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Abstract

Legal Disclaimer

Abbreviations and Acronyms

Acronym	Definition
EC	European Commission
PO	Project officer
GA	Grant Agreement
WP	Work Package
Ten-T	Trans-European Transport Networks
NUTS	Nomenclature of territorial units for statistics
GDP	Gross Domestic Product
KPI	Key Performance Indicator
TPN	Terminal Proximity Network
TEU	Twenty-foot Equivalent Unit

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Executive Summary

This document gives a description of the current stakeholders and transport flows in the Clusters and European network. It indicates the modal split and the potential to increase the use of rail and waterway transport instead of road transport.

The document is a result of task 3.5, in which a methodology is developed to search for the best possible combination of flows and (new) transport services. The starting goal is to analyze the current flows and network, in order to identify lanes for increased bundling and/or modal shift, i.e. a shift from road transport to rail or waterway transport. The identified lanes are used in Living Lab 2 to further explore the opportunities and to bring them into practice.

The European network is described in terms of infrastructure and goods transported. The KPIs for the goods transported are quantity (tons and ton-KMs), costs (euros) and emissions (CO_2).

The data used in this report (EuroStat 2015) shows a modal split, based on ton-kms, of 76% road transport, 18% rail transport and 6% waterway transport. There is potential to shift transport from road to rail and waterway in the network of intermodal clusters that are part of the project as well as in the full European network.

- The largest potential in the Clusters network is on the lane between Duisburg and Dourges. For shifting from road to rail the focus should be on the transport from Duisburg to Dourges, while the focus should be on both directions for shifting from road to waterway.

- The second largest potential in the Clusters network is shifting road to rail on the lane between Bologna and Trieste in both directions.

- There is also potential in the Clusters network to increase the rail transport on lanes that already have substantial rail transport, i.e. between Bologna, Trieste and Duisburg, and between Trelleborg and Duisburg.

- Overall, Duisburg is the most central terminal, i.e. the terminal where the most and highest volume lanes start or end, in the Clusters network.

- In the European network, Antwerp is the most central terminal. Paris and the area of Bologna also have a large potential in shifting road to rail and waterway.

- For shifting to rail, the potential is in expanding the lanes from the Bologna-Trieste area to the East. For shifting to waterway, the best potential is in expanding the lanes from the Benelux to France and Germany.

- For national transport, the potential is in increasing the modal shift on current lanes. For international transport, the potential is more in starting up a modal shift on promising lanes.

1. Introduction

1.1 Purpose of Document

The document is focused on describing and analyzing European transport flows. It provides an overview of the stakeholders in the Clusters network and the European transport flows. Moreover, it shows the potential in the European network for collaborative transport between logistics clusters, i.e. agglomerations of several types of firms and operations (logistics service providers, logistics operators, linked logistics industries and manufacturing). Furthermore, it indicates the benefits of collaborative transport with respect to increased transport efficiency and multimodality and as a result decreased costs and emissions.

The document is a result of task 3.5, in which a methodology is developed to search for the best possible combination of flows and (new) services. The starting goal is to analyze the current flows and network, in order to identify lanes for increased bundling and/or modal shift, i.e. a shift from road transport to rail or waterway transport. The identified lanes are used in Living Lab 2 to further explore the opportunities and to bring them into practice.

1.2 Intended Audience

The document is addressed to the Clusters 2.0 project partners. In addition, it is also intended to inform shippers, logistics service providers and other parties interested in joining the Clusters project.

2. Description of the current network

This chapter provides an overview of the stakeholders in the Clusters network. Furthermore, the transport flows throughout Europe (EU28 + Switzerland) in 2015 (the most recent year for which all information is available) are visualized and analyzed. This document is based on an interactive dashboard that was developed for the project. Different perspectives will be shown to identify the important lanes in the network that have the most potential for a modal shift.

Several data sources have been consulted to come to this document, e.g. rail data from UIC, Ten-T network description from the European Commission. The basis for the transport flows is EuroStat data. The data for road transport consists of tons and ton-kms from countries to countries, loaded in NUTS2[1] regions and unloaded in NUTS2 regions. These loaded and unloaded quantities are used to distribute the country quantities over NUTS2 regions, resulting in tons and ton-kms from NUTS2 regions to NUTS2 regions. The data for rail transport consists of tons and ton-kms from countries to countries. These quantities were distributed over NUTS2 regions based on GDP. The data for waterway transport consists of tons and ton-kms from NUTS2 regions to NUTS2 regions.

2.1 Stakeholders

Clusters 2.0 is aiming to bundle flows between important logistic clusters within the Ten-T network in order to reach efficiency in cost and sustainability. Logistic clusters are agglomerations of several types of firms and operations:

- Logistics service providers (transportation, 3PL)
- Logistics operations (warehousing, cross-docking)
- Linked logistics industries (IT, maintenance)
- Manufacturing

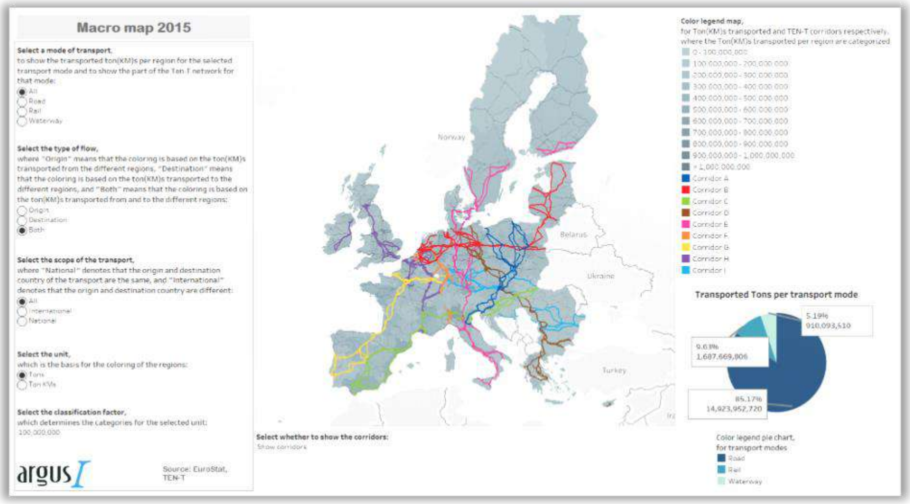
To be successful several types of stakeholders need to be involved. Next to the logistics clusters, one will need partners to execute transport both on rail and road, terminals, shippers, governments, corridor managers, and trustees. A trustee is a neutral party that operates in name of the collaboration. Three types of trustees are distinguished, i.e. a purchasing trustee (collaborative purchasing of transport), an online trustee (support in operations like load combination and synchronization, real-time network orchestration, ICT systems and interfaces) and an offline trustee (data confidentiality, matchmaking (analysis and visualization), gain sharing). Table 1 provides an overview of all these roles, indicating the partners that are currently active in the Clusters network.

[1] The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of (1) The collection, development and harmonisation of European regional statistics; (2) Socio-economic analyses of the regions; (3) Framing of EU regional policies. The NUTS2 classification refers to basic regions for the application of regional policies.

Table 1 – Stakeholders needed and conditions to be met for successful collaboration

Type of stakeholder	Condition	Stakeholders represented in Clusters 2.0	Potential other stake-holders in Europe
Logistics cluster		Dourges, Duisport, Trelleborg, Trieste, Interporto Bologna, Zaragoza, Piraeus	Antwerp
Logistics service provider	Open network	Jan de Rijk, DHL	Tiedada
Rail operator	Open network	Innovatrain, Euralogistic	Hupac, Lineas
Terminal	Open network	Air Cargo Belgium, Heathrow	
Shipper	Flows > 600 km	P&G	
Purchasing trustee	Neutral party		
Online trustee	Neutral party	Armines	
Offline trustee	Neutral party	Argusi	

2.2 Transport flows and the Ten-T network



Freight transport throughout Europe comprised about 17.5 billion tons, or 2,299 billion ton-kms, in 2015. This corresponds to an average trip length of 131 km. The transport can be divided over three transport modes[2] (see Figure 1):

- *Road*: 14.9 billion tons (85%), 1,741 billion ton-kms (76%), average trip length 117 km;
- *Rail*: 1.7 billion tons (10%), 418 billion ton-kms (18%), average trip length 248 km;
- *Waterways*: 0.9 billion tons (5%), 140 billion ton-kms (6%), average trip length 154 km.

[2] In line with the modal split in Statistical Pocketbook 2016 – Mobility and Transport from the European Commission.

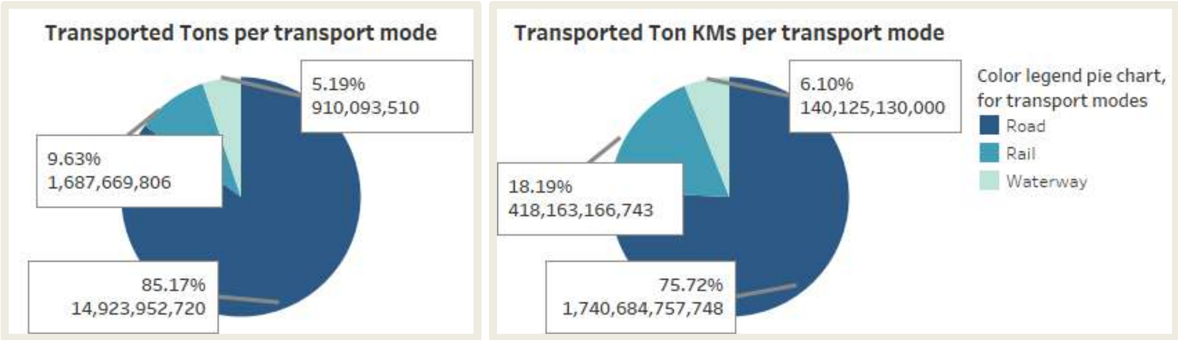


Figure 1 - Total ton(-km)s transported per transport mode

Breaking down the road transport,
Figure 2 shows the total ton-kms transported per NUTS2 region from or to that region. Figure 3 gives the same view as
Figure 2, but then for rail transport. Finally, Figure 4 shows the view for waterway transport.

As there is a proper road network that covers the whole area, indicated by the corridors in Figure 2, all regions have a significant amount of road transport. The South-West of Europe has a few regions that attract more ton-kms, which is mostly due to a longer average distance of the transport from and to those regions. For rail transport, several regions around corridors B, C and E attract more ton-kms. As expected, the North-West of Europe attracts most waterway transport. In this area, the link between transport and corridors is most apparent.

