Ports and their Connections within the TEN-T

Stakeholder Consultation Report

UNDERTAKEN BY PROJECT TEAM:

NEA a member of Panteia

UNIVERSITY OF LEEDS

significance quantitative research

TNO

Ports and their connections within the TEN-T

Stakeholder Consultation Report

Reference R20100151/31126000/SNE/HBA

Version 1- PUBLIC

Zoetermeer, June 2010

Date:
June 29th, 2010

Client name:
European Commission, Directorate-General Mobility (DG-MOVE)

Interim report for project:
Ports and their connections within TEN-T

Document version: R20100151/31126000/SNE/HBA

Report submitted by:

Contents

1 Summary

Ports and their connections within the TEN-T

Stakeholder Consultation Report

This document outlines the methodologies adopted, and interim results of the ongoing study by the NEA, ITS, Significance, TNO consortium on behalf of DG-MOVE. It is a document for discussion, and for which we invite stakeholder comments. All results shown here are *interim findings* from the consortium, which in no way represent any final conclusions or binding commitments. The purpose of this document is mainly to communicate details about the methodologies undertaken, and to provide a focal point for stakeholder inputs.

Importance of the Maritime Sector

DG-MOVE recognises the importance of the maritime sector within the development of the trans-European transport network (TEN-T). The maritime sector contributes to economic growth, trade development, EU economic cohesion and to the alleviation of inland congestion. It is clear that as the maritime sector grows in response to changes in the global economy, more attention must be paid to the integration of the maritime network and the supporting inland networks.

It should be considered that the study takes a multi-criteria approach, related to a broad range of direct, environmental, and indirect socio-economic costs related to, for example:

- Alleviation of transport externalities (all categories)
- Cohesion between member states
- Economic development
- European Neighbourhood policy
- Regional development

Focus of the Study

The current study focuses on the relationships between the development of the maritime sector, investment in ports and investment in the supporting networks. A key objective is to provide a clear view on how port related flows are dispersed over the TEN-T network. This will support decision making about the future of the TEN-T network by taking into account the role and impact of ports and port generated traffic on the TEN-T network. Scenarios are being developed by the project, considering the redistribution of global cargo, the impacts of the economic crisis, fuel scarcity and the need for de-carbonisation.

Stakeholder Involvement

Stakeholder input is needed to validate the quantitative analysis, and to inform the process of option assessment. This will include draft recommendations by the consortium in relation to the port and maritime aspects of the core network. The focus of this work will be a stakeholder event to be held on the 7th July 2010 in Brussels, in which methodologies and interim results can be discussed. Stakeholders are invited to provide input in response to the interim results.

Expected Project Results

- Analysis of current maritime freight flows
- Forecast of freight flows
- Analysis of demand and supply in ports
- Methodology for selecting candidate ports for the core TEN-T network.
- Recommendations for policy options.

Overview of Methodology

European trade flows have been analysed and converted into multi-modal transport chains routeing the traffic from origin to destination. Using trade forecasts, it has been possible to model the flows for 2030, and thus to estimate port volumes, as well as their potential hinterland impacts.

2 Key Figures

Total EU-27 seaborne goods handled in ports:

- In 2008: 3,918.6 million tonnes.
- Average annual growth rate 2002-2008: 2.72%
- Average annual growth rate 2002-2007: 3.38%

(source: Eurostat)

EU12/EU15 split:

- Tonnes handled in EU15 (Western) ports: 3,628.8 million (93%)
- Tonnes handled in EU12 (Eastern) ports: 289.8 million (7%)

(source: Eurostat)

Country Split:

- UK: 562.2 million
- NL: 530.4 million
- IT: 526.2 million
- ES: 416.2 million
- FR: 352.0 million
- DE: 320.6 million
- BE: 243.8 million

Total (seven countries): 2,951.4 million (75%)
(source: Eurostat)

Table 1: EU27 Traffic by Mode of Appearance

	Annual Tonnage 2008 (million)
Liquid Bulk	1,567
Dry Bulk	979
Containers	705
Roll-on Roll-off	431
Other Cargo	235
Unknown	0
Total	3,919
Unitised	1,136 (29%)
Bulk/General Cargo	2,781 (71%)

(source: Eurostat)

Table 2: Largest European Ports by Tonnage

	Annual Tonnage 2008 (million)	Annual Average Growth Rate 1997-2008
1. Rotterdam (NL)	384.2	2.2%
2. Antwerpen (BE)	171.2	4.6%
3. Hamburg (DE)	118.9	5.0%
4. Marseille (FR)	92.5	0.0%
5. Le Havre (FR)	75.6	2.4%
6. Amsterdam (NL)	74.4	6.6%
7. Immingham (UK)	65.3	2.8%
8. Algeciras (ES)	61.9	5.5%
9. London (UK)	53.0	-0.5%
10. Bergen (NO)	52.4	na

(source: Eurostat)

Table 3: Largest European Container Ports by TEUs handled

	Annual TEU 2008 (thous)	Annual Average Growth Rate 2001-2008
1. Rotterdam (NL)	10,631	8.4%
2. Hamburg (DE)	9,767	11.1%
3. Antwerp (BE)	8,379	15.8%
4. Bremerhaven (DE)	5,451	9.2%
5. Valencia (ES)	3,606	13.2%
6. Algeciras (ES)	3,298	9.6%
7. Gioia Tauro (IT)	3,165	4.0%
8. Felixstowe (UK)	3,131	1.4%
9. Barcelona (ES)	2,565	9.0%
10. Le Havre (FR)	2,512	7.1%

(source: Eurostat)

Estimates have been made concerning the quantity of port-related freight traffic. They indicate that approximately 24% of inland freight in the EU27 is port-related.

Table 4: Estimated Hinterland Traffic Volumes, EU27, 2007, Billion tonne-kms

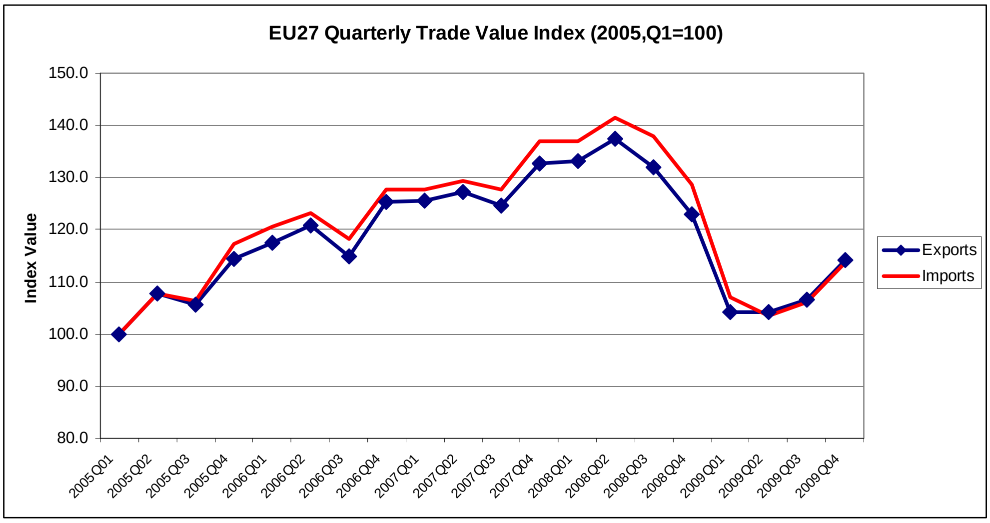
	Total	***Port Related***	***Share***
Road	1,927	406	21%
Rail	452	118	26%
Waterway	141	78	55%
Total	2,520	603	24%

Source: EU Statistical Pocketbook, 2009; WORLDNET estimates.

Impact of Economic Crisis upon EU27 trade volumes

The current economic downturn which has had such a marked impact on port volumes can be clearly seen in the trade figures.

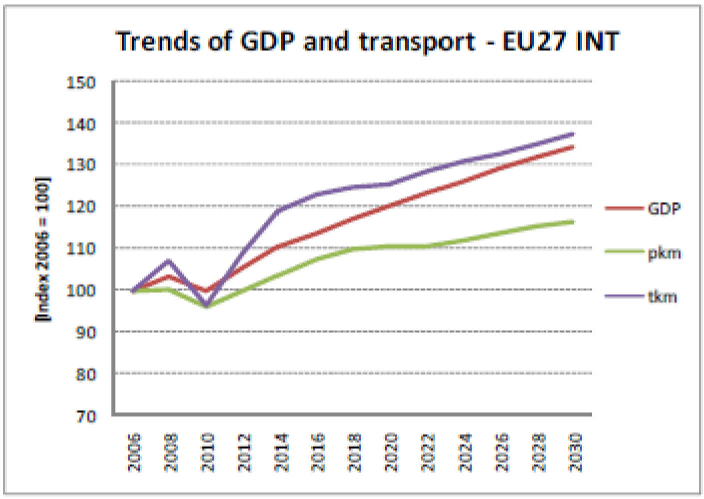
Figure 1: EU27 Trade up to Q4 2009



Source: EUROSTAT, Consultants' estimates

Following many years of steady growth, trade volumes peaked in 2008, before falling to a low point in the first half of 2009. Since then, there has been a marked recovery, but at the end of 2009, volumes were still only at 2006 levels. Economic forecasts made by the ITREN-2030 project expect that the recovery will continue (see below). However, with the prospect of structural problems and several years of austerity measures in Europe, the outlook is still uncertain.

