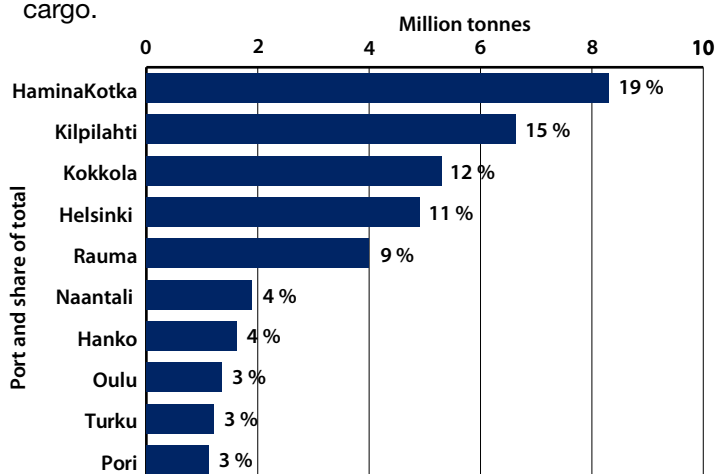


Figure 27. TOP10 Finnish ports by export volume in 2011 (Finnish Transport Agency).

Naantali, Hanko, Oulu, Turku and Pori fall under the category of ports with approximately 1-2 million tonnes of export goods handled. Of these five ports, the three first mentioned have grown their export volumes, Oulu at head with a volume growth of 604 000 tonnes (+81%), followed by Naantali with a growth of 488 000 tonnes (+35%) and Hanko with an increase of 235 000 tonnes (+17%).

The largest commodity groups in Naantali comprise oil

products and general cargo. Hanko and Oulu specialise themselves in paper and paperboard exports.

Turku and Pori have both lost volumes since 2001; Turku by 467 000 tonnes from 1.7 million (-28%) and Pori by 458 000 tonnes from 1.6 million (-29%). Turku's main commodity is general cargo and Pori specialises itself in ore and concentrate and chemical exports.

*Table 8. Main commodity distribution of TOP10 Finnish exporting ports in 2011 (Finnish Transport Agency).*

Port	Main commodity groups of TOP10 Finnish exporting ports in 2011
HaminaKotka	Paper & paperboard (36%) ; Chemicals (22%); Wood pulp (12%); Timber (11%); General cargo (5%)
Kilpilahti	Oil products (93%); Chemicals (7%)
Kokkola	Ores & concentrates (83%); Chemicals (4%)
Helsinki	General cargo (56%); Other goods (14%); Paper & paperboard (12%)
Rauma	Paper & paperboard (67%); General cargo (15%)
Naantali	General cargo (55%); Oil products (29%)
Hanko	Paper & paperboard (52%); General cargo (16%)
Oulu	Paper & paperboard (59%)
Turku	General cargo (73%)
Pori	Ores & concentrates (31%); Chemicals (19%)





## 4.7 Finland's main importing ports by commodity

### Crude oil

Crude oil constituted by far the largest commodity imported to Finland in 2011. However, the import was accumulated to two refinery ports only; Kilpilahti and Naantali. In 2011, a total of 10.6 million tonnes was imported, which was 1.5 million tonnes more (+17%) than in 2001 when 9.0 million tonnes were imported. Of the total volumes imported to Finland in 2001, the share of crude oil accounted for 17 per cent, whereas in 2011 it had increased to 24 per cent.

During 2001-2011, Kilpilahti has increased its imports by 1.6 million (+24%) to 8.3 million tonnes, whereas Naantali has more or less maintained its volumes. Kilpilahti increased its share from 74 per cent in 2001 to 79 per cent in 2011 and correspondingly Naantali lost 5 percentage points from earlier 26 per cent to 21 per cent.

### General cargo

General cargo was the second largest import commodity group. In 2011, 8.7 million tonnes of general cargo was imported, which was 683 000 tonnes more (+9%) than in 2001. Of the total volumes imported in 2011, the share of general cargo accounted for 19 per cent, whereas in 2001 it was 15 per cent.

The biggest general cargo importing port was, like in exports, Helsinki with 3.4 million imported tonnes in 2011, which was however 304 000 tonnes less (-8%) than in 2001. Helsinki was followed by HaminaKotka (1.8 million tonnes) and Naantali (1.0 million tonnes). Contrary to Helsinki these two ports have experienced growth during 2001-2011. The import of HaminaKotka has increased with 815 000

Table 9. Finnish crude oil importing ports (Finnish Transport Agency).

Commodity (1000 t)	Port		
	Year	Kilpilahti	Naantali
Crude oil	2001	6 709	2 327
	2011	8 333	2 235
% share of total 2001		74 %	26 %
% share of total 2011		79 %	21 %
Change 2001-11		1 624	-92
% change 2001-11		24 %	-4 %

tonnes (+80%) and Naantali with 198 000 tonnes (+24%). The TOP3 ports accounted for 72 per cent of all general cargo volumes in 2011 and the TOP6 ports 89 per cent. The corresponding shares in 2001 were 69 and 91 per cent.

Turku (938 000 tonnes), Rauma (479 000 tonnes) and Pori (72 000 tonnes) followed the three biggest ports in ranking. The biggest relative growth has been witnessed in Rauma representing a growth of 152 per cent in 2001-2011, whereas Turku has lost 526 000 tonnes (-36%) of its general cargo volumes since 2001. The TOP6 ports in general cargo imports accounted for 91 per cent of the general cargo volumes in 2001 and 89 per cent, in 2011.

Table 10. TOP6 general cargo importing ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		Helsinki	HaminaKotka	Naantali	Turku	Rauma	Pori
General cargo	2001	3 705	1 014	823	1 464	190	65
	2011	3 401	1 829	1 021	938	479	72
% share of total 2001		46 %	13 %	10 %	18 %	2 %	1 %
% share of total 2011		39 %	21 %	12 %	11 %	6 %	1 %
Change 2001-11		-304	815	198	-526	289	7
% change 2001-11		-8 %	80 %	24 %	-36 %	152 %	11 %

### Coal and coke

Coal and coke represented the third largest single import commodity in 2011. Coal and coke import was accumulated to ports with coal fired power plants in proximity. In 2011, a total of 7.4 million tonnes were imported representing

an increase of 741 000 tonnes (+9%) compared with 6.7 million tonnes, in 2001. Coal and coke constituted 17 per cent out of the total volumes imported to Finland in 2011, whereas the share in 2001 was 12 per cent.

The TOP3 main coal importing ports in 2011 included Pori (1.8 million tonnes), Inkoo (877 000 tonnes) and Raahe (860 000 tonnes). Pori and Raahe have increased their import of coal and coke; Pori with 397 000 tonnes (+27%) and Inkoo with 471 000 tonnes (+116%), since 2001. Raahe on the other hand has seen its volumes drop with 466 000 tonnes (-35%) from 1.3 million tonnes to 860 000 tonnes. Pori's share as coal importing port among other ports has increased from 22 per cent to 25 (+3%) per cent and Inkoo from 6 per cent to 12 per cent (+6%), whereas Raahe has lost 8 percentage points from a 20 per cent share in 2001 to 12 per cent in 2011. The TOP3 coal importing ports

accounted only for 48 per cent of the total coal volumes imported in 2011 and the TOP6 represented 77 per cent. Helsinki, Naantali and Kristiinankaupunki were ranked 4th to 6th largest coal importing ports in 2011. Naantali has increased its imported coal volumes by 438 000 (+118%) from 371 000 tonnes in 2001 to 809 000 tonnes in 2011. Helsinki has lost 159 000 tonnes (-16%) of its volumes, whereas Kristiinankaupunki represents quite even import volumes of approximately 500 000 annual tonnes. The TOP6 ports accounted for 75 per cent of total coal and coke volumes in 2001, whereas in 2011 the percentage was 77 per cent.

Table 11. TOP6 coal and coke importing ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		Pori	Inkoo	Raahe	Helsinki	Naantali	K:kaupunki
Coal, coke	2001	1 448	406	1 326	1 013	371	490
	2011	1 845	877	860	854	809	506
% share of total 2001		22 %	6 %	20 %	15 %	6 %	7 %
% share of total 2011		25 %	12 %	12 %	11 %	11 %	7 %
Change 2001-11		397	471	-466	-159	438	16
% change 2001-11		27 %	116 %	-35 %	-16 %	118 %	3 %

### Ores and concentrates

In 2011, almost 5.7 million tonnes of ores and concentrates were imported to Finland, which was 1.1 million tonne more (+23%) than in 2001 when 4.6 million tonnes were imported. In 2001, ores and concentrates comprised 8 per cent of the total Finnish import volumes, increasing in 2011 to 13 per cent (+5%).

Ores and concentrates are predominantly shipped to the port of Raahe. In 2011, more than 2.7 million tonnes were discharged in Raahe being 316 000 thousand tonnes more (+13%) than in 2001. Raahe occupied a 48 per cent share of total ore volumes imported in 2011, which was 4 percentage points less than in 2001.

Along with Raahe, Koverhar and Pori belonged to the group of TOP3 ore importing ports in Finland, both importing in excess of 700 000 tonnes, in 2011. Tornio and Kokkola belonged to ports importing more than 600 000 tonnes of ores.

The TOP3 importing ports accounted for 74 per cent share of total ore and concentrate imports in 2011 being 8 percentage points less than in 2001 thus reflecting the effect of Tornio's growing volumes, in particular. The TOP6 ports covered 97 per cent of all ore volumes imported in 2011.

Table 12. TOP6 ore and concentrate importing ports in Finland. (Finnish Transport Agency)

Commodity (1000 t)	Year	Port					
		Raahe	Koverhar	Pori	Tornio	Kokkola	Helsinki
Ores, concentrates	2001	2 403	683	868	34	580	5
	2011	2 719	727	717	672	607	68
% share of total 2001		52 %	15 %	19 %	1 %	13 %	0 %
% share of total 2011		48 %	13 %	13 %	12 %	11 %	1 %
Change 2001-11		316	44	-151	638	27	63
% change 2001-11		13 %	6 %	-17 %	1876 %	5 %	1260 %

## Crude minerals and cement

The distribution of crude minerals and cement is dispersed over many ports and hence there is no distinct concentration to any port especially. In 2011, the total volume of crude minerals and cement rose to 5.6 million tonnes being 355 000 tonnes above (+7%) that in 2001. The commodity accounted for 13 per cent of all Finnish import volumes in 2011 and 10 per cent in 2001.

The main import ports for crude minerals and cement in 2011 comprised Kokkola (782 000 tonnes), HaminaKotka (618 000 tonnes) and Raahе (557 000 tonnes) followed by Rauma (549 000 tonnes), Inkoo (397 000 tonnes) and Pori (380 000 tonnes). The most significant volume augmentations during 2001-2011 have taken place in Kokkola (+475 000 tonnes or 155%), Pori (+157 000 tonnes or 70%) and

HaminaKotka (+113 000 tonnes or 22%). Rauma on the other hand has lost 148 000 tonnes (-21%) and Raahе 101 000 tonnes (-15%) during 2001-2011, whilst Inkoo has more or less sustained its volumes over this period. Still in 2001, Kokkola was only ranked fifth among Finnish crude mineral and cement importing ports and the share of imported volumes accounted only for 6 per cent, whereas in 2011 it had risen to 14 per cent.

As mentioned earlier, the import of crude minerals and cement was dispersed over a larger number of ports and thus the TOP3 ports only accounted for 35 per cent of the total commodity volume in Finland and the TOP6 for no more than 58 per cent. The corresponding percentages in 2001 were 28 per cent and 53 per cent.

Table 13. TOP6 crude mineral and cement importing ports in Finland. (Finnish Transport Agency)

Commodity (1000 t)	Year	Port					
		Kokkola	HaminaKotka	Raahе	Rauma	Inkoo	Pori
Crude minerals, cement	2001	307	505	658	697	411	223
	2011	782	618	557	549	397	380
% share of total 2001		6 %	10 %	12 %	13 %	8 %	4 %
% share of total 2011		14 %	11 %	10 %	10 %	7 %	7 %
Change 2001-11		475	113	-101	-148	-14	157
% change 2001-11		155 %	22 %	-15 %	-21 %	-3 %	70 %

## Oil products

In 2011, a total of 4.1 million tonnes of oil products were imported to Finland being 468 000 tonnes more (+13%) than in 2001. Of all commodities imported to Finland, oil products constituted 9 per cent in 2011, which exceeded the 2001 share with 2 percentage points.

Kilpilahti was the biggest oil product importing port both in 2001 and 2011. Kilpilahti has increased its import of oil products by 1.4 million tonnes (+93%) from 1.5 million tonnes in 2001 to 3.0 million tonnes in 2011, resulting in expansion of Kilpilahti's share from 43 per cent to 73 per cent among oil product importing ports.

Naantali and HaminaKotka belong to the group of TOP3 ports with 399 000 tonnes and 245 000 tonnes imported

in 2011. Whereas Naantali has increased its volumes by 152 000 tonnes (+62%), HaminaKotka has lost 96 000 tonnes (-28%) of its volumes during 2001-2011. In 2001, the TOP3 oil product importing ports accounted for 59 per cent of the total commodity import, whilst in 2011 the share had expanded to 89 per cent mainly because of Kilpilahti's strong positive development.

Pori and Oulu have lost momentum when comparing 2011 volumes with those of 2001, whereas Kokkola has gained some. The TOP6 oil product importing ports accounted for 72 per cent of the total commodity volume in 2001 and for 96 per cent, in 2011.

Table 14. TOP6 oil product importing ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		Kilpilahti	Naantali	HaminaKotka	Pori	Kokkola	Oulu
Oil products	2001	1 549	247	341	261	52	187
	2011	2 995	399	245	153	74	63
% share of total 2001		43 %	7 %	9 %	7 %	1 %	5 %
% share of total 2011		73 %	10 %	6 %	4 %	2 %	2 %
Change 2001-11		1 446	152	-96	-108	22	-124
% change 2001-11		93 %	62 %	-28 %	-41 %	42 %	-66 %

### Timber and woodchips

Timber and woodchips were imported to Finland totalling 3.7 million tonnes in 2011. This was 813 000 tonnes more than in 2001 when 2.9 million tonnes were imported. In 2001, timber and woodchips constituted 5 per cent of Finland's total import volumes and 8 per cent in 2011.

The three leading timber and woodchip importing ports in 2011 included HaminaKotka (998 000 tonnes), Rauma (764 000 tonnes) and Pietarsaari (733 000 tonnes). In these ports the positive development has been strong entailing 406 000 tonnes (+69%) in HaminaKotka, 512 000 tonnes (+203%) in Rauma and 579 000 tonnes (+376%) in

Pietarsaari. The shares of Rauma and Pietarsaari as two out of three leading timber and woodchip importing ports have strengthened from less than 10 per cent to a fifth each. In 2001, these TOP3 ports jointly represented 34 per cent of the total commodity import whereas they amounted to 67 per cent in 2011.

Kaskinen and Kemi have seen their volumes fall during 2001-2011; Kaskinen with 137 000 tonnes (-37%) from 368 000 to 231 000 tonnes and Kemi with 345 000 tonnes (-60%) from 573 000 to 228 000 tonnes. The TOP6 ports accounted for 67 per cent of all timber and woodchip volumes in 2001 and 80 per cent in 2011.

