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Detailed analysis of the rail transport, port infrastructure and logistics in general from North Karelia and East & North Finland to Sweden and Norway

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KVARKENRÅDET
MERENKURKUN
NEUVOSTO

POHJOIS-POHJANMAA
COUNCIL OF OULU REGION

Forewords

New North is a project with the ambition to develop sustainable transport system, which consideres the future transport possibilities, in the northern parts of Norway, Sweden and Finland. The goal is to strengthen cross-border cooperation and lay the foundation for developing transport infrastructure holistically, as current geopolitics and rapidly developing industries highlight the need for improved logistics. The project is a collaboration between regional councils in all three countries, and it has received funding from the European Union's *Interreg Aurora* programme.

The project is divided into four work packages. This study is part of work package 4, the theme of which is green transport corridors. The work package focuses on railway transport and infrastructure, and ports serving the economy within the project area.

28th of May 2025,

Jyrki Suorsa
Regional Council of North Karelia

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Regional Council of Lapland

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1. The aims and scope of the study

The aims and the scope of the study

This study, *Detailed analysis of the rail transport, port infrastructure and logistics in general from North Karelia and East & North Finland to Sweden and Norway*, is the second study of work package 4 *(Green transport corridors)* in the *New North – Transport, Logistics, and Security of Supply* project which is a part of the *Interreg Aurora* program co-funded by the European Union.

The overall goal of the New North project is to address the realisation of future investment potential in the northern region and the opportunities presented by advancements in transportation and logistics technology. Work package 4 focuses on the green transport corridors, in which the rail network and rail freight play a crucial role.

The aim of this study has been to identify and analyse alternative logistics routes connecting Eastern and Northern Finland with foreign markets. The main sub-aims have been to analyse the capacity and costs of these routes, to identify the main bottlenecks and to create infrastructure development plans for sufficient routes. The main methods for route identification have been analysing previously conducted studies and a survey to the companies in the area. Bottlenecks and infrastructure development plans have been identified based on expert analysis. The Joensuu area has been used as a case example throughout the report, and the majority of the findings can be applied to other regions in the New North area as well.

This study focused on the commercial logistics of companies within the Finnish region involved in the New North project. The needs for military mobility and points of view on security of supply have been assessed in the different work packages of the New North project.

The main outcomes of this project have been the conclusions on the possible logistics routes, challenges that each of them currently faces and identifying the key actions to take in order to make those routes more usable for the companies.

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2. The roles of different transport modes

Roles of the different transport modes

The main logistics modes — sea, road, rail, air and combined supply chains — all have routes and characteristics where they either compete, cooperate, or dominate.

Strengths and main commodities of different transport modes

Ship cargo is essential for transporting large volumes of goods across the globe, particularly bulk commodities like crude oil, coal, and grain. It also plays a significant role in transporting heavy machinery, vehicles, and raw materials, benefiting from the capacity and cost-effectiveness of maritime transport. In addition, it has a key role in moving containerised goods, which include among others consumer products, between international markets.

Road cargo is widely used for transporting a diverse range of goods, including industrial products like machinery and construction materials, consumer goods such as food, beverages, and household items, and perishable products that require timely delivery. It also plays a crucial role in moving raw materials like round timber and agricultural products, as well as hazardous materials needing specialised handling. It has the lowest logistical complexity and is also generally the easiest transport mode for clients to acquire.

Rail cargo is used for transporting bulk commodities, such as coal and minerals, which are often moved in large quantities over long distances. It is also utilised for heavy machinery and construction materials, benefiting from the capacity and efficiency of rail transport. Additionally, intermodal containers, which include consumer goods and automotive parts, are frequently moved by rail, providing a reliable and cost-effective solution for long-haul transport. Intermodal transport is quite common in Europe but quite rare in Finland due to lack of a sufficient demand.

Air cargo is predominantly used for transporting high-value, perishable, or time-sensitive goods. This includes electronics like computers, smartphones and industrial components, pharmaceuticals such as medicines and vaccines, and perishable items like fresh fruits, vegetables, and seafood. Generally, air cargo constitutes a minor share of all transports.

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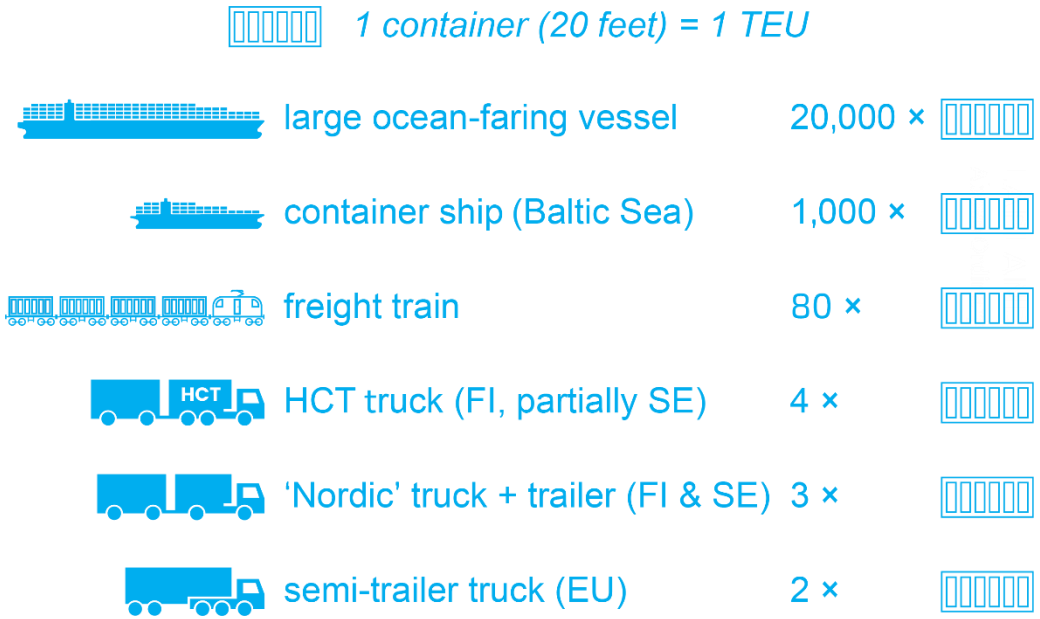
Capacity of different transport modes

The differences in usability of different transport modes are mainly explained by differences in their capacity. *Maritime traffic* has the highest capacity, with large ships capable of carrying over 200,000 tons. The ships coming to the Baltic Sea can usually carry around 5,000 to 50,000 net tons, but differences between different vessel types are large. In *road traffic* trucks are generally able to carry up to 40 net tons per trip. In Finland and partially in Sweden, *HCT trucks* up to 55 net tons can be used. *Rail traffic* can transport much larger loads, with freight trains carrying usually 1,500 to 2,000 net tons, but for some transports up to 5,500 net tons is possible. *Air traffic* typically handles smaller volumes, with cargo planes and cargo holds in passenger aircraft carrying between 10 and 100 tons per flight.



Transport times of different transport modes

Air cargo is the fastest alternative, with typical shipment delivery times from a few hours to a couple of days. Rail cargo offers a balance between speed and capacity, with transit times ranging from a few days to over a week, depending on the distance and rail network. Road cargo is highly flexible but can be slower due to traffic conditions, often taking several days or up to week for cross-border transports.

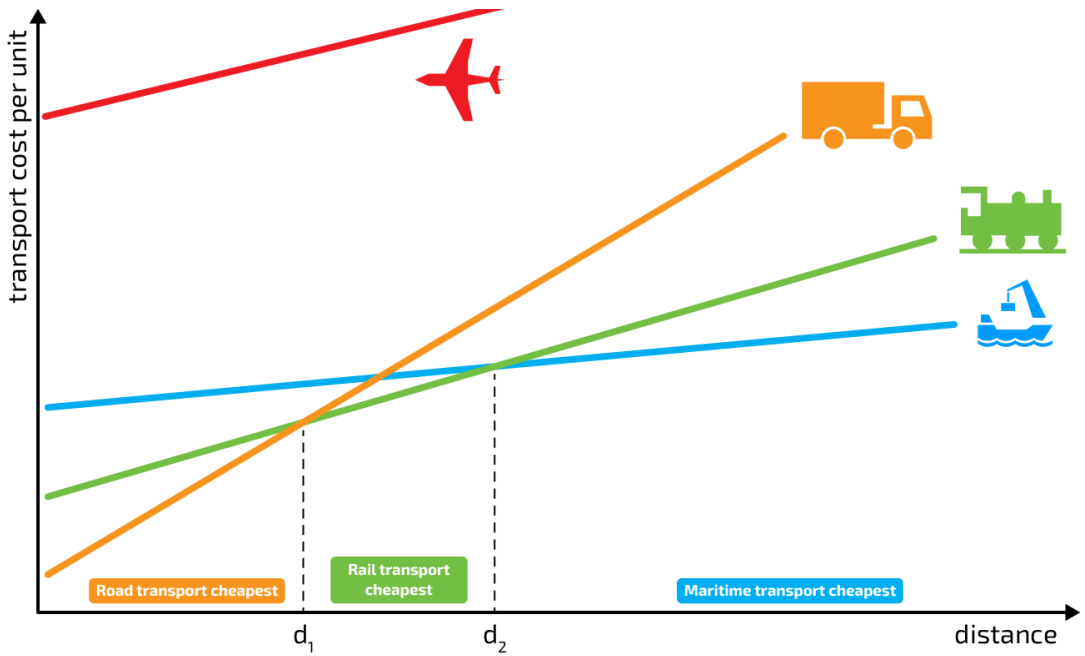
For shorter routes, road cargo is usually faster than rail shipment due to loading times. Ship cargo is the slowest with transit times ranging from 20 to 45 days for intercontinental shipments.

Costs of different transport modes

Different capacity means different transportation costs. Due to small capacity, air cargo is the most expensive, usually ranging 3–7€ per ton-kilometre. However, if the goods are valuable, the time for committed capital remains lower due to shorter shipment times.

The cost for road and rail traffic is closer to each other and more due to external and internal factors: amount and type of the commodity, the length of the route, the need for loading and unloading, the status of infrastructure, the amount of competition in the transport market and available vehicles and stock are just examples which determine the exact costs. Typically, the cost varies 0.1–0.5€ per ton-kilometre.

The cheapest transport mode is ship cargo, which typically ranges 0.05–0.2€ per ton-kilometre. However, to achieve such a low unit cost, the shipment volumes need to be large, and the transport distance should be also long enough. Therefore, other transport modes may be more cost-efficient for smaller shipments or certain routes where combining demand is not possible.



Competition or cooperation?

From a logistics perspective, each mode of transport has specific areas where it is the most practical choice for companies to use. However, there are also logistics chains where competition can be fierce due to similar service level different transport modes can deliver. The key factors influencing the selection of a logistics mode include costs, speed, capacity, distance, commodity type, infrastructure, the availability and reliability of services and level of complexity to acquire and monitor. Nowadays the environmental impact of different supply chains is also becoming an important factor. However, the biggest influence typically is the cost compared to needed time of arrival. Therefore, air transportation is an obvious choice for a spare part of a production plant but bulk commodities such crude oil and grain typically have regular supply, low committed capital cost and can therefore spend longer times in transit.

The most intense competition usually occurs between rail and road transport, as their costs can be comparable for certain commodities and routes. This is true especially for commodities which do not require special handling or storage conditions. These include for example industrial products and raw materials. In Finland and in Sweden, for example, round timber is transported a lot by both road and rail.

To some extent rail traffic can also compete with sea transport. However, the longer the route and the larger the volumes, the more difficult it gets to find cost efficiency for rail transports compared to sea transports. Capacity can also be a concern: a single train can carry about one-tenth of the cargo of a typical Baltic Sea ship and even smaller proportion than an ocean vessel.

Besides road transportation, the other transport modes are depended on each other and majority of all logistics chains involve road transport at least at some part of the chain. An exception are logistics from larger factories which have their own railway connection and are able to use it, for example to shipments to and from ports.

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3. Logistics and foreign trade in Finland

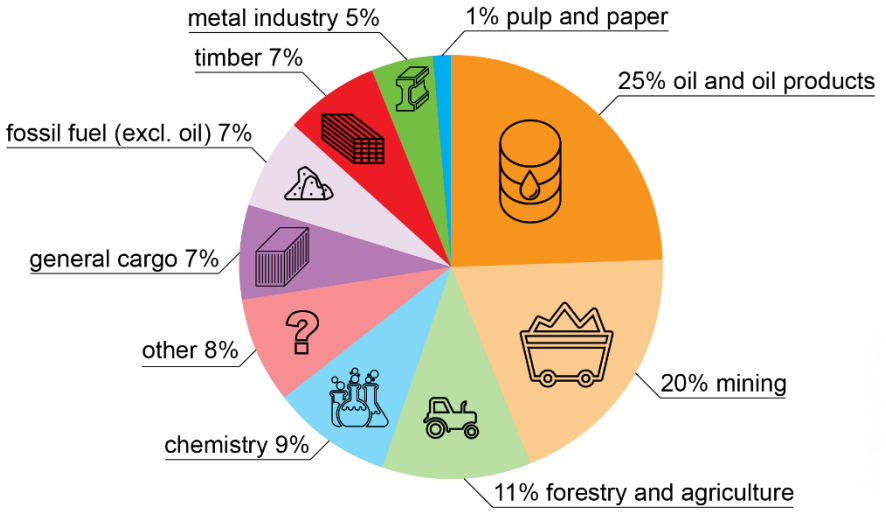
Foreign trade in Finland and the New North area

Overview of modal share and main commodities in Finland

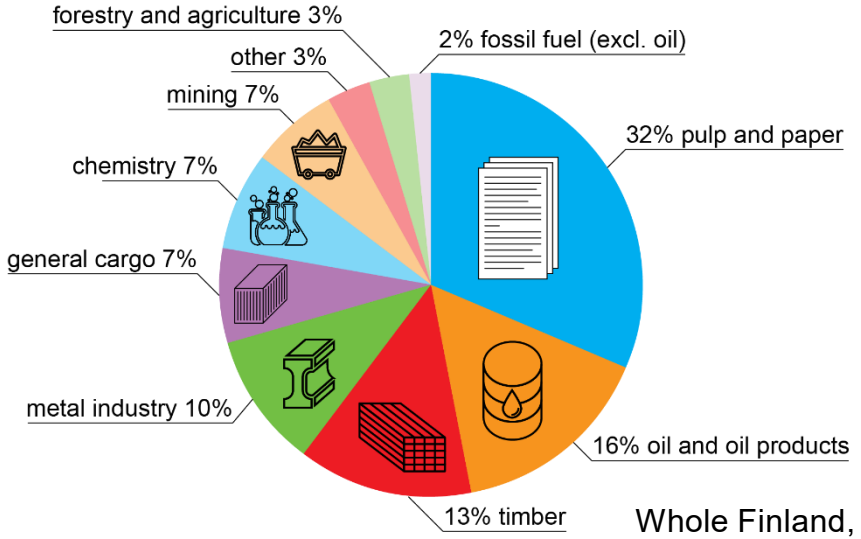
Finnish foreign trade transportation is heavily reliant on sea transports, when considering tonnage transported. In 2023, the share of sea transports in goods exports was 94% and in goods imports 97%. The share of road transport in exports was 3.8% and in imports 1.5%. The shares of air transport and rail transport by tonnage are quite small: air because the products transported are light compared to other transport modes and rail mainly because of geographical and political reasons, and also due to rail gauge difference.

Main export products of Finland by tonnage are pulp and paper, oil products, timber products and products of metal industry. The main import products on the other hand are crude oil, and products of mining, forestry, agriculture and chemistry industries.

IMPORT 53 Mt



EXPORT 41 Mt



Whole Finland, 2021, measured in tonnes

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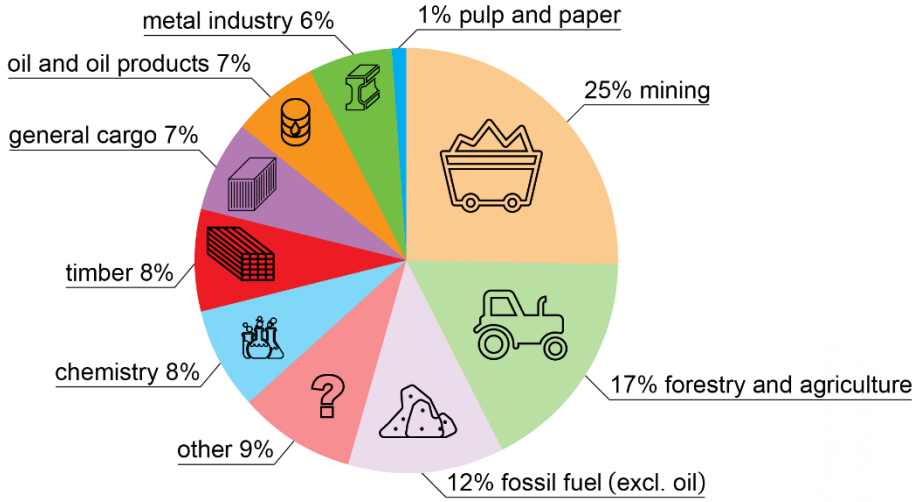
Overview of the Finnish part of the New North area

The project area constitutes approximately one-fifth of total imports in Finland measured by mass. The commodities transported generally align with the national average, except for a notably lower import of oil and oil products.

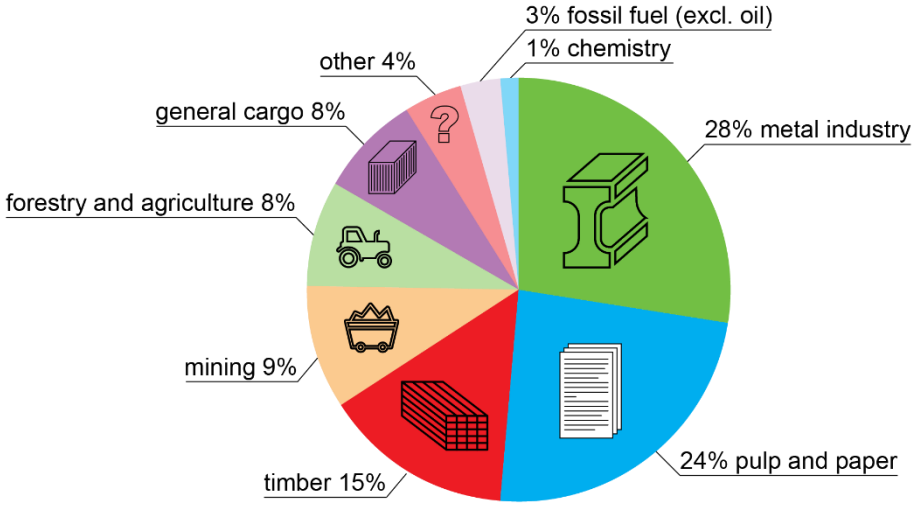
Exports from the area also constitute approximately one-fifth of the national total. Commodities exported differ slightly from the national average. Most significant are exports of the metal industry due to the Raahe steel mill. Oil exports, which contribute a lot to national figures, are not present on the project area, as those originate mostly from Sköldvik. Otherwise, the figures reflect the national average well.