Figure 2: ITREN Forecast of Economic Growth to 2030



Source: iTREN-2030

Table 5: ITREN Key Indicators, Average Growth per annum, 2010-2030

		Tonnes Lifted (%)	Tonne Kms (%)	GDP (%)
AT	Austria	0.62	2.09	1.52
BE	Belgium	1.03	1.03	1.03
BG	Bulgaria	0.43	0.88	2.12
CY	Cyprus	3.87	2.59	0.91
CZ	Czech Rep.	-0.67	1.42	2.26
DE	Germany	0.71	1.48	1.58
DK	Denmark	1.17	2.64	2.02
EE	Estonia	0.93	1.30	2.32
ES	Spain	1.85	1.89	1.53
FI	Finland	0.61	0.76	1.70
FR	France	1.04	1.18	0.66
GR	Greece	2.73	2.77	0.69
HU	Hungary	-0.75	1.46	2.29
IE	Ireland	1.48	1.76	1.86
IT	Italy	0.76	0.73	0.99
LT	Lithuania	2.64	2.82	3.27
LU	Luxembourg	2.24	2.24	1.03
LV	Latvia	1.91	3.56	2.31
MT	Malta	2.83	4.90	3.19
NL	Netherlands	0.13	0.23	1.67
PL	Poland	2.32	3.26	3.94
PT	Portugal	1.92	1.86	1.93
RO	Romania	0.46	0.72	2.58
SE	Sweden	0.59	2.40	1.67
SI	Slovenia	1.77	2.39	2.80
SK	Slovakia	0.88	2.11	2.81
UK	UK	1.02	0.33	1.91
EU15		1.00	1.31	1.39
EU12		1.16	2.27	3.13
EU27		1.03	1.50	1.48

ITREN's integrated scenario, which is the basis for the central forecast of the ongoing study shows rates of economic growth of around 1.48% per annum until 2030, with the EU12 (East European) countries growing faster than the EU15 (Western) countries. Tonne kilometres are expected grow approximately in line with GDP, but tonnes lifted only average 1.03% growth per annum. These volumes include all freight categories; international, domestic, and all modes. The forecasts take into account many long term constraints including population growth and energy supply.

3 European Maritime Trade and Trade Forecasts

The study has used trade data and trade forecasts estimated during the ITREN-2030 project. The forecasts include the expected impacts of the economic downturn. In the following tables, trade volumes for a set of forty European countries are shown, including forecasts up to 2030. Only maritime-related trade relations are shown, i.e. flows that are likely to generate port traffic.

Table 6 : Europe Total Maritime Trade by world region, million tonnes

	1995	**2005**	**2020**	**2030**	**Annual Growth 95-05**	**Annual Growth 05-30**
EU 27	541	693	956	960	2.5%	1.3%
Other Europe	131	169	171	182	2.6%	0.3%
North Africa	191	253	340	528	2.9%	3.0%
Other Africa	139	195	308	370	3.4%	2.6%
Middle East	191	201	295	361	0.5%	2.4%
Central Asia	59	98	134	152	5.2%	1.8%
Other Asia	127	235	644	1,127	6.3%	6.5%
Russian Fed.	234	410	521	507	5.8%	0.9%
North America	259	327	398	350	2.4%	0.3%
Latin America	176	255	296	359	3.8%	1.4%
Oceania	56	56	38	30	0.0%	-2.5%
TOTAL	2,105	2,893	4,100	4,925	3.2%	2.2%
NON EU	*1,564*	*2,199*	*3,144*	*3,966*	*3.5%*	*2.4%*

Source: ITREN-2030

In total, 2.893 billion tonnes of European trade are expected to contribute to port traffic. Since certain flows will generate demand at two (or more) European ports, this volume is lower than the total volume of freight handled at European ports. Overall, volumes are expected to increase by approximately 2 billion tonnes. Forecast growth rates are lower than historical growth rates, with highest growth rates expected in Asian markets, and lower growth rates for short sea and North American markets.

Table 7: Pan European Maritime trade per commodity

NST1	**1995**	**2005**	**2020**	**2030**	**Annual Growth 95-05**	**Annual Growth 05-30**
Agricultural Produce	91	127	197	244	3.4%	2.6%
Food	147	182	260	306	2.2%	2.1%
Solid Fuel	138	239	332	378	5.6%	1.9%
Oil and Petroleum	1,018	1,354	1,643	1,765	2.9%	1.1%
Ores Scrap	188	217	297	387	1.4%	2.3%
Metals	88	126	230	297	3.7%	3.5%
Crude Minerals	107	156	273	379	3.8%	3.6%
Fertilisers	45	54	95	136	1.8%	3.8%
Chemicals	104	165	306	405	4.7%	3.7%
Misc Manufactures	178	273	468	628	4.4%	3.4%
TOTAL	2,105	2,893	4,100	4,925	3.2%	2.2%
Non-Fuel	*948*	*1300*	*2126*	*2782*	*3.2%*	*3.1%*
Non-Bulk	*517*	*746*	*1264*	*1636*	*3.7%*	*3.2%*

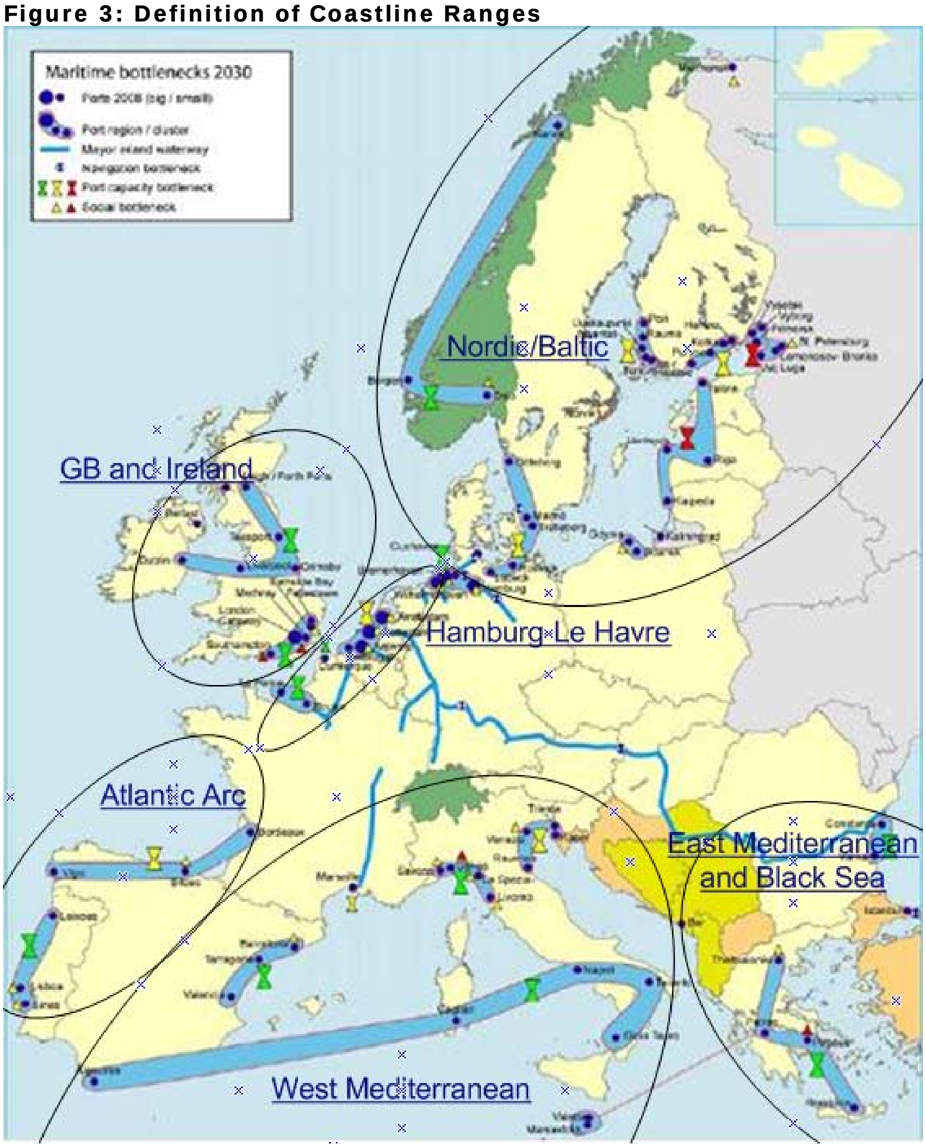
Source: ITREN-2030

By product sector, the ITREN-2030 forecasts suggest that highest growth rates will be found in the higher value-added sectors, with lower growth in the bulk sectors. Non-fuel sectors are expected to grow by 3.1% per annum, and non bulk sectors by 3.2% overall.

4 European Port Traffic Forecasts – Selected Coastline Ranges

This study has used the ITREN-2030 trade forecasts to produce forecasts according to six coastline ranges.

Figure 3: Definition of Coastline Ranges



Source: TEN-Connect (Tetraplan et al, 2009)

This map shows (with blue bands) the port groupings defined by the TEN-Connect project. These are further simplified by this study into six groups indicated by the black ovals. Note that these do not include all EU ports, and that most non-EU ports e.g. in Croatia and Turkey are not included. However these definitions are used, in order to allow a direct comparison between the pre-crisis TEN-Connect forecasts and the post-crisis ITREN-2030 forecasts. Furthermore this approach allows a comparison to be made between port demand and supply, using the capacity forecasts made by TEN-Connect.

The capacity estimates include the expected impacts of planned port developments. They are based on modelled operational ratios e.g. turnover per quay metre, per hectare of port land, but do not necessarily reflect the expectations of the ports themselves. It is important to note that capacity limits and operational efficiencies depend upon a wide range of local factors, and at best these should be considered as indicative only.

By grouping the ports it is possible to limit the discrepancies that might develop due to competition between neighbouring ports. However again it is important to note that competition both between ports within these ranges and between these ranges does exist, and therefore that gains in market share can also affect the resulting demand/supply ratios.

Demand is split into two categories; bulk cargo and unitised cargo, and a comparison is made between the pre-crisis TEN-Connect (TC) forecasts and the post crisis ITREN-2030 (ITR) forecasts. A further split is made according to the coastal ranges.