Table 15. TOP6 timber and woodchip importing ports in Finland. (Finnish Transport Agency)

Commodity (1000 t)	Year	Port					
		HaminaKotka	Rauma	P:saari	Kaskinen	Kemi	Kokkola
Timber, woodchips	2001	592	252	154	368	573	0
	2011	998	764	733	231	228	10
% share of total 2001		20 %	9 %	5 %	13 %	20 %	0 %
% share of total 2011		27 %	21 %	20 %	6 %	6 %	0 %
Change 2001-11		406	512	579	-137	-345	10
% change 2001-11		69 %	203 %	376 %	-37 %	-60 %	-

## 4.8 Finland's main exporting ports by commodity

### Paper and paperboard

Paper and paperboard was Finland's number one export commodity in 2011. A total of 8.9 million tonnes were exported, which was 1.3 million tonnes less (-13%) than in 2001. Of the total volumes exported in 2001, the share of paper and paperboard accounted for 27 per cent, whereas in 2011 it had shrunk to 20 per cent.

The two major paper and paperboard exporting ports in 2011 were HaminaKotka (3.0 million tonnes) and Rauma (2.7 million tonnes). However, these ports have seen their volumes drop significantly since 2001; HaminaKotka has lost 1.2 million tonnes (-28%) of its volumes, whereas Rauma has lost 460 000 tonnes (-15%). In 2001, the combined

volumes of HaminaKotka (41%) and Rauma (31%) accounted for 72 per cent of the total paper and paperboard volumes exported from Finland. The corresponding percentage had fallen to 64 per cent in 2011 (HaminaKotka 34% and Rauma 30%).

Other paper and paperboard exporting ports in descending order comprised Hanko, Oulu, Kemi and Helsinki, although the paper volumes in these ports did not exceed 1.0 million tonnes, but ranged from approximately 580 000 to 850 000 tonnes. The biggest relative growth during 2001-2011 has taken place in Oulu which has been able to increase volumes by 350 000 tonnes (+79%).

Table 16. TOP6 paper and paperboard exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		HaminaKotka	Rauma	Hanko	Oulu	Kemi	Helsinki
Paper, paperboard	2001	4 187	3 161	717	441	812	522
	2011	3 016	2 701	852	790	774	583
% share of total 2001		41 %	31 %	7 %	4 %	8 %	5 %
% share of total 2011		33 %	30 %	9 %	8 %	9 %	7 %
Change 2001-11		-1 171	-460	135	349	-38	61
% change 2001-11		-28 %	-15 %	19 %	79 %	-5 %	12 %

### Oil products

Oil products form Finland's second biggest export commodity by volume with 7.1 million tonnes in 2011, exceeding the 2001 figures with 2.3 million tonnes (+46%). Oil products accounted for 16 per cent of the total export volumes in 2011, compared with 13 per cent in 2001.

The export of oil products was concentrated only to a limited number of ports. The principal ports for oil products were Kilpilahti and Naantali accounting for 95 per cent of all oil product volumes with Kilpilahti alone accounting for 86 per cent, in 2011.

HaminaKotka and Kokkola were the other two ports that had some oil products exported; HaminaKotka 176 000 tonnes and Kokkola 143 000 tonnes.

All ports, except for HaminaKotka, have increased their exports during 2001-2011; Kilpilahti with 1.8 million tonnes (+41%) from 4.4 million tonnes to 6.2 million tonnes, Kokkola with 69 000 tonnes (+93%) and Naantali with 364 000 tonnes (+194%).

Table 17. TOP4 oil product exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port			
		Kilpilahti	Naantali	HaminaKotka	Kokkola
Oil products	2001	4 390	188	210	74
	2011	6 177	552	176	143
% share of total 2001		90 %	4 %	4 %	2 %
% share of total 2011		86 %	8 %	2 %	2 %
Change 2001-11		1 787	364	-34	69
% change 2001-11		41 %	194 %	-16 %	93 %

## General cargo

The export of general cargo is concentrated to the ports of the southern part of Finland with short distances and easy access to Finland's major cities. 6.2 million tonnes of general cargo was exported from Finnish ports in 2011 being 941 000 tonnes less (-13%) than in 2001. General cargo accounted for 14 per cent of all export volumes in Finland in 2011, whereas the corresponding share in 2001 was 19 per cent.

In 2011, the TOP3 general cargo ports were Helsinki (2.8 million tonnes), Naantali (1.0 million tonnes) and Turku (891 000 tonnes) followed by Rauma (587 000 tonnes), HaminaKotka (449 000 tonnes) and Hanko (256 000 tonnes).

The most noteworthy volume developments in 2001-2011 have taken place in Rauma with 355 000 tonne (+153%), Naantali with 242 000 tonne (+30%) and HaminaKotka with 174 000 tonne (+63%) additions.

The development have been the opposite for Helsinki with a marked loss of 916 000 tonnes (-25%), Turku with a loss of 479 000 tonnes (-35%) and Hanko with a loss of 310 000 tonnes (-55%). Helsinki still maintains the number one general cargo port position but, Turku and Hanko that still in 2001 were the second and fourth largest ports found themselves ranked third and sixth, in 2011.

Table 18. TOP6 general cargo exporting ports general cargo in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		Helsinki	Naantali	Turku	Rauma	HaminaKotka	Hanko
General cargo	2001	3 668	796	1 370	232	275	566
	2011	2 752	1 038	891	587	449	256
% share of total 2001		51 %	11 %	19 %	3 %	4 %	8 %
% share of total 2011		44 %	17 %	14 %	9 %	7 %	4 %
Change 2001-11		-916	242	-479	355	174	-310
% change 2001-11		-25 %	30 %	-35 %	153 %	63 %	-55 %

## Ores and concentrates

Ores and concentrates constituted, relatively measured the fastest growing export commodity in Finland with a growth rate of 257 per cent, during 2001-2011. In 2011, 5.2 million tonnes of ores and concentrates were handled which was 3.8 million tonnes more than in 2001. Ores and concentrates accounted for 12 per cent of the total export volumes in 2011 when in 2001 it only represented 4 per cent.

The handling of ores and concentrates exports was to a big majority concentrated to one port; Kokkola. Kokkola has increased the handling of ores and concentrates by 3.5 million tonnes (+397%) from 889 000 tonnes in 2001 to

4.4 million tonnes in 2011. Kokkola's share of all ore and concentrate volumes handled in Finnish ports has increased from 61 per cent to 84 per cent, during 2001-2011.

Compared to Kokkola other ore and concentrate exporting ports appear small even if all have increased their handling volumes. In 2001, the ports of Pori, Kantvik and Tornio barely had any volumes to speak of, whereas in 2011 Pori handled 348 000 tonnes, Kantvik 97 000 and Tornio 94 000 tonnes. Raahе transported 93 000 tonnes and Eurajoki 30 000 tonnes of ores and concentrates in 2011.

Table 19. TOP6 ore and concentrate exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		Kokkola	Pori	Kantvik	Tornio	Raahе	Eurajoki
Ores, concentrates	2001	889	3	0	3	69	17
	2011	4 419	348	97	94	93	30
% share of total 2001		61 %	0 %	0 %	0 %	5 %	1 %
% share of total 2011		84 %	7 %	2 %	2 %	2 %	1 %
Change 2001-11		3 530	345	97	91	24	13
% change 2001-11		397 %	> 999 %	> 999 %	> 999 %	35 %	76 %



## Chemicals

In 2011, 3.3 million tonnes of chemicals were exported out from Finland representing an absolute growth of 0.7 million tonne or 26 per cent compared with 2001 figure of 2.6 million tonnes. The share of chemicals against the total volume of export commodities has increased by 0.4 per cent from 7.1 per cent in 2001 to 7.5 per cent in 2011.

The majority of exported chemicals passed via the port of

HaminaKotka handled a total of 1.8 million tonnes in 2011 which was 466 000 tonnes more (+35%) than in 2001. Second to HaminaKotka in volumes exported was Kilpilahti, which has seen a volume increase of 277 000 tonnes from 179 000 tonnes to 456 000 (+155%). Other chemical exporting ports included Pori, Kokkola, Oulu and Helsinki, of which Pori and Kokkola have lost momentum, whilst Oulu and Helsinki have been able to increase their exports.

Table 20. TOP6 chemical exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		HaminaKotka	Kilpilahti	Pori	Kokkola	Oulu	Helsinki
Chemicals	2001	1 336	179	391	244	98	103
	2011	1 802	456	208	204	180	163
% share of total 2001		50 %	7 %	15 %	9 %	4 %	4 %
% share of total 2011		54 %	14 %	6 %	6 %	5 %	5 %
Change 2001-11		466	277	-183	-40	82	60
% change 2001-11		35 %	155 %	-47 %	-16 %	84 %	58 %

## Sawn wood

In 2011, 3.1 million tonnes of sawn wood was exported via Finnish ports equalling a loss of 1.2 million tonnes (-29%) compared with the volumes exported in 2001. The share of sawn wood compared to Finnish overall export volumes has dropped from 12 per cent in 2001 to 7 per cent in 2011.

The TOP3 sawn wood exporting Finnish ports in 2011 were HaminaKotka (944 000 tonnes), Loviisa (506 000 tonnes) and Kaskinen (256 000 tonnes), followed by Helsinki (246 000 tonnes), Rahja (205 000 tonnes) and Pori (200 000 tonnes). Unlike most other commodities, sawn

wood was more dispersed among ports. In 2011, the TOP3 ports jointly accounted for 55 per cent whereas the corresponding percentage in 2001 was 41 per cent.

Only HaminaKotka and Helsinki have been able to increase their volumes despite the general down-turn trend of the commodity during 2001-2011. The most dramatic decline has been experienced in Pori losing 542 000 tonnes in volume (-73%) and Kaskinen 150 000 tonnes (-37%), during 2001-2011.

Table 21. TOP6 sawn wood exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		HaminaKotka	Loviisa	Kaskinen	Helsinki	Rahja	Pori
Sawn wood	2001	853	522	406	240	272	742
	2011	944	506	256	246	205	200
% share of total 2001		20 %	12 %	9 %	6 %	6 %	17 %
% share of total 2011		31 %	16 %	8 %	8 %	7 %	7 %
Change 2001-11		91	-16	-150	6	-67	-542
% change 2001-11		11 %	-3 %	-37 %	2 %	-25 %	-73 %

## Wood pulp

In 2011, 2.3 million tonnes of wood pulp was exported from Finland which was 619 000 tonnes more (+37%) compared to 2001. The share of wood pulp compared to Finnish overall export volumes has increased from 4.5 per cent in 2001 to 5.2 per cent in 2011.

The TOP3 wood pulp exporting ports in 2011 comprised HaminaKotka (1.0 million tonnes), Rauma (324 000 tonnes) and Pietarsaari (299 000 tonnes), followed by Kemi, Kaskinen and Oulu. The wood pulp volumes have strongly accumulated since 2001. In 2001, the TOP3 wood pulp ports handled 52

per cent of the total pulp volumes and in 2011 the share had enlarged to 71 per cent.

The wood pulp volumes have grown aggressively (237%) and accumulated in HaminaKotka, during 2001-2011. HaminaKotka's share of all wood pulp exported in 2001 was 18 per cent, whereas in 2011 it had augmented up to 44 per cent. Also Rauma and Oulu, have witnessed a positive wood pulp development in their ports with growths of 45 and 13 per cent. Pietarsaari, Kemi and Kaskinen on the other hand have lost volumes.

Table 22. TOP6 wood pulp exporting ports in Finland (Finnish Transport Agency).

Commodity (1000 t)	Year	Port					
		HaminaKotka	Rauma	Pietarsaari	Kemi	Kaskinen	Oulu
Wood pulp	2001	298	223	351	299	210	85
	2011	1 003	324	299	233	205	96
% share of total 2001		18 %	13 %	21 %	18 %	13 %	5 %
% share of total 2011		44 %	14 %	13 %	10 %	9 %	4 %
Change2001-11		705	101	-52	-66	-5	11
% change 2001-11		237 %	45 %	-15 %	-22 %	-2 %	13 %

## 4.9 Transit traffic through Finnish ports

Transit traffic is goods traffic between two countries taking place via the territory of a third country. The transit goods are not paid for or customs cleared by the country of transit, neither are their value included in the foreign trade statistics (Widgren et al. 2000). The development of transit traffic volumes through Finland is to most part a result of the dissolution of the Soviet Union, in 1991. After the dissolution, the Soviet Union was left with fewer ports within the Baltic Sea region including ports in Kaliningrad and the rear corner of the Gulf of Finland. There have however been challenges related to difficult ice conditions in the Gulf of Finland and land connections to the central part of Russia via Lithuania and Belarus. Russia has consequently been short of port capacity which has directed cargo flows through alternative routes, thus increasing the Finnish transit traffic amongst others. Besides the shortage in port capacity, the transit traffic development has been underpinned by strong Russian foreign trade and economic development (Sundberg et al. 2010).

A total of 7.46 million tonnes of transit goods were handled by Finnish ports in 2011 accounting for 7.6 per cent of Finland's total international seaborne traffic. In 2002<sup>4</sup>, the overall transit volume was 5.24 million whereby there has been an increase of 2.2 million tonnes (+42%).

During 2002-2011, the eastbound transit handled grew by 20 per cent from 1.81 million tonnes to 2.17 million tonnes (+355 000 tonnes) and the westbound transit 54 per cent from 3.43 million tonnes to 5.30 million tonnes (+1 867 000 tonnes). The ratio of eastbound transit compared with westbound transit has remained rather steadily at a 30:70 ratio. In 2011, the commodities of westbound transit traffic accounted for 12 per cent of all handled international export goods, whereas the corresponding figure for imports was 4 per cent.

The transit volumes and thus also value of goods transported to Russia by road are equal or deviate only slightly from those handled by ports, as a small fraction of commodities may also be transported using other transport modes. Nevertheless, the value of goods recorded at road border stations gives a rather accurate indication of eastbound commodity value handled by ports. Unfortunately, there are no corresponding records produced for the westbound transit goods.

<sup>4</sup> There is no data available on transit value for 2001 and therefore the data series on total volume and value development covers here exceptionally the years 2002-2011. The remainder of the transit traffic development analysis covers the years 2001-2011, starting from the following section.



In 2011, a volume of 2.17 million tonnes of goods were passing the eastern Finnish-Russian border by road, equalling a value of 20.7 billion euros. In 2002, the corresponding figures were 1.48 million tonnes and value 12.2 billion euros (Finnish Customs). This equals a positive growth of 683 000 tonnes (+46%) and 8.5 billion euros (70%) hence speaking for a stronger development in value. The volume and value of 2011 were still below the peak years 2007-2008; volume by -41 per cent and value -33 per cent. However, the average value per ton in 2011 was 9548 euros, which was 859 euros more (+10%) than during the second best year experienced in 2005, before the economic crisis.

Measured in total value, machines and appliances constituted the biggest commodity group (30%), followed by appliances such as radios, televisions and computers occupying a share of 18 per cent (Finnish Customs).

#### 4.9.1 Main commodity development of eastbound transit

Finland's main eastbound transit commodities volume wise in 2011 comprised general cargo (1 444 000 tonnes), metals and metal manufacture (378 000 tonnes), crude minerals and cement (185 000 tonnes), chemicals (58 000 tonnes) and other cargo (56 000 tonnes).