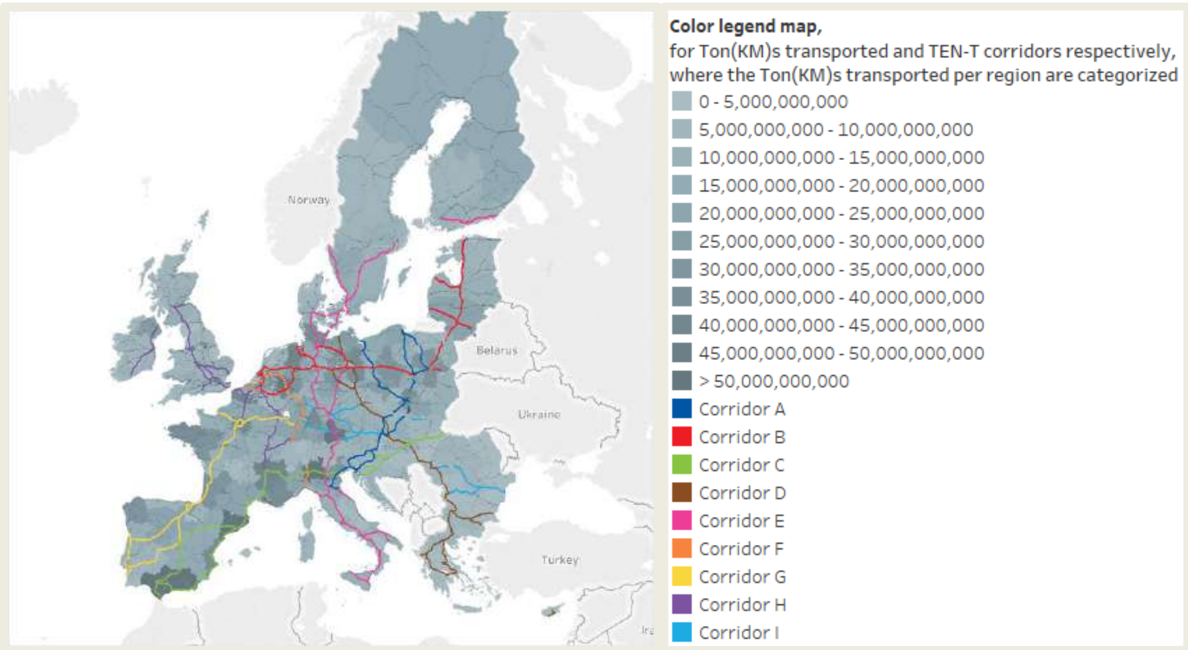


Figure 2 – Road transport (ton-kms) from and to NUTS2 regions along with Ten-T road corridors

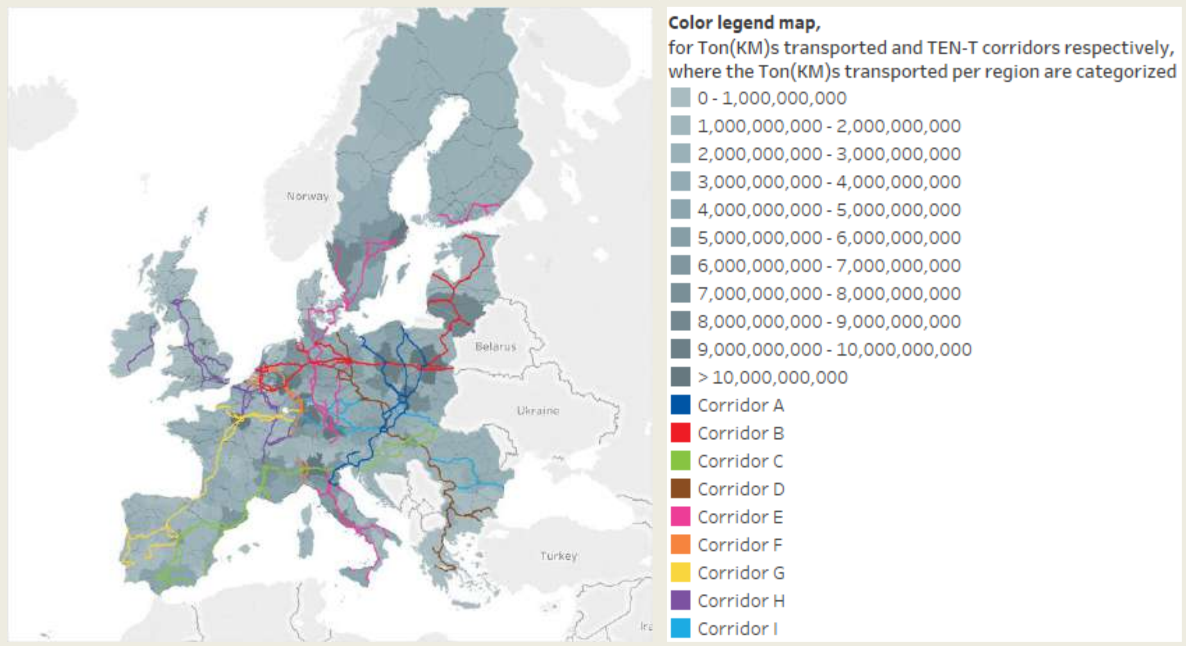


Figure 3 – Rail transport (ton-kms) from and to NUTS2 regions along with Ten-T rail corridors

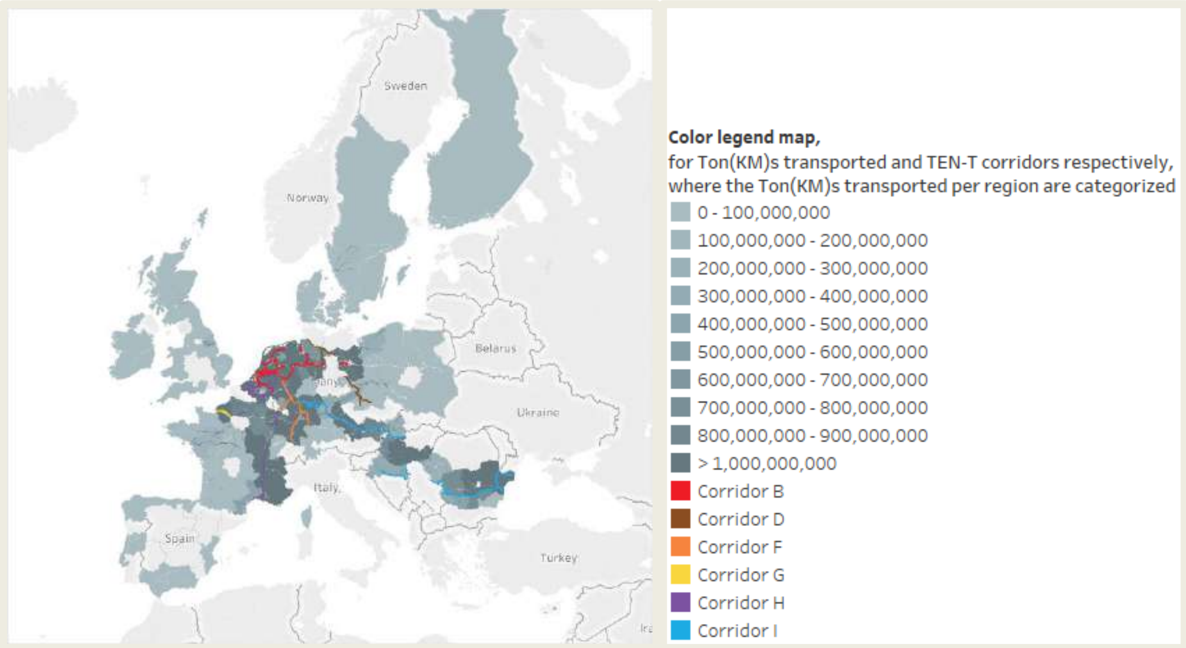


Figure 4 – Waterway transport (ton-kms) from and to NUTS2 regions along with Ten-T waterway corridors

Based on the origin and destination countries of the transport, a split can be made between national and international transport. Comparing Figure 5 and Figure 6 then show areas which are more national oriented, e.g. Spain, and areas which are more international oriented, e.g. the Netherlands. The figures also show that rail and waterway transport mostly originate from international transport.

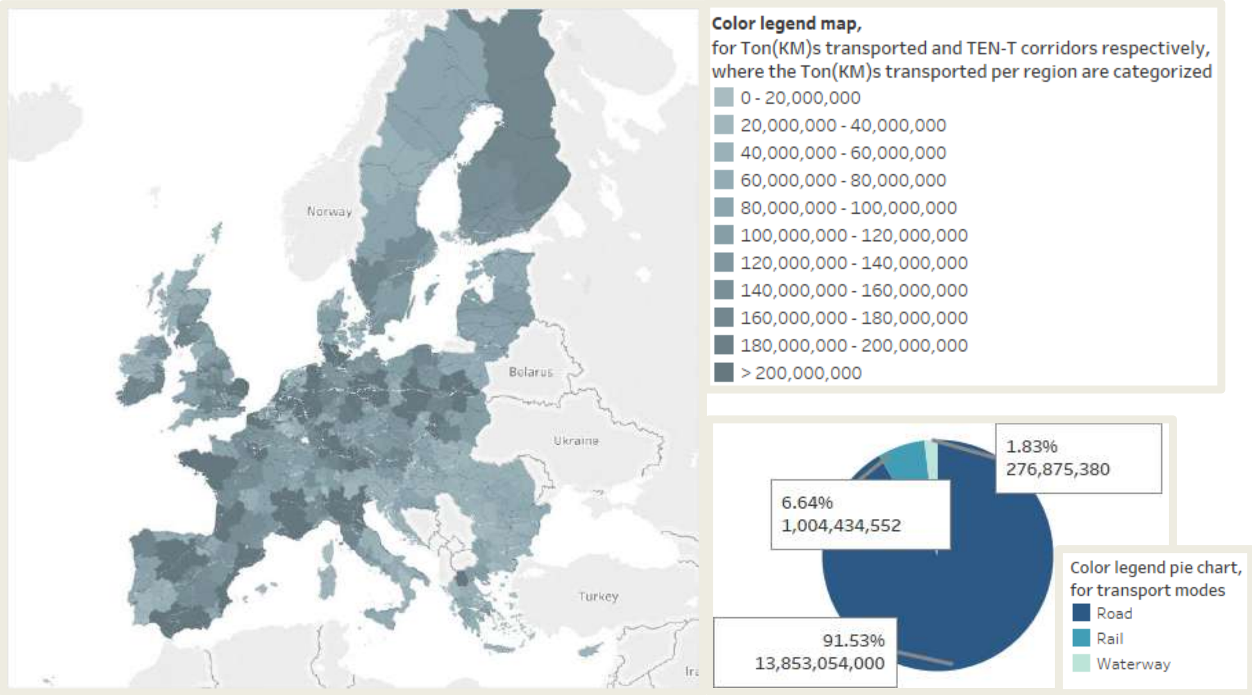


Figure 5 – National transport (tons) for all modalities for each NUTS2 region

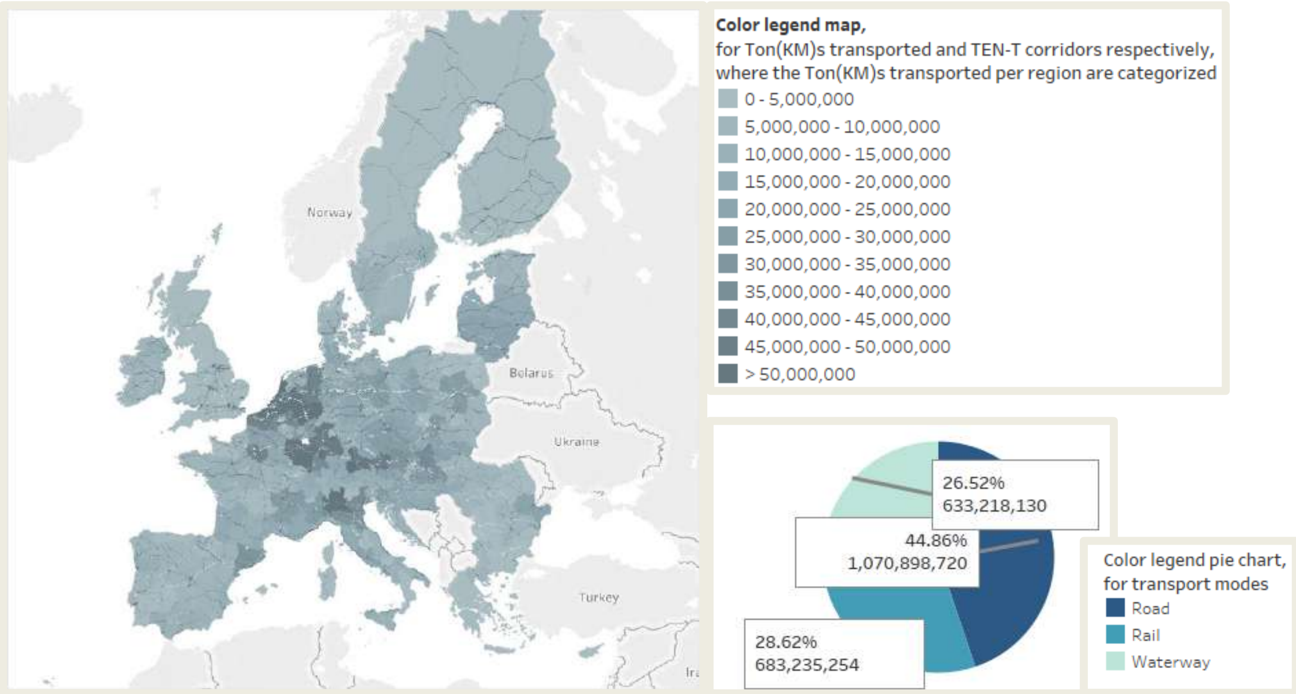


Figure 6 – International transport (tons) for all modalities for each NUTS2 region

Based on whether a region is the origin of a transport or a destination, the international transport can be further split in import and export. Comparing the left and right map in Figure 7 shows areas that export more than they import, e.g. the South of Spain, and areas that import more than they export, e.g. the South of France.