Measured by value, the project area constitutes approximately one fifth of Finnish imports and a quarter of exports. Over a half of imports consist of general goods such as consumables, groceries, appliances, and other various items. In addition to that, metal, mining and chemistry industries contribute 10% each for total imports. In exports, metal industry is on par with general goods, each having 35% share of exports by value. Paper and pulp have a combined share of 10%.

IMPORT 10.4 Mt



EXPORT 9.3 Mt



Project area, 2021, measured in tonnes

Regional differences

There are significant differences within the area: in the eastern parts, vast majority of transports are related to timber, mining industry, forestry, or agriculture. In contrast, on the coastal areas, metal industry, paper, and pulp form approximately three-quarters of exports. Mining constitutes alone almost half of the total imports within the coastal areas.

In *North Karelia,* the most significant imports are related to forestry and agriculture (approx. one-third) and mining. Exports of timber products form approx. one-third of all exports. Other key export sectors include the mining and forest industries.

In *Kainuu,* the mining industry is by far the most important sector. It contributes approx. two-third of imports and over half of exports. This is mainly due to the mine in Sotkamo. Export of timber is also significant.

In *Lapland,* imports are mostly related to mining, forestry and agriculture. Exports consist mainly of metal industry products (approx. half), and pulp and paper (together approx. one-third). Most significant contributors are steel mill in Tornio and pulp mill in Kemi.

In *North Ostrobothnia,* mining contributes approx. one-third of all imports. The share of fossil fuels imported is also greater than in other areas. That is explained mainly by Raahe steel mill. Exports consist mainly of paper and pulp (together approx. one-third), timber products, and chemistry products.

In *Central Ostrobothnia,* mining industry dominates imports with share of over three-quarters. This is mainly due to metal and mineral refineries in Kokkola. It is also reflected in exports, of which approx. one-third is from chemistry industries, e.g. fertilisers and cobalt. Exports of timber are also significant.

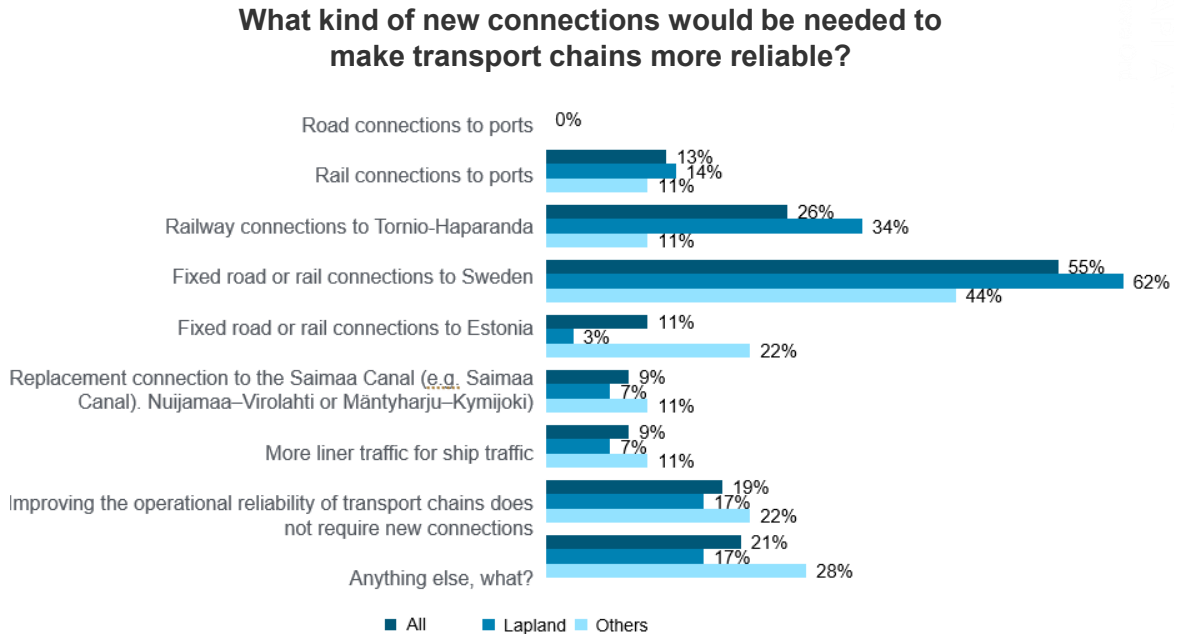
In *Ostrobothnia,* most important imports are fossil fuels (approx. one-quarter) and products of forestry and agriculture (together approx. one-quarter). Exports consist mainly of general cargo (approx. one-quarter) and paper and pulp (together approx. one-quarter), latter of which is produced mainly in Pietarsaari mills. General cargo exported from the area includes e.g. machinery.

As part of the study, a survey for Finnish logistics companies was made. The survey gathered responses from 49 participants from 45 companies representing various industry sectors. Most respondents were from Lapland region, with a significant number based in Rovaniemi and Sodankylä. The survey aimed to understand the supply chains, road network challenges, and future outlooks for logistics operations in the study area. The survey results are unabbreviated in attachment 1.

Regarding future prospects, 85% of respondents felt that investments in the current road network are needed to improve transport and logistic chains. 23% of the respondents felt that completely new connections are also needed. When asked specifically which connections would be most important, fixed road or rail connections to Sweden and especially better railway connection between Tornio and Haparanda were the most prevailing needs.

Half of the respondents believe challenges will increase in the future, citing geopolitical situations, deteriorating road network conditions, increased volume of goods, and rising bureaucracy as significant concerns. Additionally, achieving sustainability goals was mentioned as a challenge due to increased reporting requirements and the need for new transport solutions.

This study in part is one way to take these concerns into account and highlight the importance of developing this crucial cross-border infrastructure network and secure effective and resilient logistic operations.



Investment potential

In the previous study of WP 4, planned investments affecting railway transports were identified. These projects are not included in the official forecasts, as the final investment decisions have not been made yet. The most important investments expected to realise before 2030 include new pulp mills in Kemijärvi and Paltamo, and battery factory in Vaasa. The pulp mills would generate transports from Kemijärvi and Paltamo to foreign markets. The most cost-effective way would be railway transports to Oulu or Kemi and sea transport from there. Vaasa's battery factory would need about 4 trainloads input materials for the process on weekly basis, which would most likely come from Sotkamo. Exports would be modest measured by tonnes.

Investments with potential to realise before 2050 include few mines in Lapland. These would generate significant amounts of ore to be exported, which would most likely be transported by train to Kemi and from there by sea transports to further markets. These transports would significantly affect railway lines from Kolari and Kemijärvi to Kemi. For *Hannukainen mine* in Kolari, a railway connection to Norway could be a feasible option, if such connection and adequate port infrastructure would exist. However, the distance to Kemi is only half that to the Norwegian coast, creating a likely financial incentive to transport goods to ports in the Bothnian Bay instead, even if railway connection to Norway would exist.

In addition, it is estimated that amount of round timber transported within Finland would increase in the future. That will increase utilization of the rail network.

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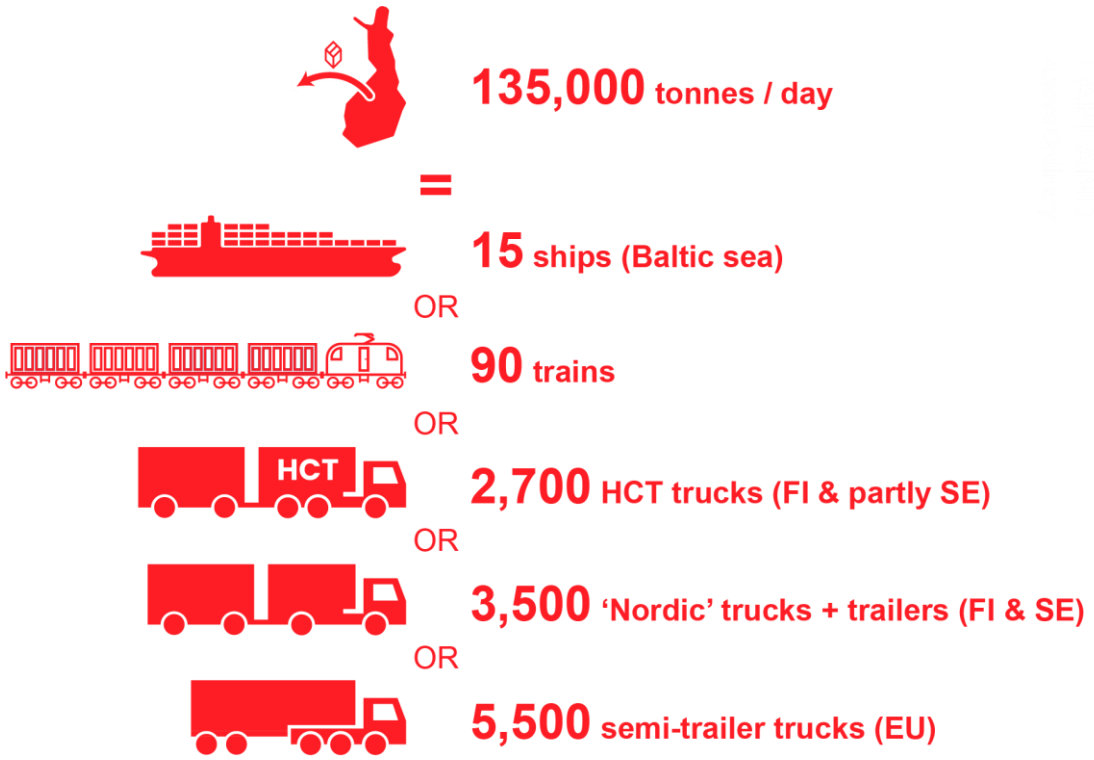
Overview of the capacity of road and rail vehicles

Finnish goods exports are around 40.2 million tonnes annually and imports around 49.9 million tonnes annually. That is approx. 110–135 thousands of tonnes per direction each day. In practice, transport volumes are significantly higher on weekdays compared to weekends or public holidays. Around 95% of Finnish foreign trade is transported by ship. Some export products are manufactured right next to a port, but large quantities are transported from inland by railways (⅔) or trucks (⅓). Same applies to imports, although it relies more on road transports.

Capacity in maritime transports is enormous compared to all other modes of transport, even on typical ships navigating in Baltic Sea. Whereas 15 fully loaded ships a day could fulfil the demand for Finnish exports, around 90 trains or thousands of trucks would be needed to transport Finnish exports by land. The extension of Finnish foreign trade would exceed capacity of a double-track railway *with no other traffic.* It would be extremely demanding for railyards as well, especially if the products had to be transferred to another train due to gauge difference. In addition, there is an insufficient number of rolling stock and trucks to transport a significant portion of Finnish foreign trade to other countries, given the substantial volume and extensive overland distances.

An estimate of daily Finnish foreign exports by different modes of transport. (Yearly total divided by 365)

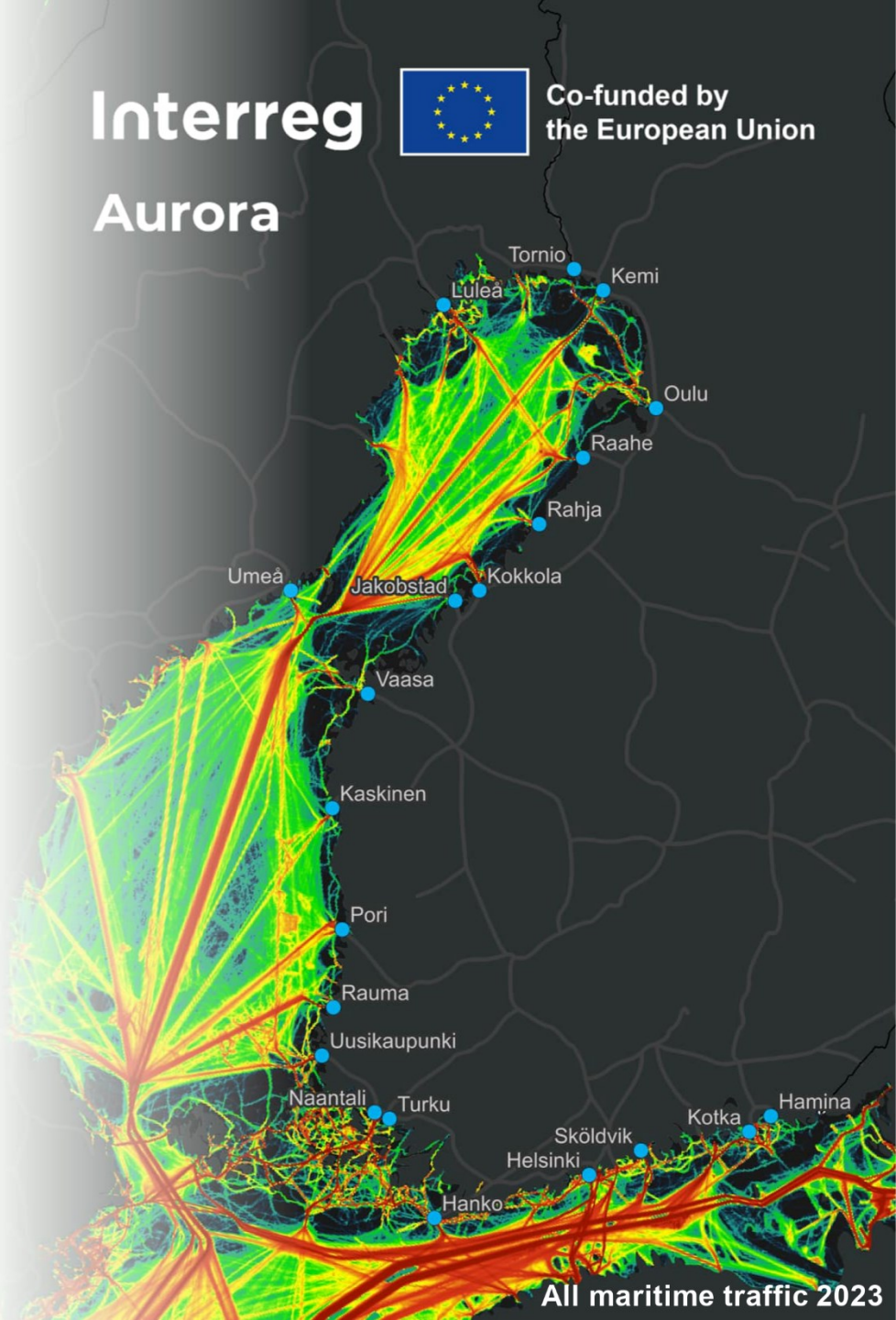


Maritime traffic and Finnish ports

Maritime traffic

There are two main types of maritime traffic:

1. *Scheduled traffic:* a route is served on a predetermined schedule and a client or a freight forwarder can book some amount of capacity on a given service. These ships usually transport containers, trailers and/or trucks. Direct connections from Finland reach to Northern Spain at the furthest. Containers can be transported efficiently to any port in the world, with transfer to other ships e.g. in ports of North Sea. From Finland, there is daily traffic at least to Sweden, Estonia and Germany and weekly traffic to all major ports in Central Europe.
2. *Tramp trade:* a client or a freight forwarder charters a ship for a given voyage. The whole ship is in use of that client and usually operates directly to the destination without any intermediate stops. These ships usually transport bulk goods. Routes can reach anywhere in the world, with regular transports from Finland to e.g. South America.

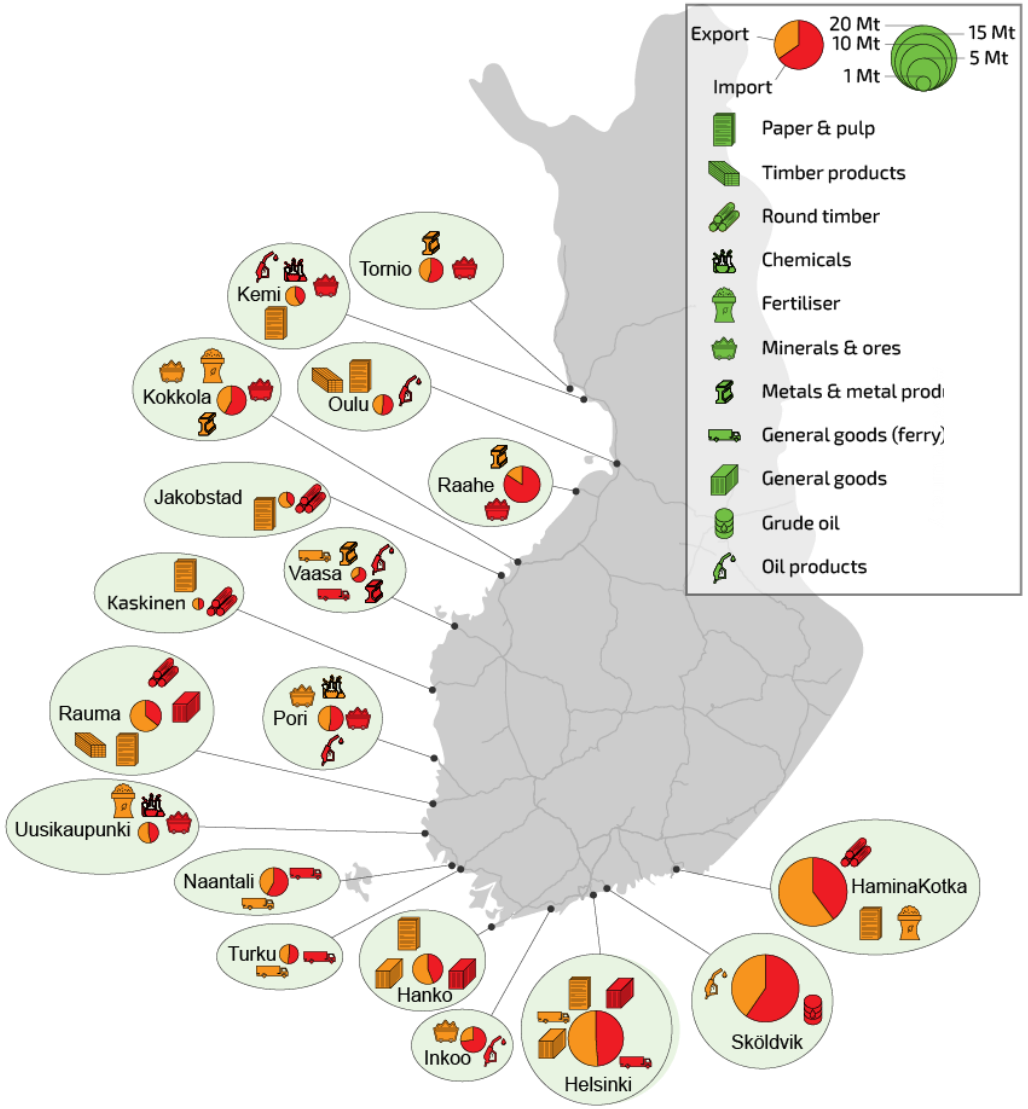


In addition to dedicated cargo ships, the Baltic Sea ferry traffic has a major role in freight transport. Trucks carried in ferries offer the second fastest deliveries losing only to significantly more expensive air cargo. Excluding ferries, most ships head to Central Europe or further. There are some coastal transports (especially for oil products) and also some transports across the Baltic Sea such as iron ore from Luleå to Raahe.