The eastbound transit volumes of general cargo have declined by 27 000 tonnes (-2 %) from 1 470 000 tonnes to 1 444 000 tonnes, during 2001-2011. During the peak years in 2007-2008, general cargo volumes exceeded 2.1 million tonnes, where after the volume more than halved in 2009. The general cargo volumes in 2011 were still 11 per cent below the 2006 figure.

The second largest eastbound transit commodity comprises of metals and metal manufactures which has seen a growth of 242 000 tonnes (+177%) from 137 000 tonnes in 2001 to 378 000 tonnes, in 2011. However, if compared with

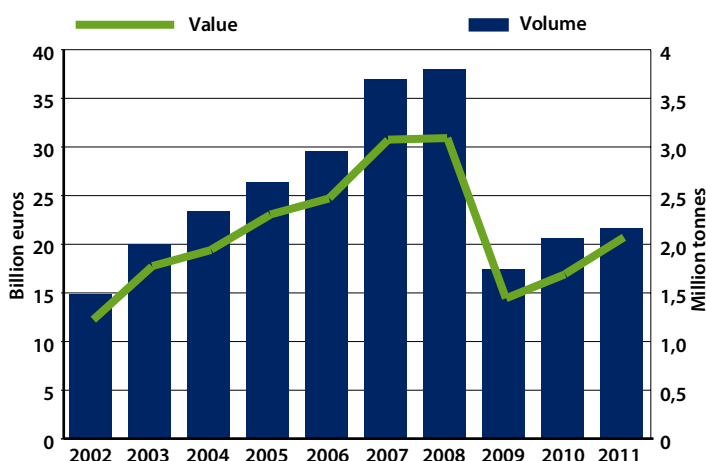


Figure 28. Volume and value development of the eastbound transit traffic by road.

the top years of 2007-2008 with 1.2 and 1.4 million tonnes handled, the eastbound transit volume of metals and metal manufacture in 2011 has declined approximately 70 per cent.

The eastbound volumes of crude minerals and cement in 2011 were 185 000 tonnes, whereas in 2001 volumes were almost non-existing.

The volumes of eastbound chemicals and other goods exceeded 55 000 tonnes in 2011, although these two commodities have had opposite development patterns, since 2001. Despite rather small volumes, the relative growth for chemicals has been positive, year 2011 representing the peak year. The overall development trend for other goods, on the other hand has been negative. The largest volumes of other goods were handled in 2008, when compared to 2011, a fourfold volume was handled.

*The eastbound transit consists mainly of valuable goods (such as electronics), whereas the westbound transit is predominately bulk cargo of low value (such as ores, concentrates and chemicals).*

Table 23. Main eastbound transit commodities (Finnish Transport Agency).

Year	Commodity (tonnes)				
	General cargo	Metals and metal manufactures	Crude minerals and cement	Chemicals	Other goods
2001	1 470 432	136 629	44	9 890	61 207
2006	1 623 793	849 605	359	7 535	144 022
2011	1 443 898	378 237	184 675	57 852	55 745
% change 2001-11	-2 %	177 %	>999 %	485 %	-9 %
% change 2006-11	-11 %	-55 %	>999 %	668 %	-61 %
Change 2001-11	-26 534	241 608	184 631	47 962	-5 462
Change 2006-11	-179 895	-471 368	184 316	50 317	-88 277

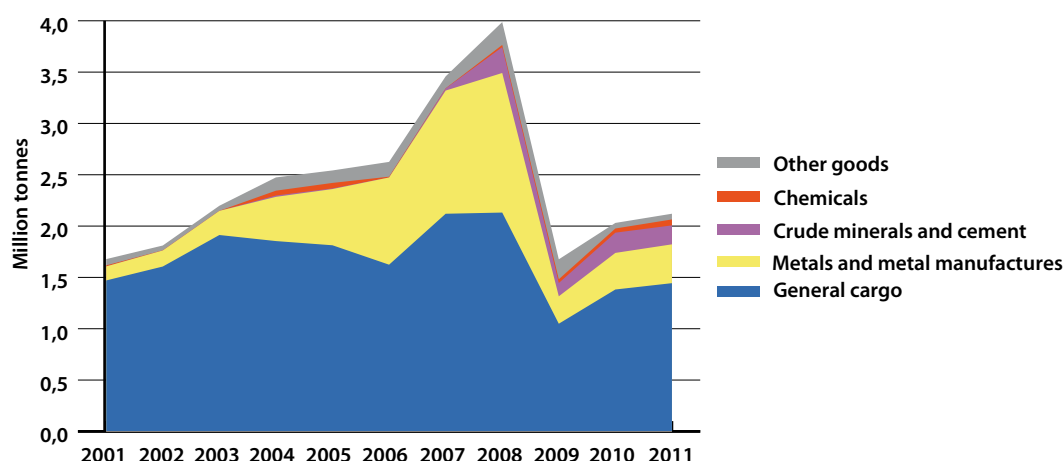


Figure 29. Main transit commodity development in eastbound traffic. (Finnish Transport Agency)

#### 4.9.2 Main commodity development of westbound transit

The largest commodity group of westbound transit traffic consisted of ores and concentrates, grown by 2.1 million tonnes (+327%) from 637 000 tonnes in 2001 to 2 715 000 tonnes in 2011, representing also one of the most marked volume augmentation both in absolute and relative terms. The westbound volumes saw a decline of 728 000 tonnes (-30%) in 2007, but quickly bounced back to the fast growth track.

In 2011, the second largest westbound commodity group consisted of chemicals which has had a relatively even development trend during 2001-2011, varying between 1.3-1.8 million tonnes. The volumes of chemicals have increased during 2001-2011 by 283 000 tonnes (+21%) from 1.3 million to 1.6 million tonnes. The economic downturn did not affect the westbound transit volumes of chemicals that much in 2009, when most other commodities saw their volumes fall, but rather a few years prior i.e. in 2005-2007.

The westbound transit of general cargo has dropped by 331 100 tonnes (-55%) from 597 000 tonnes in 2001 to 266 000 tonnes, in 2011. The volume development stagnated during 2005-2009 reducing altogether by 85 per cent, when at lowest in 2006, compared with 2001. Again in 2010 and 2011, general cargo started to regain volumes.

Paper and paperboard have increased volumes by 199 500 tonnes (+360%) from 55 000 tonnes in 2001 to 253 000 tonnes, in 2011. During the 2001-2011 period, paper and paperboard exceeded 100 000 tonnes in 2004 and 250 000 tonnes in 2010-2011.

Crude minerals and cement constitute the fifth biggest westbound commodity group although the quantities have been small. The peak years for crude minerals and cement were experienced in 2010 and 2011 with volumes of 75 000 and 116 000 tonnes.

Table 24. Main westbound transit commodities (Finnish Transport Agency).

Year	Commodity (tonnes)				
	Ores, concentrates	Chemicals	General cargo	Paper, paperboard	Crude minerals, cement
2001	636 552	1 340 286	597 132	54 945	0
2006	239 2425	1 179 601	84 683	53 439	161
2011	2 715 266	1 623 383	266 067	252 947	116 067
% change 2001-11	327 %	21 %	-55 %	360 %	n/a
% change 2006-11	13 %	38 %	214 %	373 %	>999 %
Change 2001-11	2 078 714	283 097	-331 065	198 002	116 067
Change 2006-11	322 841	443 782	181 384	199 508	115 906

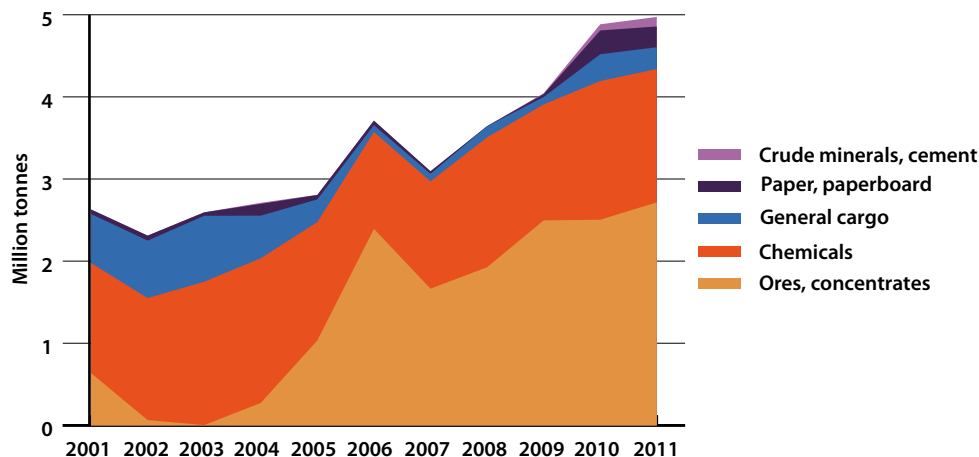


Figure 30. Main transit commodity development in westbound traffic (Finnish Transport Agency).

#### 4.9.3 The overall development of Finland's transit ports

In 2011, five principal ports were involved in handling of transit traffic goods comprising in descending volume order HaminaKotka, Kokkola, Helsinki, Hanko and Turku. During the last ten years there has been, apart from Helsinki, a clear concentration of goods to the aforementioned ports.

The ports of HaminaKotka and Kokkola are indisputably the two biggest transit ports in Finland handling 3.93 and 2.90 million tonnes of goods, whilst others handled at their maximum some 300 000 tonnes.

Table 25. The overall volume development (tonnes) of Finnish transit traffic ports (Finnish Transport Agency).

Year	HaminaKotka	Kokkola	Hki	Hanko	Tku	Others	Total
2001	3 559 246	489 668	1 416 367	71 756	48 108	94 842	5 679 987
2006	3 140 925	2 334 836	218 173	772 220	106 641	4 433	6 577 228
2011	3 926 772	2 896 886	288 649	279 963	73 137	1 004	7 466 411
% change 2001-11	10 %	492 %	-80 %	290 %	52 %	-99 %	31 %
% change 2006-11	25 %	24 %	32 %	-64 %	-31 %	-77 %	14 %
Change 2001-2011	367 526	2 407 218	-1 127 718	208 207	25 029	-93 838	1 786 424
Change 2006-11	785 847	562 050	70 476	-492 257	-33 504	-3 429	889 183
Share of total 2001	63 %	9 %	25 %	1 %	1 %	2 %	
Share of total 2011	53 %	39 %	4 %	4 %	1 %	0 %	

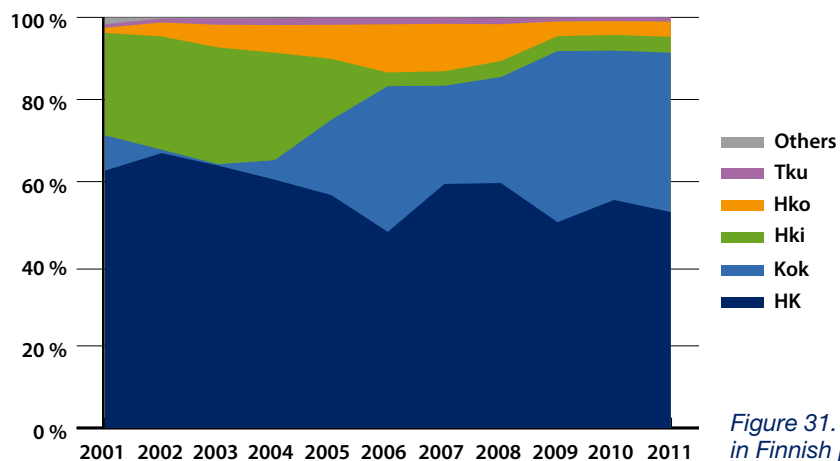


Figure 31. Visualisation of the overall transit traffic development in Finnish ports (Finnish Transport Agency).

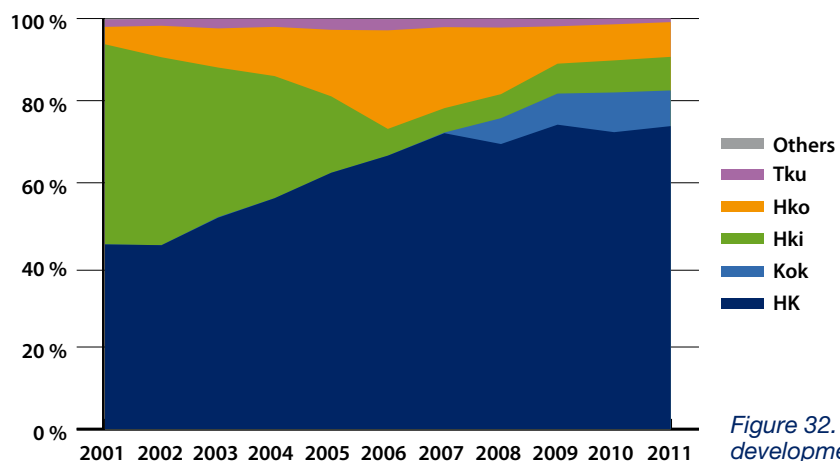


Figure 32. Visualisation of the eastbound transit traffic development in Finnish ports (Finnish Transport Agency).

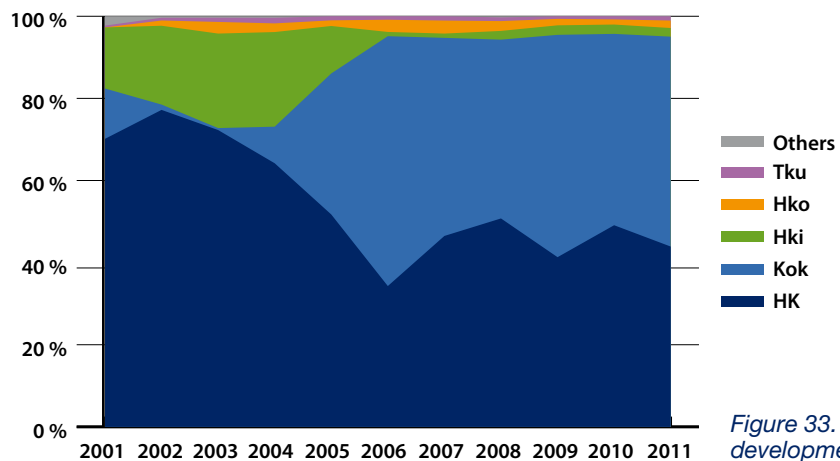


Figure 33. Visualisation of the westbound transit traffic development in Finnish ports (Finnish Transport Agency).

## *HaminaKotka*

In 2011, HaminaKotka handled altogether 3.93 million tonnes of goods accounting for more than half i.e. 53 per cent of total transit traffic goods handled in Finland. The absolute total volume of HaminaKotka has increased by 368 000 tonnes (+10%) over 2001-2011 and the development has been fairly even without major volume fluctuations.