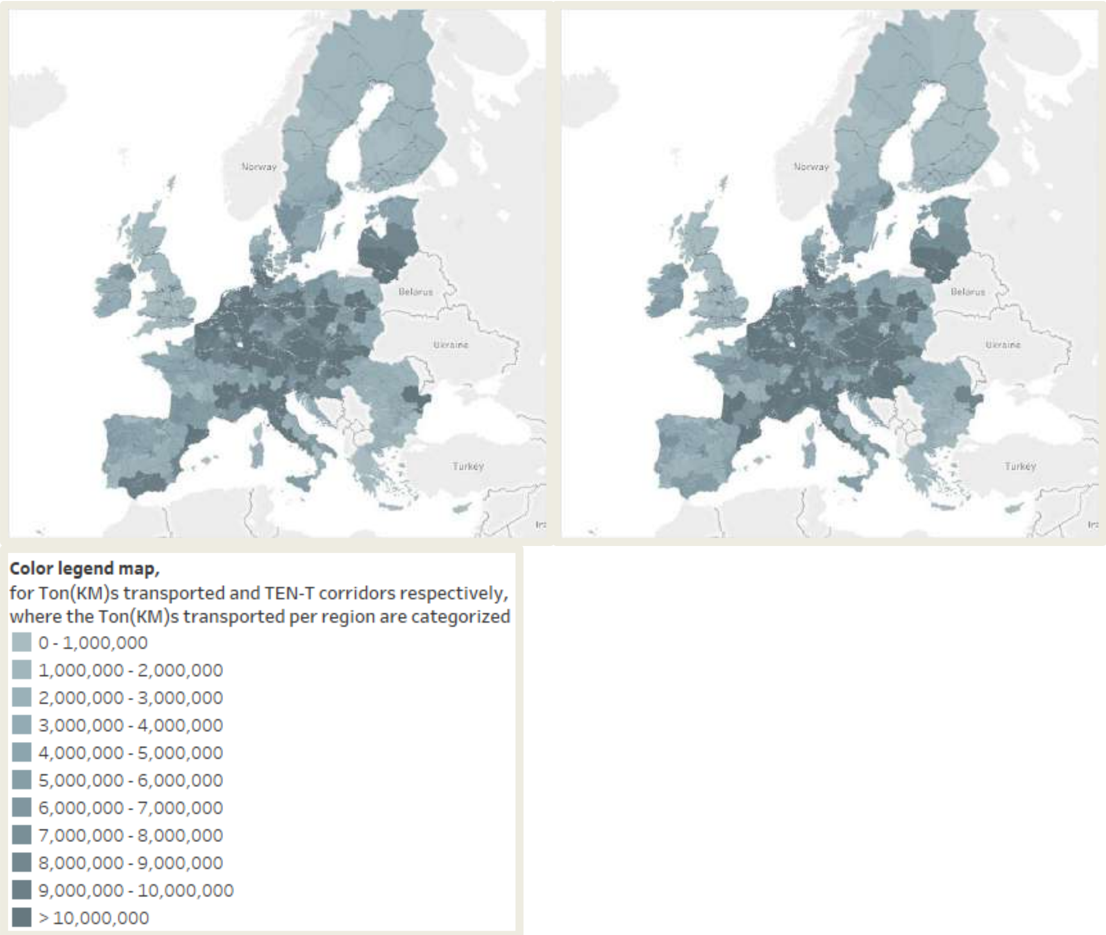
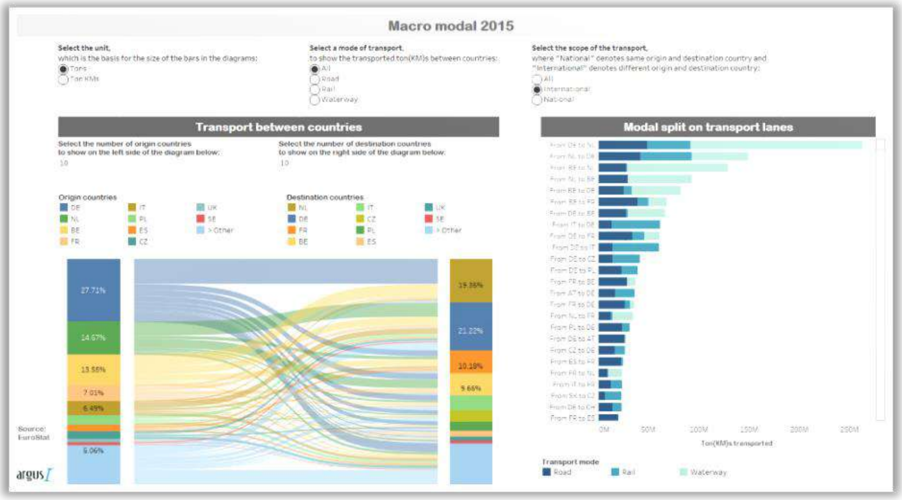


Figure 7 - International transport (tons) from (left) and to (right) each NUTS2 region for all modalities

2.3 Modal split on country lanes



The most high-volume international lanes and their modal split are given in Figure 8. Figure 9 shows the top 10 countries transporting by road, and their main destination countries. Figure 10 shows the same for transport by rail and Figure 11 for transport by waterway. Transport between Germany, The Netherlands and Belgium have the most deviating modal split, especially due to the waterway transport.

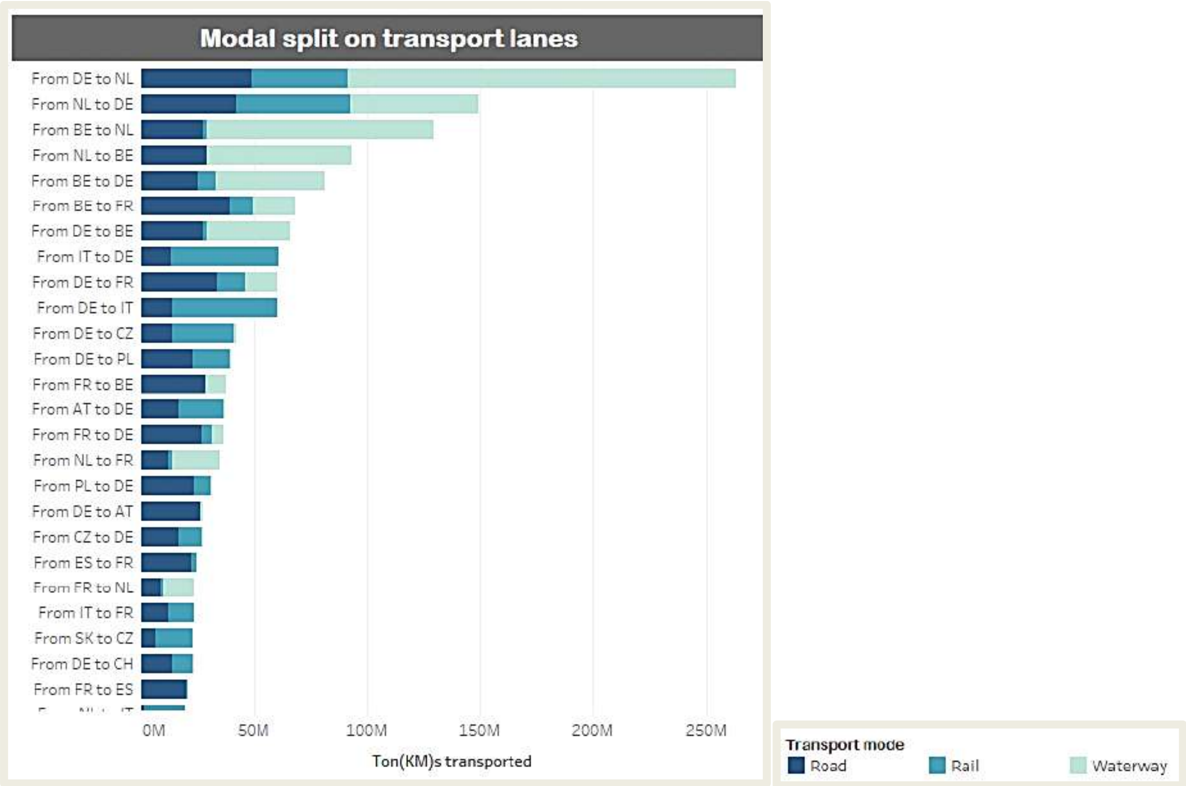


Figure 8 - Modal split on main international transport lanes (tons)

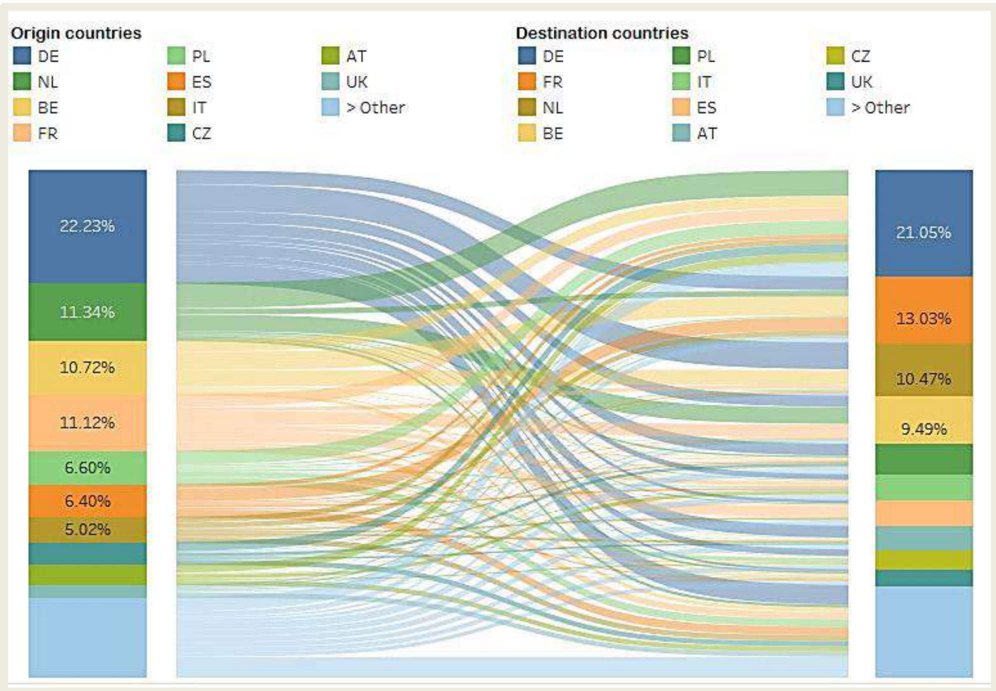


Figure 9 - Main international transport lanes for road transport (tons)