Ports in Finland

The strong role of sea transports emphasises the importance of ports and the infrastructure that leads to the ports — i.e. roads and railways — when discussing foreign trade logistics.

The largest non-specialised ports in Finland are Helsinki (14Mt p.a. in 2024) and HaminaKotka (13Mt). Most foreign groceries and consumables are imported to Finland via Helsinki either by container ships, or by trucks onboard ferries. It also handles significant amounts of exports. Despite that, HaminaKotka is Finland's largest port for exports, especially for paper, pulp and fertilisers, most arriving from eastern Finland.



Turku (1.7Mt) and Naantali (3.8Mt) have ferries to Sweden and therefore are important for truck transports heading to or coming from Central Europe. Hanko (4.2Mt) and Rauma (4.5Mt) are important export ports for forest industry in Southern and Central Finland.

Sköldvik (21Mt) is heavily specialised to imports and exports of oil, as it mainly serves oil refinery next to it. Measured by tonnes, it is Finland's busiest port. Similarly, Raahe (6.2Mt) mainly serves a steel mill next to it.

Goods used to be transported also trough Saimaa Canal to Eastern Finland. The volume transported in 2019 was 0.98Mt, which consisted mainly foreign imports and exports of round timber, minerals and fertilisers. As the Canal runs trough Russia, the transports have ceased. This has hindered industries in Eastern Finland and forced to switch to road or rail transports instead.

Ports in the project area

Port of *Tornio* (2.7Mt) is mainly a 'private' port for a steel mill located right next to it. Ores are imported and metals exported.

Port of *Kemi* (1.8Mt) is an important export port for Northern Finland. Most dominant are exports of paper and pulp produced in nearby mills. In addition, recently there have been some exports of metals and ores. Import volumes are modest, but the port has nevertheless important role in imports as well. It has a crucial role in fuel imports in Northern Finland. In addition, it serves occasional transports of windmill parts and heavy machinery. A separate port area in *Veitsiluoto* island has been quiet since a paper mill was closed on the island but import of lime will most likely begin there in the near future. Permit for those operations was granted late 2024.

Port of *Oulu* (1.9Mt) is a versatile general harbor. There are three separate port areas. *Oritkari* handles mostly containers and forest industry products, *Nuottasaari* raw materials of forest industry, and *Vihersaari* both liquid and dry bulk. Most important commodities exported are timber products, paper and pulp, whereas most important imports are fuels and raw materials for forest industry. Its hinterlands cover mainly the nearby areas, and pulp and paper mills in Oulu have also an important role.

Port of *Raahe* (6.2Mt) is mainly a private port for nearby steel mill. Imports consist mainly of ores and coal. Exports include metals and minerals. Vast quantities of iron ore is transported from Luleå to Raahe. In addition, Raahe is one of the most important ports in Finland for wind farm industry.

Port of *Kokkola* (4.0Mt) is the most important port in Finland for mining, but it is able to serve wide variety of commodities. The port focuses on dry bulk with most important commodities imported being ores, minerals, and chemicals. Exports consist of significant amounts of fertilisers, ores, metals, minerals, and chemicals. It is important also for project cargo, with windmill parts being a common import. Hinterlands are mid-sized reaching nearby region and North Savo.

Port of *Jakobstad* (1.1Mt) is relatively small and serves mainly local area. Maritime connections are also quite limited. It mainly exports pulp and timber products. Volume of imports is smaller and consists mainly of round timber.

The Port of *Vaasa* (1.0Mt) is a smaller port in Österbotten in terms of tonnage. Unlike the Port of Jakobstad, Vaasa primarily handles imports, with nearly half of these being oil products. It does not have any dominant commodities in addition to that. It serves mainly local area and has only limited maritime connections. A distinct feature in ferry service to Umeå with one or two daily departures. While traditionally underdog for project cargo, Vaasa has substantial potential for offshore wind power industry.

Port of *Kaskinen* (0.6Mt) is even smaller port than Jakobstad or Vaasa. It mainly serves import and export needs of local forest industry. It handles mostly dry bulk and has only limited maritime connections. In addition, Port of *Rahja* (0.4Mt) is located in the project area. It is a tiny port with small amount of traffic. It mainly exports timber products.

Ferries

Several Finnish ports have regular ferry connections within the Baltic sea. Some of these ferries are dedicated for cargo, whereas others transport both cargo and passengers.

For trailer transports, by far busiest is *Helsinki* (670,000 trailers p.a.). Large proportion of ferries are destined for Tallinn, with Germany (Rostock & Travemünde) being another major destination. Other destinations with weekly service include Stockholm, Antwerp, Zeebrugge, Aarhus, Sheerness & Bilbao.

Hanko (160,000) is the second largest trailer port. It has weekly connections to Lübeck, Rostock, Gdynia, Paldiski, Antwerpen, Travemünde, Århus & Tilbury.

Naantali (120,000) and Turku (77,000) both have daily ferries to Sweden destined for Kapelskär and Stockholm respectively. These services stop on Åland islands. Vaasa (20,000) has daily connections to Umeå. Several other Finnish ports have occasional ferry services.

Volumes of foreign trade in Finnish ports in 2024

port	tonnes (tot.)	trailers	TEUs*
Sköldvik	21,227,861	-	-
Helsinki	13,948,353	669,652	434,190
HaminaKotka	13,218,975	5,470	563,924
Raahe	6,180,222	-	217
Rauma	4,526,773	1,439	196,222
Hanko	4,245,986	158,700	56,291
Kokkola	3,978,427	-	15,722
Naantali	3,778,219	118,137	-
Inkoo	3,061,819	-	-
Pori	2,903,613	-	14
Tornio	2,687,974	-	13,189
Uusikaupunki	1,942,180	6,394	172
Oulu	1,888,466	45	31,951
Kemi	1,774,270	67	3,677
Turku	1,688,859	77,042	1,618
Pietarsaari	1,143,051	890	198
Vaasa	1,017,837	20,139	14
Kaskinen	615,523	-	-

*Twenty-foot Equivalent Unit, a measure of containers transported.

Key ports and routes from the New North area perspective

The ports located in the New North area are from north to south Tornio, Kemi, Oulu, Raahe, Rahja, Kokkola, Pietarsaari, and Vaasa. Some ports focus solely or mainly to serving large industrial plants next to the port. Such ports include Tornio, Kemi and Raahe. Meanwhile ports of Oulu and Kokkola are the most important ports for transport originating from or heading to companies further inland. Vaasa is a special one in the project area, as it is the only one to have ferry service.

Other significant ports for the project area are HaminaKotka, Helsinki, Turku and Naantali. HaminaKotka is most important export port for Finnish industries. Main products exported include paper, pulp and fertilisers from Eastern Finland. It is also largest container port in Finland. Helsinki is another one with large quantities of container traffic. It is extremely important for imports of general goods. Both have extensive network of scheduled maritime services.

There are ferry services from Helsinki to numerous locations on shores of Baltic Sea. Turku and Naantali have ferry services to Stockholm region in Sweden. Some ferries serve only freight traffic and its drivers, while others serve also passengers. Cargo is carried on all ferries.

Connections to ports

All ports have road connections, but some have better connections than others. On the western coast of Finland road connections from north to south along the coast are good for all ports. Connections to inland vary more port by port. Ports of Oulu, Kokkola and Vaasa have most extensive road connections in the project area. Other ports have more or less restricted road connections to inland. Outside the project area, HaminaKotka, Helsinki, Turku and Naantali also have extensive road connections.

While most ports have railway connections, some of these connections are inadequate. Best railway connections on the project area are to Oulu and Kokkola. Ports of Tornio, Kemi, Raahe, and Jakobstad have also good railway connections, but railways serve more industrial plants next to port, than the port itself. Tornio is located few kilometers from Swedish border, so extending standard gauge track from Sweden to Tornio could be beneficial. Vaasa has a railway connection, but currently the line section has very limited capacity and could serve freight traffic only at nights. Kaskinen has railway connection, which has been temporarily closed to traffic due to poor condition since autumn 2024. Rahja has no railway connections at all.

Outside the project area, HaminaKotka has excellent railway connections. Port of Helsinki has a railway connection to Vuosaari, but other port areas do not. Ports of Turku and Naantali have railway connection, but reaching these from the project area isn't straightforward.

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4. Swedish and Norwegian rail network and ports

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Swedish and Norwegian rail network

The capacity of the Swedish rail network

The Swedish rail network is divided into 279 line sections. Most of the rail corridors have available capacity when looking at the 24-hour window. However, when looking at a busiest 2-hour window analysis (see the map on the right), the capacity is mostly full in lines approaching to the major cities of Malmö, Gothenburg and Stockholm, where train lines for both regional and commuter traffic as well as commercial long-distance trains converge. That applies also to the *Malmbanan* (Narvik–Kiruna–Luleå). In addition to these limitations, there are many stations such as Umeå, Gävle, Örebro, Uppsala, Kungsbacka, and Malmö C, where there are capacity shortages in terms of available platform tracks, storage sidings, and possibility to reverse trains.

In the map on the right, red means high utilisation which is that more than 80% of the capacity is used, yellow means middle utilisation of 61–80% and green means less than 60% of the capacity is used which is low utilisation. Basically, in high utilisation situations it is difficult to add more trains or even increase maintenance on the tracks. For 61–80% utilisation, the system is already non-resilient and if there is a need for additional operations, like additional maintenance, it is a trade-off with the other traffic in regards of schedules. For a utilisation less than 60%, the system can handle more traffic and maintenance, if needed.

The key challenges of the Swedish rail network include aging of the infrastructure, bottlenecks that disturb the whole system, slow (freight) and fast (passenger) trains on the same tracks and the fact that majority of the railway lines are single-track with limited passing stations. Another challenge is, that often a given line has free capacity only on certain times, which may lead to long waiting times during the transport.

An analysis made in 2023 about the rail capacity development in Sweden concluded, that rail demand is increasing faster than the capacity of the network. This creates even more challenges to add traffic from Finland to the Swedish tracks without additional, major investments, like double-tracks.

From Finland's point of view, the most interesting rail routes are from Haparanda to Narvik port, to Gotherburg port and to Central Europe through *Øresund* Bridge. All these routes have major capacity issues and even thought development plans exists, no major capacity uplift is expected with the known investments. In the north, the new *Norrbotniabanan* between Luleå and Umeå will provide some new capacity from 2030s onwards but other capacity challenges through Sweden remain.

Malmbanan to Narvik port

The route from Haparanda towards Narvik port is called *Malmabanan* on the Swedish side and *Ofotenbanen* on the Norwegian side. The Malmbanan is a single-track line and therefore highly sensitive to disruptions. The entire stretch from Luleå to Norwegian border in *Riksgränsen* has insufficient capacity, but the largest bottlenecks are on the sections Luleå–Boden and Murjek–Kiruna. The line has both passenger and freight traffic. Majority of the traffic is ore transportation from Kiruna mine to Narvik port, and also partially ore to port of Luleå (approx. 20% of all ore volumes). There are no alternative railways to reroute the traffic and ore is in general difficult or impossible to transport by road. The ore transports have very high significance to Swedish economy leading to high priorisation over other traffic.

The main challenge of Malmbanan is that the freight trains are 600–750 meters long, but many passing loops can only accept trains upto 500 metes, which makes them insufficient. Out of 28 passing loops, 12 are too short.

In addition, the traffic between Kiruna and Narvik is forecasted to increase during the nearest future. This would require more capacity than is currently available.

North-south lines through Sweden

There are several routes from Haparanda to reach either Gothenburg port or the Øresund Bridge, which is the main rail connection from Sweden to Central Europe. However, all these routes have capacity issues which means that transportation times would be long and not much new traffic can be added.

The most challenging parts of the network are the areas close to Gothenburg and Malmö because these areas have large amounts of passenger train traffic as well. Passenger and freight trains typically have different speed. This means that enough passing loops are needed in order to add more freight trains on sections with high traffic density. In Northern Sweden, single-tracks, lack of sufficient passing loops, and weight restrictions are the causes of the most capacity problems.

The capacity of the Norwegian rail network

The Norwegian rail network includes the isolated *Ofotenbanen* line in the north, which links the Swedish Malmbanan line to the port of Narvik. The rest of the network is well-connected internally and has multiple connections to Sweden, but it does not connect to the Ofotenbanen.

Photo: Nick-D / Wikimedia Commons (CC BY-SA 4.0)

The railway network is heavily utilised in several sections and the maximum capacity is reached. Lack of capacity is seen mostly in the Oslo area where the tracks through and towards Oslo are fully used all day. The largest capacity constraint is the Oslo tunnel. The entire Oslo–Trondheim route is overloaded, which means that it has lower capacity than demanded. This also applies to the next corridor, from Trondheim to Bodø. Similar challenges as in Sweden restrict the capacity for freight traffic: passenger traffic, difference in speed, single-tracks, and weight restrictions.

Ofotenbanen is the most heavily trafficked railway line for freight in the country, due to the transport of iron ore from Sweden and combined transports from Oslo via the Swedish railway network. It is a single-track line, and the heavy traffic causes significant wear and tear, and there are challenging winter conditions with a high risk of avalanches. However, the most capacity issues are on the Swedish side of the Haparanda–Narvik connection.

The main Norwegian rail network can be accessed from Sweden when coming from north first from Östersund via Storlien into Norway. From there, the tracks leading to Mo i Rana and onwards to port can be accessed, as well as the southern connection through Trondheim. Currently the line is not electrified, which limits operations. Electrification is however under construction. Looking from Finnish perspective, accessing these areas using train connections creates a very long route when compared to the geographical distance.

Swedish and Norwegian ports

Assessing the capacity of ports is not as straight forward as it is for rail network as it depends on several factors. The main aspects when looking at a capacity of a port include:

- Access from the sea
- Number and condition of berths, handling equipment and services
- Storage capacity
- Hinterland connectivity

The capacity also depends on the commodity: a port specialised in container traffic does not have the equipment to handle bulk cargo and visa versa. This implies that, when assessing capacity, it is crucial to distinguish between the existing commodities managed and the port's potential to augment such traffic. It is also important to note, that the amount of needed increase matters: a bulk port is probably able to handle one container ship a year, but it will take a lot longer to load or unload and it will not be as efficient as it would be in a container specific port.

Capacity of the Swedish ports

The overall situation of Swedish ports is considered good capacity wise. The most capacity issues are more linked to the hinterland connectivity than the port operations or facilities themselves. Like in Finland, many of the ports are specified to handle a certain type of cargo, but general ports do also exist. By far the largest of them is *Gothenburg* port, which is also the only Scandinavian port with direct container ship services from other continents.

From the perspective of Finland's current logistics routes, significant ports include *Stockholm* (2.6Mt p.a. in 2024) and *Kapellskär* (2.9Mt), which manage substantial trailer traffic from ferries, as does *Vaasa–Umeå* ferry. Additionally, southern ports such as *Helsingborg* and *Trelleborg* serve as gateways to Central Europe from Sweden. Besides, the *Vaasa–Umeå* ferry also has trailer traffic between Finland and Sweden.

Considering that majority of the Swedish ports have same geographical risks as the Finnish west coast ports, the most interesting ports from Finland's point of view are the ones that are located in Southern Sweden. Especially interesting of those are the ones on west side of the *Øresund* bridge, as they can be accessed with the larger ships including container ships used in intercontinental transports. Currently Port of Gothenburg is the sole port with direct intercontinental container traffic. The rest of container ports – and Port of Gothenburg to great extent – rely on feeders to/from Central European ports in order to connect to global container transports. Other interesting ports in the area are *Trelleborg*, and *Uddevalla*.

The Port of *Gothenburg* is the largest public port in the Nordic countries. It handles nearly 30% of Sweden's foreign trade and is a crucial hub for cargo handling in Scandinavia. It handles mostly containers, trailers and mineral oil products. The port managed approximately 40 million tons of cargo and 909,000 TEU in 2024. With over 11,000 port calls per year from more than 140 destinations worldwide, it is the only Swedish port capable of accommodating the largest modern ocean-faring container ships. The port is equipped with 49 berths and several terminals. Daily, around 70 trains arrive and depart from the port serving 26 inland terminals and covering 33 routes across Sweden and Norway. There is a weekly container train connection from Haparanda to Gothenburg, but it has currently no Finnish customers.

By 2026, the fairway and the port will be deepened from 13.5m to 16.5m, to ensure even larger vessels with full load. The port itself has free capacity and could increase its operations. However, the port has major rail hinterland connectivity issues, as the railway capacity near Gothenburg is mainly used.