The overall growth has been a result of a strong eastbound growth of 840 900 tonnes (+111%) from 760 000 tonnes to 1.60 million tonnes, in 2011. 74 per cent of all Finnish eastbound transit goods passed through the port of HaminaKotka, making it the biggest eastbound transit port. HaminaKotka's biggest eastbound transit commodities comprised 1.2 million tonnes of general cargo and 257 000 tonnes metals and metal manufacture. The volume of general cargo has grown with 550 000 tonnes (+80%) and metal and metal manufacture with 241 000 tonnes (+1508%), since 2001. In 2011, HaminaKotka's general cargo volumes accounted for 86 per cent of Finland's total eastbound general cargo volumes (47% in 2001) and the corresponding share for metals and metal manufactures was 68 per cent (12% in 2001).

The westbound transit volumes have on the other hand shrunk by 473 000 tonnes (-17%) from 2.8 million tonnes in 2001 to 2.3 million tonnes, in 2011. The 70 per cent volume share of Finland's overall westbound transit in 2001 has diminished to 44 per cent, in 2011. HaminaKotka's main westbound transit commodities in 2011 comprised chemicals (1.6 million tonnes) and paper and paperboard (244 000 tonnes) followed by crude minerals (116 000 tonnes). Out of Finland's westbound transit volumes HaminaKotka's share in chemicals was 98 per cent (98% in 2001) and in paper and paper board 97 per cent (90% in 2001).

## *Kokkola*

Kokkola has experienced an aggressive overall growth from 490 000 tonnes in 2001 to 2.90 million tonnes (+ 2 407 000 tonnes or 492%), in 2011. Kokkola's share of total transit volumes handled in Finland represented no more than 9 per cent in 2001, whereas in 2011 the share had expanded to 39 per cent. The giant leaps in volumes took place in 2004-2005 from 267 000 tonnes to 1.03 million tonnes and further doubling to 2.33 million tonnes, in 2006.

Kokkola's overall growth has been a result of a massive volume growth in westbound transit traffic. Westbound transit traffic has grown by 2.22 million (+453%) from 490 000 tonnes in 2001 to 2.7 million tonnes, in 2011. In 2011, the westbound transit accounted for 94 per cent of the overall transit volume handled by Kokkola. The westbound

transit volume of Kokkola represented 51 per cent of all Finnish westbound transit volumes in 2011 making it the biggest exporting port volume wise. In 2001, the share was 12 per cent.

Import has grown from merely nothing to 189 000 tonnes thus increasing the share of the total Finnish eastbound transit to 9 per cent, in 2011. Kokkola's eastbound transit volumes consist almost solely of crude minerals and cement. Kokkola accounts for 98 per cent of all crude minerals imported to Finland.

## *Helsinki*

Helsinki has witnessed its overall transit traffic volumes drop from 1.4 million in 2001 to 289 000 tonnes in 2011, (-1 128 000 tonnes or -80%) reducing the share of all transit volumes handled in Finland from 25 per cent to 4 per cent. The volumes drastically dropped during 2005-2006 to approximately today's level.

The reduction in transit volumes during 2001-2011 has been contributed both by shrunken eastbound transit from 823 000 to 177 000 tonnes (-646 000 tonnes or -78%) and declined westbound transit from 593 000 to 111 000 tonnes (-482 000 tonnes or -81%). The falls took place in 2006.

In 2001, Helsinki was the biggest port for eastbound transit traffic with a share of 49 per cent which has reduced to 8 per cent, in 2011. In 2011, the main eastbound transit volume consisted of 156 000 tonnes of general cargo, which represented 11 per cent of Finland's eastbound general cargo volumes (51 % in 2001).

In westbound transit the share has diminished from a 15 per cent share in 2001 to 2 per cent share, in 2011. The major westbound volume in 2011 came from general cargo (100 000 tonnes) constituting a 37 per cent share of all westbound general cargo in Finland. In 2001, the corresponding volume was 582 000 tonnes equalling a share of 97 per cent.

## *Hanko*

In 2011, Hanko's share of all transit volumes handled in Finland represented 4 per cent. When comparing Hanko's volumes of 72 000 tonnes in 2001 with 280 000 tonnes in 2011, it all looks quite reasonable, representing a growth of 208 000 tonnes (+290%). If a comparison of 2011 volumes was carried out against 2006 volumes of 772 000 tonnes (Hanko's second best year of the time series) the reality would be somewhat different i.e. Hanko has lost a fair share of its transit volumes.

The economic downturn reduced Hanko's overall volumes by 70 per cent in 2009 and the volumes have shown to settle during the last three years on a level between 200 000 and 300 000 tonnes. The reduction was mainly caused by the collapse in import transit of metals and metal manufactures i.e. cars aimed at the Russian market. The main eastbound commodities in 2011 were metals and metal manufactures (106 000 tonnes) and general cargo (46 000 tonnes). In 2001, Hanko represented a 39 per cent share of all eastbound metal volumes, whereas in 2011 it had reduced to 28 per cent.

During 2001-2011, the westbound transit has varied between 44 000 and 109 000 tonnes. Unlike eastbound transit, westbound transit volumes did not react as dramatically to the economic downturn in 2009, although roughly a third of the volumes were lost. In 2001, the main westbound transit volume consisted of 50 000 tonnes of general cargo which accounted for 19 per cent share of all westbound transit general cargo in Finland.

#### *Turku*

Turku has experienced a similar development as Hanko described above. The overall development shows a growth of 52 per cent (+25 000 tonnes) during 2001 and 2011, but if compared with the peak years in 2006-2007, Turku has lost almost a third of its volumes since then.

The eastbound transit of Turku has dropped from 30 000 tonnes in 2001 to 19 000 tonnes (-38%), in 2011. There was a steady growing trend during 2001- 2008 with volumes reaching 90 000 tonnes, but ever since the fall in 2009, Turku has not been able to retrieve lost volumes. The main eastbound transit volume in 2011 consisted of metals and metal manufacture.

The westbound transit has during 2001-2011 varied between 18 000 tonnes in 2001 and 54 000 tonnes in 2011, characterised by rather noteworthy relative annual variations. Year 2011, was the peak year for westbound transit volumes.



## **4.10 Finnish port investments**

During 2006-2010 port investments in Finland amounted to 999 million euros. The construction of Vuosaari (Finland's biggest port located in Helsinki) alone accounted for 476 million (58.8%) of all port owner investments in Finland.



The next biggest investments were made by Kotka (56.9 million euros), Raahе (38.1 million euros), Pori (32.7 million euros) and Kokkola (31.4 million euros). Of the near one billion investment port operators accounted for approximately 190 million euros (20%). The biggest port investments made by port owners were channeled to fairways and port basins, quays, development of port areas, roads and municipal engineering (Karvonen, 2010).

Based on 2010 data, the predicted overall port investment figure for the period 2011-2015 was anticipated to be 539 million euros. However, the economic downturn has reduced the magnitude or delayed port and fairway projects. The drastic drop between the two comparison periods is a result of the completion of Vuosaari project (Karvonen, 2010).

Currently, one port and fairway investment project is taking place in Finland entailing the port of Pietarsaari. The ports of Uusikaupunki, Rauma, Kokkola and Kemi also have development projects ahead in the coming years.

In general, the depths of the existing fairway network have matched rather well the current maritime transport economic needs. However, there are development needs associated with fairway use of individual production plants. Moreover, some development projects are based on anticipated transport expansion prospects and shifts in the nature of logistics.



#### 4.11 Fairway and port investments in progress

The Port of Pietarsaari is having its 9 metre fairway dredged to 11 metre due to inadequate fairway depth. The main users of the port consist of UPM-Kymmene Oyj and Oy Alholmens Kraft Ab power plant. The investment was motivated by cost savings in particular in timber, biofuel

and coal import. Already today, the ships have been forced to lighten their loads elsewhere. The overseas import of timber is expected to increase due to Russian wood tariffs. The port basin depth is deepened in conjunction with the fairway dredging.



#### 4.12 Planned fairway and port investments

The port of Uusikaupunki consists of two harbours; the harbour of Yara and Hepokari. The port of Uusikaupunki is having its fairway leading to Yara deepened from 10 metre to 12.5 metre. The harbour of Yara Finland serves the production plant's raw material and product transports. Yara Finland has three nitric acid plants and two fertilizer plants in Uusikaupunki producing nitric acid and fertilizers for the Finnish and export markets. An 8.5 metre deep fairway leads to the harbour of Hepokari. The port of Uusikaupunki expects future traffic flows to increase in Southwest Finland. Companies in steel and car manufacturing are investing and Europe's largest soy processing plant is currently being built. The rapidly increasing manufacturing activity in Uusikaupunki requires major investments in warehouses and other port facilities (Finnish Transport Agency).

The port of Rauma was Finland's sixth busiest port in 2011 and an important exporting port of forestry products, for instance. One of Rauma's two fairways will be deepened from 10 metre to 11 metre or possibly to 12 metre in order to gain economy of scale related to the overseas export of paper, raw materials and container traffic. The dredging work is anticipated to cost, depending on the realisation of the fairway depth, either 18 million or 35 million euros. The port of Rauma will furthermore invest in the second stage of its container harbour, port basin dredging and expansion

of the port area at Ulko-Petäjäs with associated road- and rail connections.

The volumes handled by the port of Kokkola have grown strongly during the past ten years and especially with regard to export. In 2011, Kokkola was the fourth biggest Finnish exporting port. The draught of vessels coming in to Kokkola is often too deep and vessels therefore sail partially loaded. The fairway of port of Kokkola will therefore be dredged to 14 metre. The outlook for the dry bulk volumes is favourable in particular in the Finnish-Russian trade. The biggest potential found in domestic traffic is related to transports of Kolari and Sokli mines. The investment programme will furthermore include the deepening of the port basin and enlargement of the port area. The investment project is expected to cost 34 million euros.

The need to deepen the Ajos fairway leading to port of Kemi is related to start-ups of Kolari region mines and subsequent concentrate transports. The total volumes are expected to set at 3 million annual tonnes. The port development plans further include dredging of the port basin. However, if the desired volume level is not achieved the investment will not be followed through. The investment allocation is 24 million euros (Finnish Transport Agency).



## 5 DRY CARGO VESSEL DISTRIBUTION AND SIZE DEVELOPMENT

### 5.1 Ro-Ro passenger ships

The overall growth trend for Ro-Ro passenger ships' size development has been upward in 2001-2011. As the ship size has grown, the number of vessels has simultaneously had on opposite trend, in particular after 2007.

In 2011, 12 500 Ro-Ro passenger ship calls were made to Finnish ports in foreign trade accounting for 40 per cent of all 31 200 ship calls made to Finland (Finnish Transport Agency). The overall number of Ro-Ro passenger vessel calls has fallen by 1 860 vessels (-13%) from 14 300, in 2001. Among vessel types engaged in transportation of dry cargo, Ro-Ro passenger ships form the largest group measured by the number of vessel calls. At best, in 2004-2005 the number of Ro-Ro passenger vessel calls rose closer to 18 000.

However, the share of Ro-Ro passenger vessels out of the total number of port calls in Finland, has grown with 1 percentage point from 39 per cent, in 2001. During 2004-2007, the number of ships were up to 16 200-17 900 per year.

Of the total net tonnage (NT) volume calling at Finnish ports

Ro-Ro passenger ships accounted for 72 per cent in 2001 and 75 per cent in 2011. The overall NT of Ro-Ro passenger ships amounted to 236 million NTs in 2011, which was 75 million NT's more (+44%) than in 2001.

The average net tonnage of Ro-Ro passenger ships has grown significantly (+7 500 NTs or 65%) also contributed by the reduced number of vessels, since 2001. Great leaps in size development took place in 2007-2009 with an average 2 000 to 3 000 NT yearly growth.

When comparing import and export cargo volumes transported with the overall NT of all arriving and departing vessels, possible capacity utilisation rate differences and imbalances can be identified. For Ro-Ro passenger vessels, the inbound and outbound transported cargo volumes are closely associated. The drop in volumes per total NT experienced in 2009 was rather steep, indicating that shipping companies operate Ro-Ro passenger vessels with dedicated vessels in scheduled traffic, leaving little room for alteration flexibility in number, frequency or capacity of the fleet.

Table 26. Vessel calls and NT development of Ro-Ro passenger vessels in Finnish foreign trade (Finnish Transport Agency).

	No. of vessel calls	Total NT of vessel calls	Average NT per vessel	Share of total number vessel calls	Share of total NT in Finnish ports
2001	14 328	163 900 000	11 439	39 %	72 %
2006	16 501	198 500 000	12 030	42 %	70 %
2011	12 468	235 900 000	18 920	40 %	75 %
% change 2001-11	-13 %	44 %	65 %		
% change 2006-11	-24 %	19 %	57 %		

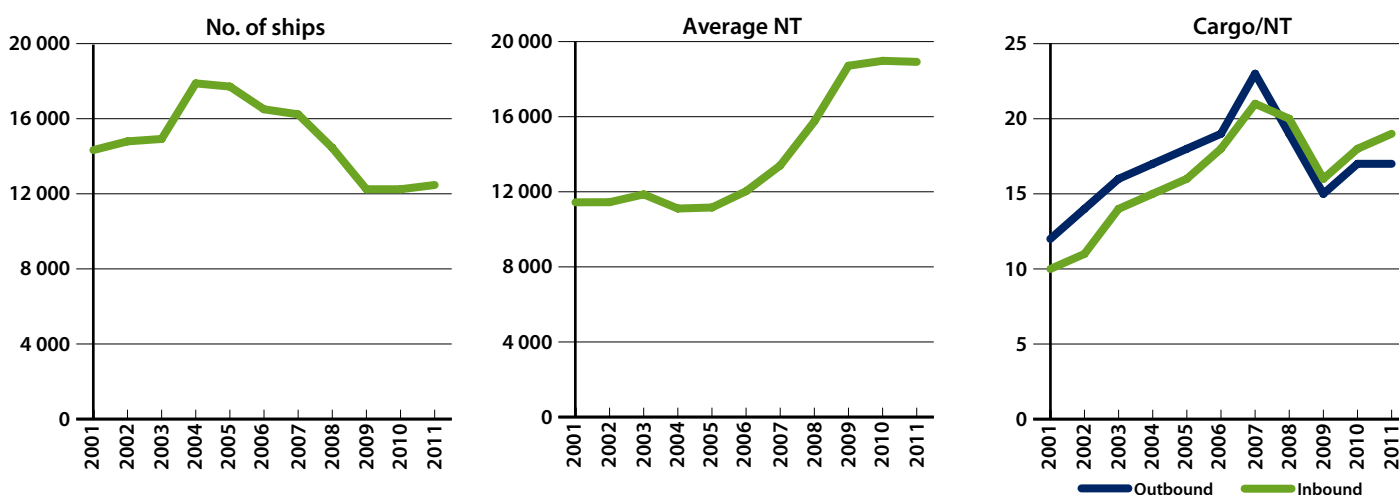


Figure 34. Size development of Ro-Ro passenger ships in Finnish foreign trade.

## 5.2 Ro-Ro cargo ships

The size development of Ro-Ro cargo vessels has compared to Ro-Ro passenger ships been more moderate, during 2001-2011.

In 2011, 4 800 Ro-Ro cargo ship calls were made to Finnish ports accounting for 15 per cent of all 31 200 ship calls made to Finland (Finnish Transport Agency). The overall number of vessel calls has fallen by 1 670 vessels (-26%) from 6 400, in 2001.

The share of Ro-Ro cargo vessel calls compared to the total number of all vessel calls made to Finnish port has decreased with 2 percentage points from 17 in 2001 to 15 per cent, in 2011.