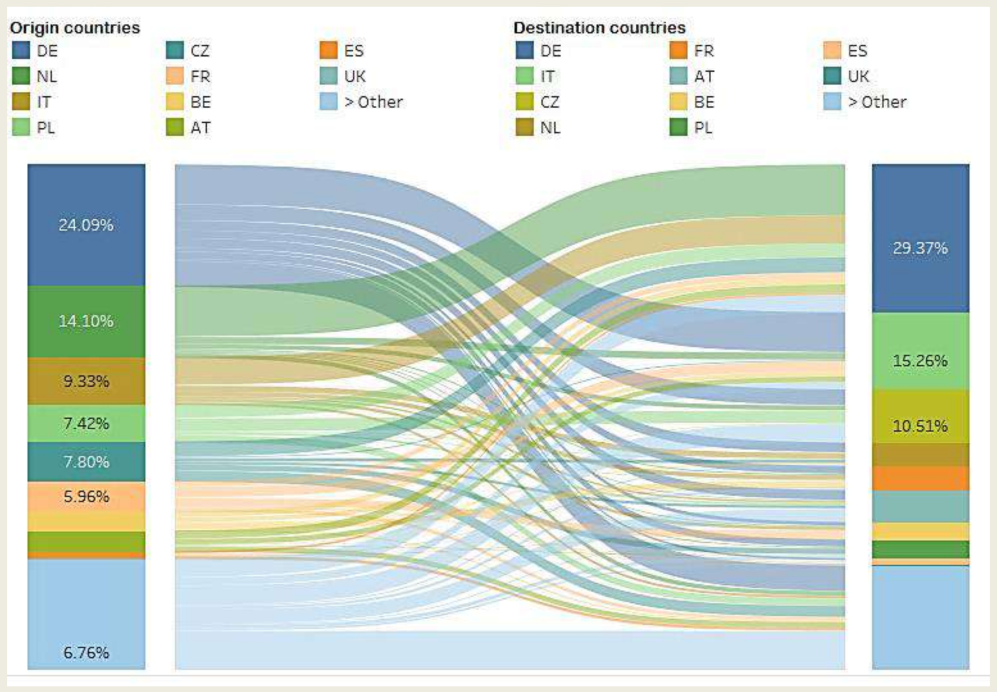


Figure 10 - Main international transport lanes for rail transport (tons)

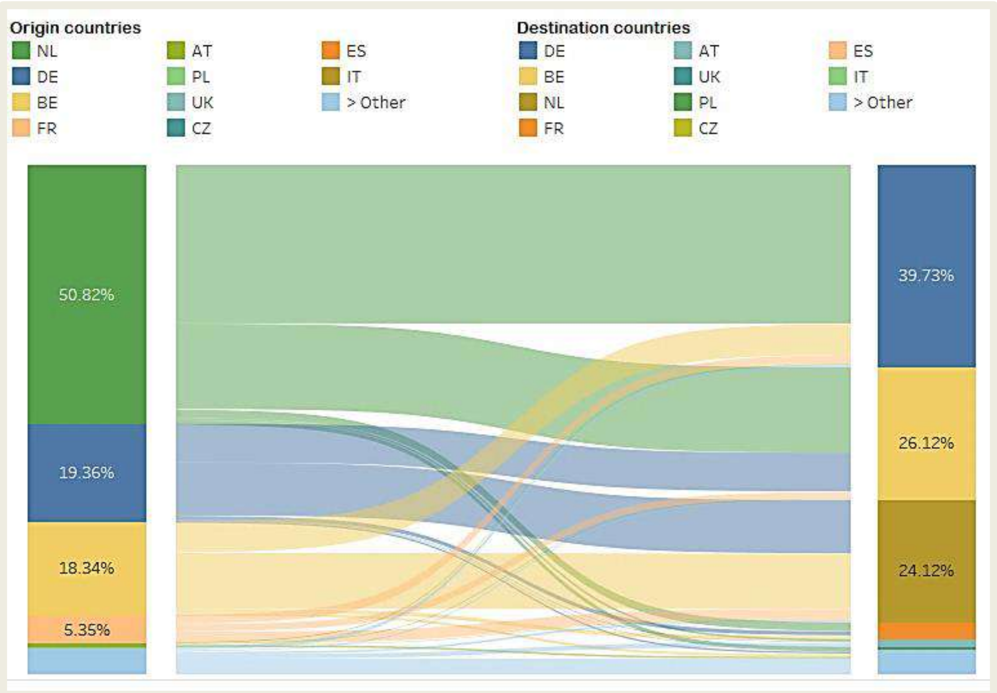
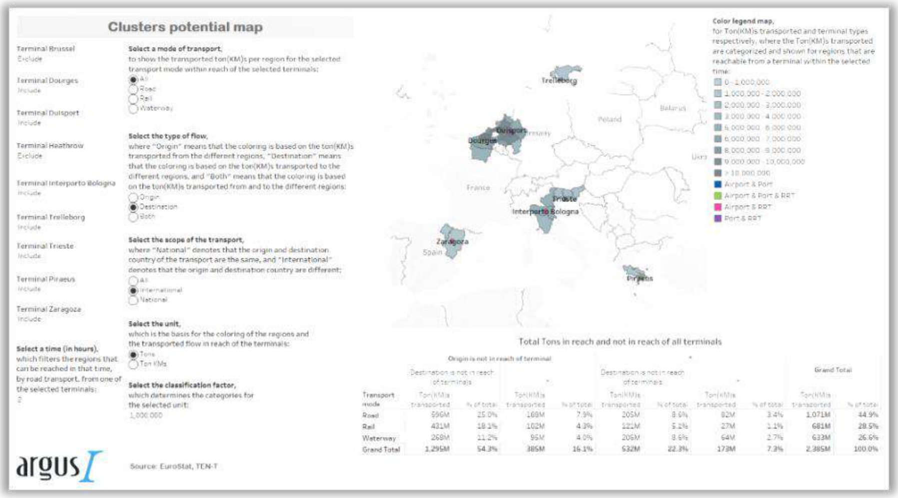


Figure 11 - Main international transport lanes for waterway transport (tons)

2.4 Transport around the clusters



To get an idea of the potential of the clusters within the Clusters 2.0 project, Figure 12 shows the NUTS2 regions within 2 hours from the main terminals (rail and waterway) in the project, i.e. Duisport, Zaragoza, Trieste, Trelleborg, Piraeus, Interporto Bologna and Dourges. International transport between these regions amounts to 32.9 billion ton-kms, which is about 4% of the total ton-kms transported internationally in the European network. Transport by road between the regions covers 3% of the total international road transport, rail covers 4% and waterway 7%.

The percentages for different times to reach the terminals are given in Table 2. More than a third of the European transport can be covered with a reach up to five hours. For waterway transport it even increases to almost 80%.

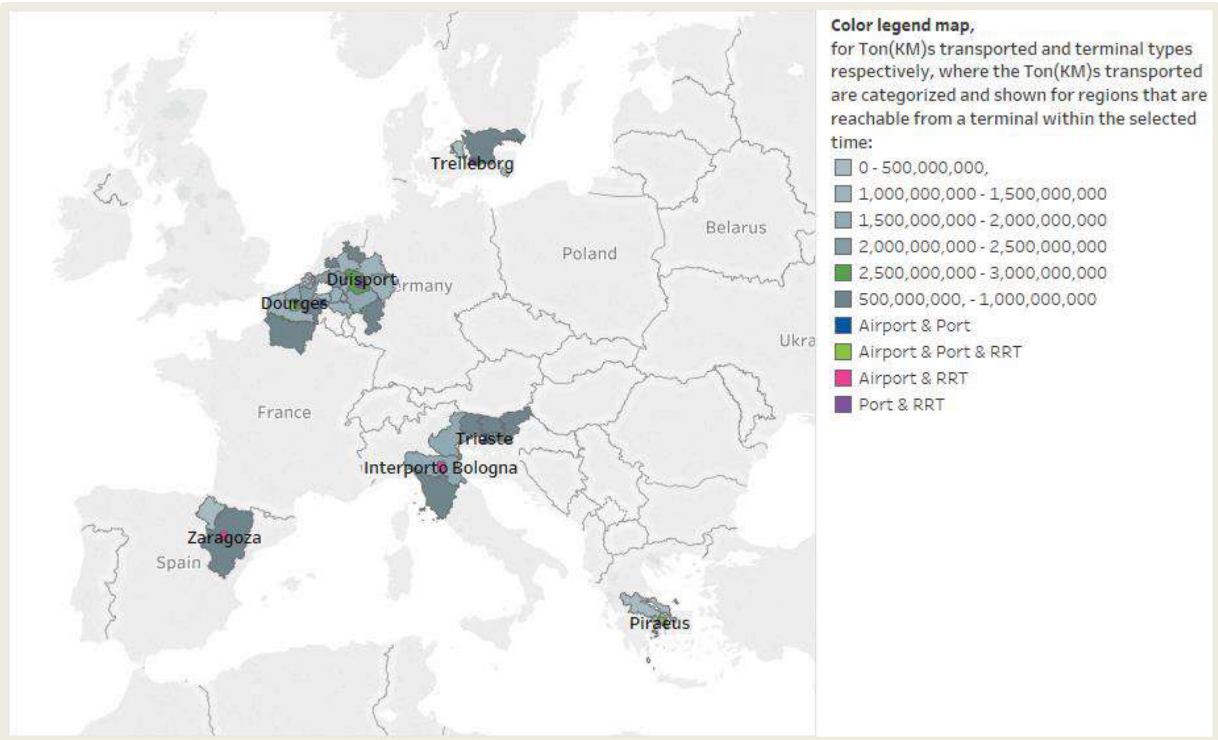
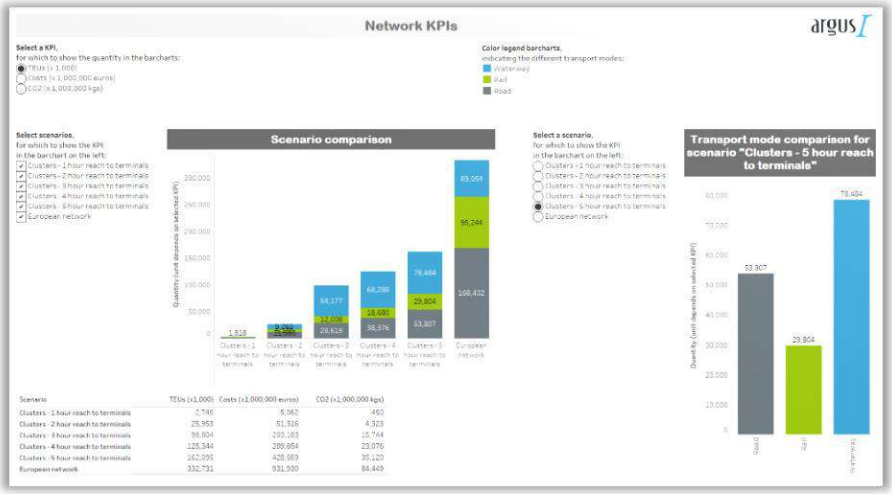


Figure 12 – International transport (ton-kms) from and to NUTS2 regions within a 2-hour reach of the clusters

Table 2 - Coverage of international transport (ton-kms) by the clusters

Time to reach terminal	Ton-kms transported between regions in reach (billions)	% of total ton-kms transported in the network			
		All modes	Road	Rail	Waterway
1 hour	5.1	0.6	0.6	0.5	0.4
2 hours	32.9	3.8	3.2	3.8	7.0
3 hours	130.6	14.9	10.8	12.8	42.4
4 hours	202.4	23.1	18.1	20.8	56.8
5 hours	351.1	40.1	33.5	41.4	77.6

2.5 Network Key Performance Indicators



A network design model is used to determine key performance indicators (KPIs) for the whole European network and for the Clusters network. For the Clusters network catchment areas (areas that can be reached from a terminal within a given time) are defined, which represent the Terminal Proximity Networks (TPNs). It gives insight in how the clusters, or TPNs, perform within the bigger network. Later in the project the model and the KPIs can be used to compare the AS IS situation with possible TO BE situations.

The basis for the network model consists of the international flows from the former analyses. For each flow it is given whether it was transported by road, rail or waterway. The model then determines the lowest cost route from origin region to destination region using the corresponding network based on the costs in Table 3. The corresponding network means the road network if the flow was transported by road, the rail network (based on the Ten-T corridors) if it was transported by rail and the inland waterway network (based on the Ten-T corridors) if it was transported by waterway.

The KPIs that are determined are:

- The number of TEUs transported (in thousands),
- Transport costs (in million euros), and
- CO_2 emissions (in million KGs).

The parameters for calculating the KPIs are given in Table and Figure 13. It is furthermore assumed that 1 TEU equals 7 tons[3].