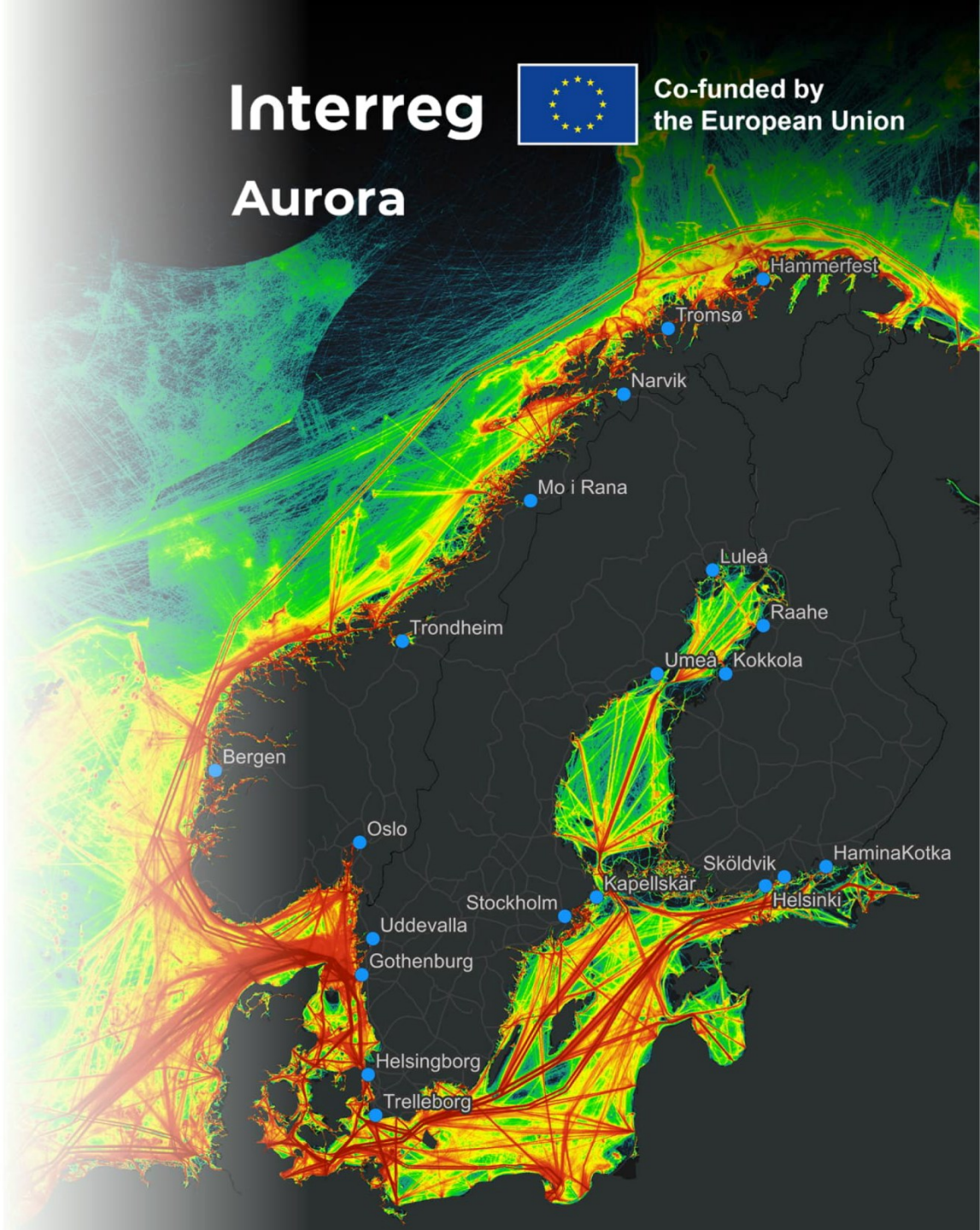
The Port of *Trelleborg* is the second largest port in Sweden (12Mt) and the largest ro-ro-port (roll-on, roll-off) in Scandinavia (800,000 trailers). Unlike other ports, figures for Trelleborg are from 2023, as 2024 figures have not been released. The port is focused on trailer traffic especially between Sweden and Germany. The port is equipped with 13 berths, including specialised berths for transporting railway wagons and general cargo. It is also the Baltic Sea's largest railway port, accommodating vessels up to 240 meters in length. The capacity issues are similar to Gothenburg and relate to the overall lack of available rail capacity in Southern Sweden.

Port of *Helsingborg* is the third largest port in Sweden (7.3Mt p.a. in 2024). It is a full-service port handling containers (250 000 TEU), trailers (400 000), dry and wet bulk, and petroleum products. Large part of Swedish food imports come trough it. The port features three main dock systems with 4 berths. Similar to Gothenburg, the port itself could cope with increase of traffic, but both rail and road connections form a bottleneck.

Port of *Uddevalla* is fairly capable port on the west coast, north of Gothenburg. It handled 1.2 million tonnes of cargo in total in 2024. A new port area *Västra Hamnen* is being developed to allow larger ships and volumes. It mainly focuses on dry and wet bulk goods including sto-ro, and also some project cargo. Connections by railway and road are good.

The capacity of the Norwegian ports

In Norway, the port network is a vital component of the country's transportation, playing a crucial role in both domestic and international trade. By far the largest port in Norway (and in the Nordic) is the *Bergen og Omland* which is a crude oil port handling 67 million tonnes of it in 2024.



The second largest port of Norway is *Narvik*, which focuses on ore transports from Kiruna area in Sweden. Container traffic in Norway is focused more to the Southern ports, *Oslo* port being the largest with 226,000 TEUs in 2023. However, none of the Norwegian ports currently have direct scheduled calls from other continents.

From Finland's perspective, the ports with direct intercontinental calls are the most interesting ones alongside with the ones with good connections to continental Europe. From this point of view, many of the Swedish ports are more interesting than the Norwegian ones. From the New North area point of view, the most interesting Norwegian ports are the ones that are located in the North and could be easily accessed from the area. Among Narvik port, these include *Hammerfest*, *Tromsø* and *Mo i Rana*.

Port of *Narvik* (18Mt p.a. in 2024) is Europe's northernmost core port. It has no depth restrictions, and it is ice-free allowing operations year-around. Among ore transportations, it accommodates cruise ships contributing to regional tourism. The port has four berths, of which three are used for ore transportations. The port itself has some capacity issues, which means that additional regular traffic through the port could require an expansion. Due to the mountainous surroundings, any enlargements are expected to be costly. Besides the capacity restrictions in the port, the railway to the port (Malmbanan) has its own capacity restrictions.

Port of *Hammerfest* (4.5Mt) is the sixth largest port in Norway and is focused on liquefies gas and oil products. It has no rail connection.

Port of *Tromsø* (0.69Mt) is one of Norway's largest fishing and cruise ports. However, measured by cargo handled, the port is quite small, and it has no railway connection.

The Port *of Mo i Rana* (4.5Mt) is a seventh largest Norwegian port, and handled 8,500 TEU in 2023. It is mainly focused on dry bulk. The port has four berths. It has a railway connection but, not directly from the north. This means that from the New North area perspective, accessing the Mo i Rana port by rail has a detour through Mid-Sweden and Mid-Norway.

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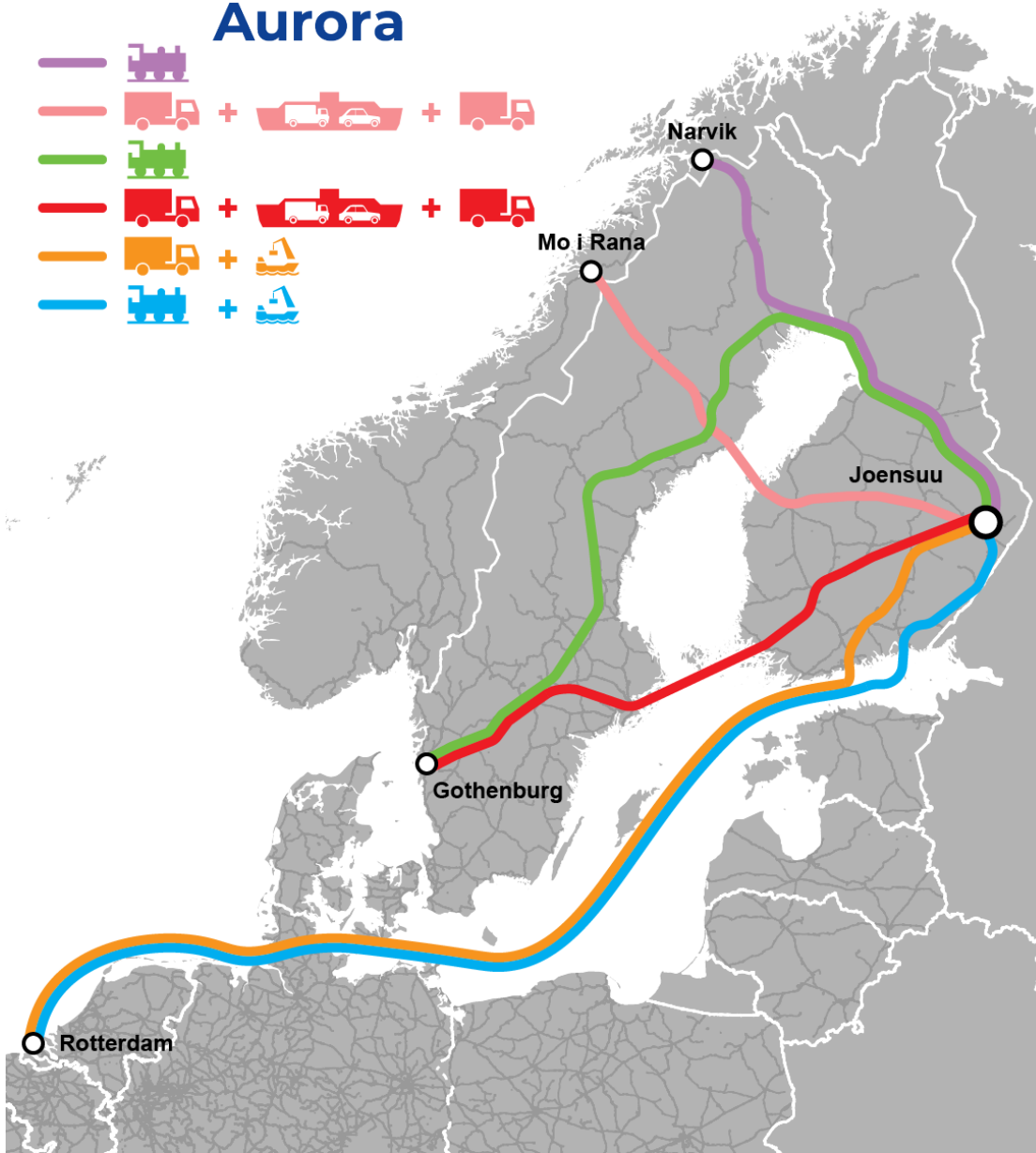
5. Comparison of alternative routes: Case Joensuu

Compared routes

Due to the geographics in Finland, a disturbance at the Baltic Sea could possibly interfere largely with the foreign trade logistics. For this kind of scenario, alternative logistics routes have been studied. They would utilise the Swedish or Norwegian transport infrastructure. From Eastern and Northern Finland perspective, the most interesting routes would be the connections to the larger ports of Sweden and Norway. In this study, the following routes have been selected for further analysis:

- Joensuu–Narvik by rail
- Joensuu–Mo i Rana by truck and ferry
- Joensuu–Gothenburg by train
- Joensuu–Gothenburg by truck and ferry
- Joensuu–Rotterdam by truck and container ship
- Joensuu–Rotterdam by rail and container ship



Methodology

This analysis is partly done with Swedish transport model Samgods, partly through literature study. The monetary costs are calculated as distance-based costs using distances collected from Samgods. The distance-costs are based on previous cost-comparison studies and traffic modelling the project team has done. Loading and unloading costs have also been included on point of origin, destination and — if necessary — along the route as well.

The transportation times are collected from a time matrix in Samgods. Times based on average speed are stated for every link for each transportation mode. With these, the time for the whole route is calculated. Time for the loading and unloading is not included since that could not be extracted from Samgods easily. It is also dependent on the amount of cargo, so it will vary.

For trucks and trains, the emissions have been calculated based on the emission factors from Global Logistics Emissions Council Framework. As emissions for sea transports vary greatly ship-to-ship, two different methods are used for it: first one utilises the same framework used for land-based transports. The second one uses MRV data, to which every vessel must legally report actual emissions each year. The values based on MRV are more accurate and can take into account characteristics of any given route, whereas emissions from the framework are more comparable to truck and train emissions calculated.

For the transport route from Joensuu to Haparanda, it is assumed that the entire stretch is non-electrified. However, the following leg from Haparanda to the port of Narvik is considered fully electrified. Throughout the transport chain, we assume that each container carries an average cargo of ten tons.

For the ferry connection between Vaasa and Umeå, CO_2-equivalent emissions are based on data from the ferry company. The port of Mo i Rana is assumed to be fully electrified. Similarly, the Gothenburg route is assumed to be entirely electrified.

The Turku to Stockholm ferry route is considered to follow the consumption profile of a typical ferry on that given line with a deadweight tonnage of 8,000–9,000. For road transport, the assumed vehicle type is a rigid truck with a gross vehicle weight of 26–32 tons, transporting containers.

The Joensuu to HaminaKotka route is assumed to be fully electrified. Finally, the Helsinki to Rotterdam leg is carried out by a dry container vessel, and emissions are calculated on a well-to-wake (WTW) basis.

Key figures

Cost wise route from Joensuu to Kotka by rail, and onwards to Rotterdam by cargo ship is the cheapest. It seems logical given, that it is currently a prevalent route. However, route to Narvik by train does not have that much premium, beating even Joensuu–Helsinki–Rotterdam route. That is more expensive, as cost of truck to southern coast of Finland costs over a half more than train does.

Despite the general efficiency of railways, a direct railway connection from Joensuu to Gothenburg via Haparanda is costly. That is mainly due to long transport distance. Truck routes to Mo i Rana and Gothenburg are mid-priced.

Timewise routes to Rotterdam are time-consuming, given the slow speed of sea transports. Both truck-ferry-combinations and train to Narvik have nearly identical transport times.

Road transport causes high emissions compared to other transport modes, which can be seen clearly from the figures. Routes containing truck segments compete for the last place with each other, whereas train routes are much more environmentally friendly.

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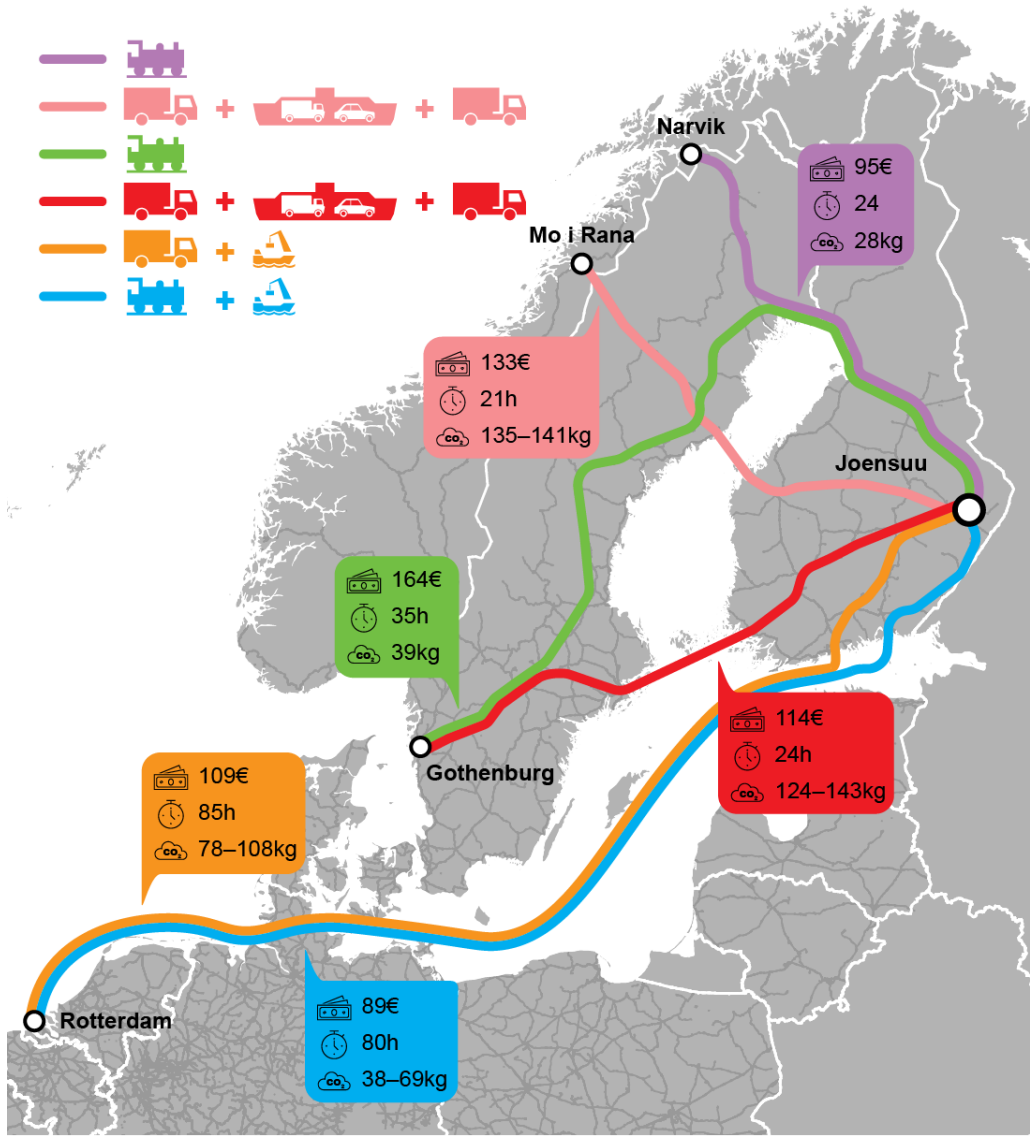

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As the train route to Narvik does not contain any sea transports and is almost half the length of route to Gothenburg, it has unambiguously the lowest emissions. Would the line from Joensuu to Kontiomäki be electrified, the emission would be considerably less. Route to Rotterdam via Kotka gets most of its emissions from the voyage, and railway transport forms only a tenth of total emissions.