Of the total NT volume calling at Finnish ports Ro-Ro cargo ships accounted for 8 per cent in 2011 and 14 per cent

in 2001. The overall net tonnage of Ro-Ro cargo ships amounted to 25.7 million NTs in 2011 which was 5.3 million NTs less (-17%) than in 2001.

The average net tonnage of Ro-Ro cargo ships has grown by 592 NTs (+12%) from 4 800 NTs in 2001 to 5 400 NTs, in 2011.

For Ro-Ro cargo vessels, the inbound and outbound transported cargo volumes were closely associated, although there was a significant difference in capacity utilisation between inbound cargo and outbound cargo volumes; outbound volumes clearly dominating. The drop in volumes per total NT experienced in 2009 was not as steep as witnessed for Ro-Ro passenger vessels, which indicates that shipping companies can adjust better to cargo volume fluctuations by fleet and operational adjustments.

Table 27. Vessel calls and NT development of Ro-Ro cargo vessels in Finnish foreign trade (Finnish Transport Agency).

	No. of vessel calls	Total NT of vessel calls	Average NT per vessel	Share of total number vessel calls	Share of total NT in Finnish ports
2001	6 440	31 000 000	4 814	17 %	14 %
2006	6 420	33 200 000	5 171	16 %	12 %
2011	4 754	25 700 000	5 406	15 %	8 %
% change 2001-11	-26 %	-17 %	12 %		
% change 2006-11	-26 %	-23 %	5 %		

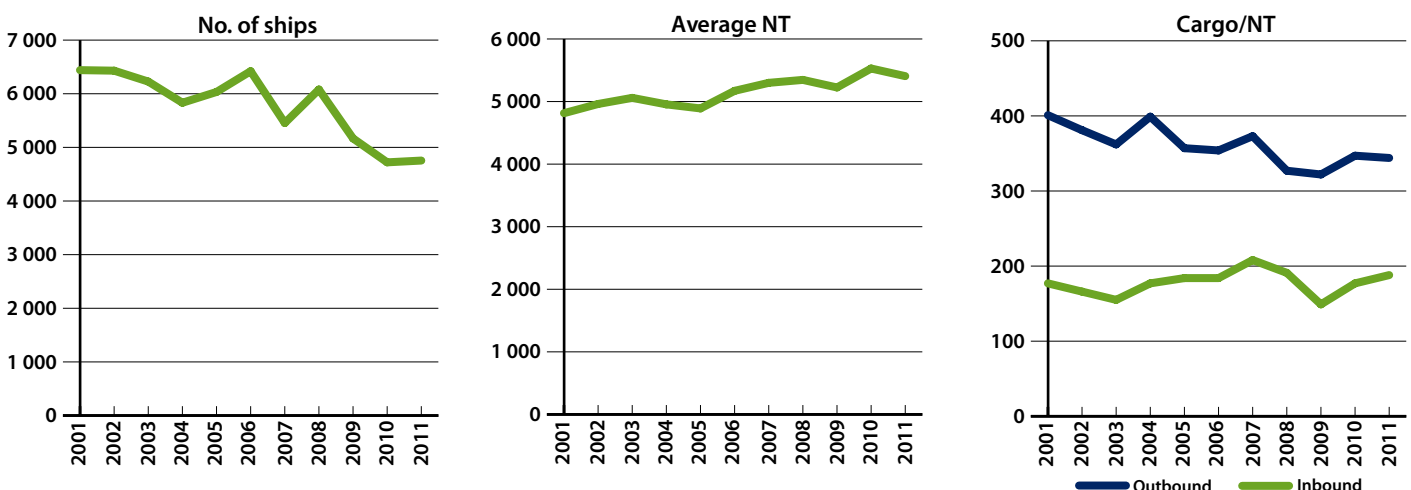


Figure 35. Size development of Ro-Ro cargo ships in Finnish foreign trade.

### 5.3 Dry bulk ships

Dry bulk ships represent, among dry cargo vessels analysed in this report, the one type that has measured in number of vessel calls, reduced the most whilst the average net tonnage simultaneously has increased notably.

In 2011, there were 1 000 dry cargo ship calls made to Finnish ports accounting for no more than 3 per cent of all ship calls made to Finland. The number of ship calls has sunk till 2011 by more than 600 ships (-61%) to 400 ships reducing the share of dry bulk vessels down to 1 per cent, in 2011 (Finnish Transport Agency). The declining trend has been constant without fluctuations during 2001-2011.

Of the total NT volume calling at Finnish ports dry bulk ships accounted for 1 per cent in 2011 and 2 per cent in

2001. The overall net tonnage of dry bulk ships amounted to 2.9 million NTs in 2011, which was 1.8 million NTs less (-38%) than in 2001.

The average net tonnage of dry bulk ships has grown by a considerable 2 700 NTs (+58%) from 4 700 NTs in 2001 to 7 400 NTs, in 2011.

For dry bulk vessels, the balance or relation of inbound and outbound transported cargo volumes deviated strongly representing more or less a mirror image development of each others. The inbound cargo volume per NT dropped beginning from 2007, whilst outbound volumes on the contrary started to increase, thus narrowing the marked difference in capacity utilisation.

Table 28. Vessel calls and NT development of dry bulk vessels in Finnish foreign trade (Finnish Transport Agency).

	No. of vessel calls	Total NT of vessel calls	Average NT per vessel	Share of total number vessel calls	Share of total NT in Finnish ports
2001	1 007	4 700 000	4 667	3 %	2 %
2006	682	4 300 000	6 305	2 %	2 %
2011	394	2 900 000	7 360	1 %	1 %
% change 2001-11	-61 %	-38 %	58 %		
% change 2006-11	-42 %	-33 %	17 %		

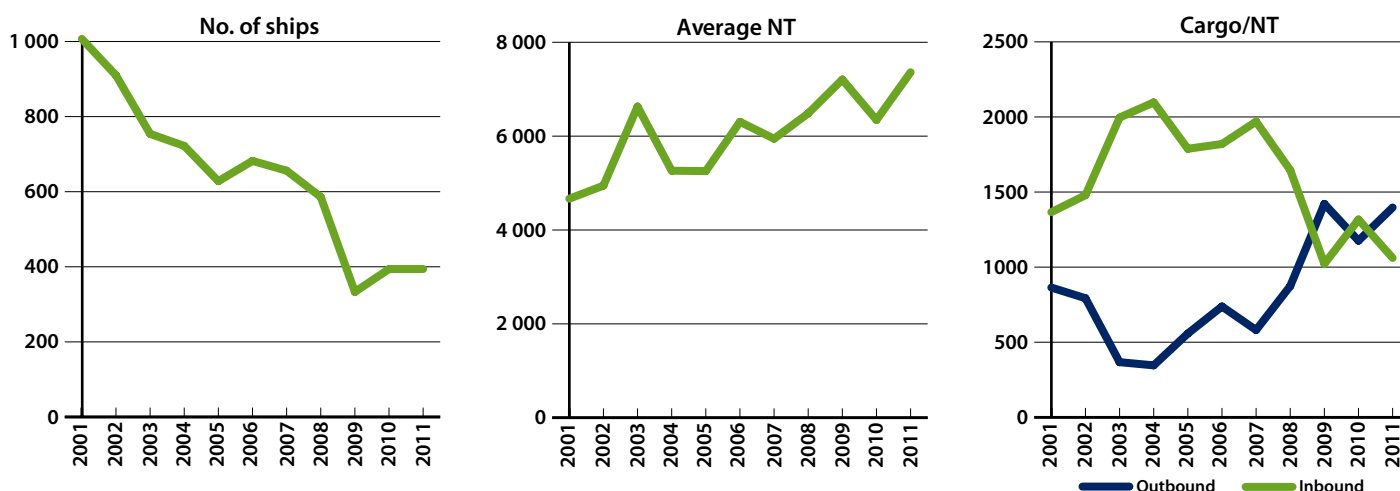


Figure 36. Size development of dry bulk ships in Finnish foreign trade.

*Ship size has grown among all ship types analysed and the number of ship calls has reduced in 2001-2011.*

*The biggest drop in vessel calls has been witnessed among dry bulk vessels.*

*Capacity utilisation of Ro-Ro passenger and general cargo vessels relatively balanced. Significant differences in utilisation rates between import and export have been witnessed for Ro-Ro cargo vessels and dry bulk vessels.*

## 5.4 General cargo ships

In 2011, there were 8 600 general cargo vessel calls made to Finnish ports accounting for 28 per cent of all 31 200 ship calls made to Finland (Finnish Transport Agency). The overall number of general cargo vessel calls has fallen by 1 100 vessels (-11%) from 9 700, in 2001.

The share of general cargo vessels out of the total number of port calls in Finland has grown with 2 percentage point from 26 per cent in 2001 to 28 per cent in 2011. Before the economic crisis during 2002-2008 the number of vessel calls did not go below 10 000, whereas it drastically dropped in 2009 to 7 600 vessel calls.

Of the total NT volume calling at Finnish ports general cargo ships accounted for 7 per cent in 2001 and 8 per cent in

2011. The overall NT of general cargo ships amounted to 24.3 million NTs in 2011, which was 7.6 million NTs more (+46%) than in 2001.

The average NT of general cargo ships has relatively seen grown significantly. The average size of the general cargo vessels has grown by 1 100 NTs (64%) from 1 700 NTs in 2001 to 2 800 NTs, in 2011.

For general cargo vessels, the inbound and outbound cargo volumes have been relatively well balanced throughout the period of 2001-2011, despite slightly better capacity utilisation in exports, during 2001-2007. After 2007, the development shifted to import dominance.

Table 29. Vessel calls and NT development of general cargo vessels in Finnish foreign trade.

	No. of vessel calls	Total NT of vessel calls	Average NT per vessel	Share of total number vessel calls	Share of total NT in Finnish ports
2001	9 683	16 700 000	1 725	26 %	7 %
2006	10 465	22 700 000	2 169	26 %	8 %
2011	8 582	24 300 000	2 832	28 %	8 %
% change 2001-11	-11 %	46 %	64 %		
% change 2006-11	-18 %	7 %	31 %		

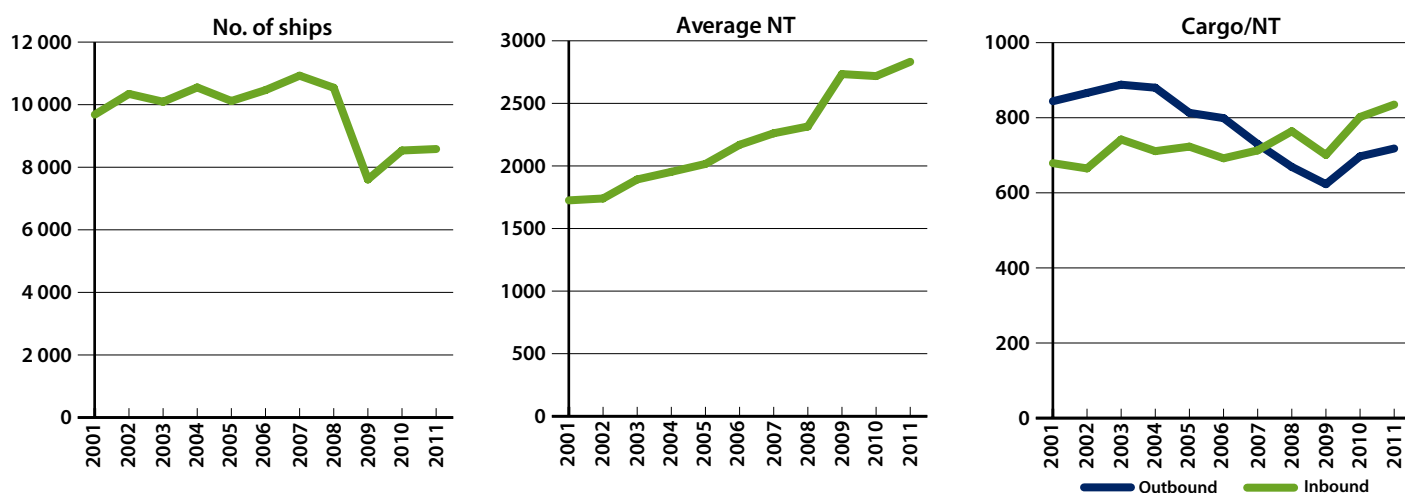


Figure 37. Size development of general cargo ships in Finnish foreign trade.

*The distribution of total NT in Finnish ports 2011:*

*Ro-Ro passenger vessels 75%*  
*Ro-Ro cargo vessels 8%*  
*Dry bulk vessels 1%*  
*General cargo vessels 8%*  
*Other vessel types 8%*



## 6 CHANGE FACTORS AFFECTING MARITIME TRANSPORT AND VESSEL DESIGN

### 6.1 Structural changes in Finnish industrial and logistics sectors

As a result of a globalising world, intensified competition, polarisation and geographic shifts of markets, the Finnish economic structure has and continues to adjust to new settings and circumstances. The Finnish industrial and logistics sectors are undergoing a structural change pressing them to adapt to new terms in order to ensure future profitability and to defend and sustain their business positions. The role and importance of efficient and functioning logistics and supply chains are emphasised, as the production of goods and services can take place far away from the actual end-user market. For Finland, its geographic location and climate affects logistics, weakening Finland's economic competitiveness compared to many other countries. Transport cost efficiency and control of low-processed industry output is of particular importance, whereas for high-processed goods, the emphasis is on efficient supply chain management, characterised by just-in time delivery, and customer and service integration.

Generally, the main Finnish industry sectors indicate an increasing level of services, further processed products and lower levels of warehousing. However, it can be argued that the growing costs of transportation, imposed by environmental regulations, may actually direct to an opposite direction i.e. increase warehousing and stock levels.

A fair share of industrial output, in particular that of heavy bulk is channeled via ports within a reasonable distance radius. The service level and specialisation degree of ports and associated companies, are of relevance when companies and industries choose which port to use, optimising their logistical solutions. For most part, the logistics sector in Finland, including maritime transport, functions well and without major impairments. The fairway depths have so far been adequate, although a few dredging projects are planned or in progress to increase the economies of scale in Finnish foreign trade.

When considering transportation of unitised goods, the length of land-based transport from production plant to port or from port to destination of delivery, is less relevant if compared to heavy bulk transports. In transportation of unitised goods, regularity and frequency of services are central. Even if unitised goods are concentrated only to a number of ports, the volumes have not been high enough to invest and introduce automation in port side cargo handling (Paavola et al. 2012).

The future of Finnish industry and logistics is anticipated to be affected by factors, such as energy efficiency, control of environmental effects, increasing automation and developing technology, rising logistical cost and concentration of international ownership (Paavola et al. 2012).

The Finnish economy is to a high degree dependent on the development and success in foreign trade, the export of which relies on three principal industrial sectors; technology industry, chemical industry and forest industry. The industrial production gross value of all Finnish industry sectors amounted to 88.6 billion euros in 2011, technology sector accounting for 42 per cent, chemical industry 24 per cent and 18 per cent (Statistics Finland). These industries are however sensitive to economic fluctuations as witnessed in 2009, when export revenue dropped between a quarter and a third.