[3] https://www.acea.be/uploads/publications/SAG_15_European_Freight_Transport_Statistics.pdf

Table 3 - Parameters for transport costs and emissions calculation

Transport mode	Transport costs[4]		CO_2 emissions[5]
	Per ton	Per ton per km	
Road		0.65 €	62 g/ton-km
Rail	121.2 €	0.19 €	22 g/ton-km
Waterway	90.5 €	0.11 €	31 g/ton-km

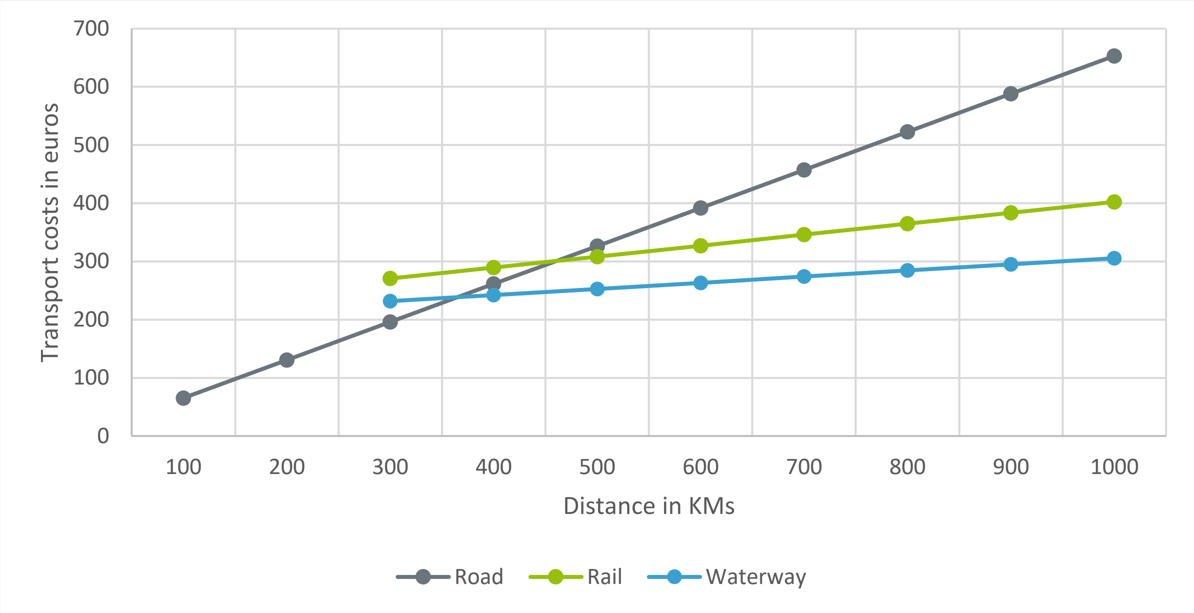


Figure 13 – Total transport costs per transport mode for increasing distance (per TEU)

To compare the Clusters network to the total network, six scenarios are defined that include different sets of the international flows:

- *European network*: includes all tons transported internationally in the European network (EU28 + Switzerland).
- *Clusters – 1 hour reach to terminals*: includes all tons transported internationally from and to the NUTS2 regions that can be reached within 1 hour from one of the terminals in the project.
- *Clusters – 2 hour reach to terminals*: includes all tons transported internationally from and to the NUTS2 regions that can be reached within 2 hour from one of the terminals in the project.
- *Clusters – 3 hour reach to terminals*: includes all tons transported internationally from and to the NUTS2 regions that can be reached within 3 hour from one of the terminals in the project.
- *Clusters – 4 hour reach to terminals*: includes all tons transported internationally from and to the NUTS2 regions that can be reached within 4 hour from one of the terminals in the project.
- *Clusters – 5 hour reach to terminals*: includes all tons transported internationally from and to the NUTS2 regions that can be reached within 5 hour from one of the terminals in the project.

[4] "Economical and Ecological Comparison of Transport Modes: Road, Railways, Inland Waterways" by PLANCO Consulting GmbH, Essen and Bundesanstalt für Gewässerkunde (November, 2007)
[5] Recommendations by McKinnon in https://www.ecta.com/resources/Documents/Best%20Practices%20Guidelines/guideline_for_measuring_and_managing_co2.pdf

In Table 4 the scores for all KPIs are given per scenario. Figure 14 (“Clusters – 2 hour reach to terminals” scenario) and Figure 15 (“European network” scenario) show the transport costs versus transported TUEs. Figure 17 (“Clusters – 2 hour reach to terminals” scenario) and Figure 17 (“European network” scenario) show the transport costs versus CO_2 emissions. Due to the big share of rail and waterway transport, the clusters scenarios have a better economical as well as environmental ratio.

Table 4 - KPIs per scenario

Scenario	TEUs		Costs		CO2	
	in thousands	% of total	in million euros	% of total	in million kgs	% of total
Clusters - 1 hour reach to terminals	2,745	0.8	5,062	0.5	450	0.5
Clusters - 2 hour reach to terminals	25,953	7.8	51,316	5.5	4,323	5.1
Clusters - 3 hour reach to terminals	98,804	29.7	203,183	21.8	15,744	18.6
Clusters - 4 hour reach to terminals	125,344	37.7	289,854	31.1	23,076	27.3
Clusters - 5 hour reach to terminals	162,095	48.7	428,669	46.0	35,120	41.6
European network	332,731	100.0	931,930	100.0	84,449	100.0

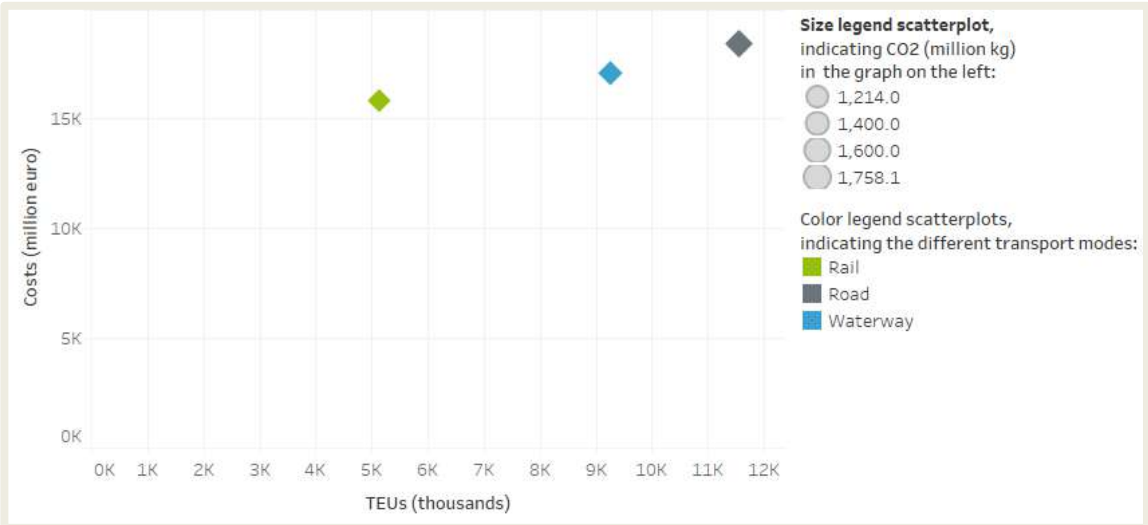


Figure 14: Transport costs versus TEUs for the clusters (2 hour reach)

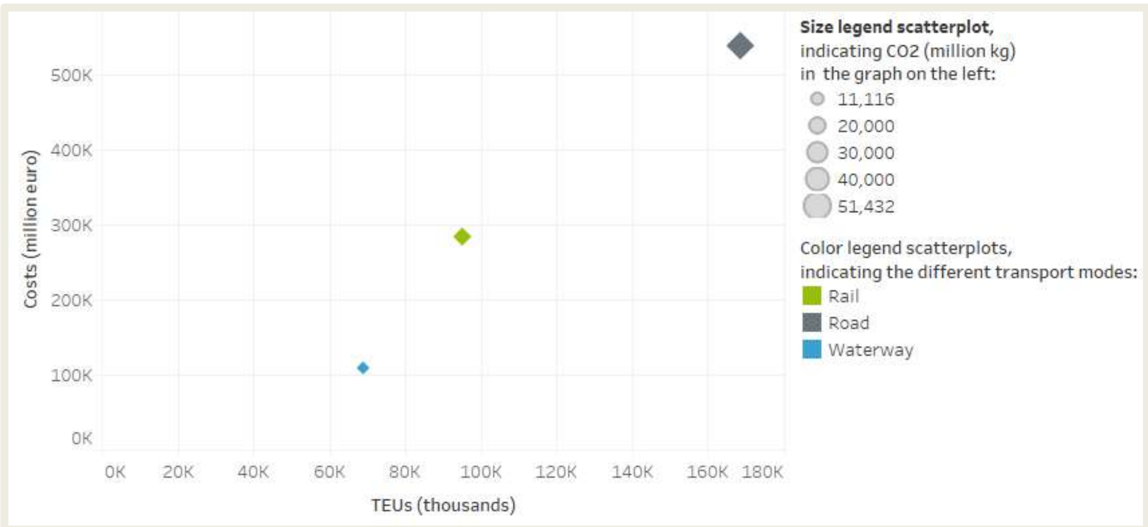


Figure 15 - Transport costs versus TEUs for the European network

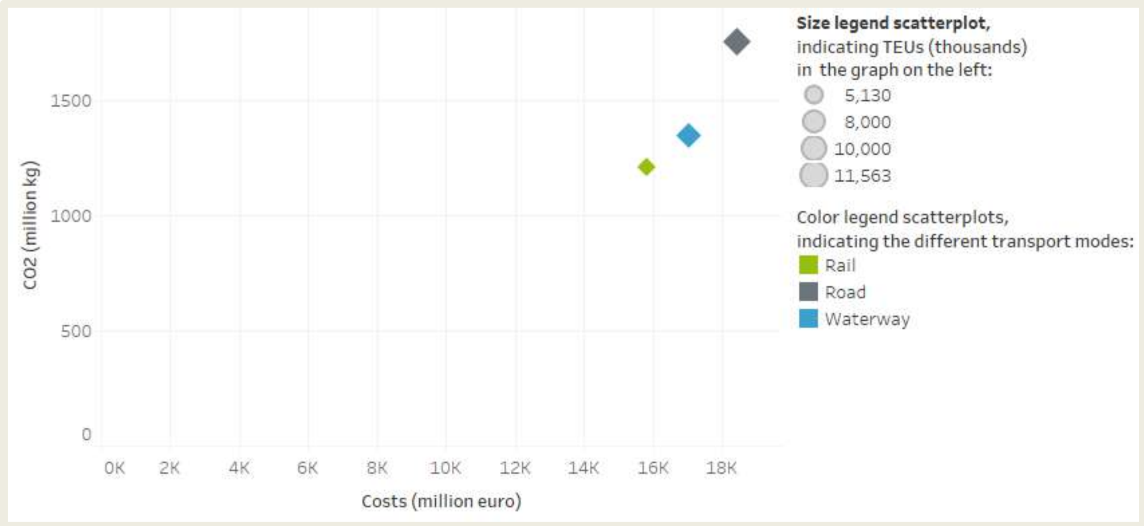


Figure 16 - Transport costs versus CO2 emission for the clusters (2 hour reach)

Figure 17 – Transport costs versus CO_2 emission for the European network

Figure 18 ("Clusters – 2 hour reach to terminals" scenario) and Figure 19 ("European network" scenario) show the transported TEUs for rail and waterway transport in the Ten-T network. It makes the corridor from North-West Europe to South(-East) Europe stand out in rail transport and from North-West Europe into the South and East direction in waterway transport.