Based on this comparison, the 'northern route' from Joensuu seems competitive to currently dominating routes via South Finland. There is a degree of uncertainty about onward transport, as Central European ports have more extensive connections to overseas. Comparing these connections is tricky, as ship schedules change constantly depending on market demand. A calculation done today could be outdated next week.

route	mode of transport	cost (€/t)	time (h)	emissions, MRV ($kgCO_2eq/t$)	emissions, framework ($kgCO_2eq/t$)
Joensuu–Narvik	train	95	24	28	28
Joensuu–Vaasa–Umeå–Mo i Rana	truck + ferry + truck	133	21	141	135
Joensuu–Haparanda–Gothenburg	train	164	35	39	39
Joensuu–Turku–Stockholm–Gothenburg	truck + ferry + truck	114	24	143	124
Joensuu–Helsinki–Rotterdam	truck + cargo ship	109	85	108	78
Joensuu–Kotka–Rotterdam	train + cargo ship	89	80	69	38

Capacity

Despite having decent cost, fast transport time and low emissions, route from Joensuu to Narvik is very troublesome when it comes to capacity. On Finnish side, Joensuu is somewhat dead end. Connections to the south are fair, but towards the north and west railways lack electrification and have inferior capacity. Section between Tornio and Haparanda is a bottleneck due to different gauge in Sweden and Finland. That requires transfering goods from a train to another. For containers, that is relatively easy and can be done with a reachstacker in 2–3 hours and for relatively low cost of 40–50€/container. Vehicles can naturally unload and load themselves. However for bulk commodities — which form majority of transports from/to the project area — transferring is much more difficult and takes significantly longer. Currently there are no regular border-crossing trains, so the option is theoretical. However, regular transfers from trucks to train take place in Haparanda, and same equipment could be used for moving containers between trains.

Problems do not stop after Finnish border. Ofotenbanen and especially Malmbanan are in a tricky situation regarding capacity. The Swedish iron ore is particularly important for Sweden's export, and therefore it might be political pushback to introduce more or other traffic that might risk the iron ore transportation. In conclusion, the capacity from Haparanda to Narvik is extremely limited and getting any slots there is assessed hard.

Route to Gothenburg has the same troubles on Finnish side. Still, the main setback for this route is the distance leading to long transportation time. However, the capacity situation is somewhat acceptable. In the northern parts along the northern main line, there is some free capacity, and it is estimated to have so according to the 2045 forecast. Before 2045, the new railway stretch *Norrbotniabanan* will be done to ease the capacity situation in the northeast part of Sweden.

The main bottlenecks are in the Gothenburg area. The sections leading to Gothenburg already have capacity issues. The port of Uddevalla might be interesting to investigate further. It is a large port with upcoming investments to enhance the port capacity with better handling of wet and dry bulk, and project cargo. They have a weak spot at container handling. Shipping to the port of Uddevalla also avoids the most crowded railway section around Gothenburg and has a better capacity situation as a route in whole.

Route by truck to Mo i Rana has no capacity issues. All the roads can fit more traffic without any major complications. For ferry between Vaasa and Umeå, new departures with the current vessel can be added to increase capacity, if demand is sufficient.

For the route to Gothenburg by truck, the most significant constraint is the approach to Gothenburg, as the motorways can queue up. There are often delays in the Stockholm area as well, although that depends on the time of the day. On the Finnish side, both highways 5 and 6 have some capacity and safety issues, but those are not as severe as on the Swedish side. Near Turku, the relatively new motorway carries extra load without any problems.

Transports to Rotterdam via Helsinki Port (Vuosaari), the busiest section is approach to Helsinki and Ring Road III. On those, delays are common. Highways 5 and 6 have the issues depicted in the previous paragraph. Port capacity or maritime connections are not an issue.

Railway connection from Joensuu to Kotka has fairly high capacity usage, but recent and ongoing improvements and decrease in traffic from Russia allow an increase in transports. The line may however face capacity issues in the future. Kotka Port has good facilities and maritime connections, which will not be an issue.

Reliability

Reliability of a transport system is a complex topic. One key concept is *resilience of a transport system,* which can be defined as its capability to recover from disruptions and return to normal operations. Transport modes with high efficiency usually have poor resilience and vice versa. Usually a centralised system is more efficient, but more scattered system has more resilience.

Disruptions can be caused by extreme weather effects, accident, conflicts, political decisions, economic instability, cybersecurity breaches, etc. Some sources of disturbance will get more and more common, as e.g. climate change increases likelihood of extreme weather effects.

Road transports are usually not prone to large distuptions, as an alternative route can be taken. Individual disruptions are common but usually have little significance. Some routes e.g. through mountainous terrain form an exception, which is case for example with road to Mo i Rana. It is subject to weather and doesn't have practical alternative routes.

Ship transports have different impacts depending on location of disturbance. While disturbances in a gateway port will have mostly regional impacts, issues in hubs or on important shipping routes might have serious consequences.

Rail network disruptions are usually long-lasting and difficult to circumvent. Mesh-like networks such as South Sweden have better resilience. Railways increasingly rely on digital systems and — while extremely unlikely — a fault in those systems may cease transports in large parts of country for long periods. As electric traction is more and more common, railways also rely on power grids. Those are highly redundant, but severe blackouts have happened e.g. in Texas 2021 and on Iberian Peninsula 2025. A big and lasting collape is unlikely, but in the everyday life trains are disturbed by infrastructure failures. The infrastructure is quite old on some lines both in Sweden and Finland, which makes some types of problems quite common.

On transport system level, it is advantageous to have multiple modes of transport and routes, as that makes it more resilient. Then, in a case of disturbance, other routes and modes can compensate. It is always easier to scale up an existing route than start using a completely new one. Using an alternative supply chains from time to time is advantageous for prepardness. This is however a delicate balance between efficiency and resilience.

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6. Future development

Already planned investments

Investments in cross-border transport infrastructure are crucial for enhancing connectivity, economic growth, and regional development. Finland, Sweden, and Norway have all their own national transport plans, which include specific investments in transport infrastructure. These plans are typically long-term, spanning over a decade, and are periodically updated. National transportation plans emphasise efficiency, accessibility, sustainability, and safety, with a focus on both national and cross-border projects.

Transport infrastructure investments are funded by various mechanisms. Those include national budgets, EU funding programs like the *Connecting Europe Facility (CEF),* and public-private partnerships.

Planned transportation infrastructure investments in Norway

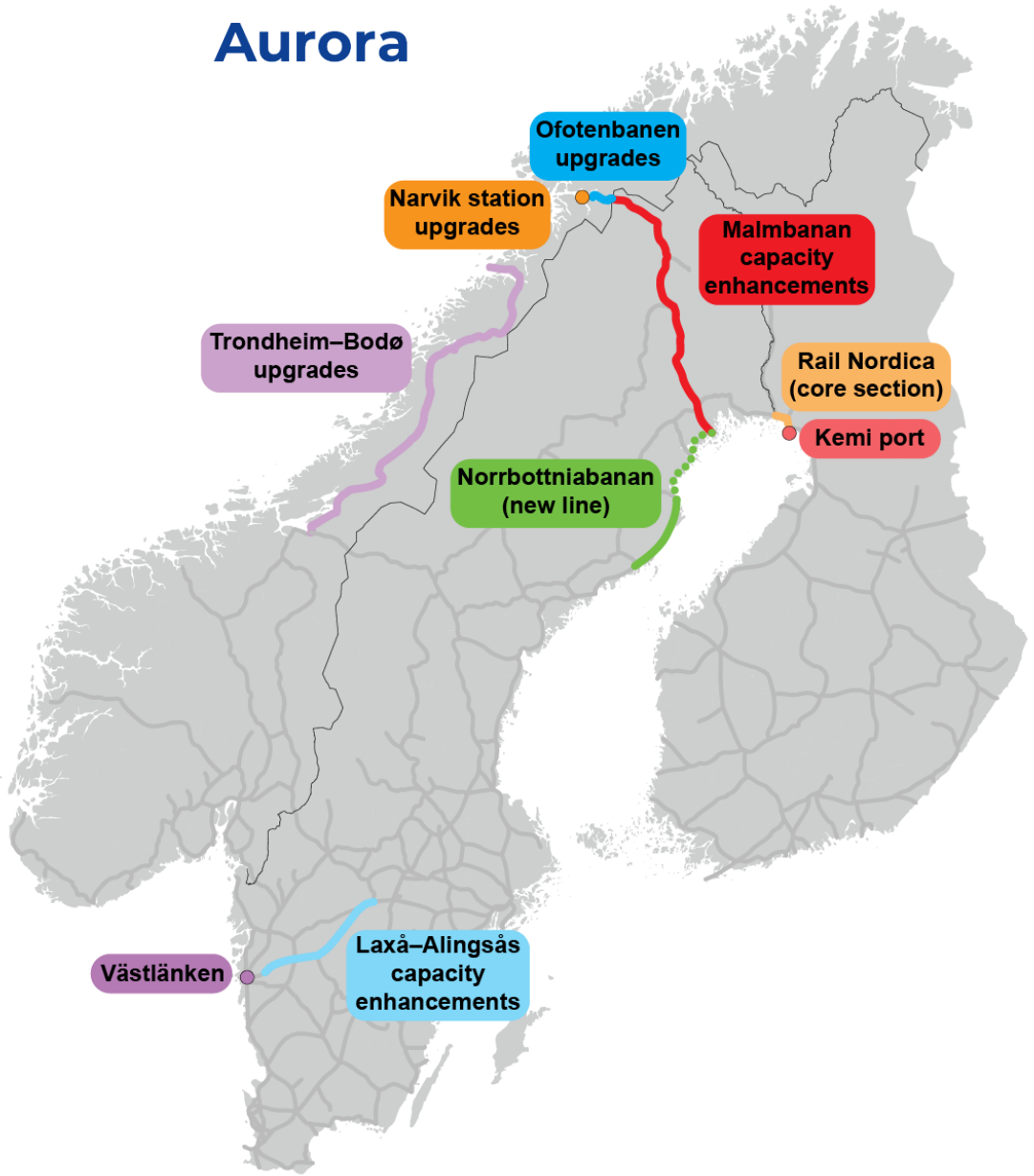
Nasjonal transportplan 2025–2036 (National Transport Plan 2025–2036) is Norway's strategic framework for developing transport infrastructure in Norway over a 12-year period. It consists of plans for investments in roads, railways, maritime transport, and aviation. Key projects include road network upgrades, railway improvements, airport developments, and initiatives to boost public transport and reduce environmental impact.

The estimated cost for completing major investment projects initiated before the planning period is NOK 144 billion in central government funds. This amount is divided into road (45%), railway (41%), maritime (3%) and aviation (3%) investments as well as public transport projects (8%).

Projects in Nasjonal transportplan 2025–2036 are divided also in two major timelines, 2025–2030 and 2031–2036. For the first six-year period, only investments in the aviation have been allocated in the northern part of Norway. Overall period 2025–2036 consists of multiple road network upgrades, Ofotenbanen upgrades and High North Strategic Investments. Overall period also includes specific project, Trondheim–Bodø Corridor.

There are also several investments planned for Narvik terminal and Narvik station. The Narvik terminal is undergoing significant upgrades to increase capacity and efficiency. This includes the construction of two new tracks for loading and parking, as well as a new crossing track between Narvik station and the terminal. The project also involves the extension of tracks in the northern part of Terminal Nord, providing an additional 574 meters of parking capacity for wagons. These tracks are expected to be operational by April 2025, with further expansions planned.

Narvik station is set for a major overhaul to increase capacity. This includes the construction of a new railway bridge and culvert, and the extension of the side platform from 265 meters to 350 meters. The station will be equipped to handle 35-ton axle loads on tracks 2–5, allowing for the crossing of 750-meter-long trains. The existing signalling system will be upgraded and adapted until the European Rail Traffic Management System (ERTMS) is implemented.



The planned measures aim to increase traffic from 46 to 66 trains per day. Maintenance activities will require track access, temporarily reducing capacity. However, the new measures will ensure acceptable capacity utilisation even during maintenance periods. After 2030, fewer weeks with 7-hour continuous maintenance are expected, once the tracks are upgraded with the new superstructure.

Planned transportation infrastructure investments in Sweden

To address the issues considering Malmbanan, extensive renovations and investments are planned, focusing on enhancing the robustness and reliability of the infrastructure. Key initiatives include comprehensive renovations and the introduction of new signalling systems, enhancements to accommodate long trains between Luleå and Kiruna, and increasing axle load capacity on major sections of Malmbanan. Significant traffic disruptions are anticipated during the renovation period.

Specific projects include upgrades between Boden and Kiruna, such as track replacements, overhead line replacements, switch replacements, and bridge renovations. Passing loops will be extended to accommodate 750-meter-long trains at Gällivare–Kiruna, and all passing loops for 750-meter-long trains between Luleå and Gällivare will be completed before 2030. Capacity enhancements will increase passenger traffic at Luleå Central. Axle load will be increased to 32.5 tons between Luleå and Gällivare, with planning for axle load increases between Kiruna and Riksgränsen, coordinated with Ofotenbanen. Additional projects include continuous improvements in fencing and passageways, new passing loops and partial double tracks between Sunderby and Sävast, and various track and switch replacements across multiple locations.

Future considerations include LKAB's announcement of a 50% production increase, potential developments such as pellet plants in Narvik, Jokkmokk Iron Mines, increased combined transports to and from Narvik, and addressing total defense needs.

The upcoming national plan includes a budget of 1,171 billion SEK, representing a 20% increase compared to the current plan. Key focus areas include major investments in road maintenance and upgrades, significant funding for railway maintenance, and new investments.

Development programs for the Malmbanan/Ofotenbanen focus on increasing capacity and operational reliability over time. Maintenance programs aim to improve infrastructure and vehicle maintenance, address weak points, and implement test and introduction programs. Climate adaptation efforts include short and long-term drainage improvements, enhanced management, and winter climate adaptation. Digital maintenance initiatives involve continuous measurement and collaboration between Sweden and Norway.

Additionally, the Swedish government has approved the construction of a new stretch on *Norrbottniabanan,* which will run from Dåva in Umeå to Skellefteå. This project aims to improve transport options for work commuting and freight transport in Northern Sweden.

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location	description	expected opening	cost
Kiruna–Riksgränsen	Axle load increased from 30 to 32.5 tons, enabling heavier ore trains.	2028–	22M€
Harrträsk	Extended passing loop to 750 m for 750-meter-long trains (e.g. ore trains).	2027	10M€
Nuortikon	Extended passing loop to 750 m for 750-meter-long trains.	2027	5M€
Murjek	Extended passing loop to 750 m for 750-meter-long trains.	2026–2027	26M€
Näsberg	Extended passing loop to 750 m for ore trains (750 meters long).	2026	3M€
Sikträsk	Yard extension to allow 750-meter-long train crossings.	2025–2026	15M€
Nattavaara	Yard extension to allow 750-meter-long train crossings.	2027–2028	25M€
Boden–Gällivare	Fencing and animal crossings to reduce collisions and aid wildlife movement.	2026–	26M€
Lina Älv, Harrå, Fjällåsen	Extension of passing locations to enable 750-meter-long train crossings.	2025–2026	3M€

Norrbotniabanan is a planned high-speed railway line in Sweden, stretching from Umeå to Luleå. The line will be approximately 270 kilometers long and is designed to improve accessibility between major cities along northern Sweden's coast. The project aims to handle around 1.6 million passengers per year and significantly reduce travel time between Umeå and Luleå to just 90 minutes. The construction of the initial section from Umeå to Dåva began in 2018, with the entire project expected to be completed by 2036.

There are several planned investments on the route to Gothenburg. *Västlänken* — a tunnel under central parts of Gothenburg — is currently being built with cost of 2.1–2.4G€. During the construction, it causes great disturbance on the railway traffic. Between Laxå and Alingsås five new passing loops fitting 750 m freight trains are being built with cost of 67M€. Both of these are expected to be finished by 2030.

Planned transportation infrastructure investments in Finland

The Finnish government has embarked on significant infrastructure projects to enhance the railway network in northern Finland, focusing on improving connectivity and supporting regional development.

Rail Nordica project aims to establish a European standard gauge railway connecting Kemi in Finland to Haparanda in Sweden and eventually extending to the Norwegian port of Narvik. The initial planning phase, funded with 20 million euros, will take place from 2026 to 2029. The first phase involves constructing a new line between the Haaparanta–Tornio border crossing and Kemi, with future plans to extend the line to Oulu and Rovaniemi. This project is strategically important for improving military mobility, enhancing supply lines, and boosting regional development.

Another critical initiative is the transition from the current Russian gauge (1,524 mm) to the European standard gauge (1,435 mm) in Northern Finland. An initial study, funded with 20 million euros, will explore the feasibility of this transition. This long-term plan is vital for seamless cross-border rail traffic and is expected to have significant employment impacts in Lapland and Northern Finland.

To support the Rail Nordica project and enhance capacity to handle increased cargo traffic, significant investments are planned for Kemi Port. This port is a key node in the planned rail connection to Narvik, facilitating efficient cargo transport from the Gulf of Bothnia to the Arctic Ocean.

Development path

Infrastructure development

Currently Malmbanan and Ofotbanen are significant bottlenecks. Improving capacity on these lines would benefit local economy and logistics in the northern parts of Finland, Sweden and Norway by adding flexibility and resilience to supply chains. Currently, the port of Narvik is able to accomodate more transports (especially ro-ro) than the railway line leading there. On short term currently planned investments – described in previous chapter – allow an increase in transports.

Despite the current investments, in the long term, a double-track is needed. It is the only way to allow vast transport volumes of the new investments. Improving these lines is backed by potential new mining investments and expanding current operations in Kiruna area. The route is also important for grocery and consumable transports to and from *Troms* and *Nordland* regions and would be beneficial for security of supply and military mobility as well.

Constructing a double-track to the entire section between Luleå and Narvik has an estimated cost of 7.1–12G€. Its construction can be phased so that Kiruna–Narvik (2.5–4.3G€) and Luleå–Boden (0.5–1G€) would be constructed in the first phase.

Another major railway infrastructure development need is the line between Joensuu and Kontiomäki. The main limitations are lack of electrification and minuscule overall capacity, which is most likely the worst of any railway line in Finland. Electrification is crucial for competitiveness, as around 85% of railway cargo in Finland is transported by electric locomotives due to its efficiency and environmental aspects. Electrifying the whole line is estimated to cost 80–100M€.

Before new investments, the line would need a major overhaul, which has been estimated to cost 139M€ in study by FTIA in 2023. In addition, that study recognised development needs worth of 13.4M€ to the current infrastructure.

The capacity is a major hindrance, as it limits possible operating windows and drastically decreases reliability. Improving the line is essential to increase competitiveness on the 'northern route' from Eastern Finland and utilising current infrastructure as efficiently as possible. Increase of capacity requires both constructing new passing loops (to allow trains heading opposite directions to pass each other) and improving signalling (to allow more trains simultaneously on one direction).

To ensure good capacity on the line, approximately 6–9 new passing loops would be needed. If each new passing loop would have only a single side track, cost estimate for that would be around 31–47M€. Passing loops with two side tracks each – which is usually preferred – would increase the cost up to 95M€. Signalling improvements are most efficient to implement as part of *Digirata* project (Finnish ERTMS implementation), which is scheduled for completion in 2040 on Joensuu–Kontiomäki line. In total, the costs for Joensuu–Kontiomäki line would be approx. 250M€ excluding signalling, which would be part of Digirata.