This report will discuss and focus on the structural changes of chosen industry sectors as change factors, potentially affecting future maritime transport needs and complement the produced scenarios presented in Chapter 7. These industry sectors include the mining industry, forest industry and chemical industry.

### 6.1.1 Mining Industry

Mining industry belongs to the industry group of Metals Industry, which in turn is a member of Technology Industry.

Apart from the Nordic countries and Russian Kola Peninsula, Europe is short in its mineral reserves and thus among the biggest importers of concentrates and metal products. The EU is keen to develop and exploit its own mineral reserves, whereby the attention is drawn, amongst others, to Finland.

Mining is regarded on governmental level to comprise one of the growing sectors in Finland. The vision of Finland's mineral strategy for 2050 is to become a forerunner in sustainable exploitation of minerals on a global level. The mineral sector is also envisaged to be one of the mainstays of Finnish economy.

Several new mines are planned to be established in Northern and Eastern Finland. These mines could multiply the current mining transport volumes. If all new mine projects and extension plans for existing mines are realised, the total transport volume of mining could increase to 7.5 million annual tonnes during the ongoing decade, whereas the current total volume of the Northern mines is approximately 2.4 million tonnes.

The planned iron ore mine in Hannukainen, Kolari with an operative life cycle of 20 years is planned to be opened in 2015, produce 2-3 million annual tonnes, a volume which is anticipated to be shipped out from the Bay of Bothnia ports. Additionally 1.5 million tonnes of phosphorus deriving from the Sokli mine is planned to be transported via the same ports. The planned opening of the mine is 2016 and it is estimated to be operative for 20 years. Besides the Finnish mining industry, the transit traffic from Russia via the international border crossing station at Vartius on the eastern Finnish border is expected to increase during the coming years from the current 2-3 million tonnes.

In 2012, there were 12 operational metallic mineral mines in Finland. The commercial production of the new mines including Laiva gold mine and the multi-metal mines of

Kylylahti and Kevitsa, has been initiated. Industrial minerals were extracted from about 30 mines.

In 2011, the estimated annual revenue of Finnish mining industry was approximately 1.48 billion euros, of which the metallic mineral mines accounted for 963 million euros (Uusisuo, 2012).

#### Export

Concentrates originating from Finnish metal ore mines have so far mainly been processed in Finland and therefore export of metal ores and concentrates has been marginal compared to import volumes discussed hereinafter. The majority of ores extracted in Finland is further processed to metals that are predominantly exported.

Export of metal concentrates is bound to escalate, if concentrates produced from new projects are sold abroad for further processing. In 2011, the export volume of metal concentrates was 81 900 tonnes equalling a value of 57.2 million euros (Uusisuo, 2012). Volume wise, zinc (65%) and nickel (29%) ores and concentrates constituted the main ore products. The overall volume of metal ores and concentrates exported in 2004 was 2 500 tonnes, where after a growth up

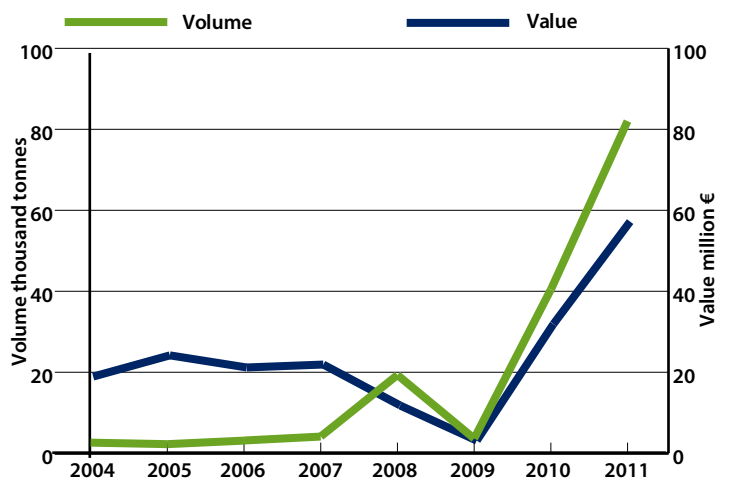


Figure 38. Volume and value development of exported metal ores and concentrates.



to 19 200 tonnes took place in 2008 (+681%) and further to 81 900, in 2011 (+327%). The overall growth during 2004-2011 has been in excess of 3 200 per cent.

The export value of metal ores and concentrates was more evenly spread among different ore types compared to volume distribution, in 2011. Zinc ores that constituted 65 per cent of the exported volumes only accounted for 36 per cent of the overall value exported and zinc ores for 37 per cent respectively. Back in 2008, nickel ores accounted for 77 per cent of all volumes. The development of export value was rather constant during 2004-2007, where after the value dropped in 2008 by 38 per cent from 18.9 million to 11.8 million euros. Between 2008 and 2011 the positive development in value was regained (+384%). The overall export value has four-folded during 2004-2011.

The average tonne price for metal ores and concentrates during 2004-2007 fluctuated between 5 400-11 800 euros/tonne. From 2008 onward, the average price has remained under 1 000 euros/tonne, fluctuating between 620-790 euros/tonne.

In 2011, the main export markets comprised China, Belgium and Germany. The main types of ore concentrates exported were nickel and noble metals to China (21.7 million euros), zinc to Belgium (20.6 million euros), noble metals ores and concentrates to Germany (11.9 million euros).

Carbonate minerals that Finland mainly exported in 2011 consisted of 49 600 tonnes of burnt lime and 29 000 tonnes of kaolin. The export value of kaolin and burnt lime was 11.7 million euros (Uusisuo, 2012).

## Import

In 2011, Finland imported altogether 4.9 million tonnes of metal ores and concentrates worth 1.9 billion euros. Volume wise iron ore accounted for 3.6 million tonnes (74% share) of all ore and concentrate volumes imported to Finland in 2011, followed by zinc ore with 547 000 tonnes (11% share) and copper ore and concentrates with 415 000 tonnes (9% share). There have not been any major fluctuations in the shares when comparing with the overall volume development.

During 2004-2008, the total import volumes fell by 589 000 tonnes (-11%), where after in 2008-2011 it on the contrary grew with 257 000 tonnes (+6%).

The average tonne price for metal ores and concentrates during 2004-2008 fluctuated between 199-503 euros/tonne. In 2006-2008 the imported volumes fell, whilst the value on the contrary grew, thus generating values per tonne exceeding 400 euros/tonne.

The overall development of imports has during 2004-2011 dropped with 332 000 tonnes (-6%) from 5.2 million tonnes to 4.9 million tonnes (Uusisuo, 2012).

The import value shares of metal ores and concentrates were more evenly spread among the different ore types in 2011 compared to the volume distribution, such as in the case of exports. Nickel ores that constituted only 9 per cent of imported volumes accounted for 36 per cent of the overall import value. Volume wise the biggest imported ore group i.e. iron ore (74% share) accounted only for 23 per cent of the overall import value. The third biggest group consisted of zinc ores with an overall value share of 19 per cent.

The development of overall import value varied between 1.0-2.3 billion, during 2004-2008. In 2009, the value dropped by over a half from 2.0 billion euros to 887 000 million euros. In year-on-year comparison between 2008 and 2011 there has been zero growth in value. Compared to 2004, the import value in 2011 has grown by 914 000 million euros (+88%).

In 2011, Finland imported metal ores worth 530 million euros with Sweden at the head. Almost all iron ore processed in Finland has its origin in Sweden. Finland imported from Peru copper and zinc ore worth 323 million euros. The third biggest import country by value was Canada with 212 million euros entailing nickel, copper and zinc trade. Other significant import trading partners representing trading value above 100 million euros included South-Africa, Chile, Portugal and Ireland (Uusisuo, 2012).

Carbonate minerals that Finland mainly imported in 2011 consisted of 918 000 tonnes of kaolin worth 114 million euros and of 2.26 million tonnes of limestone worth 82.7 million euros (Uusisuo, 2012).

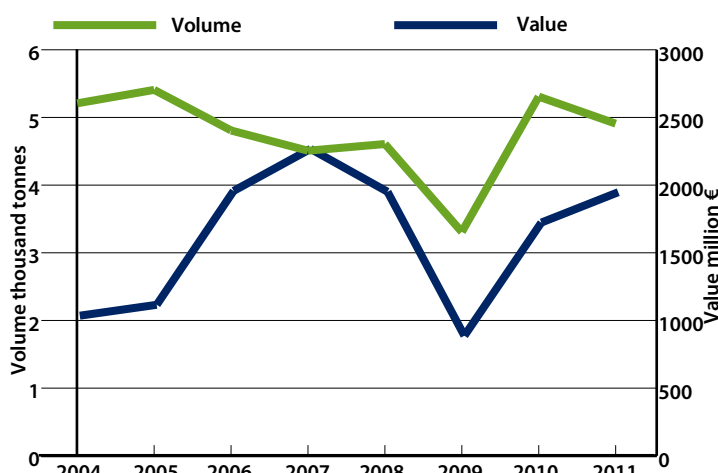


Figure 39. Volume and value development of imported metal ores and concentrates.

## Transport needs

The choice of transport corridors for mining products is mainly based on total cost of various transport modes, service level and location of ports. Ports have a significant role in transportation of mine products and raw materials especially in large volume mine projects. Further processing of mine products is expected to predominantly take place in Europe, whereas the share of overseas markets is expected to be limited at least from a short-term perspective.

The largest in Finland operating metal and steel industry companies are located along the coastal areas, such as Ruukki steel production plant in Raahе and Outokumpu in Tornio. 86 per cent of the iron and steel transported in 2009 used seaborne transportation (Sundberg, 2009). The raw-materials i.e. iron ore are transported to Raahе on barges from Luleå in Sweden. Coal needed in steel production arrives also through the port of Raahе. Finished steel products are to a high degree transported to Europe via the same port. Outokumpu facility in Tornio transports steel products to Europe via port of Tornio. Outokumpu produces currently 270 000 tonnes of ferrochrome, the production of which requires seaborne raw material transport from Europe to Tornio. Outokumpu has intentions to double its ferrochrome production volume as of 2013 (Ramboll Finland Oy).

The steel industry is sensitive and prone to react to economic fluctuations. The demand for steel products has intensified as a result of escalating Chinese and Indian demand. The financial crisis has however had its impact on Finnish production levels, with its main market in Europe. The steel production is very energy intensive and the industry relies considerably on affordable energy prices. Furthermore, changes in market demand, are rapidly reflected in transport volumes and in how the volumes are directed. The demand for steel may well increase after economic stability has been regained, boosted by the Asian demand, especially.

*Mining industry holds great potential in future Finnish maritime transport.*

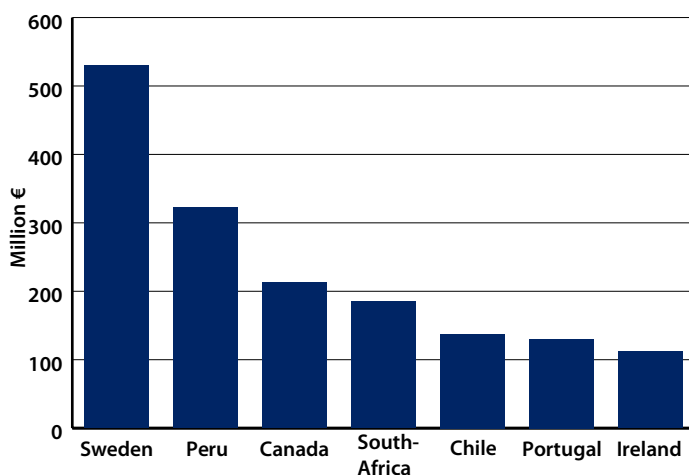
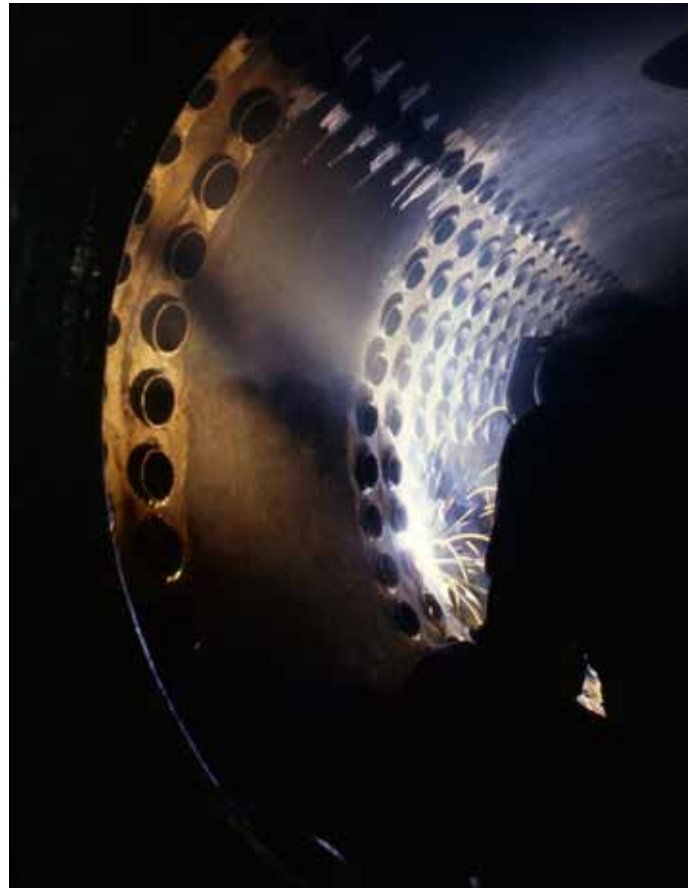


Figure 40. Main iron ore and concentrate import countries by value exceeding 100 million euros (Uusisuo 2012).

## 6.1.2 Chemical industry

Chemical industry is one of three major industries in Finland. The majority of chemical industry products are sold for the use of other industrial sectors and agriculture. Principal industrial customers are represented by forest industry, transport, electronics industry, metal industry and construction. Principal product groups include pulp and paper industry chemicals, petroleum products, fuels and lubricants, plastics, packaging and precision plastics, paints, plastic piping systems, as well as damp-proofing and thermal insulation materials. Products are manufactured into a variety of intermediate industrial and consumer, and product applications (The Chemical Industry Federation of Finland).

Approximately 40 per cent of all chemical industry products produced is exported, accounting for 23 per cent of Finland's total industry export value. In 2011, the export value was 12.2 billion euros, of which basic chemicals accounted almost for one third. Other major product groups were



petroleum products, plastic products and pharmaceuticals. The most important export products in terms of value were pharmaceuticals, oil products, polypropylene and polyethylene among many others. Nearly three quarters of the total production is exported either directly or as intermediates. Finland's main export market is the EU, which accounts for more than half of all chemical industry exports. In 2011, the most important export markets were Sweden, Russia, and the Netherlands. Russia has clearly strengthened its role as the most significant non-EU export country (The Chemical Industry Federation of Finland).

In 2011, the import value of the chemical industry products was 11.2 billion euros. The bulk of imports is made up by various raw materials, the single largest product group being crude oil. Basic chemicals account for a third, followed by oil products and pharmaceuticals. In 2011, the main import markets of chemical industry products were Russia, Germany and Sweden. These countries have been the leading import markets for years (The Chemical Industry Federation of Finland).