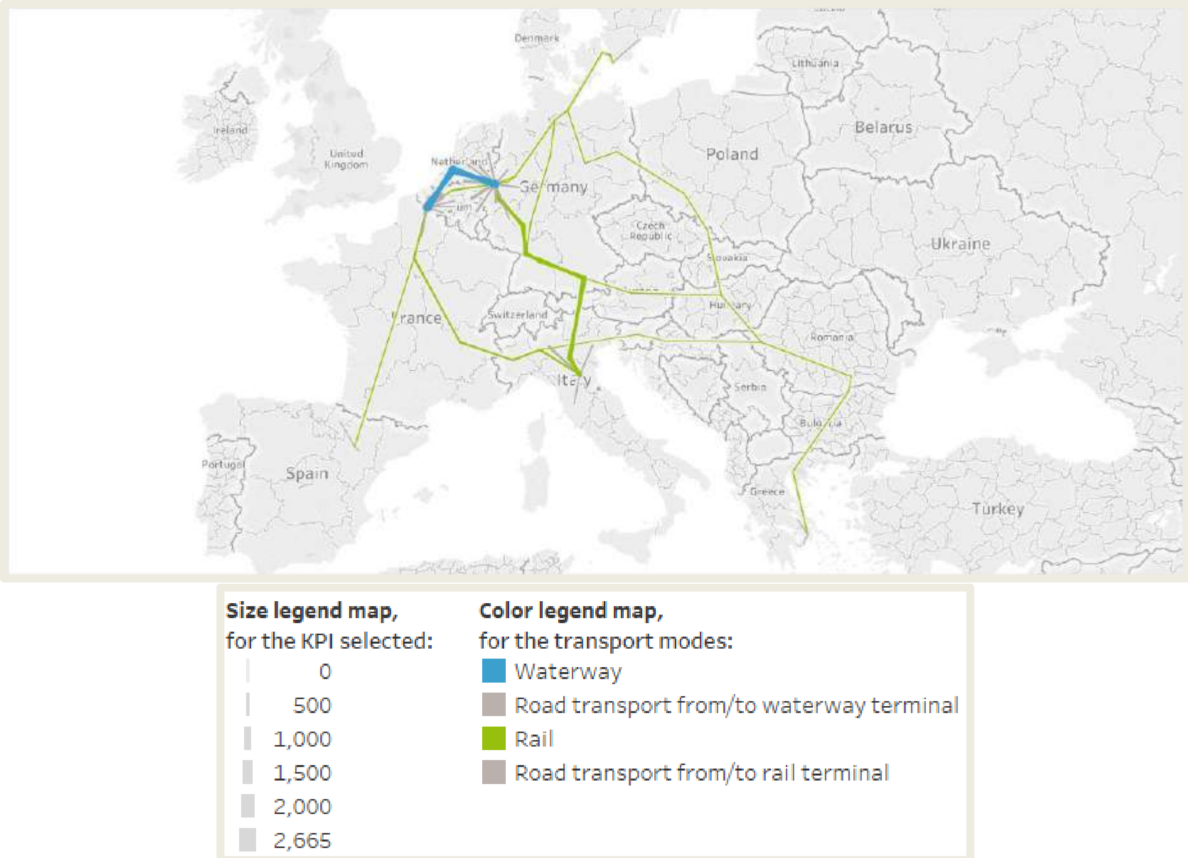


Figure 18 – Transported TEUs for rail and waterway transport in Clusters network (2 hour reach)

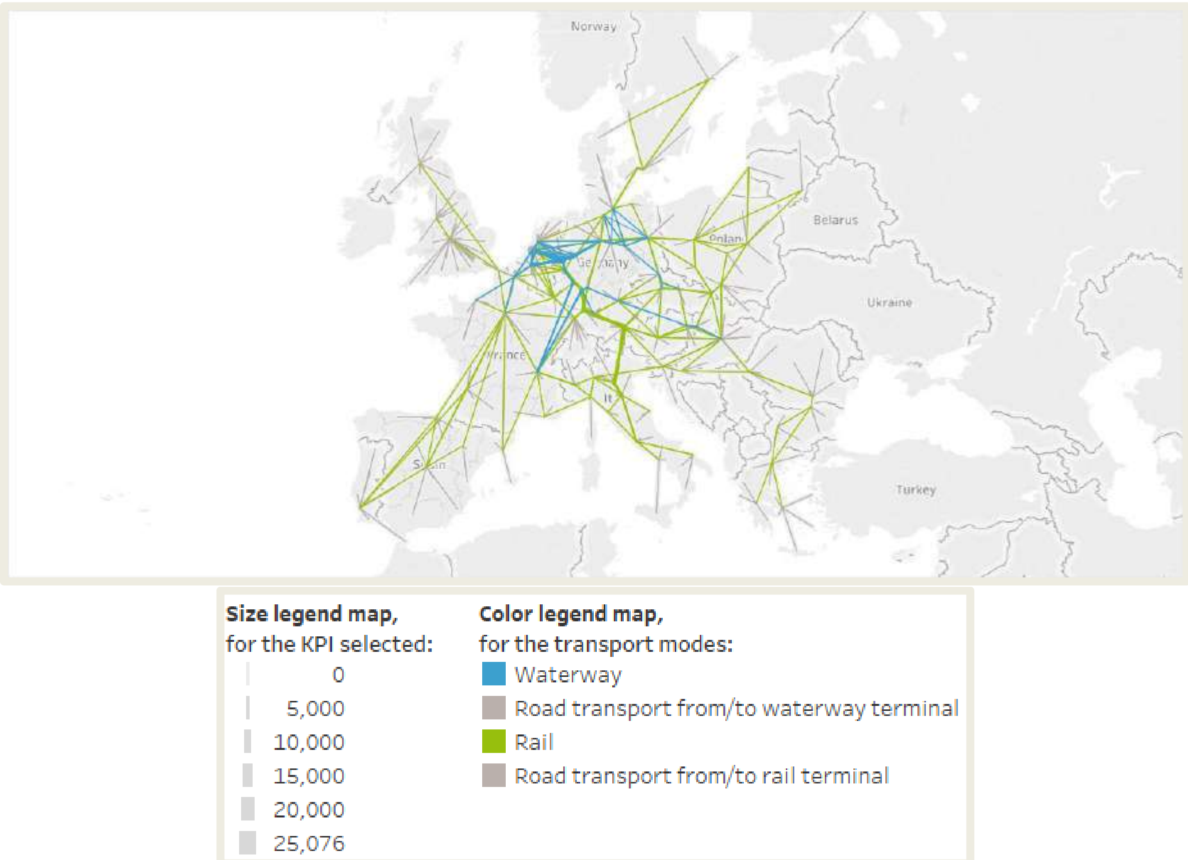
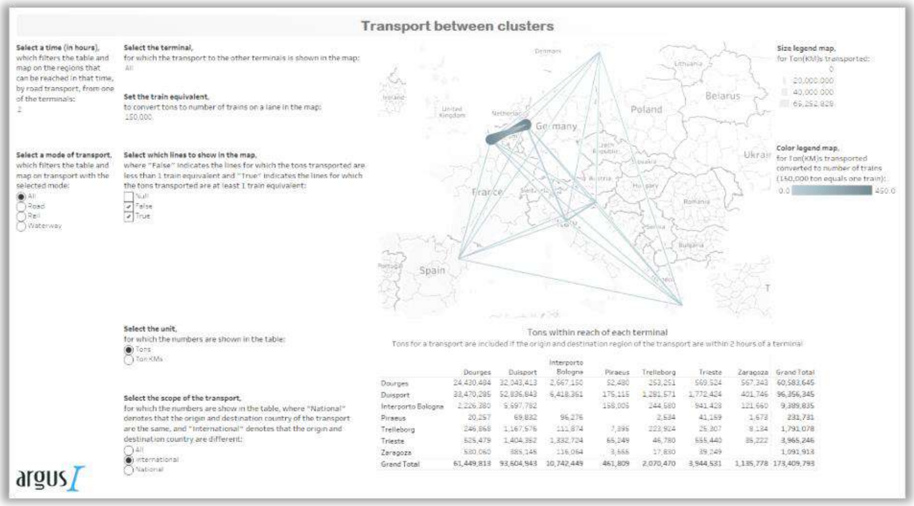


Figure 19 – Transported TEUs for rail and waterway transport in European network

3. Potential in the current network

This chapter shows the determination of the main transport lanes and the comparison to the available network. The aim is to find the potential for modal shift. This is first done for the Clusters network and then for the European network.

3.1 Potential of the clusters



In Figure 20 the road transport between the clusters in the Clusters project is depicted. This shows that the main transport lane is between Dourges and Duisburg. If this is compared to the rail transport between the clusters, depicted in Figure 21, one can see that there is already a substantial volume transported by rail from the Dourges region to the Duisburg region (possibly not direct, but via different terminals). Another insight is that there is potential for the backhaul, from the Duisburg region to the Dourges region. However, there is also an alternative in using inland waterways. As can be seen in Figure 22, which depicts the waterway transport between the clusters, the lane between Dourges and Duisburg is already used intensively for waterway transport in both directions.

The transport lane between Trieste and Bologna has the next largest road transport flow. For this lane there is potential for increasing the rail transport that is already present in both directions.

Figure 20 – Lanes with road transport between regions in a 2-hour reach of the terminals

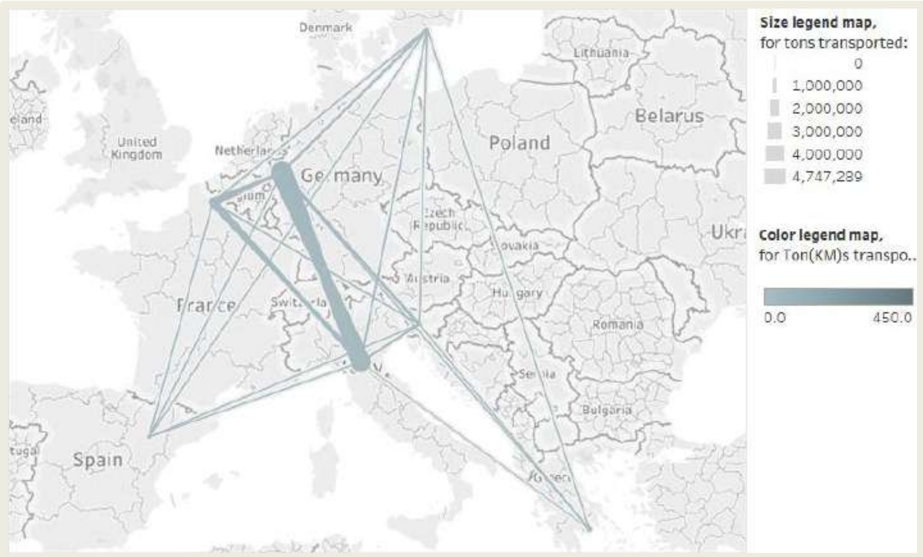


Figure 21 - Lanes with rail transport between regions in a 2-hour reach of the terminals

Figure 22 - Lanes with waterway transport between regions in a 2-hour reach of the terminals

Table 5 shows the modal split on the lane between the clusters at the left of each cell (in green) and the percentage of tons transported on that lane as a percentage of the total tons transported between the clusters at the right of each cell (the top 10 lanes in blue). From this overview one can see that the third important lane is between Duisburg and Bologna. For this lane the rail transport has a larger share than the road transport and it might be a good opportunity to piggyback on the existing volume. Even more so if Bologna and Trieste can act as one Proximity Terminal Network (PTN), as the situation is similar for the lane between Duisburg and Trieste.

The last lane to point out is between Duisburg and Trelleborg. For the lane to have potential the focus should be on increasing the transport, especially from Trelleborg to Duisburg, while riding on the existing rail volume.