Figure 4: Forecast port demand, bulk cargo

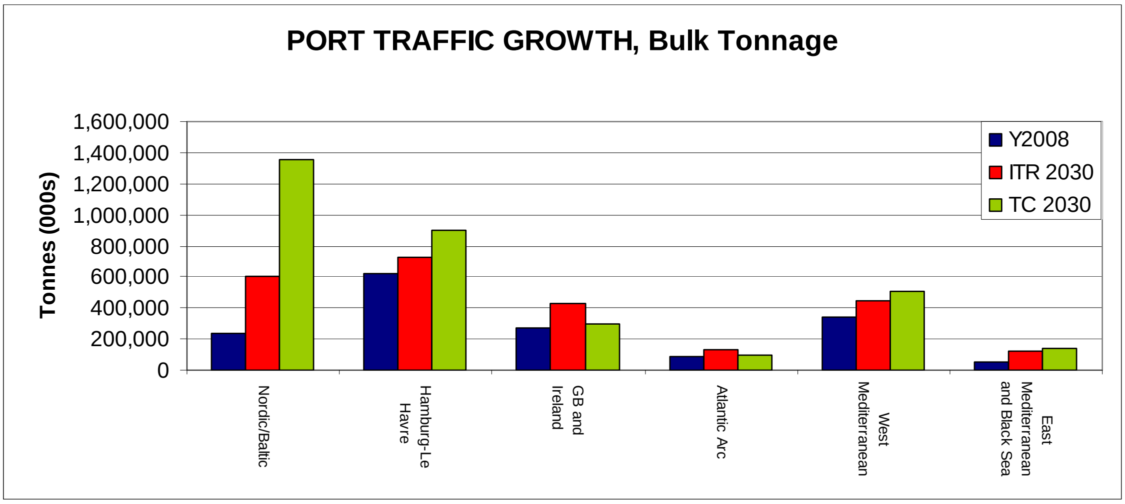
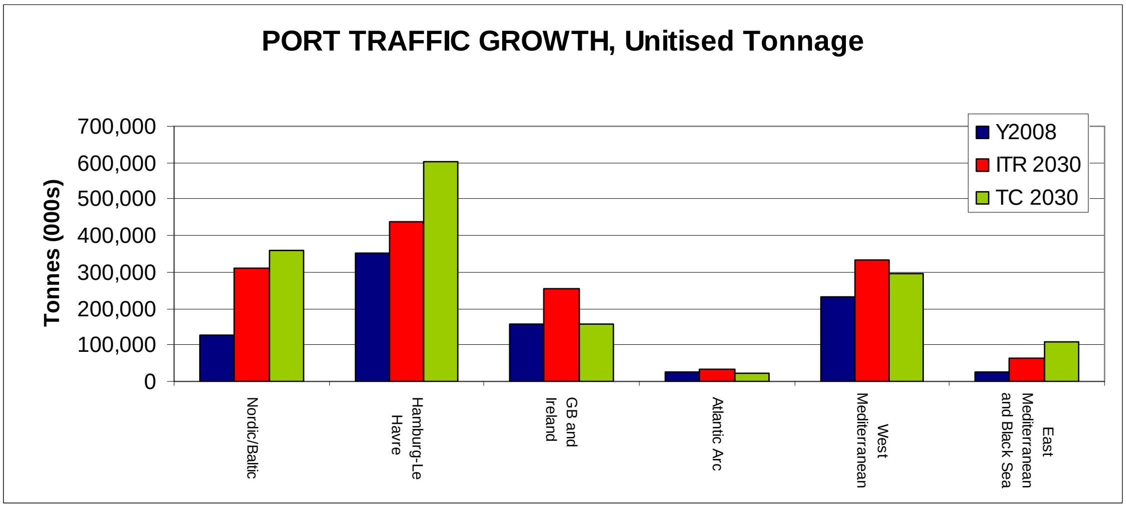


Figure 5: Forecast port demand, unitised cargo



ITREN (ITR) forecasts shown above in red are generally lower than the TEN-Connect (TC) shown in green.

Capacity estimates for 2020 and 2030 have been adopted from the TEN-Connect project. These are shown below.

Figure 6: Capacity Estimates by Port Range, Bulk Cargo

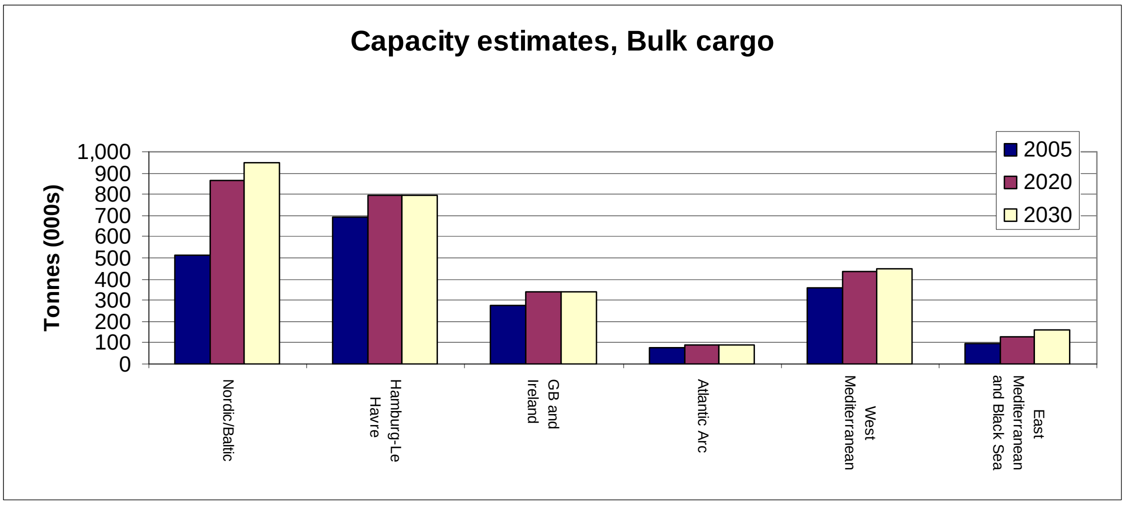
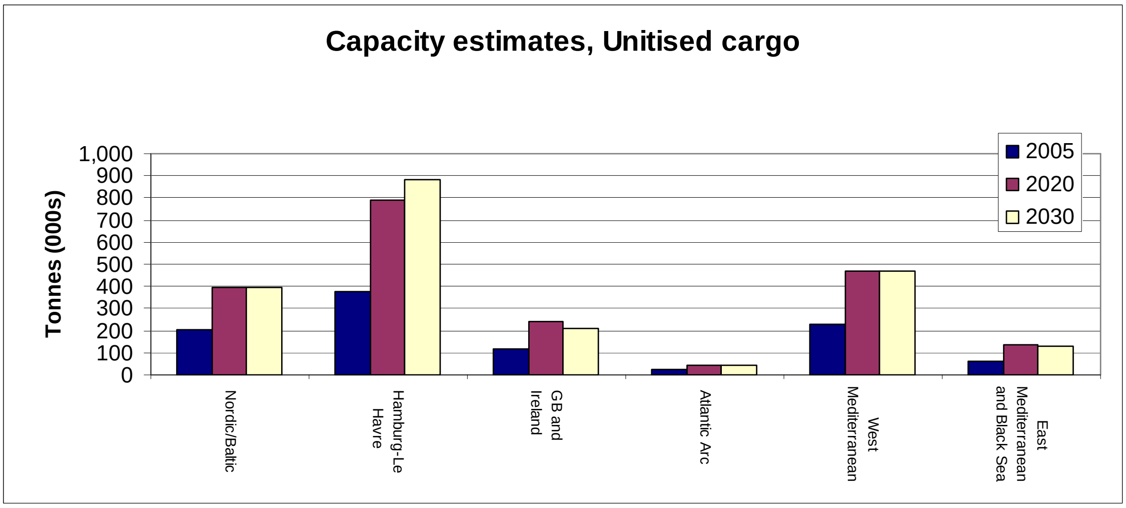


Figure 7: Capacity Estimates by Port Range, Unitised Cargo



By combining the demand forecasts with the capacity estimates, it has been possible to examine potential shortfalls in port capacity. Note that not all European ports are considered, and also that the estimation of capacity uses an inexact measure which may not agree with the estimates being made by the port operators. Furthermore, since only broad product groups are considered, there may be product-specific or localised capacity shortages which cannot be seen.

Figure 8: Demand / Supply ratios for 2030, Bulk Traffic

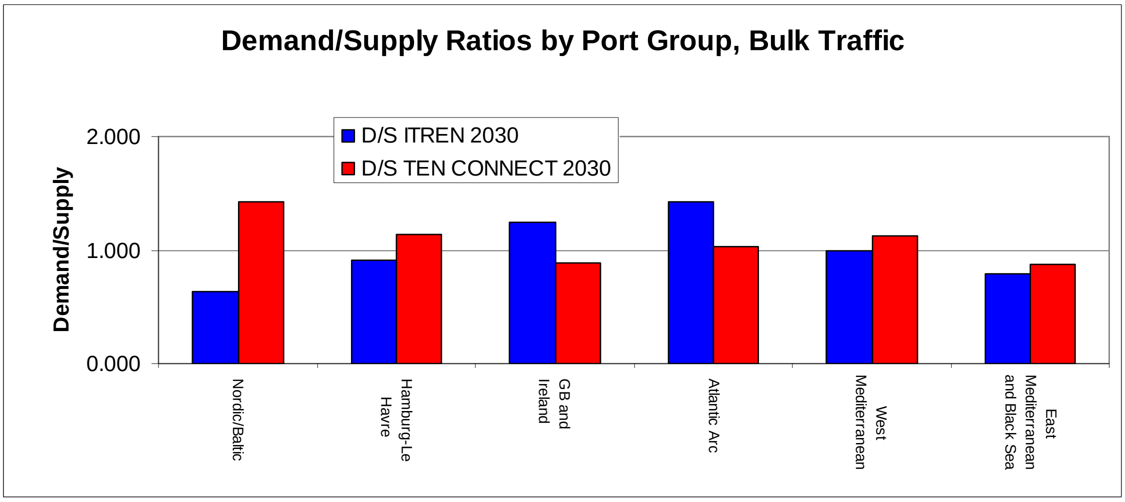
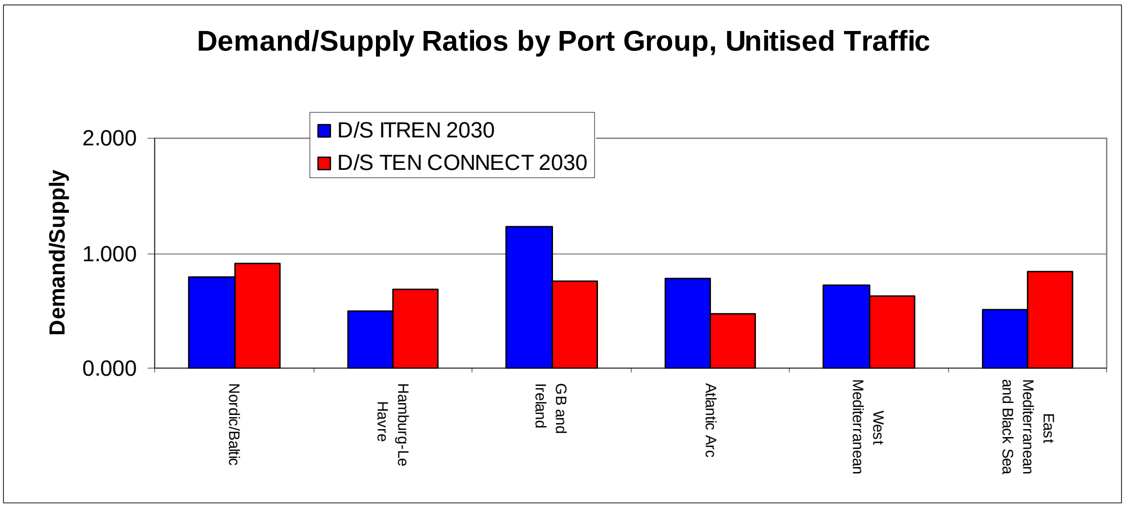