In addition to these 'northern' measures, ensuring adequate available capacity for freight trains in north-south corridors in Sweden is important, in order to provide better opportunities for railway transports between Western Barents region and Central Europe. This requires, among other measures, increasing capacity near major Swedish cities. The Fehmarnbelt tunnel and its associated projects in Germany and Denmark will provide new opportunities, but those will benefit Western Barents region only if links across Sweden can sustain it.

Studies and actions

Infrastructure improvements alone will not solve all issues. During this study, multiple possible actions with potential to develop green logistics in the project area were identified.

The change in track gauge between Finland and Sweden is a serious complication for bulk transports. Containers can be transferred from train to another (or to/from trucks) relatively fast and in cost efficient manner using reach stackers or portal cranes. The same however does not apply to bulk, where unloading and reloading goods will take significantly longer and might be weather dependent. As majority of transports imports and exports of the project area are bulk, this is an important issue to solve.

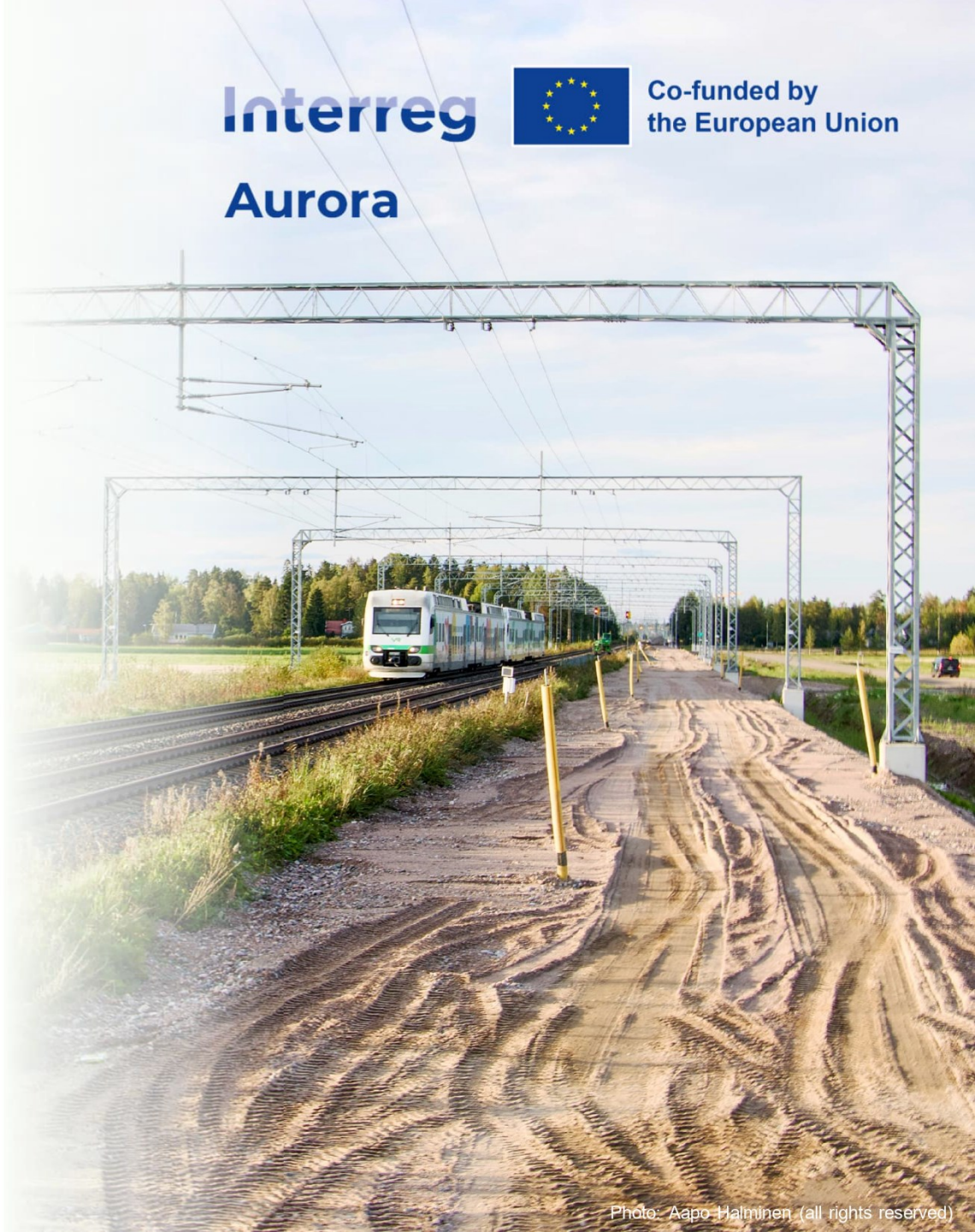
One possible solution is to utilise containers more in bulk transports. Currently around one fifth of Finnish foreign trade is transported in containers, and even then, it is quite common that goods are loaded to containers at the port of departure rather than at the factory. There are solutions to transport bulk goods in containers, such as using cradle containers or a load plate. There is an imbalance in container transports to and from Nordic: demand for imports is higher than for exports. This provides additional benefit in favour of utilising containers in exports, as it reduces need for transporting empty containers.

Capacity management on railways has its own flaws resulting in inefficient use of current infrastructure. Procedures for granting capacity and levying infrastructure charges differ between the countries, but all three have similar difficulties. Current capacity management principles lead to ’dead capacity’, which is applied for but not used. Current charge criteria also encourage use of the most direct links rather than distributing load evenly on the network. In Finland — contrary to Sweden — infrastructure charges are also higher for electric train than for diesel trains. It is important to promote this topic to ensure means for development.

As approximately 15% of Finnish foreign trade is with Sweden and around 5% with Norway, significance of logistics between these countries should not be forgotten either. It would be beneficial to study supply chains within the region to discover possible additional potential for railway transports. Origins and destinations matter a lot, as transporting goods e.g. from Uusimaa to Skåne via Haparanda isn’t economically viable. Because of that, a good time for this kind of study could be in a year or two, when Finnish transport model is more refined.

As approximately 15% of Finnish foreign trade is with Sweden and around 5% with Norway, significance of logistics *between* these countries should not be forgotten either. It would be beneficial to study supply chains within the region to discover possible additional potential for railway transports. Origins and destinations matter a lot, as transporting goods e.g. from Uusimaa to Skåne via Haparanda isn't economically viable. Because of that, a good time for this kind of study could be in a year or two, when Finnish transport model is more refined.

Fostering cross-border discussion between companies and both regional and national organisations is highly recommended. There are numerous companies considering investments in the project area, and many of these are depended on capable transport infrastructure. Cross-border cooperation and discussion would have positive effects on economy of the Western Barents region.



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7. Summary and conclusions

Summary

Roles of different transport modes

Maritime transports have the highest capacity and are most affordable. Intercontinental transports for containerised goods are extremely efficient due to economics of scale, but for bulk commodities maritime transports are a competitive option even in coastal transports.

Railway transports are competitive for bulk transports due to relatively high capacity per train and low cost. They are also essential for transports between ports and factories inland. In Norway and Sweden, intermodal transports are also common.

Road transports are easiest to acquire and have superior reach but have quite limited capacity and a high environmental impact. Almost all supply chains use road transports at least on one stage.

Finnish foreign trade

Maritime traffic contributes to approx. 95% of Finnish foreign trade by mass due to its efficiency and affordability. Most important ports for the project area area in general are Helsinki and HaminaKotka in south and Vaasa, Kokkola, Oulu and Kemi on the west coast. Helsinki is main import port for consumer products, and HaminaKotka is crucial export port for forest industry in Eastern Finland. The ports on west coast serve both imports and exports of various commodities. In addition, ports of Tornio and Raahe are important for factories located next to them.

Sweden is Finland's most important trade partner, as approximately 15% of Finnish foreign trade (by mass) is to or from Sweden. Imports are mainly iron ore and oil products. Exports constitute mainly of oil products, raw materials, steel, and products of forest industry. Norway's share of Finnish foreign trade is slightly under 5%.

The project area constitutes approximately one fourth of Finnish imports and exports by mass. Most of transports from or to the project area are bulk. Most common imports are related to mining, forestry and agriculture. In exports, metal and forest industries form almost three quarters of total exports. Most important industrial sites are mainly on the coast, with Sotkamo mine being largest site located inland. There are also several potential investments to new pulp mills, mines, and factories which would increase transport demand.

Capacity

Largest ports in Sweden are located in the southwest. Ports on the east coast are also important but serve mainly the local area or have very specific cargo e.g. in connection to an industry such as a sawmill.. In Norway, large cluster of ports is located in the southwest. Ports of Narvik, Mo i Rana and Trondheim on the western coast are also relatively large.

The ports themselves could handle increase in transports relatively easily, but connections between ports and hinterlands are bottlenecks in many cases. Maritime transports have superior capacity compared to railways, which in comparison have superior capacity to trucks.

Railway capacity available for transports between Finland and Atlantic ports is quite limited. These routes could accommodate several weekly trains with current infrastructure. On railways, Tornio–Haparanda is a significant bottleneck especially for bulk commodities. For containers, loading and unloading is relatively fast, but it still poses an extra cost.

Maritime transports

Maritime traffic can be divided to two distinct categories: *scheduled traffic* and *tramp trade.* The forementioned operates, as the name would suggest, on fixed routes and timetables, and is common for container transports as well as transporting trailers. The Nordic has scheduled traffic mainly within Europe, with Port of Gothenburg having few intercontinental routes. In tramp trade, a client books an entire ship for a given transport, which is usually transported directly from port of origin to destination. It is used to transport bulk goods that are not loaded to trailers or containers.

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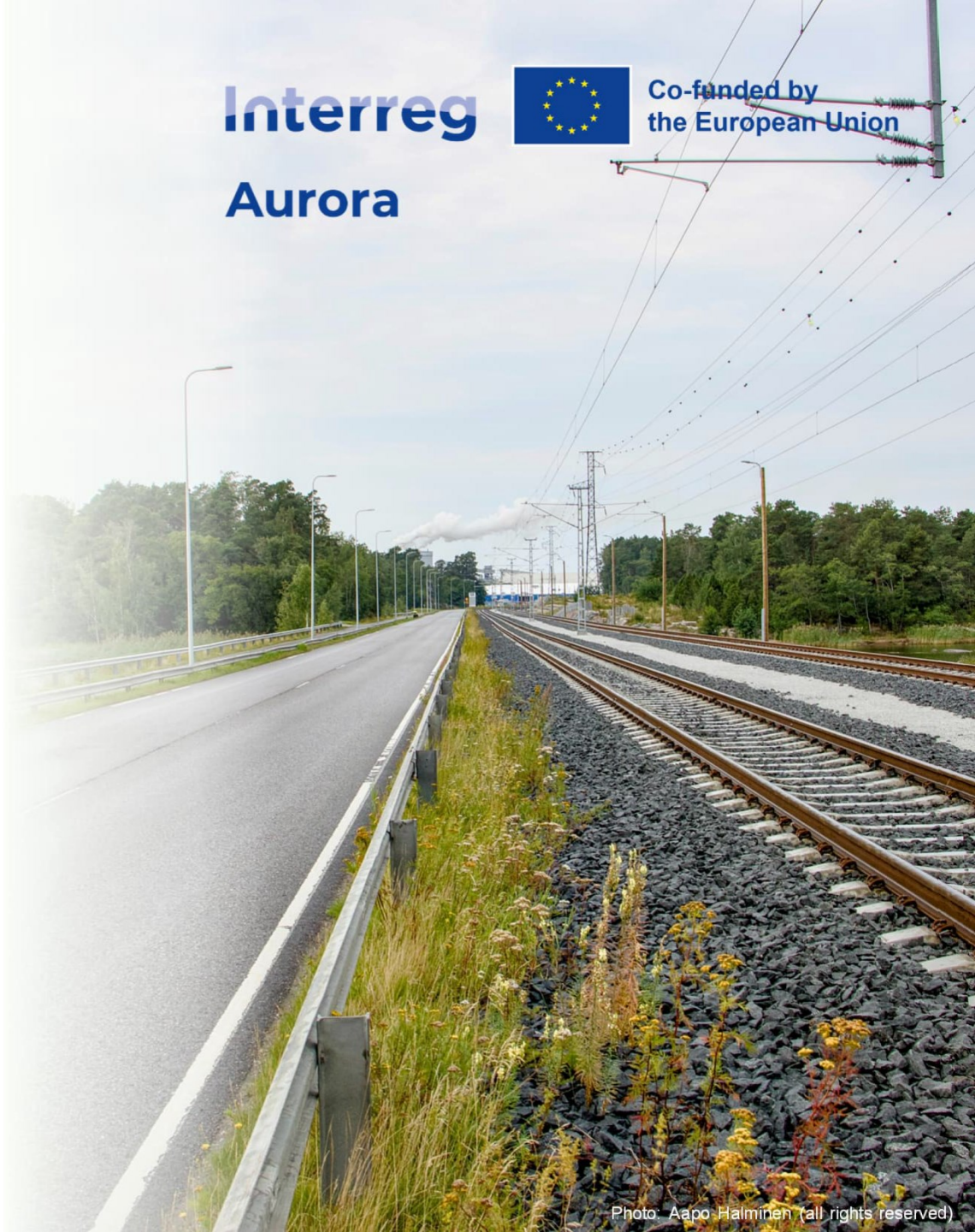
Alternative routes for transports

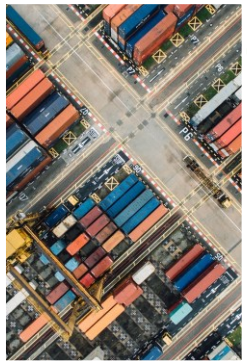
Alternative routes for container transports from Joensuu to various Atlantic ports were compared. Routes via Southern Finland to Rotterdam were cheapest together with direct railway connection to Narvik. Routes to Gothenburg and Mo i Rana were more costly. However, transport to Rotterdam had by far the longest transport times. Connection to Narvik faces severe capacity constraints.

All train routes — even when combined with ships or partly operated by diesel locomotives — had relatively low emissions. In comparison, all routes relying on road transport caused substantial emissions.

There is a inverse relationship between efficiency and resilience. Usually more efficient transport systems are less resilient and vice versa. On transport system level, having multiple routes and modes of transports available is the best way to prepare for disruptions.

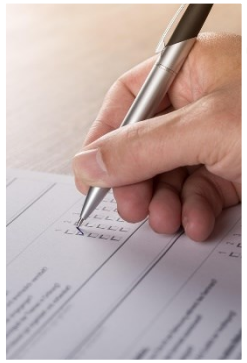


Conclusions

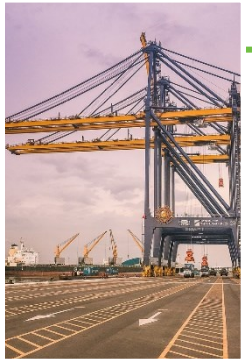


Supply chain consisting of railway and sea transports is the most efficient option for large-volume industries located inland.

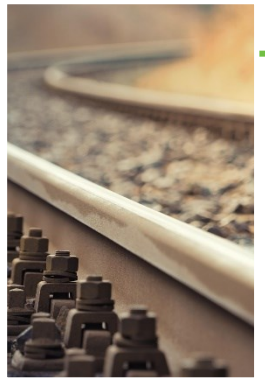
Local companies are mostly happy or content with current supply chains. Availability and cost of rail transport is seen as a largest single hindrance.



When asked about new connections, local companies see links to Scandinavia as most important. Upkeep of current road network is also prevalent in the answers.



Ports do not form a bottleneck for transports and would be able to accommodate more transports in most cases. However, connections between ports and hinterlands are or will be a bottleneck in many cases.



Small capacity improvements to Malmbanan have been planned, and a swift execution of these plans is recommended.

Planning electrification and capacity upgrades to line between Joensuu and Kontiomäki and a double-track to Malmbanan have been recognised as essential for the area.

Numerous industrial projects planned in the area could benefit from new transport infrastructure investments and vice versa

Finnish foreign trade relies heavily on sea transports. Other transport modes cannot often offer similar capacity or efficiency.

While land-based transports could possibly carry ca 10% of Finnish foreign trade, sea transports will retain crucial role also in the future.

Efficient transport modes usually have poor resilience and vice versa. Resilience is improved best, when multiple transportation modes and routes are available, but there is a delicate balance between efficiency and resilience.

For security of supply, having multiple possible routes is crucial. Alternative routes should be used regularly for prepardness.

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Aurora

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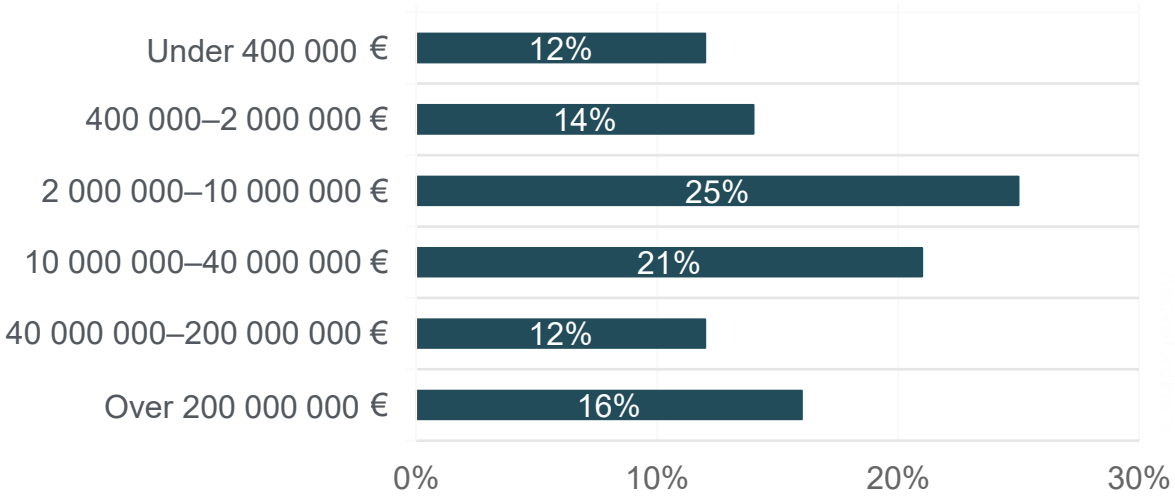
Appendix 1: Survey results

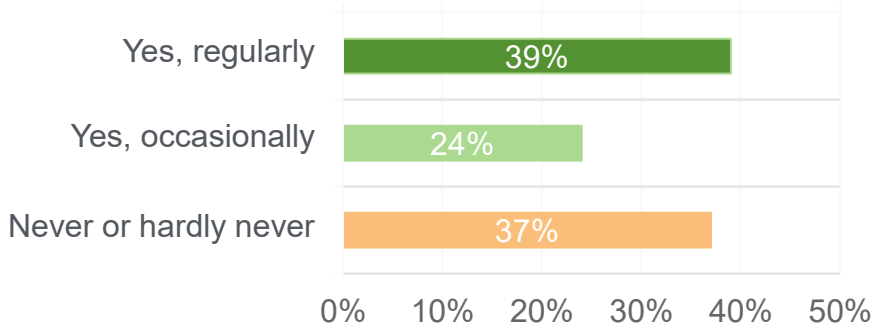
Survey background information

- 49 respondents answered the survey from 45 companies.
- 28 respondents' companies are located in the Lapland region, half in Rovaniemi and 18% in Sodankylä.
- 7 companies from the respondents are based in North Karelia, while in other regions, there are only one or two companies each
- Questions related to transport chains were directed to those transport companies that have occasional or regular international transports.
- Questions related to the road network, future challenges, and outlooks were for all respondents.