Table 5 – Tons transported between NUTS2 regions within a 2-hour reach of the clusters

		Dourges		Duisport		Interporto Bologna		Piraeus		Trelleborg		Trieste		Zaragoza	
		Modal split per lane	*% of total tons*	*Modal split per lane*	*% of total tons*	*Modal split per lane*	*% of total tons*	*Modal split per lane*	*% of total tons*	*Modal split per lane*	*% of total tons*	*Modal split per lane*	*% of total tons*	*Modal split per lane*	*% of total tons*
Dourges	*Road*			77.9%		67.9%		100.0%		68.7%		90.0%		97.3%	
	Rail			2.1%	4.6%	32.1%	0.3%	0.0%	0.0%	31.3%	0.0%	10.0%	0.1%	2.7%	0.1%
	Waterway			20.0%		0.0%		0.0%		0.0%		0.0%		0.0%	
Duisport	*Road*	94.0%				26.0%		95.7%		65.3%		57.8%		85.3%	
	Rail	2.1%	4.8%			74.0%	1.8%	4.3%	0.0%	34.5%	0.4%	42.2%	0.5%	14.7%	0.1%
	Waterway	3.9%				0.0%		0.0%		0.2%		0.0%		0.0%	
Interporto Bologna	*Road*	74.0%		26.5%				98.1%		12.0%		95.6%		95.5%	
	Rail	26.0%	0.4%	73.5%	1.6%			1.9%	0.0%	88.0%	0.1%	4.4%	2.3%	4.5%	0.0%
	Waterway	0.0%		0.0%				0.0%		0.0%		0.0%		0.0%	
Piraeus	*Road*	100.0%		97.1%		100.0%				46.3%		79.8%		100.0%	
	Rail	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%			53.7%	0.0%	20.2%	0.0%	0.0%	0.0%
	Waterway	0.0%		0.0%		0.0%				0.0%		0.0%		0.0%	
Trelleborg	*Road*	69.0%		55.0%		21.9%		42.9%				37.5%		78.0%	
	Rail	31.0%	0.0%	40.9%	0.3%	78.1%	0.0%	57.1%	0.0%			62.5%	0.0%	22.0%	0.0%
	Waterway	0.0%		4.0%		0.0%		0.0%				0.0%		0.0%	
Trieste	*Road*	91.6%		60.8%		97.2%		82.7%		46.3%				98.7%	
	Rail	8.4%	0.1%	39.2%	0.4%	2.8%	2.4%	17.3%	0.0%	53.7%	0.0%			1.3%	0.0%
	Waterway	0.0%		0.0%		0.0%		0.0%		0.0%				0.0%	
Zaragoza	*Road*	96.9%		82.5%		93.6%		100.0%		82.2%		98.4%			
	Rail	3.1%	0.1%	17.5%	0.1%	6.4%	0.0%	0.0%	0.0%	17.8%	0.0%	1.6%	0.0%		
	Waterway	0.0%		0.0%		0.0%		0.0%		0.0%		0.0%			

3.2 Other potentialities in the network

Looking beyond the clusters in the project, Figure 23 gives an indication of the main rail lanes in the European network. It shows the lanes with more than 1,000,000 tons transported by rail. Figure 24 shows the lanes on which more than 1,000,000 tons are transported by road and for which there is an alternative to transport by rail. This then gives an indication of the potential in the network for shifting road transport to rail. The main observation from this figure is that most lanes are national and a lot of them are in Germany. Zooming in on this national transport in Figure 25, one can see that Paris, Warsaw, Vienna, Mantova and Athens have the highest potential. These are also the terminals that appear in the current rail transport, so the potential is mostly in expanding current practice. Zooming in on the international transport in Figure 26, one can see that Antwerp has the highest potential for shifting road to rail transport with Barcelona coming second. Furthermore, it shows that the lane from the Clusters network, between Bologna and Trieste, has potential to be expanded to the East. The potential here is mostly in exploring new lanes, as these are different terminals than the ones that appear in the current rail transport.

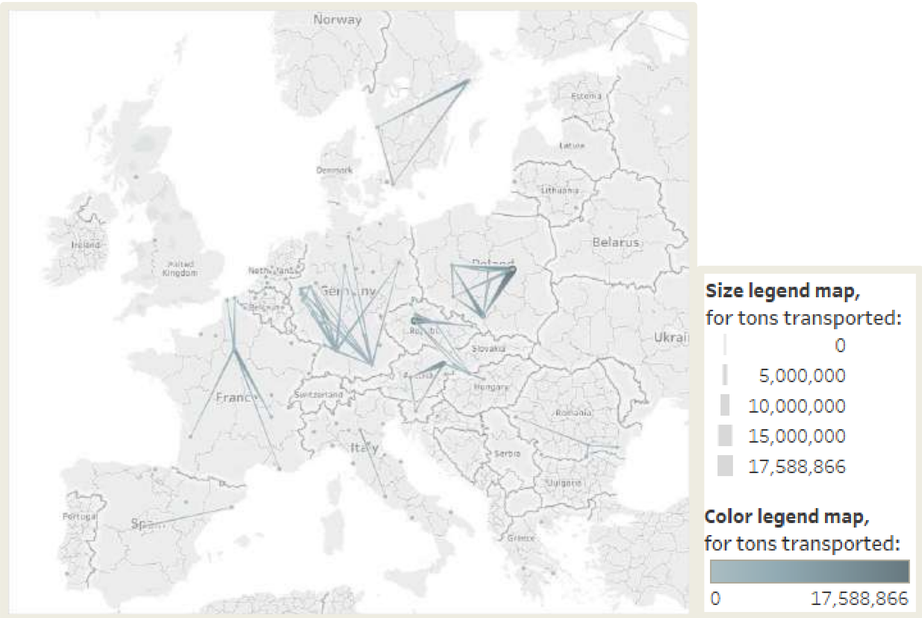


Figure 23 - Rail transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal

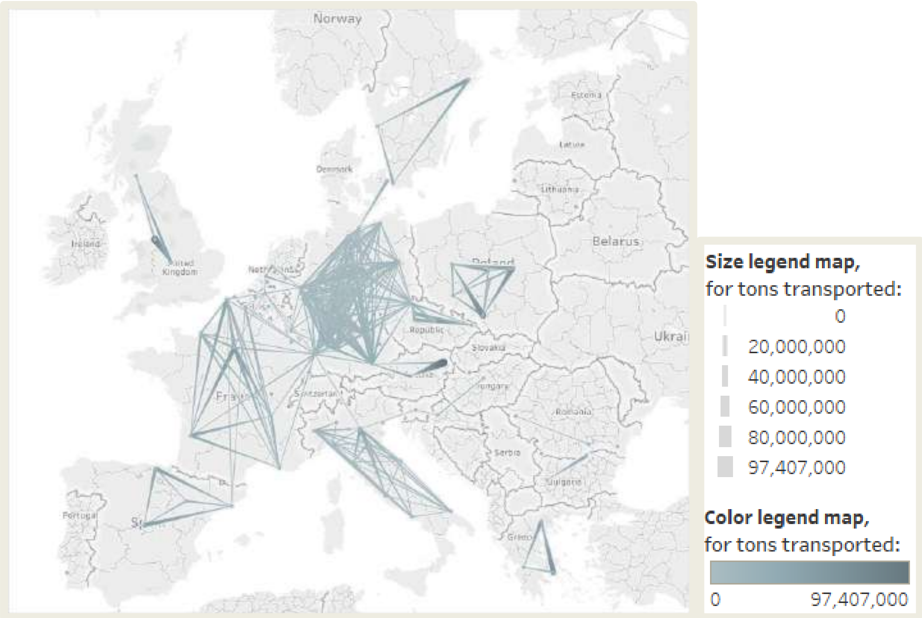


Figure 24 - Road transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by rail

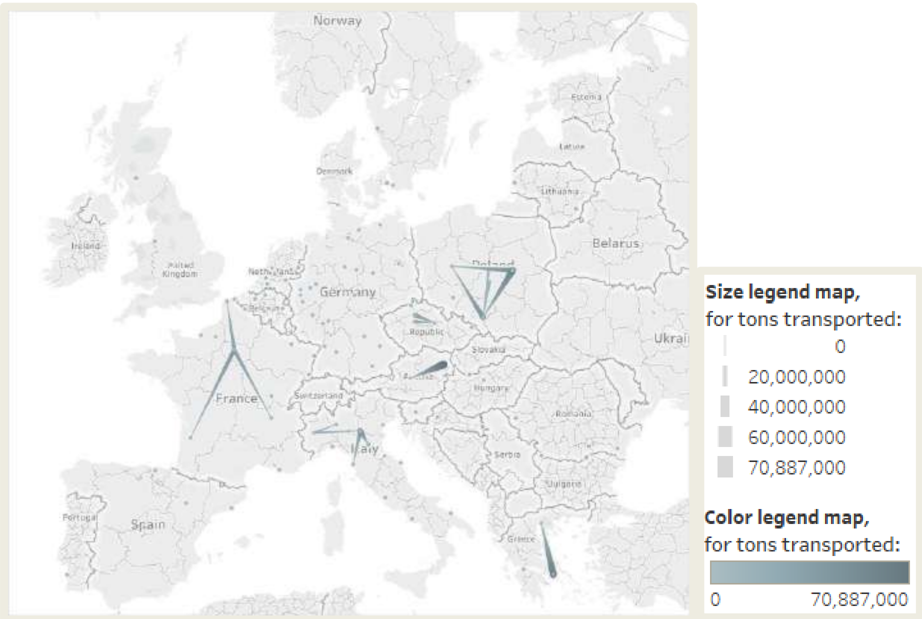


Figure 25 - National road transport lanes with more than 15,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by rail

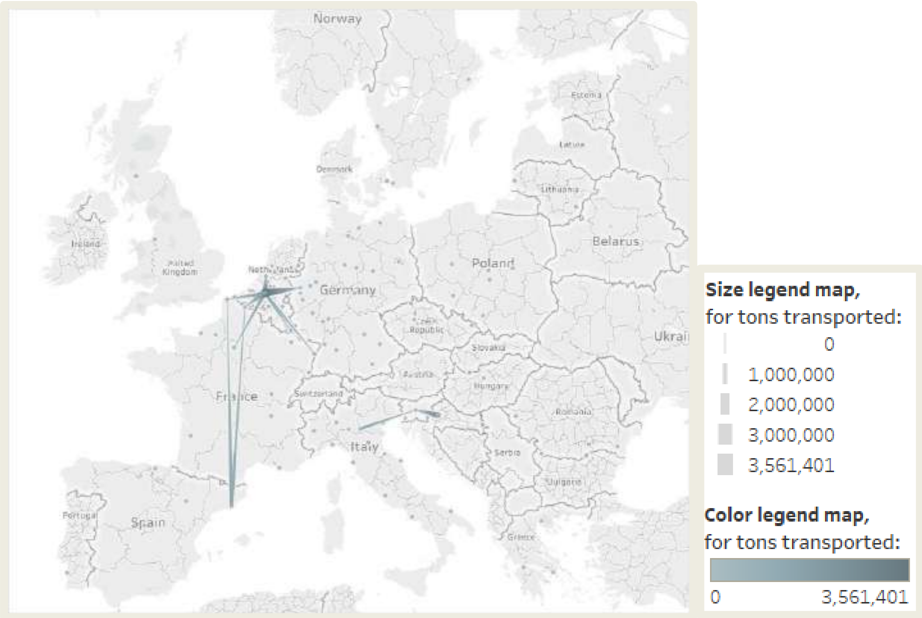


Figure 26 - International road transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by rail

A similar analysis can be done for waterway transport. Figure 27 shows the main waterway lanes in the European network, which are primarily in the Benelux and Germany. Figure 28 shows the lanes on which more than 1,000,000 tons are transported by road and for which there is an alternative to transport by waterway. This expands the area to France and a larger part of Germany, so there is potential to make more use of waterway transport. Figure 29 zooms in on national transport and it points out Paris and Cremona as main terminals. Figure 30 zooms in on international transport and points out Antwerp as central terminal.