Figure 9: Demand / Supply ratios for 2030, Unitised Traffic



The blue bars have been calculated from the ITREN-2030 forecasts. A value greater than 1.0 indicates a potential shortfall in capacity. The general picture is that current port capacity, and known port expansion plans are sufficient to match the post-crisis demand estimates, with possible exceptions in the UK, Ireland, and the Atlantic Arc. However, if growth returns to the pre-crisis trend, bottlenecks would start to appear in other regions such as the Western Mediterranean.

5 Comparison of Trade Growth and Port demand by Country

A set of maps has been produced comparing the growth of maritime trade by European origin or destination, with the expected growth in port demand, also by country. These are also split by unitised and bulk sectors.

Maritime Trade: means the sum of trade flows that use the sea mode e.g. exports from Germany to Japan. All European countries generate maritime trade.

Port Traffic: means the handling of cargo within the ports belonging to a specific country e.g. the loading of cargo at Spanish seaports. Only countries with a coastline generate port traffic.

By differentiating maritime trade and port traffic it is possible to differentiate between the concept of freight generation (the demand for transport services in general) and route/mode choice (the demand for specific transport services).

The objective here is to compare volumes and growth rates according to the countries generating the maritime flows and to relate these to port demand.

Figure 10 shows bulk traffic generation. Figure 12 shows unitised traffic generation. Figure 11 shows where the bulk flows are likely to generate port traffic, and figure 13 shows the same for unitised flows.

For example, in the UK, traffic generation in the hinterland and port demand are almost identical since all UK trade must pass though UK ports, but in other areas of Europe there will differences because trade generated in land locked countries will generate port traffic in coastal regions. For example, a part of German trade generates port traffic in the Netherlands and Belgium.

Overall it can be confirmed that the largest volumes are to be found in the Western countries but that the highest growth rates are to be found in the East. So, although the East-West balance is shifting, it is still expected that by 2030, the largest flows are still in the West. The most extreme changes appear in Russia, dominated by liquid bulk exports, but data for Russia is difficult to verify, so these results should be treated with caution.