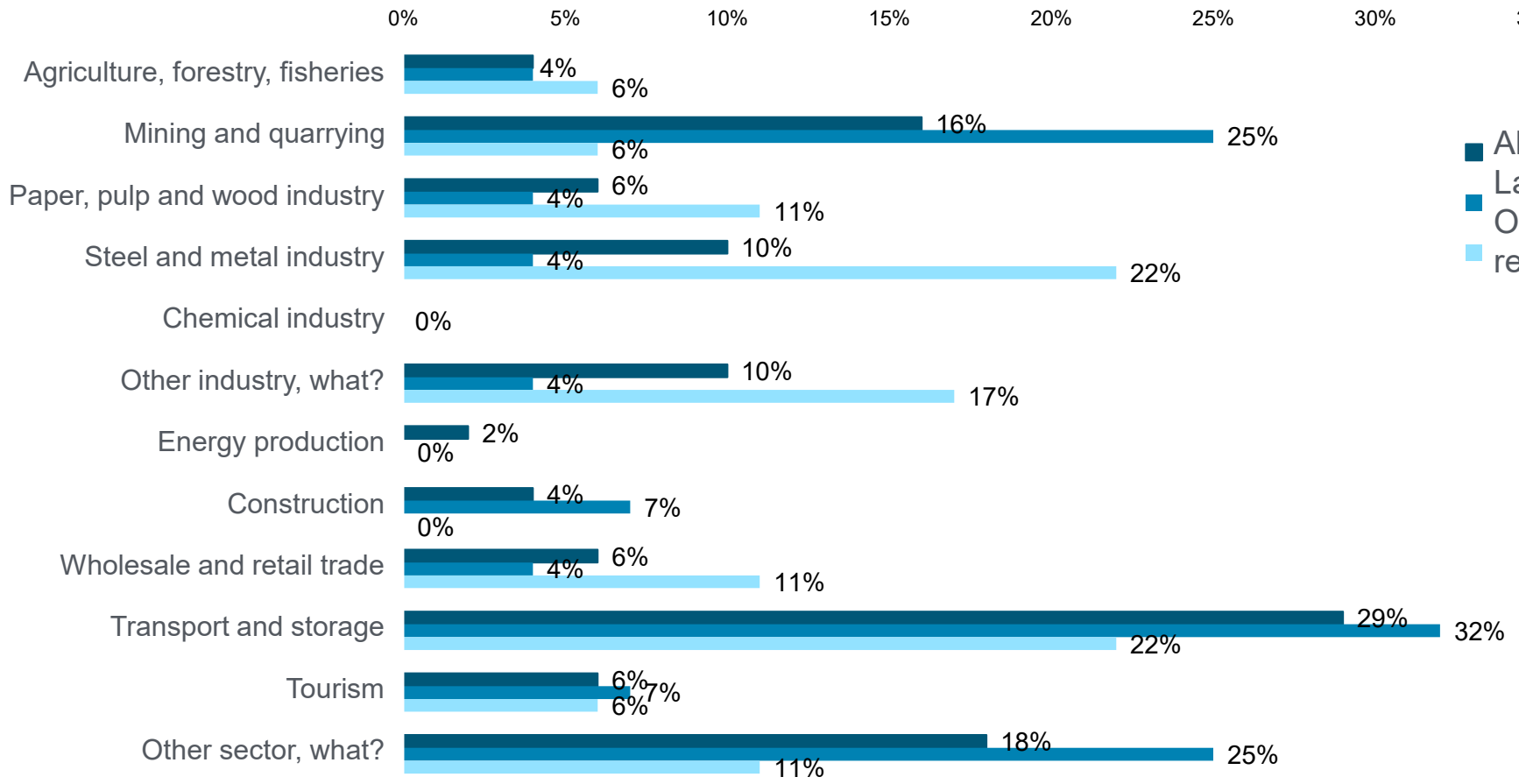
What is your company's revenue range?



Does your company have international goods transports?



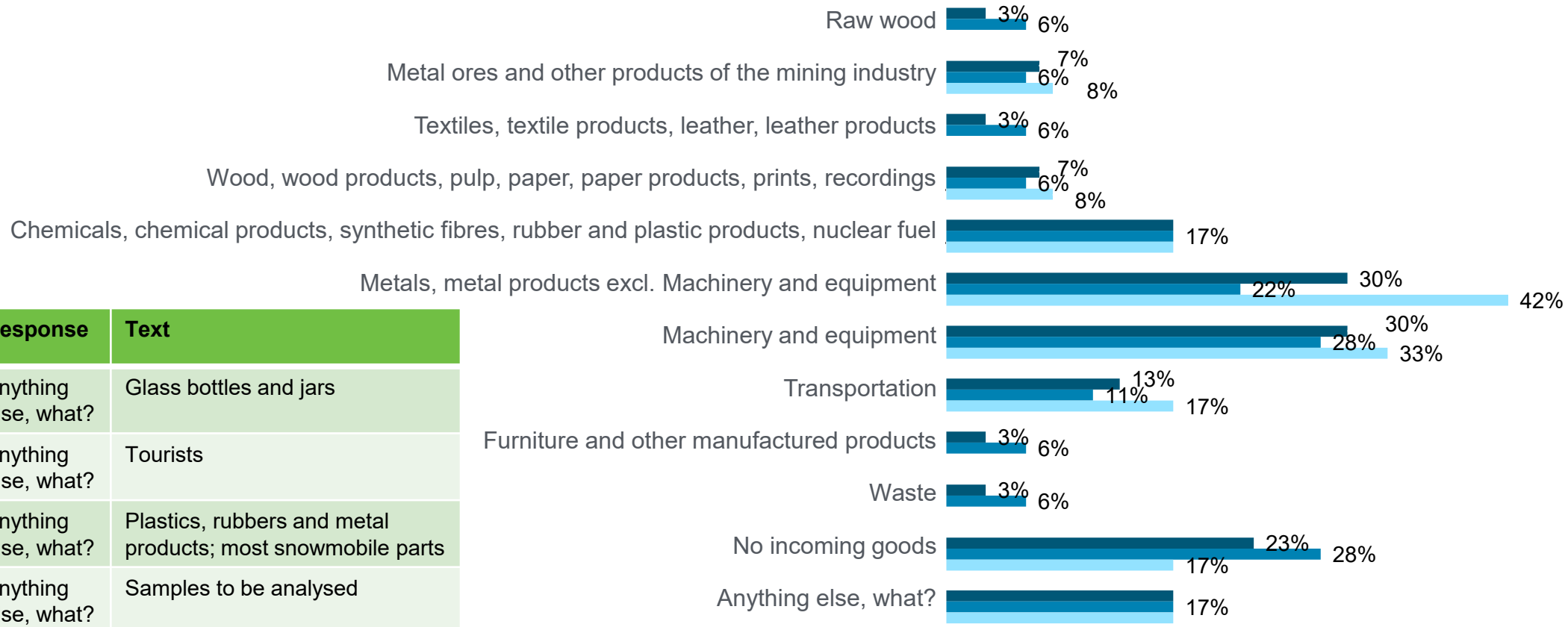
Indusry sector of the companies



Response	Text
Other sector, what?	Developing logistics
Other sector, what?	Development
Other industry, what?	Manufacturing natural fibre composite products
Other Industry, what?	'Car manufacturing' → snowmobile manufacture
Other sector, what?	Environmental testing and analytics

International goods transports

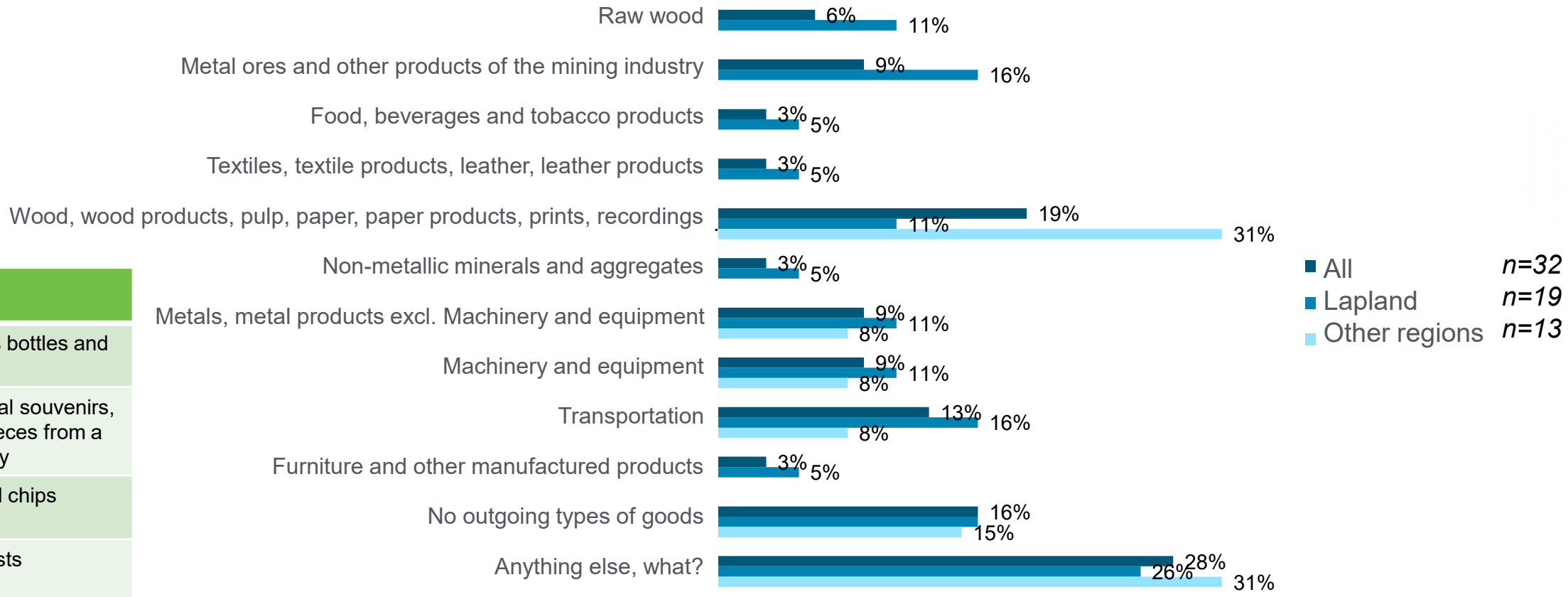
Incoming goods types



Response	Text
Anything else, what?	Glass bottles and jars
Anything else, what?	Tourists
Anything else, what?	Plastics, rubbers and metal products; most snowmobile parts
Anything else, what?	Samples to be analysed
Anything else, what?	Machinery, cores

International goods transports

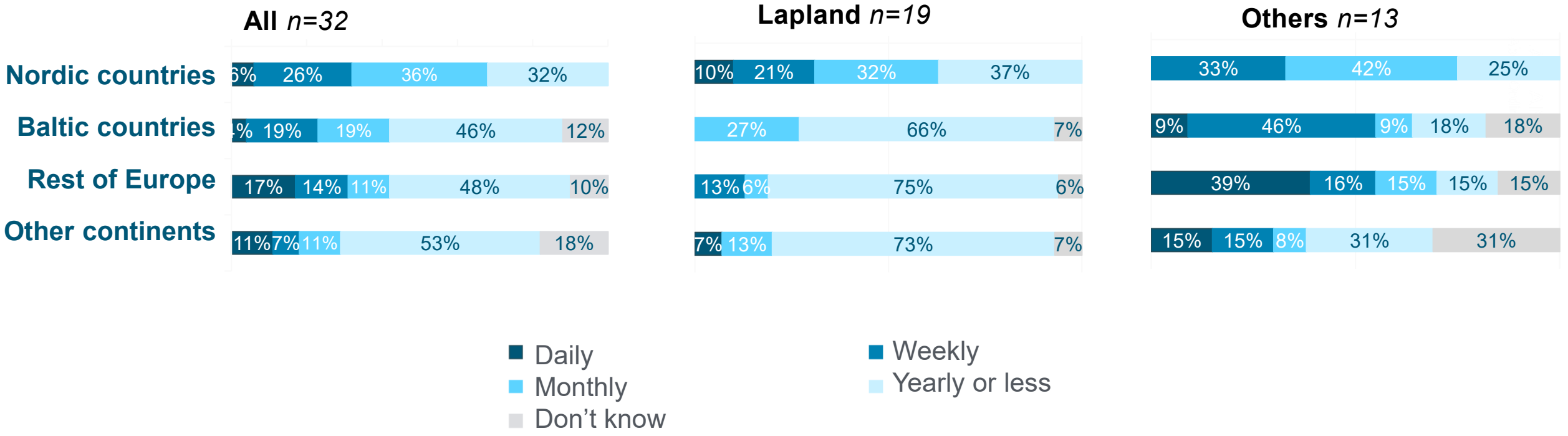
Outgoing goods types



Response	Text
Anything else, what?	Glass bottles and jars
Anything else, what?	Typical souvenirs, art pieces from a gallery
Anything else, what?	Wood chips
Anything else, what?	Tourists
Anything else, what?	Samples to be analysed

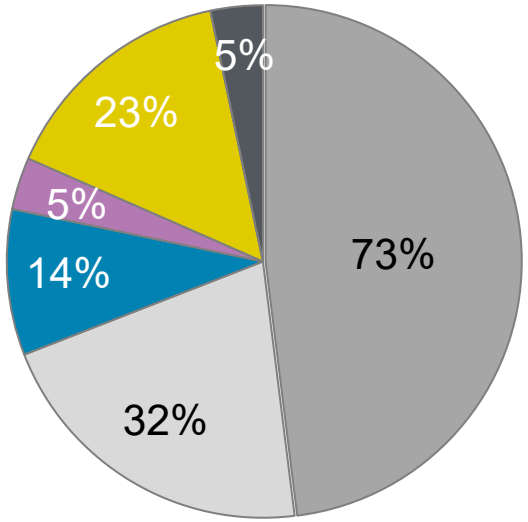
Where are the transports headed?

How many transports does your company have per year between Finnish locations* and the following areas?