In terms of production gross value, chemical industry is Finland's second largest industrial sector after technology industry. In 2011, production gross value totalled 21.9 billion euros, accounting for 19 per cent of Finland's total industrial output. Petroleum products contributed almost 50 per cent and basic chemicals one fifth to production gross value. In terms of value added, basic chemicals are the largest product group. About 20 per cent of value added is contributed by plastic products.

Over the past few decades, chemical industry has experienced a structural change which has led to specialisation in niches. Special chemicals, plastic products and composites have increased their shares compared to standard chemicals. The special chemicals, used for example in electronics, are high-value products seeing increasing demand. Production success of these chemicals in Finland is supported by high-level automation, production and products, and reliable logistics (Pohjakallio, 2012).

The Finnish chemical industry is largely dependent on global markets. The chemical industry is also one of Europe's largest industrial sectors. The development witnessed the last 10 years shows that the EU, being a global leader in chemical sales has lost ground to Asia. The effects of globalisation can be divided in to three main factors of change: escalating energy and raw material prices, shifts in global demand and cost of labour (The Chemical Industry Federation of Finland). The chemical industry is an energy intense sector and therefore rising energy and raw material prices have shifted the production to low-cost countries including Asia and the Middle-East. The rising energy prices have contributed to the shift from oil-based

chemical production to the use of cheaper raw materials. On the other hand, bio raw materials will compensate the use of oil and gas. The Finnish chemical industry sees potential and business opportunities in product, technology and process innovations, associated with climate change control and scarcity of raw materials. The focus of chemical industry is in increasingly processed end products, systems and services, thus potentially resulting in smaller transport volumes.

### 6.1.3 Forest industry

Forest industry products are categorised to wood product industries and to pulp and paper industries, the latter which represents the bigger industry both volume and value wise.

In 2011, 8.9 million tonnes of paper and paperboard was exported. The corresponding volume for wood pulp was 2.3 million tonnes. Sawn goods accounted for 6.2 million cubic metres and wood-based panels 1.0 million cubic metre.

In 2011, forest products were exported for the value of 11.2 billion euros out of which wood pulp, paper, paperboard accounted for 9 billion euros and wood product industries (incl. furniture production) totalled 2.2 billion euros. The production gross value in 2011 was 16.1 billion euros accounting for 18 per cent of the overall industry total (Statistics Finland).





The Finnish forest industry has and is undergoing a structural change in attempt to safeguard its competitiveness. Since 2005, the production capacity of paper has been reduced by closer to 20 per cent. Significant reductions have been linked also to wood pulp production capacity. Paperboard production on the other hand has expanded its production capacity lately.

Capacity reduction and other adjustment measures witnessed in Finnish forest industry is a consequence of general global development and transitions. The plantation forestry e.g. is gaining grounds from wood raw material markets of the “Northern hemisphere”. In developed countries paper consumption has been falling due to electronic publishing and communication, whereas new developing countries are expected to create an intensified demand. Furthermore, the production facilities are removed to low-cost locations and closer to the consumer markets. The effects on paperboard may however be the opposite as e-commerce may actually increase the demand for packaging material (Kniivilä, 2012).

Paper industry’s challenge in Europe has been an over-capacity of paper machines, causing a weak paper price development and a shrinking demand. Future paper machine close-downs are still to be anticipated in Finland. According to certain estimates, paper production is anticipated to decline by over a fourth by 2020 from the current 8.6 million tonne production (Kniivilä, 2012). Pulp and wood pulp production is tightly associated with that of paper production even if the Finnish wood pulp market is more global compared to paper markets.

The long-term goal of Finnish forest cluster is to increase the production gross value of products and services to more than 40 billion euros by 2030 and act as forerunner in sustainable development in a bio-focused society. A set target is that half of the value should come from new product and service innovations (Forestcluster).

Forest industry is the biggest user of different transport modes measured in tonne kilometres. For some while, the characteristic transport trends of forest industry has entailed smaller batches and transition from bulk to unitised cargo and special transport units such as the SECU-unit (Stora Enso Cargo Unit) as the industry’s focal point has shifted from volume to value. The industry often chooses to transport its goods via ports near the industry production plant in order to decrease the logistical costs. Logistics represents 15 - 20 per cent of forest industry’s overall costs (Finnish Forest Industries Federation). The forest industry uses more than 15 Finnish sea ports for the import and export of forest industry products.

Future opportunities of forest industry are likely to be found in the field of “renewable forest industry” including biofuels, bio-composites and e.g. nanotechnology-based applications and products which are recyclable and used as biofuel in the end of products’ life cycle.

## 6.2 EU transport policy TEN-T

The European Commission published its guidelines for the trans-European transport network (TEN-T), which was approved by the EU transport ministers, in 2012. Based on the approved proposal, the transport network will be divided in two levels – a core network and a supporting comprehensive network entailing national transport connections. The TEN-T core network will be completed by 2030 consisting of 10 major pan-European transport corridors forming the backbone of European transports. The connective comprehensive network will be completed by 2050.

The EU objective of the TEN-T is to improve cross-border connections, build missing connections, renew infrastructure and eliminate traffic bottle necks by establishing a transport network that efficiently promotes intermodalism integrating land, air and sea traffic networks covering the whole Europe. Moreover, the ambition is to develop and introduce intelligent transport systems, enabling safe, efficient and sustainable transports. The TEN-T core network includes main routes and traffic nodes which are central for transports in the single market and between the EU and other countries of the world.

The cost of the EU infrastructure development matching the transport demand has been estimated to amount to 1.5 trillion euros, over the period 2010-2030. The implementation of the TEN-T transport network is funded e.g. by the TEN-T programme and the European Regional Development Fund, amongst others.



The Finnish core network comprises earlier defined priority projects including the Nordic Triangle (European road route E18 stretching from Naantali/Turku to Vaalimaa and the railway connection from Turku to Vaalimaa at the eastern border), the Motorway of the Baltic Sea (sea routes connecting the EU countries around the Baltic Sea with Central and West-Europe) and Rail Baltica (Helsinki-Tallinn-Warsaw traffic corridor). A new project in the core network is the Bothnian Corridor that goes around the Gulf of Botnia (main railroad and extending from Helsinki to Tornio and National Road 4 stretching from Helsinki via Jyväskylä to Kemi). The ports of Naantali, Turku, Helsinki and Hamina/Kotka belong to the core network ports.

### 6.3 Environmental regulation

The renewed IMO MARPOL (International Convention For the Prevention Of Pollution From Ships) Annexes IV, V and VI are due to enter in force in 2013 and 2015, setting new requirements regarding disposal of shipboard garbage and emission of SO<sub>x</sub> and NO<sub>x</sub> gases in the in the SECA areas (Sulphur Emission Control Area). The SECA areas comprise the Baltic Sea, North Sea and English Channel.

Discharging sewage into sea is regulated by the MARPOL Annex IV. New passenger vessels are required as of 2016, and all passenger vessels from 2018 onwards to treat their sewage in order to remove nutrients such as nitrogen and phosphorus when they are in Special Areas, such as the Baltic Sea. Therefore the ship either requires a sewage treatment plant or a sewage comminuting and disinfecting system or a holding tank. The regulation will come into force if the reception facilities for sewage are sufficient enough in passenger ports in the Baltic Sea area.

MARPOL Annex V regulates the handling of solid waste including food, domestic and operational waste

produced during normal operation of vessel. It prohibits disposal of plastics anywhere into the sea, strictly restricts discharges of other garbage from ship into the coastal waters and Special Areas (Shortsea Promotion Centre). Furthermore Annex V regulates handling of cargo residues and washing water. The Annex obliges Governments to ensure the provision of adequate reception facilities at terminals and ports. The amendments of Annex V will enter into force in 2013.

IMO approved in 2004 the International Convention for the Control and Management of Ships' Ballast Water and Sediments, by which the spreading of invasive plant and animal species in ballast waters causing a threat to local ecosystems is regulated. The convention has been prepared for over 10 years and will enter in to force in phases.

#### 6.3.1 Regulations on air pollutants

The maximum allowed sulphur content in fuel is defined in MARPOL Annex VI. The Baltic Sea, defined as a SECA area, will as of 2015 have sulphur limits lowered to 0.1% from the current 1.0%. Globally the limits have been lowered from 4.5% to 3.5% as of 2012 and further to 0.5% in 2020 or alternatively 2025 in the event that no fuel can fill these criteria by 2020.

The IMO resolution on future SO<sub>x</sub> limits has generated discussion about distorted competitive settings among industries within the EU area and in relation to those non-EU areas. As a consequence of the resolution, implementation is furthermore believed to cause a shift from seaborne traffic to land-based traffic.

The transport costs of Finnish seaborne foreign trade have been forecasted to increase as of 2015, when shifting from the use of LS380 heavy fuel oil with sulphur content below 1% (currently used in the SECA area) to low-sulphur fuels



such as marine gas oil (MGO) with less than 0.1% sulphur. The current fuel consumption ratio for LS380 and MGO is 85:15 due to the use of MGO when lying in ports.

The price difference between LSO380 and MGO was approximately 227 euros/tonne (13.12.2012) i.e. the low-sulphur MGO is about 38 per cent more expensive compared with the currently used LS380. This price difference defines the cost effect when a vessel shifts to use low-sulphur fuel.

A majority share of NOx emissions has its origin both in land-based and seaborne traffic. MARPOL Annex VI and its technical code regulate the technical development and emission quantity of marine diesel engines. The annex includes Tier standards which define the NOx emission levels for marine diesel engines installed on vessels after a certain construction year. The Baltic Sea countries reflect on introducing sea areas as NECA-areas (Nitrogen Emission Control Area).

The emission levels of greenhouse gases will be controlled in the future by the construction of more energy efficient ships. An Energy Efficiency Design Index (EEDI) has been established to regulate the fuel consumption of new-buildings.

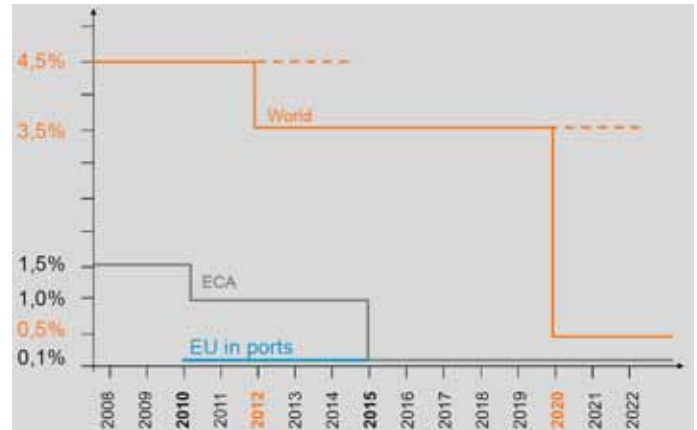


Figure 41. IMO defined sulphur limits (Wärtsilä Oyj Abp).

Table 30. Cost effect of MARPOL Annex VI.

Vessel type	Consumption/vessel/ 2011	Cost/vessel/ 2011	Cost/vessel/ 2015	COST DIFFERENCE
Ro-Ro passenger ship	11 783	5 918 346	8 195 688	2 277 342
Ro-Ro cargo ship	6 173	3 100 369	4 293 371	1 193 002
Container ship	2 718	1 365 161	1 890 467	525 305
Car carrier	2 310	1 160 443	1 606 973	446 531
Cruise ship	2 038	1 023 411	1 417 213	393 802
Passenger ship	1 118	561 657	777 779	216 122
Tanker	1 007	505 782	700 404	194 622
Gas carrier	796	399 948	553 846	153 898
Oil tanker	784	393 829	545 372	151 543
Chemical tanker	779	391 215	541 752	150 537
Other general cargo ship	710	356 466	493 632	137 166
Train ferry	394	197 897	274 047	76 150
Bulk carrier	372	186 713	258 559	71 846
Other ship	341	171 260	237 160	65 900
Tugboat	223	111 866	154 911	43 045
Barge	32	16 017	22 180	6 163

## 6.4 Finnish transport policy

### 6.4.1 Winter navigation

Almost all ports in Finland are ice-bound during average winters. However, year-round navigation is essential for the Finnish economy and therefore, seven Finnish ice-breakers are needed to assist maritime transport. The European Union has classified the icebreakers as a part of the trans-European network. Finland's policy is to keep 23 out of 50 commercial Finnish ports open throughout the year (Short Sea Promotion Centre Finland).

The Finnish Transport Agency is tasked with public office duties and procurement associated with the assistance of winter navigation as well as with national coordination, development and guidance thereof. The Finnish Transport Agency furthermore makes decisions concerning the assistance period for winter navigation, exemptions and traffic restrictions.

When the ice situation becomes more difficult, the Finnish Transport Agency imposes traffic restrictions for winter ports. Icebreaker assistance is given to vessels which meet the traffic restrictions issued by the Finnish Transport Agency for vessels calling at a relevant port. Icebreaking services include assistance of vessels in ice and related towing. Winter navigation assistance is free of charge.

For the provision of icebreaking services the Finnish Transport Agency has signed agreements with the Swedish state, Arctia Icebreaking Ltd., Alfons Håkans Ltd. and other private towing companies. (Finnish Transport Agency).

Finland and Sweden have co-operated in ice-breaking based on Nordic ice-breaking agreement since 1961. The co-operation has manifested itself especially in the Gulf of Botnia area but during harsh winters also in the Baltic Sea basin between Finland and Sweden. The Finnish Government presented in late 2012 a 20-year long ice-breaking agreement proposal between Finland and Sweden for approval. The agreement requires Finland to provide a 5 ice-breaker vessel capacity, four vessels being of A-class ice-breakers and one being a B-class ice-breaker. The objective of the agreement is to increase the degree of planning and execution of winter navigation, thus ensuring more efficient and economic ice-breaking services (Ministry of Transport and Communication).

Arctia Shipping is a state owned limited company which amongst others offers ice-breaking services. The ice-

breaking fleet comprises four in the Baltic Sea operative traditional ice-breakers - Otso, Sisu, Urho and Voima and one oil-recovery icebreaker, Kontio. Arctia's two multi-purpose vessels MSV Fennica and Nordica are suitable also for a wide range of maritime tasks, including those requiring dynamic positioning (DP) capability, towing of merchant vessels in harsh ice conditions and operating on ice management assignments for the oil industry (Arctia Shipping).

The Finnish and Swedish maritime authorities have elaborated and issued Finnish-Swedish ice class regulations (or rules, FSICR), since 1971. The regulations have also been incorporated into the rules of classification societies.

In Finnish law, provisions on ice classes are included in the Act on the Ice Classes of Ships and Icebreaker Assistance (1121/2005). A ship's year of build determines which set of regulations apply to it. Provisions on the application of the various sets of regulations are laid down in the 2010 regulations.

The ice class regulations define the minimum engine output, hull strength, machinery and rudder strength of ships navigating in ice. The ice class affects the net tonnage of the ship, which in turn forms the basis for determining the level of the fairway due to be charged. When restrictions concerning icebreaker assistance are imposed, it depends on the ice class whether a ship is entitled to assistance or not. The aim of the regulations is to ensure that ships operating in the Baltic Sea are capable of navigating in ice and winter navigation runs safely and smoothly.