Figure 10: Maritime trade - bulk commodities

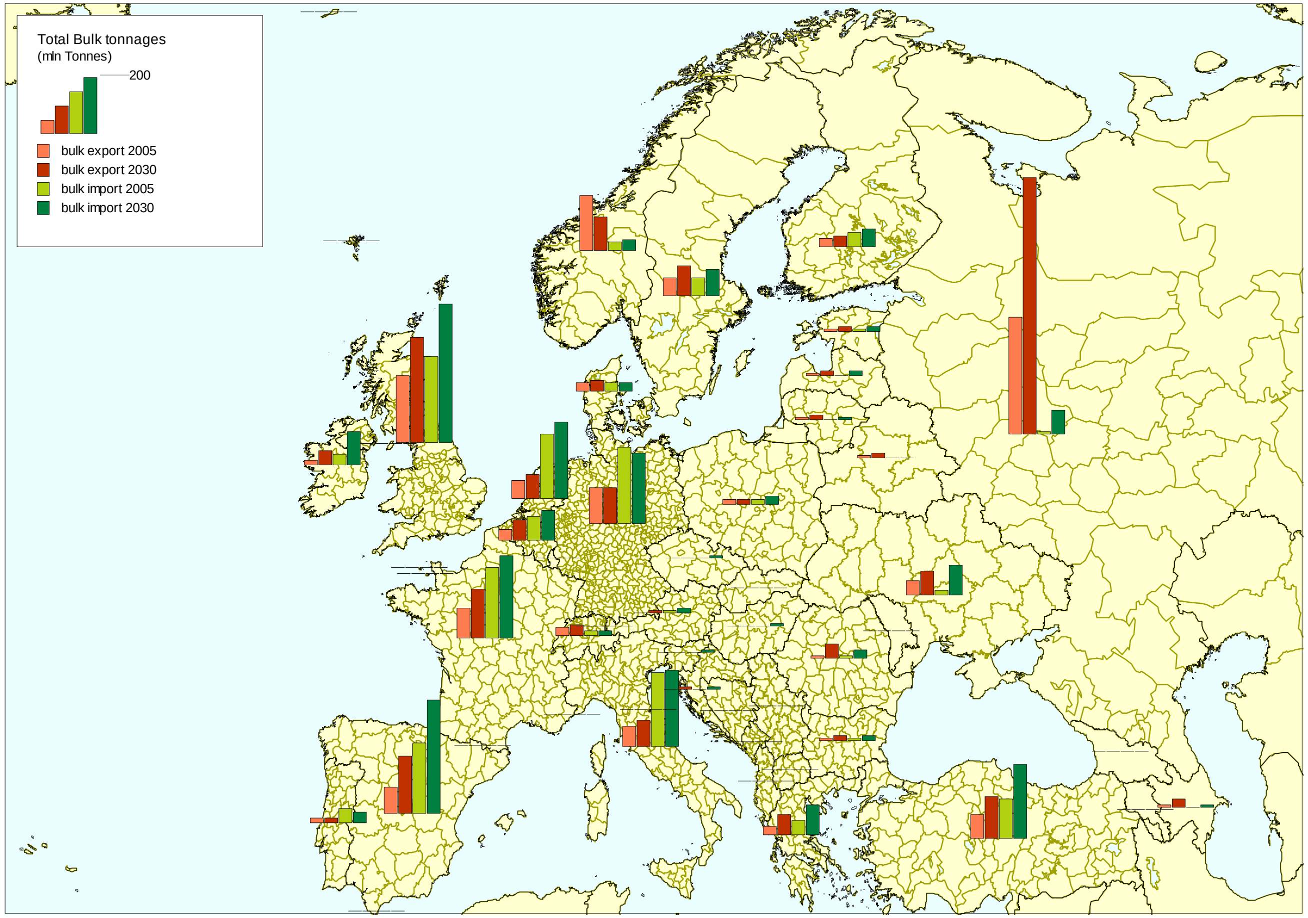


Figure 11: Port traffic - bulk commodities

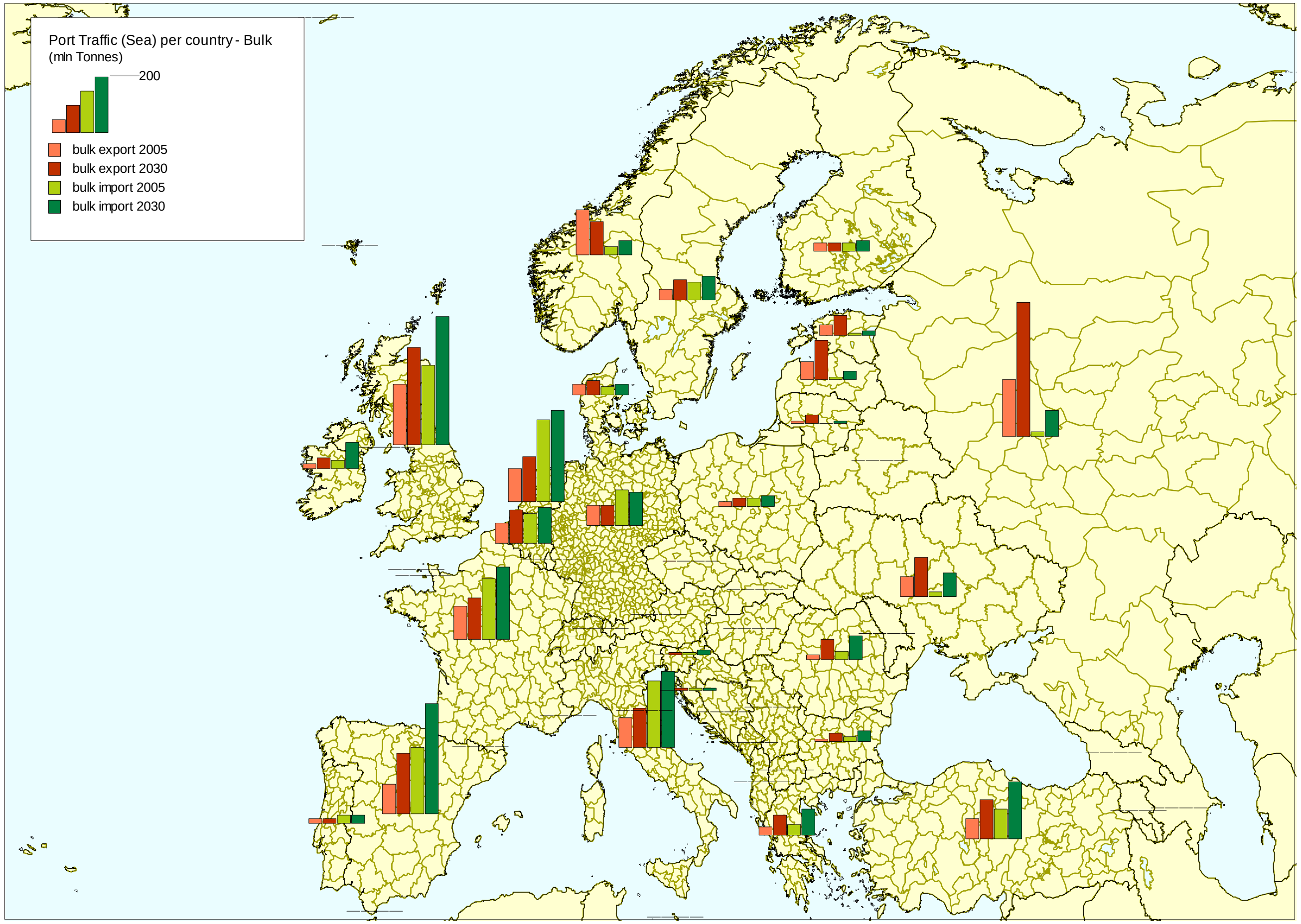
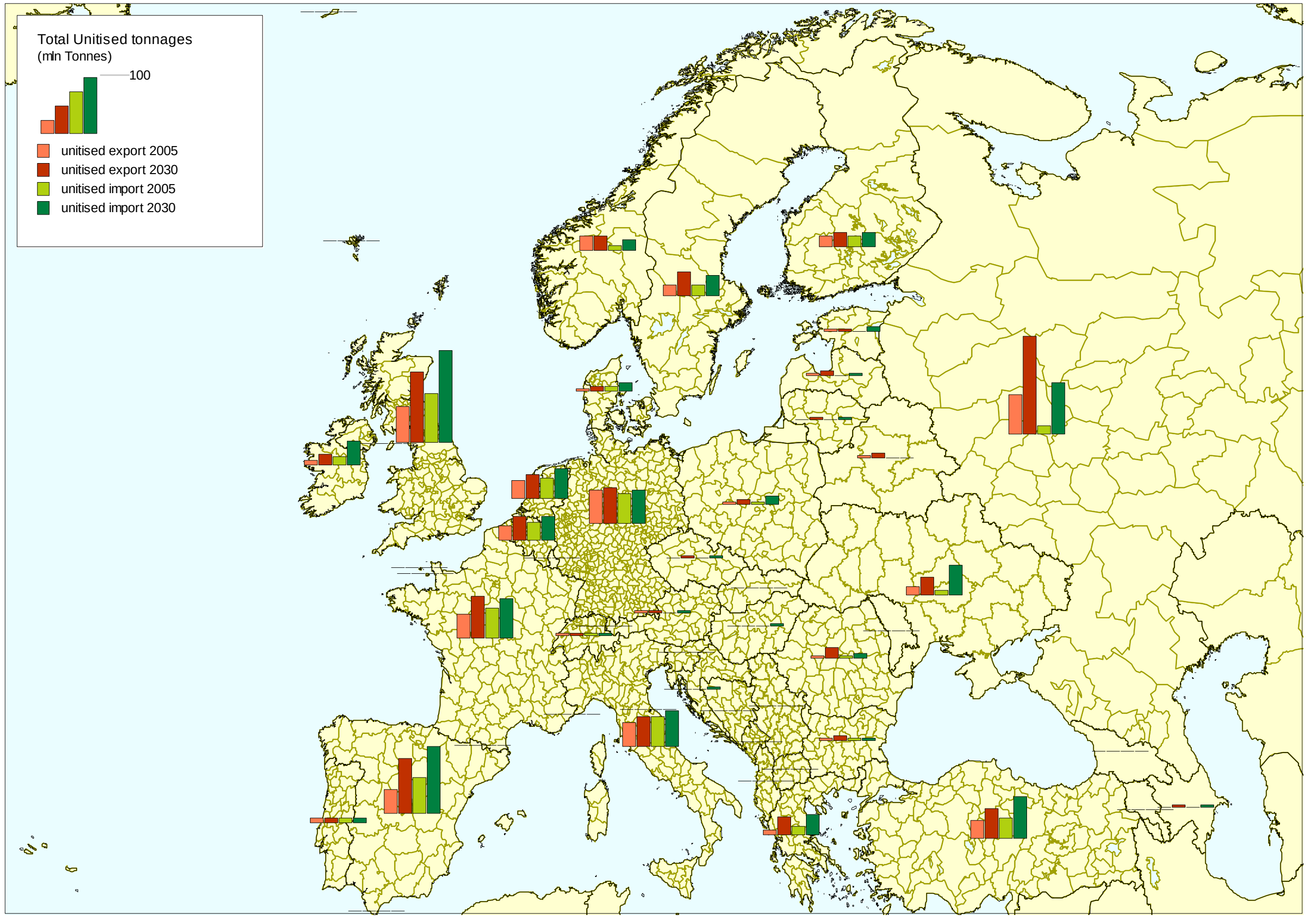
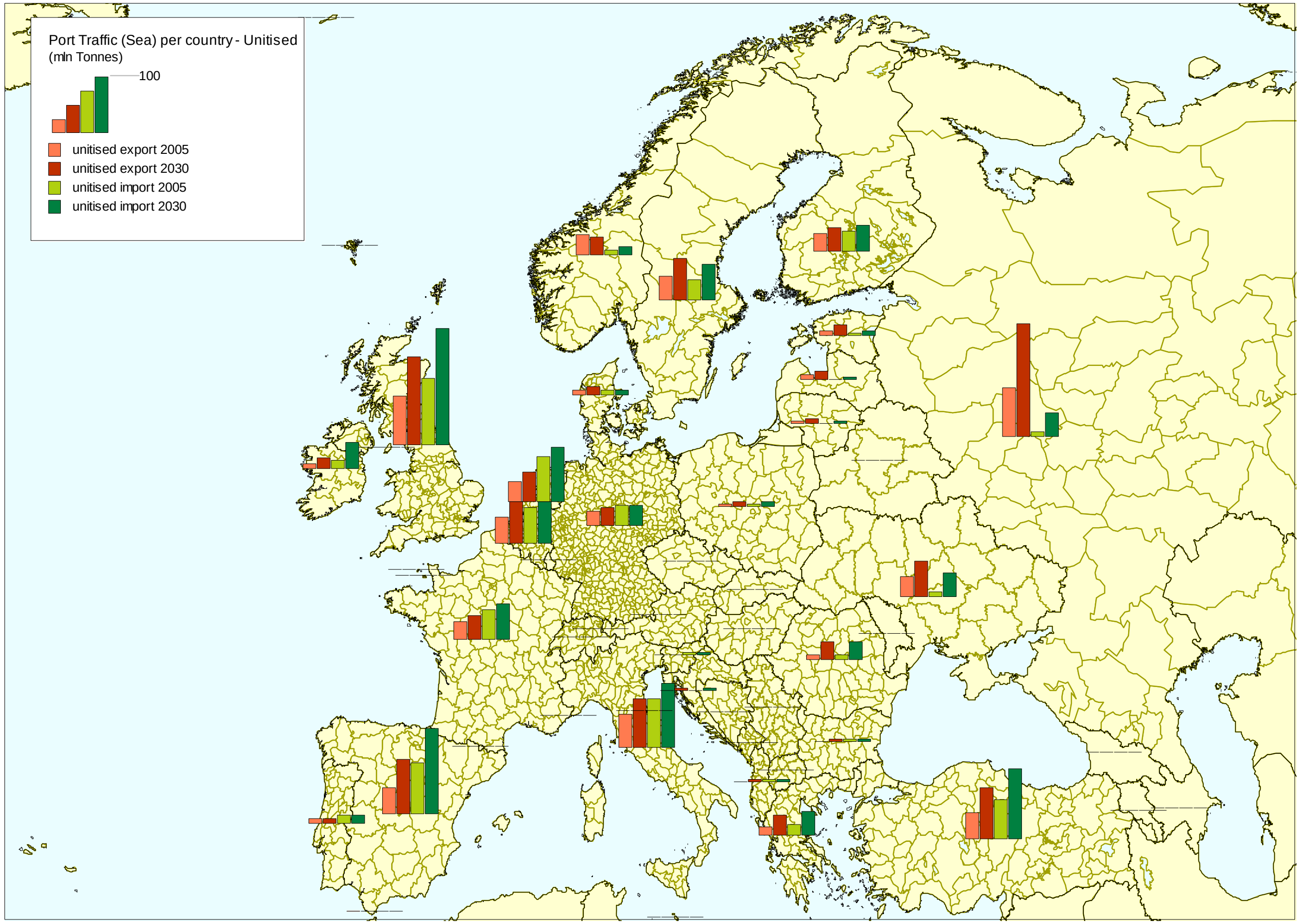


Figure 12: Maritime trade – unitised commodities



Source: nea

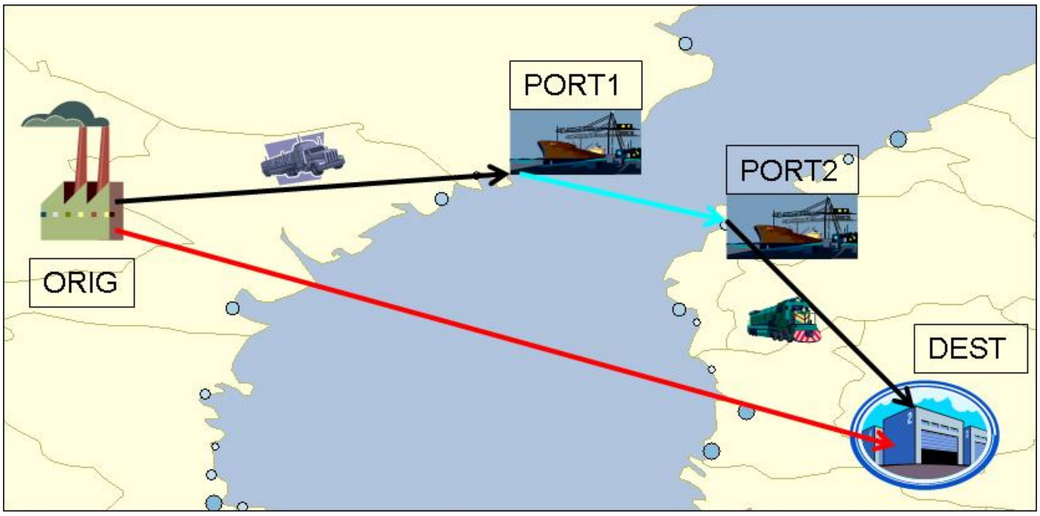
Figure 13: Port traffic – unitised commodities