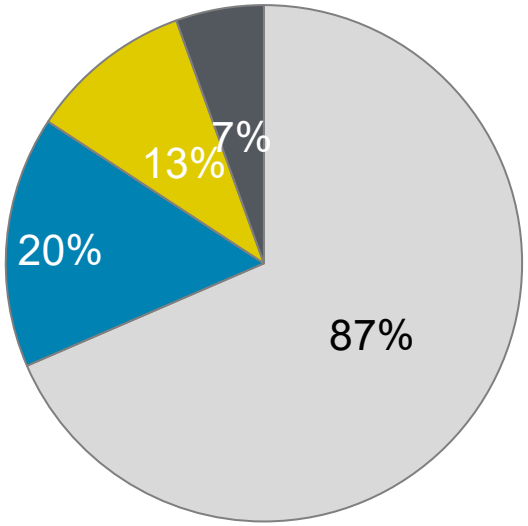


Transport chains

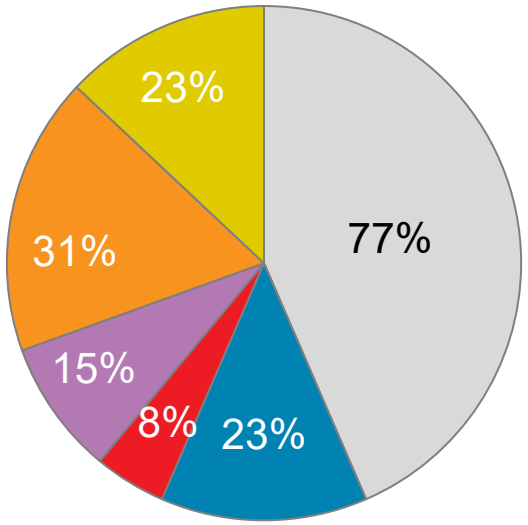
Finland – Nordics
n = 22



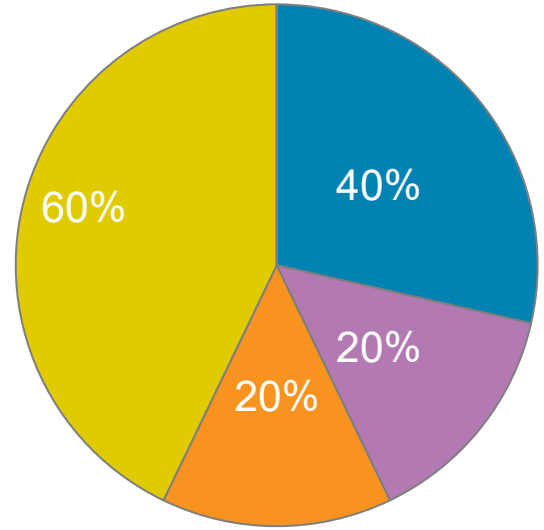
Finland – Baltics
N = 15



Finland – Rest of Europe
n = 13



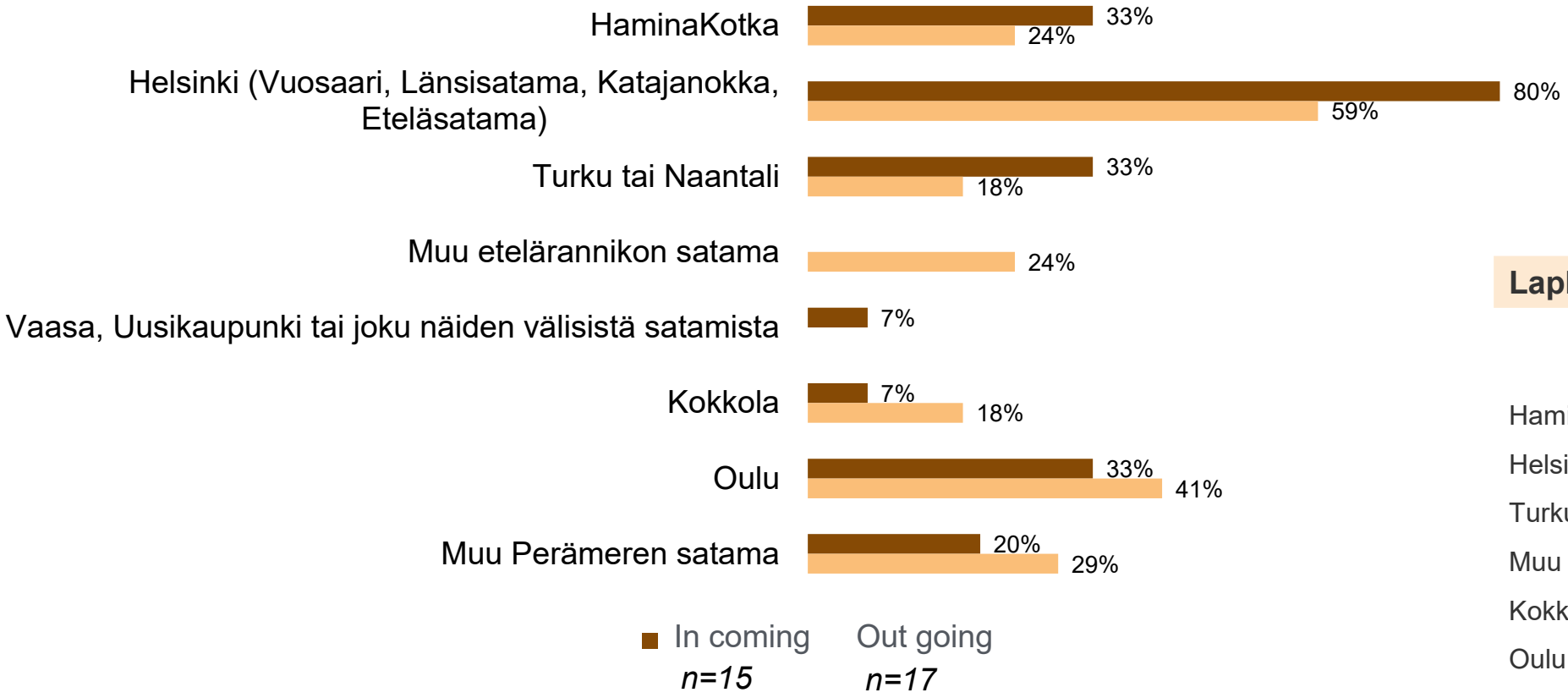
Finland – Other continents
n = 10

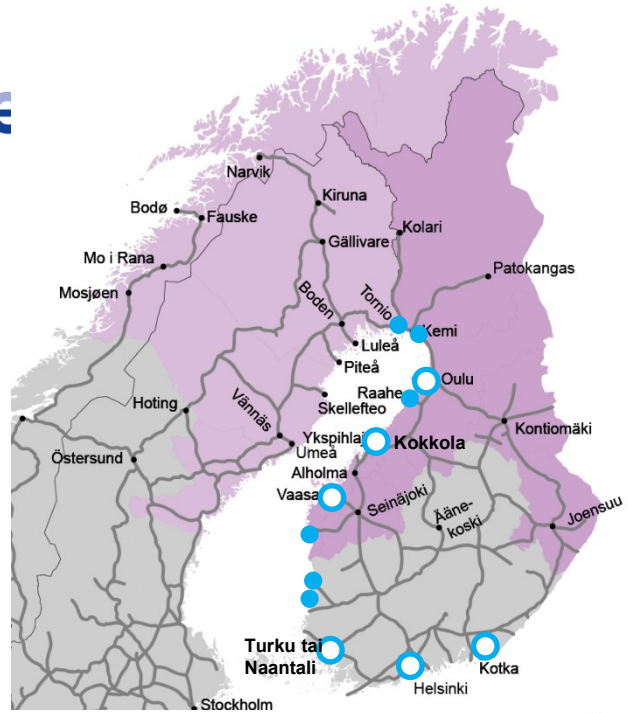


- Direct road transport
- Road transport + sea transport with vehicle
- Road transport + sea transport (off loading from vehicle)
- Rail transport + sea transport
- Rail transport + Road transport + sea transport
- Air transport + Road transport
- Transports are bought from a service provider
- I don’t know or other

Ports

Through which domestic ports does export to foreign countries go out, and through which ports do goods come in?

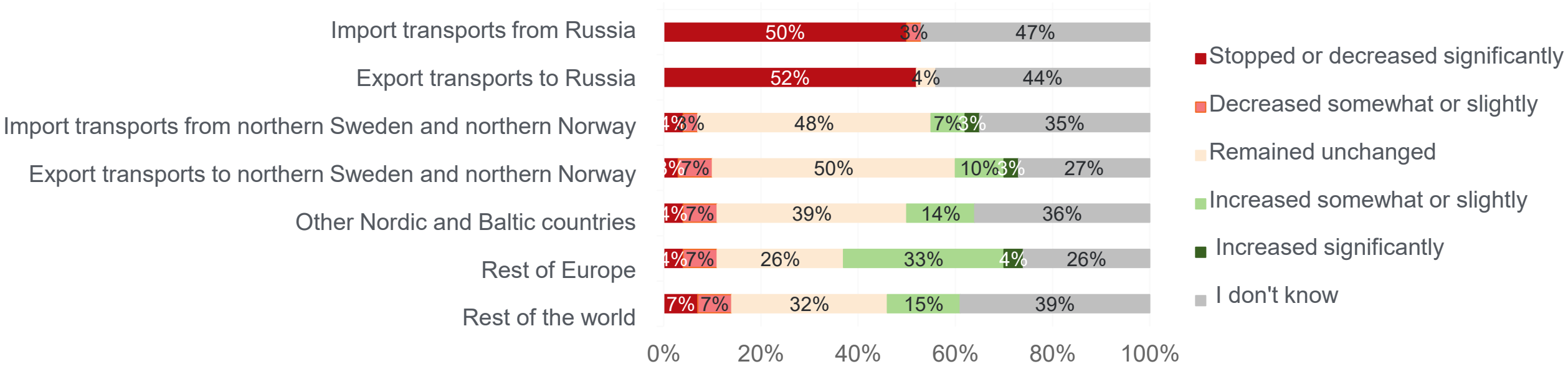




Lapland region

	Saapuvat n = 6	Lähtevät n = 7
HaminaKotka	1	1
Helsinki	4	4
Turku tai Naantali	2	1
Muu et. rannikko	0	1
Kokkola	0	1
Oulu	3	3
Muu Perämeri	2	3

Changes in the last years



When asked whether the modes of transport used have changed significantly in recent years, **74% said that there have been no significant changes.**

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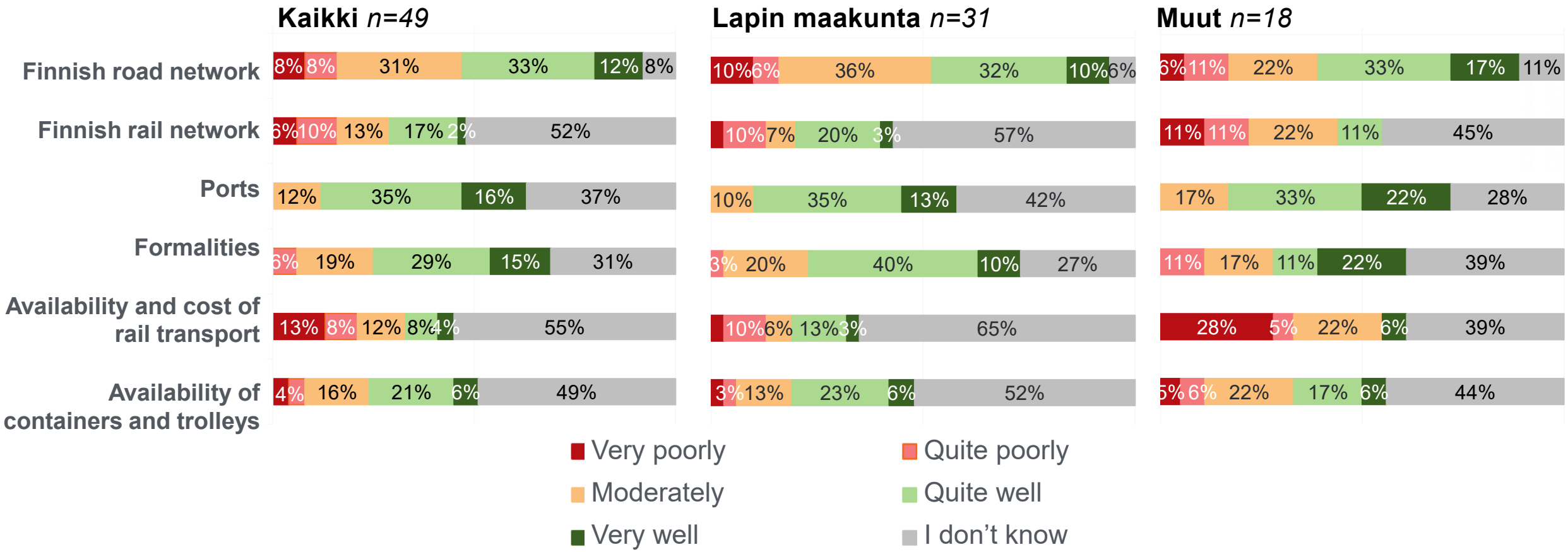
Infrastructure and other aspects along the tranport chain

How well do the following aspects of transport chains work from the perspective of your companies' international transports?



Future prospects

49% of respondents believe that challenges will increase in the future. Respondents highlighted geopolitical situations, the deterioration of road network conditions and maintenance levels, the increase in the volume of goods, and the rise in bureaucracy as challenges. Additionally, it was mentioned that achieving sustainability goals also creates challenges for transport due to increased reporting and the need to find new transport solutions. 12% answered no, and 39% did not know what to answer.

85% of respondents (n=47) believe that investments in the current road network are necessary to improve transport chains. 23% answered new road connections, and 19% hope for investments in the current rail network.

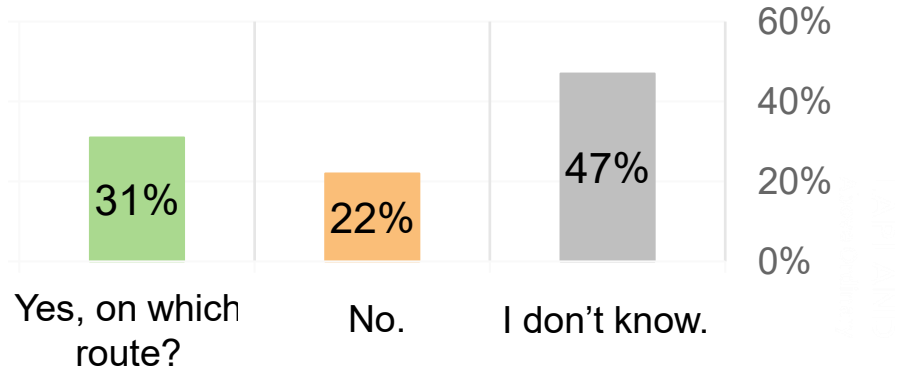
Does your company have a plan related to logistics chains and transports for potential crisis situations or logistical disruptions?

Yes 44 %

No 46 %

I don't know 10 %

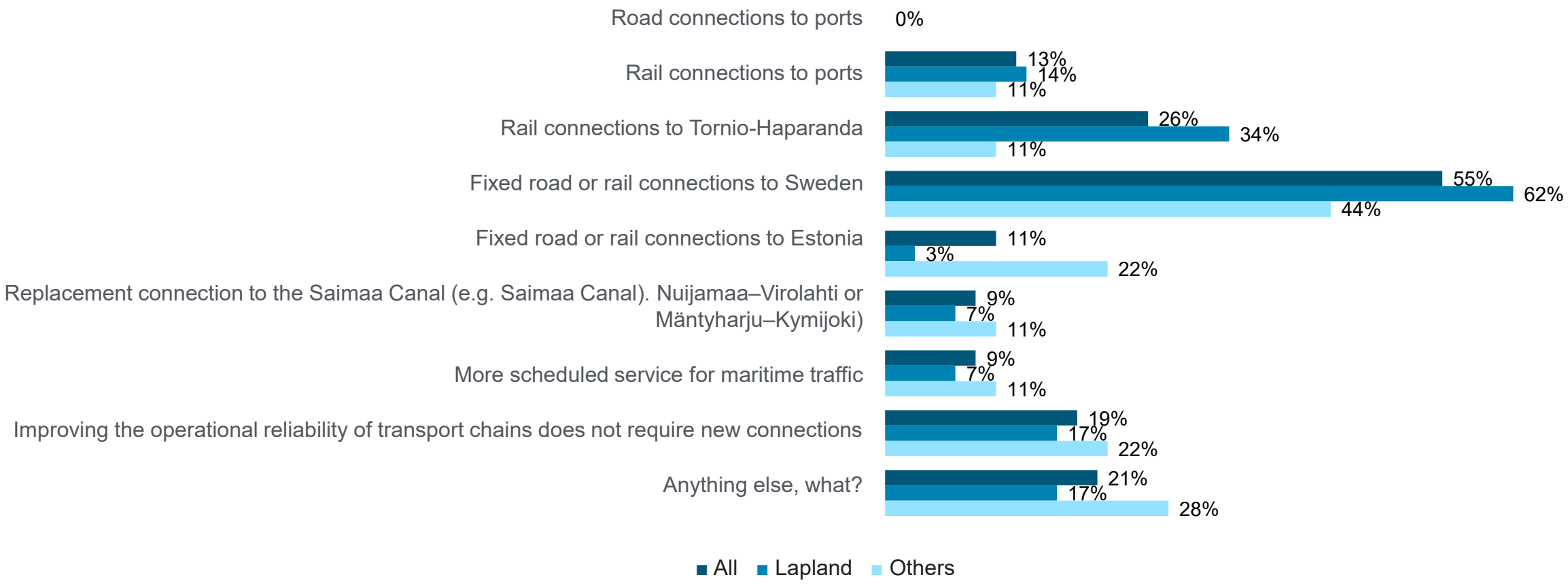
Would you be willing to shift some of your transports to a more expensive route if this route would enable transports even in crisis or exceptional situations?



Yes, on which route?
The Kvarken connection and the Tornio-Haparanda rail connection
Routes to Asia, North America, and the EU - via Rovaniemi through Sweden
Instead of using rail connections, we have used trucking companies on a one-time basis.
Rautetie
Nearest possible

Future prospects

What kind of new connections would be needed to make transport chains more reliable?



What other measures do you consider important to address the current challenges in your company's international transportation and ensure operational reliability? 1/2

Answers
Companies in our region are hoping for better connections to the port and industrial parks, as well as the development of a distribution network for alternative future fuels.
Strengthening logistics routes to Sweden and Norway.
Improving the road network.
Wintertime maintenance in road network.
More leniency in driving time regulations for charter services.
1. The situation between Finland and Russia is probably the most important issue to address. The reader may not agree, but on the other side of Finland's nearly 1500 km long border is Russia, and this is not going to change anytime soon. Finland needs to humble itself and accept this fact. It is better to get along with Russia. As for the USA, they are thousands of kilometers away from Russia. 2. Icebreakers need to be increased and renewed. Most goods come by sea, and it is much more efficient than truck transport. Rail logistics are seriously lagging behind; it is neither fast nor cheap to build new tracks. 3. Icebreakers should be based in the north, not in Katajanokka, where there is not much ice.
Improving the efficiency of container traffic from Central European ports to northern ports.
Increasing the capacity of the Helsinki-Oulu railway, enhancing the capacity of the Oulu-Haparanda-Kiruna railway considering crisis situations, and establishing a Kolari-Arctic Ocean railway connection for security reasons.

What other measures do you consider important to address the current challenges in your company's international transportation and ensure operational reliability? 2/2

Answers
A functional circular route: Rovaniemi-Kuusamo-Salla-Kemijärvi-Rovaniemi. For example, even buses did not run last summer between Rovaniemi and Kuusamo. Routes are planned only for southern ski holidays, not for trade and raw material transportation.
Widening and complete renovation of VT21.
Efficient transport chains for both passenger and freight logistics. Currently, the focus is entirely on Helsinki-Vantaa, where, for example, the only so-called “screening” equipment is located.
More fair transport subsidies.
Available transport capacity for the transportation of railway carriages and trams.

If you have any other comments related to the topic, you can write them here

Answers
The road network is sufficient, but resurfacing work needs to be increased, and winter maintenance should be enhanced and reorganised. We can take Sweden as an example.
Logistics also includes data flow. It must also be maintained. Almost the most important thing is to ensure that Finnish entrepreneurs and larger companies update their IT skills and software to facilitate foreign trade. Not enough children are being born, so soon we will be in trouble when we can't order goods by email in time. Of course, we have EDI in use, but many do not have it (perhaps a hypothesis).
The maintenance of the road network in Lapland must remain at least at the current level. Additionally, speed limits MUST NOT be reduced from the current levels.
Monitoring the maintenance of roads in Northern Finland to ensure that contractors fulfill their obligations. Additionally, planning and executing work in a timely manner to maintain safety.
Sweden started improving their road network to make it wider, safer, and more modern 25 years ago. Finland has really fallen behind in this regard. Investing in widening major roads ensures that logistics function during economic growth. Our old road network is crumbling under the weight of 76-ton loads.
In Lapland, there is already a very comprehensive road network created by MH. The railways are in good condition and there is no need for additional capacity. The mountain railway is not needed. Sokli should not be opened due to the geopolitical situation. The Americans will buy it, leaving us with the cleanup and polluted nature, including the waters.
Rail transport through Northern Sweden to Norwegian ports can never replace maritime freight transport under any circumstances. The capacity is insufficient. Such ideas are occasionally suggested, and while it's a good idea in theory, it just doesn't work.
The survey has completely omitted air transport and the logistics it enables for both freight and passenger traffic. This, along with future unmanned logistics such as drone logistics, is a crucial part of Finland's logistics functionality and should be included in the project.