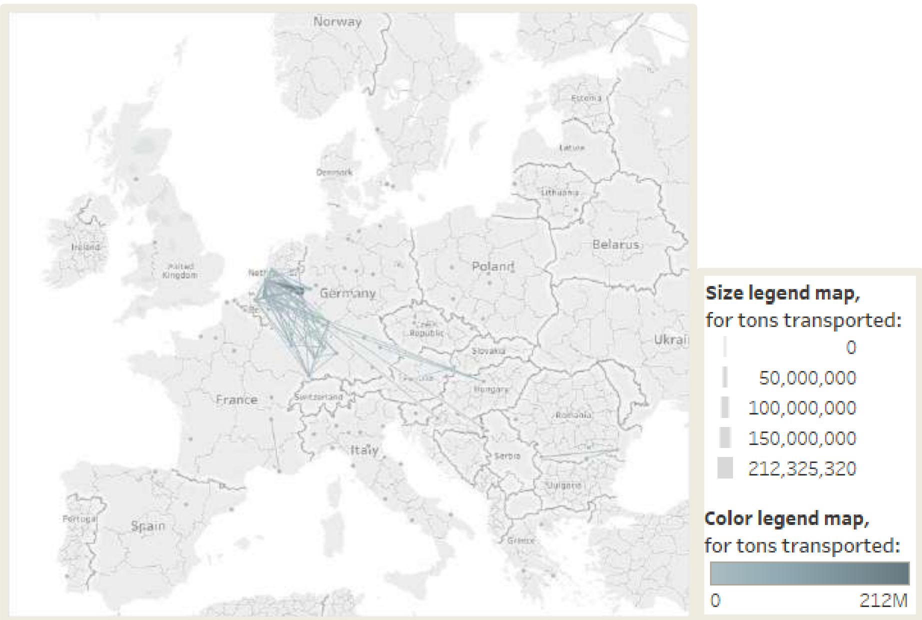


Figure 27 - Waterway transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal

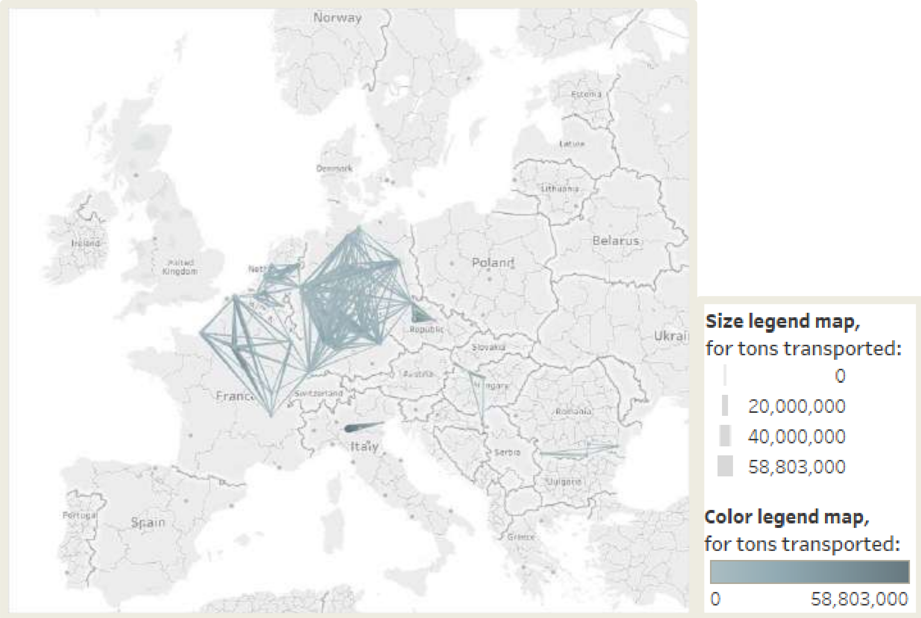


Figure 28 - Road transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by waterway

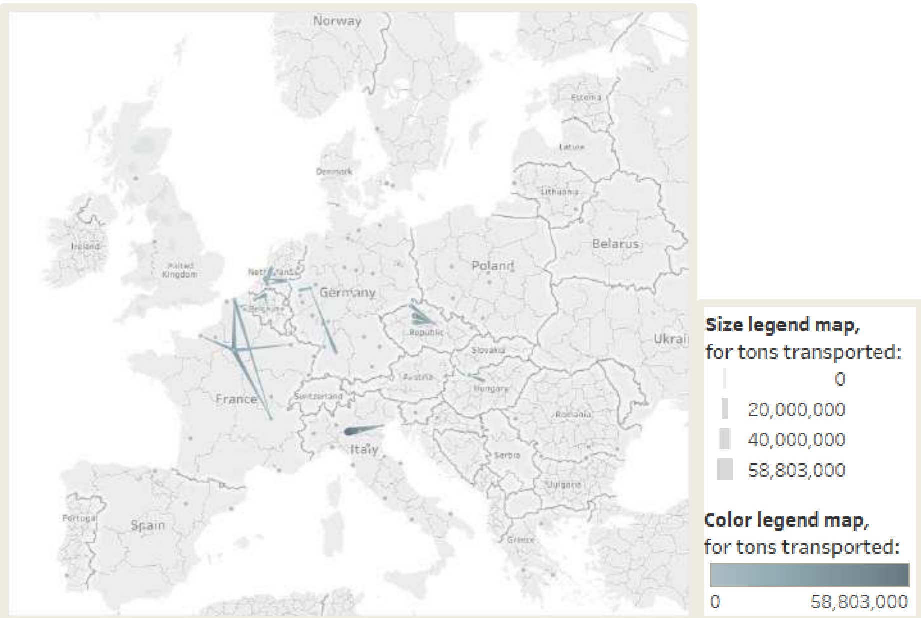


Figure 29 - National road transport lanes with more than 10,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by waterway

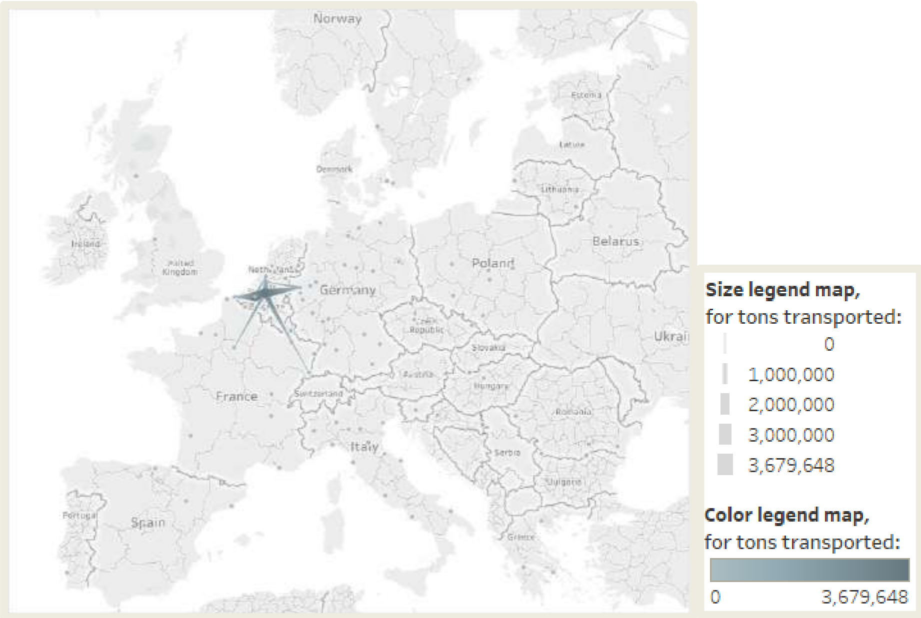


Figure 30 - International road transport lanes with more than 1,000,000 tons transported between regions in a 2-hour reach of a Ten-T terminal and with the option to be transported by waterway

4. Conclusion

The data used in this report (EuroStat 2015) shows a modal split, based on ton-kms, of 76% road transport, 18% rail transport and 6% waterway transport. There is potential to shift transport from road to rail and waterway in the network of clusters that are part of the project as well as in the full European network.

- The largest potential in the Clusters network is on the lane between Duisburg and Dourges. For shifting from road to rail the focus should be on the transport from Duisburg to Dourges, the focus should be on both directions for shifting from road to waterway.
- The second largest potential in the Clusters network is for shifting road to rail on the lane between Bologna and Trieste in both directions.
- There is also potential in the Clusters network to increase the rail transport on lanes that already have substantial rail transport, i.e. between Bologna, Trieste and Duisburg, and between Trelleborg and Duisburg.
- Overall, Duisburg is the most central terminal in the Clusters network.
- In the European network, Antwerp is the most central terminal. Paris and the area of Bologna also have a large potential in shifting road to rail and waterway.
- For shifting to rail, the potential is in expanding the lanes from the Bologna-Trieste area to the East. For shifting to waterway, the best potential is in expanding the lanes from the Benelux to France and Germany.
- For national transport, the potential is in increasing the modal shift on current lanes. For international transport, the potential is more in starting up a modal shift on promising lanes.

4.1 Next steps

Next, the identified lanes with the largest potential will be further investigated. They will be matched with current rail and waterway services and the CargoStream platform will be used to find shippers and LSPs that have flows on the lanes. Supporting the massification methodology, the aim is to establish a stable, long-term collaboration in which flows are bundled and transport is shifted from road to rail or waterway.

Annexes

EuroStat data processing

Road transport

Sources used

a) road_go_cta_gtt: Annual cross-trade road freight transport by link, group of goods and type of transport (1 000 t), from 2008 onwards
b) road_go_ia_rc: International annual road freight transport by country of loading and unloading with breakdown by reporting country (1 000 t, million tkm)
c) road_go_ta_rl: Annual road freight transport by region of loading (1 000 t, million tkm, 1 000 jrnys)
d) road_go_ta_ru:Annual road freight transport by region of unloading (1 000 t, million tkm, 1 000 jrnys)
e) road_go_na_rl3g: National annual road freight transport by regions of loading (NUTS3) and by group of goods (1 000 t), from 2008 onwards
f) road_go_na_ru3g: National annual road freight transport by regions of unloading (NUTS3) and by group of goods (1 000 t), from 2008 onwards

Data processing

1) Sources (c) and (e) are used to calculate the tons loaded per NUTS2 region, split in national and international transport.
2) Sources (d) and (f) are used to calculate the tons unloaded per NUTS2 region, split in national and international transport.
3) Then for each loading NUTS2 region, the national loaded tons are spread over the unloading NUTS2 regions in proportion of the national unloaded tons.
4) To calculate the national ton-kms, the tons are multiplied by the distances between the corresponding NUTS2 centers calculated over a road network. As these distances are too large on average, the numbers are corrected with a factor based on country totals. We know the total ton-kms for national road transport per country, we divide this by the national tons per country from step 3 to get the average kms per country. Then the correction factor equals these average kms divided by the average distance from the road network.
5) Sources (a) and (b) are used to calculate the tons loaded from origin countries to destination countries.
6) Then the tons transported between the countries are spread over NUTS2 regions in those countries in proportion of the international tons for the loading and unloading regions.
7) To calculate the international ton-kms, the tons are multiplied by the distances between the corresponding NUTS2 centers calculated over a road network. Also, these distances are too large on average, and the numbers corrected with a factor based on country totals similar to step 4.

Rail transport

Sources used

a) rail_go_trsorde: Annual railway transit transport by loading and unloading countries (1 000 t, million tkm)
b) rail_go_intcmgn: International annual railway transport from the loading country to the reporting country (1 000 t, million tkm)
c) rail_go_intgong: International annual railway transport from the reporting country to the unloading country (1 000 t, million tkm)
d) rail_go_typeall: Railway transport - goods transported, by type of transport (1 000 t,

million tkm)
e) rail_go_contwgt: Annual railway transport of goods in intermodal transport units

Data processing

1) Source (a), (b) and (c) are used to calculate the tons and ton-kms transported between countries.
2) Source (d) is used to get the tons and ton-kms transported nationally.
3) Then a correction is made to add the transport by intermodal transport units, based on source (d) and (e). The tons for a loading country are increased by the fraction of the intermodal transport tons compared to the total railway tons for the loading country.
4) Then the tons and ton-kms between the countries are spread over NUTS2 regions in those countries in proportion of the GDP for the loading and unloading regions (population for Switzerland).

Waterway transport

Sources used

a) iww_go_atygofl: National and international inland waterways goods transport by loading/unloading region

Data processing

1) Source (a) is used to calculate the tons and ton-kms transported between NUTS2 regions and between countries.
2) As the tons and ton-kms between NUTS2 regions are missing some data, a correction is made based on the tons and ton-kms between the countries. The tons between regions are multiplied by the proportion of the tons transported between the corresponding countries based on country totals and the tons transported between the corresponding countries based on region totals. The same is done for the ton-kms.

All data is from 2015 and filtered on EU28 countries plus Switzerland.
All numbers are compared with the statistical pocketbook 2016, chapter on freight transport.