6 Overview of Model System

The model system for linking trade flows to port demand is based upon the estimation of multi-modal transport chains. The principle is illustrated below:

Figure 14: Overview of Modelling System



Trade data provides a good basis for estimating freight volumes between countries, illustrated by the red line linking origins and destinations. Transport chains cannot be directly observed, so they have been estimated. Trade flows are disaggregated into NUTS3 regions and then assigned to a multi-modal network, to produce chains illustrated by the sequence:

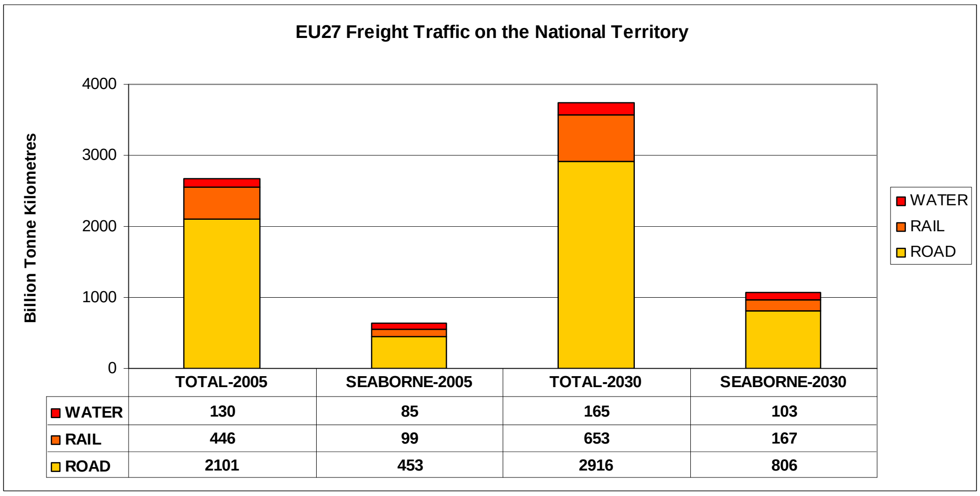
ORIG-PORT1-PORT2-DEST

The likely transport modes linking the points in the chain are also estimated, so that the sequence can alternatively be described, for example, as:

ROAD-SEA-RAIL

From these steps it is possible to quantify the hinterland impacts of port traffic, by mode and in comparison to other freight flows. Figure 15 below compares the quantity of (sea-borne) hinterland traffic with the total volume of freight traffic within Europe.

Figure 15: Hinterland Impacts



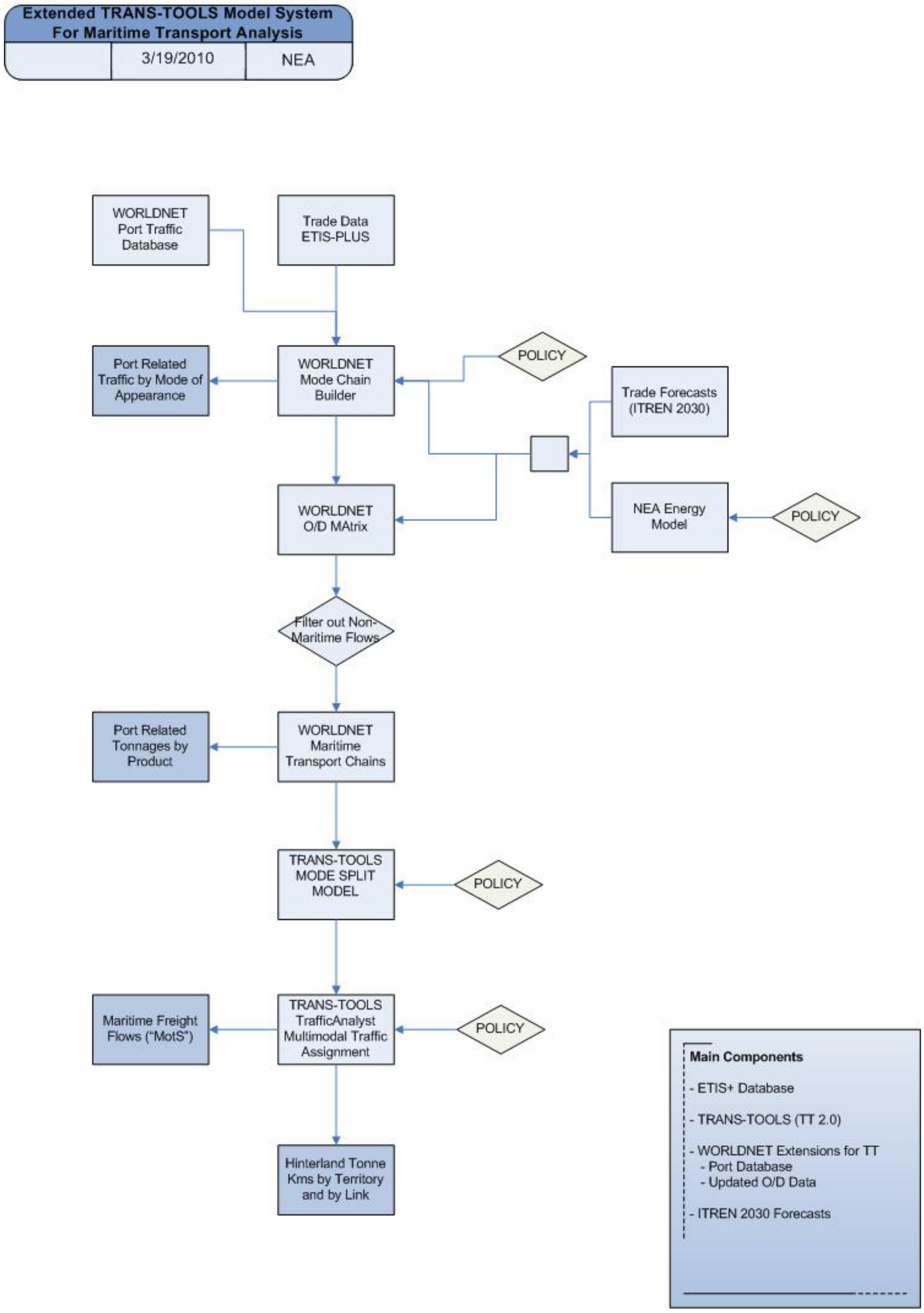
	TOTAL-2005	SEABORNE-2005	TOTAL-2030	SEABORNE-2030
WATER	130	85	165	103
RAIL	446	99	653	167
ROAD	2101	453	2916	806

Total inland EU Freight is expected to grow by 39% by 2030 (ITREN-2030), but we estimate that the seaborne subset will grow by 70%, and thus that growth in the maritime sector may potentially add 30bn HGV Kms in the EU27.

These results, showing port traffic increasing relative to other flows, underline the need to integrate port networks into the planning of the TEN-T. Furthermore, because ports act as multi-modal distribution nodes, feeding substantial traffic volumes into the rail and waterborne freight networks, there is a strong case for aligning port growth expectations with hinterland infrastructure development across all the main inland modes.

A more detailed view of the modelling system is shown below. It is an extension of DG-MOVE's TRANS-TOOLS model, using inputs from WORLDNET and ITREN. The system is calibrated to generate accurate volumes at the port nodes according to the main product groups, so that for example liquid bulks are only assigned to ports that currently handle such traffic and not to specialist container ports for example.

Figure 16: Detailed Flow Chart of Modelling System



A deeper analysis of container traffic is provided by linking outputs from the system to the TNO container model.

Overview of TNO Container Model

The first version of the world container model was developed as part of a study in 2008, as part of the Mobility and Logistics Programme of the Dutch Ministry of Transport (Perrin et al, 2008). The objective was to explore the linkages between trade and transport in the container market by an improved understanding of port choice processes in the global market.

Our study showed that it is possible to reproduce routing and port choices for containers at an aggregate level using publicly available data and a simple transport model. The main input of the model is trade and network data; the outputs are the seaborne routing, the port choice and the hinterland routing of freight. It includes various policy sensitive variables, which makes it useful for policy analysis. The current main limitation of the model is that congestion, mode choice, inventory logistics and global trade responses are not endogenous.

Geographical Scope

The modelled network connects all regions of the world and includes the basic hinterland networks on each continent. The model allows analyses over the world's main shipping routes between 437 container ports around the world, taking into account more than 800 known maritime container line services. Lines are connected through sea-sea transhipment possibilities.

Figure17: Core network of the global container model

Data Content

Import, export and transhipment flows of containers at ports, as well as hinterland flows are distinguished. The key sources for these data are the Comtrade database, Eurostat and ESPO port data. Because of the worldwide scope of the model, the level of detail is not high and accessibility indicators rely on aggregate specifications of transport costs and transport times.

Model Usage

For the current study, the O/D data from the base year 2005 (Worldnet) and from the integrated baseline scenario for the year 2030 (iTREN-2030) have been assigned with the model to produce the container throughput in the European ports. This step has been mainly carried out in order to test the link between

Worldnet/iTREN-2030 results and the world container model and to check the results.

In a later step, the world container model will be applied to run a number of sensitivity analyses on top of the iTREN-2030 scenario results. Through the port choice mechanism, the world container model provides insight in competition between ports and changes in O/D flows on the European hinterland network.