The Finnish Transport safety Agency has issued a regulation on which Finnish ice classes are equivalent to the class notations of recognised classification societies (the so called list of equivalences). If a ship has an ice class notation of a recognised classification society, it is granted one of the Finnish ice classes IA Super, IA, IB, IC, II and III in accordance with the equivalence list. The regulation also includes provisions on documentation required for the determination of the ice classes of ships (Finnish Transport Safety Agency).

#### 6.4.2 Charges and dues related to Finnish maritime traffic

##### *Fairway dues*

The Ministry of Transport and Communications has assigned a working group which in accordance with the Finnish traffic policy will produce a report on price and charge development of different traffic modes including maritime transport. A separate working group is preparing a report on fairway dues in maritime traffic.

The purpose of fairway dues is to cover the costs incurred to the state from ice-breaker operations and construction, maintenance, and management of public fairways and required maritime safety equipment. Fairway dues are levied on all merchant vessels sailing to and from Finland or operating in domestic traffic.

The Act on Fairway Dues (1122/2005) bases the payable dues on a unit price multiplied with vessel's dead weight tonnage. The unit price is determined by the ship type (passenger ships, cruise ships, high-speed vessels and cargo ships) and ice class of cargo and passenger ships. Cruise ships and high-speed vessels on the other hand have constant unit prices regardless the ice class.

Passenger ships and high-speed vessels pay fairway dues for the 30 first port calls during a calendar year whereas cargo ships only pay for the 10 first port calls.

##### *Pilotage*

Pilotage fee is based on dead weight tonnage of the vessel in question and the distance to be piloted. The pilotage fee is charged for each beginning nautical mile. In accordance with the Pilotage Act, the Board of Directors at Finnpilot, determine annually the unit price, the reduced unit price and other possible commission fees.



##### *Tonnage due*

A Finnish vessel under registration obligation used in foreign merchant traffic and foreign vessel practicing merchant traffic to Finland is subject to tonnage due which is levied once every calendar year. The sum is 10 cents times the vessel DWT. Unlike fairway dues, tonnage due is levied only when the vessel is declared, either in or out, the first time during a calendar year. The tonnage dues collected are used to support e.g. search and rescue activities.

##### *Port dues*

Port dues are divided into fees for public services and fees for private services. The fees for public services include cargo charges, vessel charges, waste management fees and passenger fees levied by the Port Authority or a Port enterprise. Today the price setting of public fees has been freed. The premises for vessels and cargo charges may vary between ports.

Cargo charges are levied on goods transported by sea via ports and are levied based on gross weight. The cargo charges are divided into groups according to the Statistics on Shipping taking into consideration the Harmonised Commodity Description and Coding system of Customs Tariffs.

A vessel in merchant operations, is subject to vessel charge when entering/leaving a port. In cases when the vessel charge is collected on the basis of net tonnage, the amount of the charge is calculated according to the net tonnage indicated in vessel's bill of measurement, rounded to the nearest whole net tonnage.

Merchant shipping vessels mooring at port quays are charged waste management fees, the amount of which depends on the type of waste and whether the waste has



been sorted. The ship's net tonnage is used as a basis for ships' waste disposal fees. The waste disposal fees are established by multiplying the ship's net tonnage with waste disposal unit price.

A passenger ship in foreign traffic pays for each embarking or disembarking passenger a passenger fee.

Waste disposal fees will not be charged on black water if ships have a certificate granted by The Finnish Transport Safety Agency giving the right to deviate from regulations concerning the compulsory disposal of ship waste.

A ship using harbour services for receiving oliferous waste must notify the port of the waste and amount thereof at least 24 hours before port arrival, or immediately after leaving

the previous harbour if the duration of the trip is less than 24 hours.

Ports may apply lowered vessel charge tariffs based on environmentally friendlier ships using e.g. lower-sulphur fuels or technology reducing the amount of air pollutants or noise. Environmental discounts may also concern waste management if vessels use technology and practices to increase the sorting and reduce the volume of waste. Discount may be granted against an acceptable certificate proving the environmentally friendlier applications.

Fees for private services comprise payments for mooring and unmooring, water provision, electricity supply, use of cranes and loading equipment and storage and facility charges, for instance.



## 7 LAIVA 2025 ALTERNATIVE FUTURE SCENARIOS FOR SHIP CONCEPT CREATION

There are many significant changes to be anticipated in the marine environment within the ongoing decade and foreseeable future. The scope of “Laiva 2025” research project is to define, which ship concepts best correspond to the needs of the sea transport dependent Finland and its import and export logistics needs. Based on industry and commercial induced transport requirements, environmental and energy aspects, marine technology related development factors of change, three scenarios were established to support vessel concept planning.

In scenario generation members of the steering group (shipping companies, heavy industry representatives, universities) and a number of other experts within the field of maritime transport and logistics joined together to a “scenario generation day” to produce alternative scenarios for alternative vessel concepts, in 2025. Of the scenarios generated, two were chosen (“Sea Dream” and “7th wave”) and considered as inspirational guidance for the vessel concepts.

An electronic survey was furthermore conducted among the members of the steering group and other chosen experts within the fields related to logistics, to quantitatively underpin the qualitatively generated scenarios. A general result summary of the e-survey with focus on year 2025 is presented below.

### **The amount of international passenger traffic**

- The majority of the respondents foresee the number of passengers to grow

### **Industrial production**

- Forest industry
  - Production volumes are likely to decrease or remain at the 2012 level
- Metals industry
  - The opinions were somewhat varied although the majority of respondents foresee declining production volumes rather than growing ones
- Chemical industry
  - The production is anticipated to remain at current 2012 level
- Mining industry
  - The production is anticipated to increase significantly

### **Wholesale**

- The wholesale volumes are expected to grow moderately, especially what concerns imports

### **The overall volume development of Finnish foreign trade**

- The total volumes are not expected to change markedly
- The shrinking heavy industry export volumes are compensated with growing import of wholesale and other goods
- Finland-Asia trade is seen to grow aggressively
- Finland-Russia trade is likewise anticipated to grow strongly, although transit traffic is expected to shrink
- Finland-South or North-American trade is expected to remain on the same level

### **The use and significance of transport routes**

- The use and significance of land routes between European countries are expected to grow moderately compared to today’s transports, whereas a rather firm opinion about the growing use of Via/Rail Baltica was expressed
- The expectations for direct overseas transport are focused on a declining development
- Approximately half of the panelists believed that by 2025 Finnish foreign trade will use the North-East passage

### **Characteristics of goods transport**

- The share of dry bulk is foreseen to remain on current level, but depending on the development of the mining industry in the northern part of Finland, volumes can even grow significantly
- The share of unitised goods is clearly expected to grow
- The opinions about batch size development were spread, whereas transport frequency and time sensitivity of goods are expected to grow
- The duration of long-term warehousing has been decreasing and the same development is believed to continue

### **The number of ports**

- Half of the respondents believed in a reducing port number in Finland, whereas the opinion on port number development within the whole Baltic Sea region was spread

### **Accumulation of seaborne transports**

- Both volume and commodities are expected to accumulate to fewer ports in Finland and the Baltic Sea region

### **Energy prices**

- The prices of crude oil and LNG are expected to rise
- The price of other energy sources is mainly expected to grow, although for liquid and solid biofuels and in particular alternative energy sources, there may be an opposite development to be expected



**Transport of energy raw materials**

- In 2025, the transport of crude oil is anticipated to be of current level
- Transport of coal and peat is believed to be clearly under today's level
- Transport of LNG is expected to grow markedly
- Transport of ethanol, bio-oil and other biomasses, and waste are also foreseen to grow strongly

**Ship size development**

- The size of general cargo vessels are expected to grow
- The size of dry bulk and container ships are foreseen to grow or maintain on today's level
- The size growth potential of Ro-Ros ja Con-Ros is not clearly envisaged

**The use and significance of different ship types**

- The use and significance of container and general cargo ships are expected to grow
- No major changes anticipated for dry bulk, Ro-Ro or Con-Ro ships

**Operational efficiency of ships**

- The significance of life cycle thinking and vessel energy efficiency is expected to increase strongly
- The significance of flexible multipurpose use and automation degree of vessel (engine, propulsion, navigation, steering, cargo handling) is emphasised compared to today's situation
- Sailing speed is expected to slow down

**The use and exploitation of technology**

- The use of various technologies related to energy and environment is expected to grow strongly, as well as the use and significance of ICT and, material- and production technologies



### 7.1 “SEA DREAM” – The scenario of dynamic and fast development

The Finnish economy has recuperated well from the national recession induced by the global economic and fiscal crisis in the end of the first decade of the 21<sup>st</sup> century. The strong recovery of the global economy has propelled the Finnish export sector, in particular. The dynamic development has been a consequence of successful international co-operation and subsequent economic efficiency. Technology has taken giant leaps and innovations are widely spread and quickly applied. The European Union and the euro zone have enlarged and the internal market functions unhindered. All in all, Europe has been able to strengthen its relative competitiveness beyond the global level.

As a result of restructuring of Finnish economy, it is balanced and on solid ground. Finland has been able to reduce its sovereign debt substantially since the economic crisis and holds the highest possible credit rating. The economic and political development in Finland and Europe has been smoother and more buoyant compared to the global development, generally. Finland has a high employment rate, despite increasing weight of the service sector. Welfare has grown increasing the consumer purchasing power and spending.

National GDP contribution of the industrial sector is still significant, supported by a high level of competence,

expertise and innovation. Mining has become the leading industrial sector in Finland underpinned by innovations and advanced development of logistics. Know-how in logistics and environmentally friendly transport solutions promote the success of mining and the role of logistics, as a competitive factor, is emphasised.

Raw material intensity and energy consumption have reduced. Despite fairly elevated energy prices, high energy efficiency, new production methods and consumer behaviour, the pricing does not whittle away at Finland's economic growth. The fast evolving green technology enables increased carbon dioxide capture and storage, reducing the emission of greenhouse gases. The transportation of biomasses has increased massively. The use, distribution and logistics of LNG has grown and evolved, whilst the price difference to marine diesel has endured.

The Finnish merchant fleet is young and modern as a result of the EU sulphur directive and other statutes. Consequently the ships are more energy efficient and environmentally friendly, which is a competitive advantage for Finland. The vessel size of the traditional ship concept has reduced, although the concept has diversified.



## 7.2 “THE 7<sup>th</sup> WAVE” - The scenario of predictable and manageable risks in business as usual development

The state of global economy has not recovered to desired extent or speed since the global economic crisis in the end of the first decade of the 21<sup>st</sup> century, although some glimpse of optimism in long term positive economic development can be perceived in the horizon. The economic development and growth of Finland is still dampened by extended and sluggish global economy and problems related to public debt levels of South European countries. The growing population of elderly people and toughened international competition make the future look uncertain.

International competition is fierce and the cost level of Nordic countries does not validate mass production. In foreign trade, the Finnish export is strongly supported as the trade balance is still slightly in deficit due to high energy and raw material prices and weaker price development of exported products in comparison with imported goods. Finland's major trading partners are still found in Europe accounting for more than 50 per cent of the total seaborne exports. The large quantities of crude oil shipped to Finland, sustain Russia as the biggest import trading partner even if China has risen to hold a position among the group of Finland's traditional top import countries.

The shares of electronics and the electro-technical industry and forest industry have reduced, whilst the chemical industry and mining form the foundation of the Finnish industry. Export of mining industry raw materials has increased strongly even if the trend generally entails a shift from raw material exports to that of semi-finished products.

The Finnish economy has undergone a structural shift from industrial production towards service production. The volumes of industrial export have fallen significantly thus reducing the

need for transport which in turn has increased the logistical costs further. As a consequence of diminished industrial export volumes, the commodity and product batches of various industrial sectors have accumulated to ports specialised in serving these aforementioned commodities, whereby the Finnish port network has reduced in number. The Baltic Sea long-haul Ro-Ro operations have declined due to continuous price elevations of oil and LNG but sustained their role and position on short-haul routes to Estonia and Sweden. In logistics the significance and weight of intermodalism has increased leading to standardisation of different container sizes to EILU (European Intermodal Unit) used in intra-Europe (intermodal) transportation. All-weather terminals have become common enabling the automation of mooring and loading procedures. Despite challenging times Finland has been able to adjust to prevailing economic uncertainty and handles associated risks commendably. Finland has responded to competitive challenges it has encountered, by developing and investing in competence, expertise, innovations and automation to augment productivity.

Based on the scenario the significance and use of multipurpose vessels will increase even if the underlying concept is a less expensive vessel design with conversion readiness features included. The vessel size will grow based on increasing liner traffic model. As a result of sulphur directive implementation, the weight of extra-SECA zone ports, such as Brest and Liverpool for instance will be emphasized, both with regard to the European core hub network and overseas traffic. Central to the ship concept is a high energy efficiency and environmental friendliness; powered by LNG and dual fuel. The ship is furthermore characterised by a high automation level.



### 7.3 "THE CRESCENT AND POLARIS" -The scenario of precaution in a threat reflected development

Extended long-term political turmoil and instability in the Middle East and North African countries affect the mutual politico-economic relations negatively and those in particular between the Western countries and the earlier mentioned areas. The governments of the Arabic world aspire to a higher degree free themselves from the American leash, which further weakens America's local impact and other Western countries' attempt to gain political and economic balance in these unsettled countries. Anti-Western ideology and general disorder contribute to terrorism paralysing maritime traffic in various locations around the world but that in particular of the Red Sea, Gulf of Aiden and Arabic Sea reducing the number of navigational routes, accumulating the maritime traffic flows and impairing the global production.

As a consequence of the internal restlessness in the Middle East and the crisis formed between the Westerners and the Arab world, the Suez Canal is closed. As a further development OPEC countries agree on lowering the oil production leading to rising oil prices and scarceness in availability. The limited oil availability and soaring price development alter consumer behaviour increasing the need for bioenergy, development and implementation of alternative energy efficient energy sources and technologies both in households and industries. Moreover, the significance of arctic resources grows further.

The instability of the Arab world, terrorism, traffic restrictions and traffic concentration in combination with oil price elevations affect initially Finnish foreign trade unfavourably leading to a structural shift in the Finnish economy with

service sector capturing a growing share. The impaired Finnish foreign trade looks for alternative and safer trade routes as a consequence of augmenting production and maritime transport costs, and excess idle vessel capacity. Alternative transport modes, including inland waterways, are taken in to more efficient use. Also, the construction of Rail Baltica tunnel connecting Finland and Estonia is initiated. Idle vessels are reused as production and/or storage facilities or they are converted to production plants and transport vehicles of fresh (and potable) water.

The role of China as Finland's trading partner is emphasised, whereby the transportation need between Finland and China grows and materialises as initiation of liner traffic along the North-East passage. Finland's northbound land-based transport flows grow as a result of increasing usage of the North-East passage and thereof Finland invests in developing and constructing northbound transport corridors and infrastructure. The leasing of Liinahamari Port in Russia, characterised by easy transit procedures, provides access to the Arctic Ocean.

Due to shortage of maritime transport capacity, the efficiency of maritime transport and safety criteria are maximised in ship design, operations and transport markets. The ship size grows and the versatility of operations and utilisation are emphasised; the separation between bulk and unitised cargo fades out. The vessel is Arctic proof, equipped with required ice classing and ice-breaker qualities. The vessel uses biofuels as power source.





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