7 Methodology for Identifying Core Ports

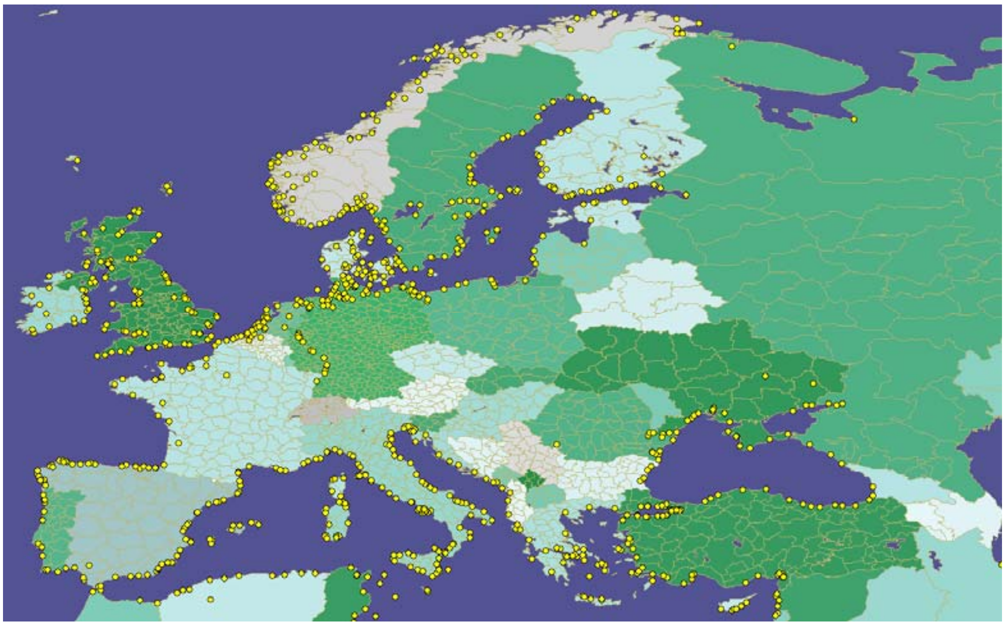
The model system has also been used to provide a method for selecting potential candidates for the proposed TEN-T core network.

The main principle has been to select a combination of ports that optimises accessibility to the main shipping lanes for the freight generating regions. This has been carried out using a location-allocation heuristic, similar to the methods used for example to select locations for distribution centres. It poses the question: given the current and forecast distribution of traffic, and the current or forecast inland networks, what would be the optimal network of European ports?

The objective has been to arrive at a network of core ports using a repeatable and transparent methodology. The network is optimised for accessibility, i.e. how to minimise the system costs. The method is described step by step.

Step 1: All the main ports in Europe, for which traffic data is published by Eurostat, are listed and ranked by their throughput. These make up the long list of candidates. Potentially any of these could be selected for the core network. Note, that the inland ports shown here are automatically excluded at a later stage.

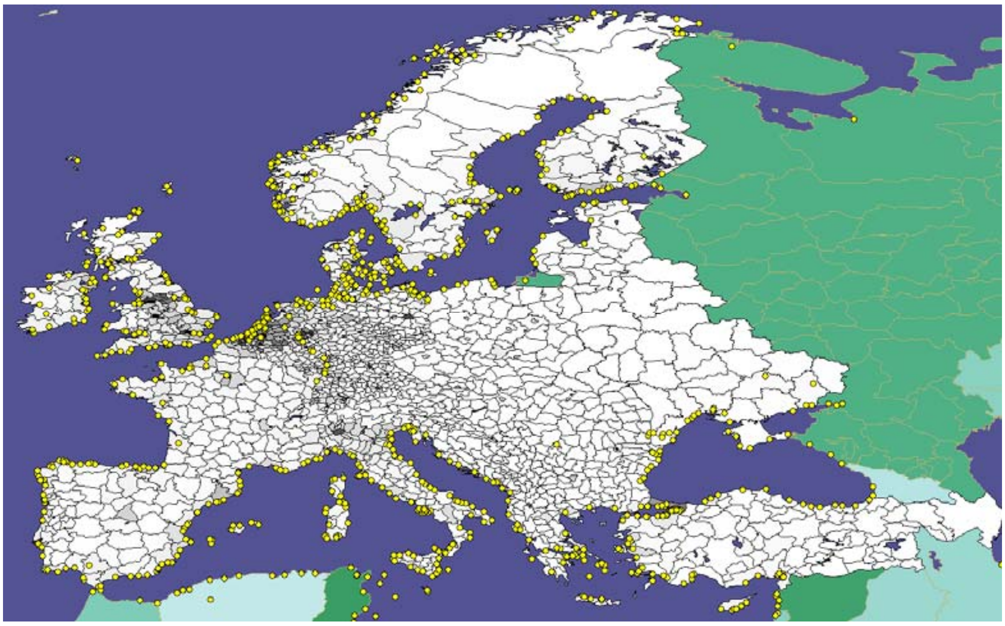
Figure 18: Long list of candidate ports



Step 2: A traffic matrix is constructed, showing the amount of sea-borne freight produced or consumed per NUTS3 region. There a several possible approaches here. The method adopted has been to use the WORLDNET 2005 freight matrix for the whole of Europe excluding the Russian Federation to estimate ***sea-borne traffic flows, measured by their value in Euros***.

In this way, the potentially distorting effects related to the high-volume, low-value density bulks are reduced relative to the higher value-added sectors. Nevertheless, all cargo is included.

Figure 19: Step 2: Traffic Density

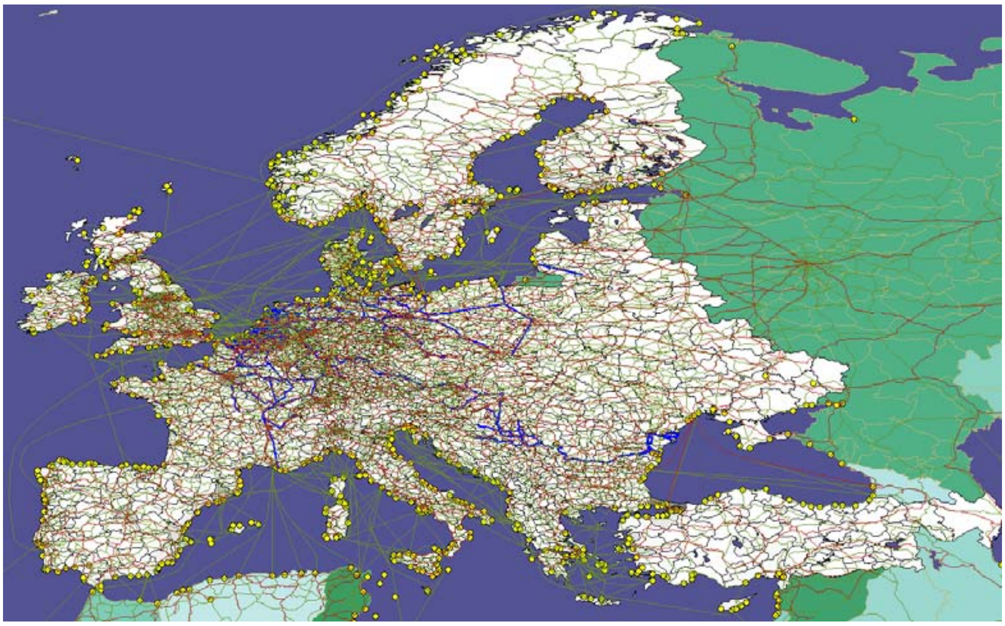


The map shows the traffic density, with the darker colours indicating the highest volumes generated or attracted per square kilometre.

Step 3: Modal networks are introduced in order to estimate transport impedances (the cost of moving a truck-load of freight from A to B). Since the concept of the Core Network is multi-modal, the three main inland network modalities have been used. These are merged to arrive at a ***composite impedance*** for each port to region combination.

Again, different approaches are possible here, but the chosen approach is to make a simple, un-weighted average of the costs for each inland modality. Essentially this lowers the apparent inland cost from ports with access to rail and waterway links.

Figure 20: Step 3: TRANSTOOLS Networks



The map now indicates the extent and density of the networks used for the analysis. Road links are shown in green, rail in red and navigable waterways in blue. These layers include the extensions into the neighbouring regions, and also the interconnecting ferry services.

Impedances are calculated door to door, including loading and unloading costs and tolls, using the data and methodology established in the ETIS (FP5) project. Thus regions with relatively high road tolls such as the Alps are taken into consideration. Border crossings (EU/EFTA to non EU/EFTA) also incur (time) penalties.

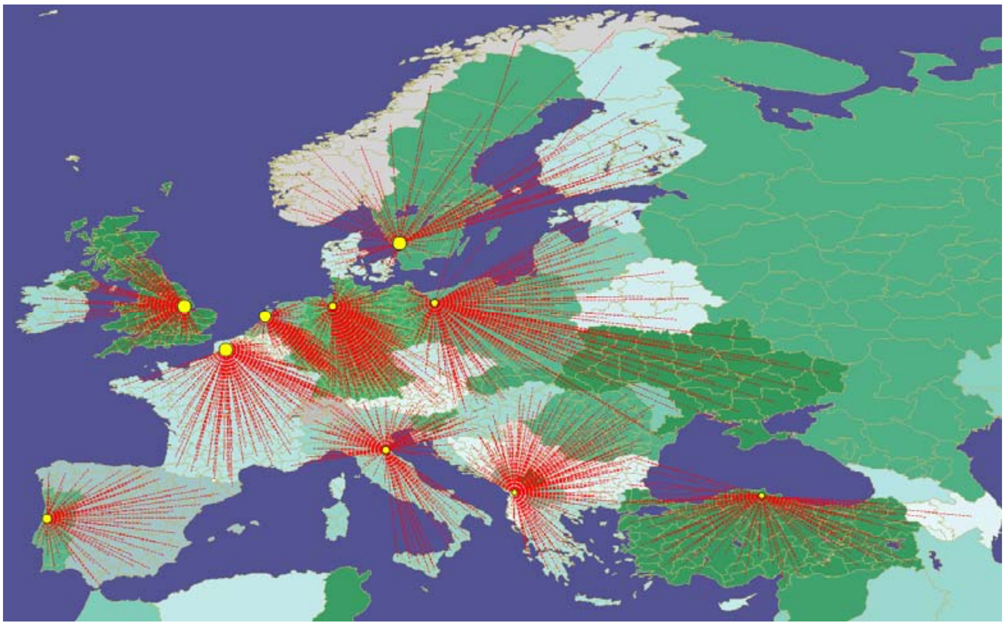
Step 4: The optimisation process involves identifying the port set which minimizes total access cost. However, the objective is not to direct the traffic to the coast, but rather to the main shipping lanes via the ports. Thus an additional step was made to measure the distance from any given port to the main shipping routes, and to add this to the accessibility score.

Figure 21: Step 4: Definition of Main Shipping Lane

Step 5 : The port selection process starts by identifying which locations are the most accessible. In other words it attempts to minimise the sum of the traffic kilometres, here calculated as Euro-kilometres, since the traffic volume is expressed in Euros.

The iteration adds a single port location each time, and gradually builds up a network. After ten iterations the distribution below appears.

Figure 22: Step 5: Distribution with 10 Ports



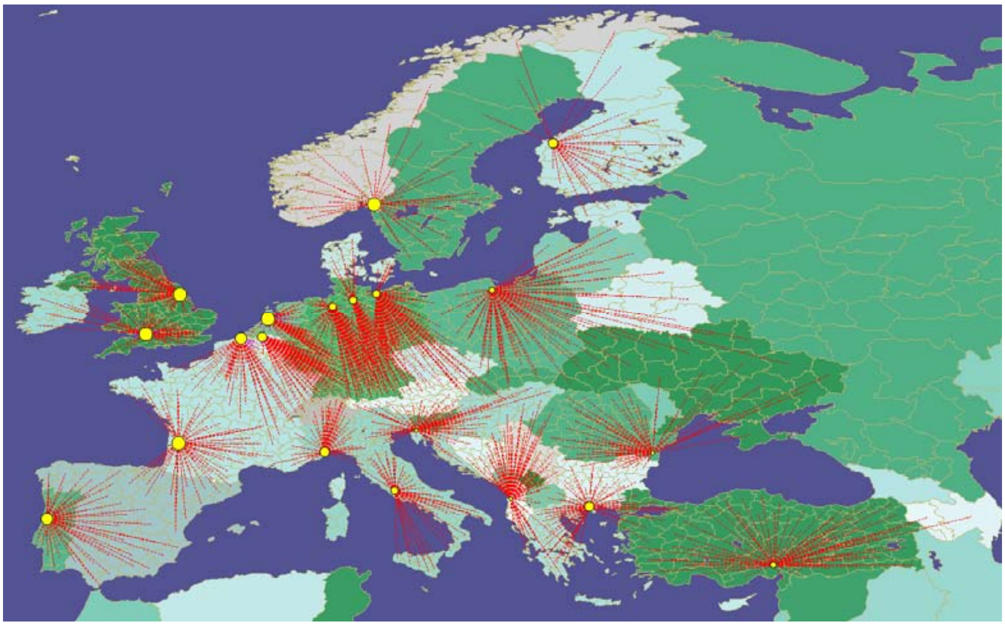
The yellow dots are the selected port locations and the red lines associate each zone to the nearest port (as defined according to the impedance calculation). The size of the yellow dot shows relatively how much economic activity (seaborne trade) is captured in each port location.

Note, these are not supposed to show actual port hinterlands, but the accessibility of any given zone to the core port network.

At an early stage of the calculation, a natural pattern is starting to appear with ports selected in each of the main island or peninsular territories: Iberia, France, Italy, Britain, the Balkans, Anatolia and Scandinavia. For the mid-continental block, a range of locations are selected in Netherlands, Germany and Poland.

Areas with poor access at this level (long red lines) include the Western Mediterranean, the Aegean, the Baltic, the Black Sea and Ireland.

Figure 23: Distribution with 20 Ports

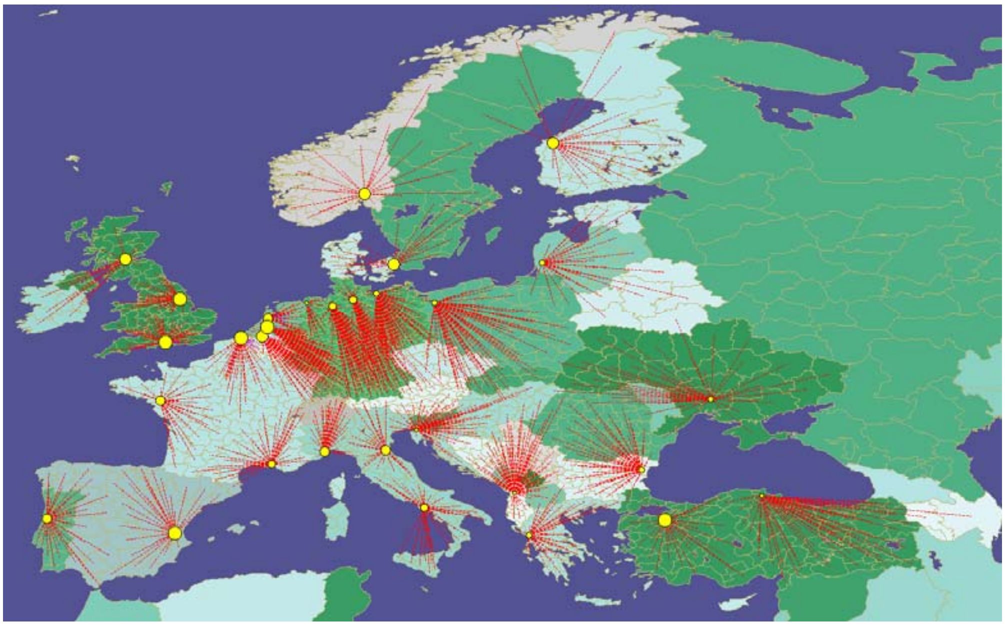


After twenty iterations the distribution is similar, but many of the previous gaps have been filled. Port locations have been identified in Romania for the Black Sea and close to Thessaloniki for the Aegean. In Turkey, there is then a shift from the Black Sea coast to the Mediterranean coast. In or adjacent to Italy, three locations have been selected for the Ligurian coast near Genoa, the Northern Adriatic near Trieste and towards the South near Rome.

Spain and Southern France are perhaps surprisingly lacking a candidate, but France now has two locations close to Dunkerque and close to Bordeaux. Britain has two locations, in the North West near Immingham and in the South West near Bristol. In Belgium, the Netherlands, Germany, Denmark and Poland the pattern is similar, but more new sites are appearing close to Hamburg, allowing the Polish location to shift East towards Gdansk. The Scandinavian site moves North towards Oslo, and a new site appears in Finland near Vaasa.

Gaps still exist however in the North of the Black Sea region; some Ukrainian traffic accesses the port network in Poland. The Aegean is also possibly under represented, and there are still large gaps in Southern and Eastern Spain.

Figure 24: Distribution with 30 Ports



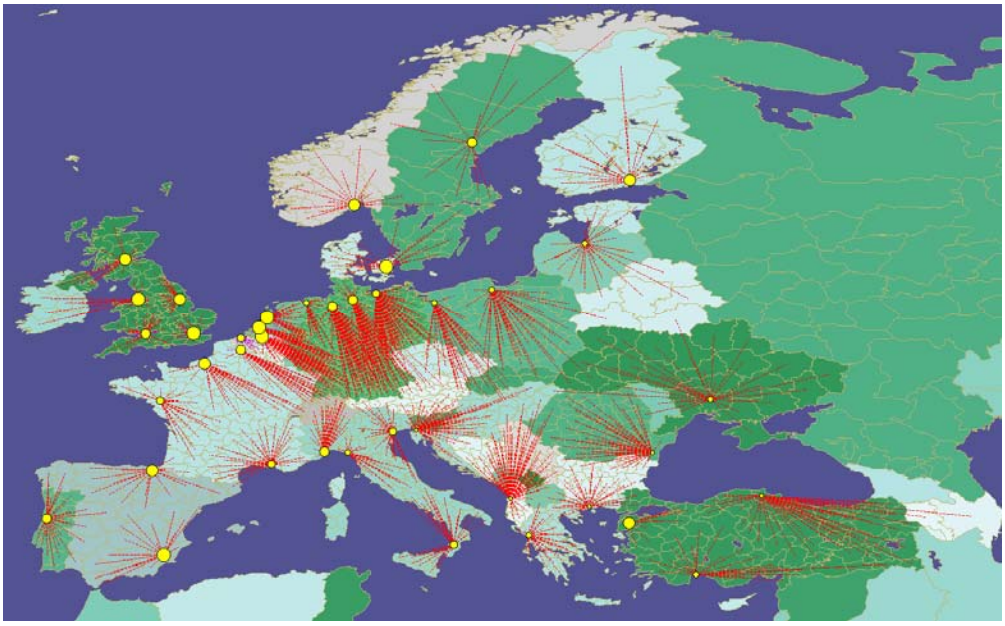
With thirty iterations the network is starting to appear more complete. In Iberia, both the East and West are covered, and in France all three coastlines are now represented with the addition of Marseille. Bordeaux has been replaced with Nantes.

In Britain, the North is better represented with a port in Scotland, and the southern port choice is Southampton rather than Bristol.

In the Aegean area, a location appears in the South East Marmara, close to Izmit, and the Greek choice moves Westwards to Patras, rather than Thessaloniki. In the Black Sea there are ports in Varna (BG), Odessa (UA) and Samsun (TR).

In The South Baltic sea, Gdansk is replaced in the East with Klaipeda (LT) and in the West with Szczecin/Swinoujscie. In Scandinavia, a new point is created in Malmo/Copenhagen, and in Finland, Vaasa remains.

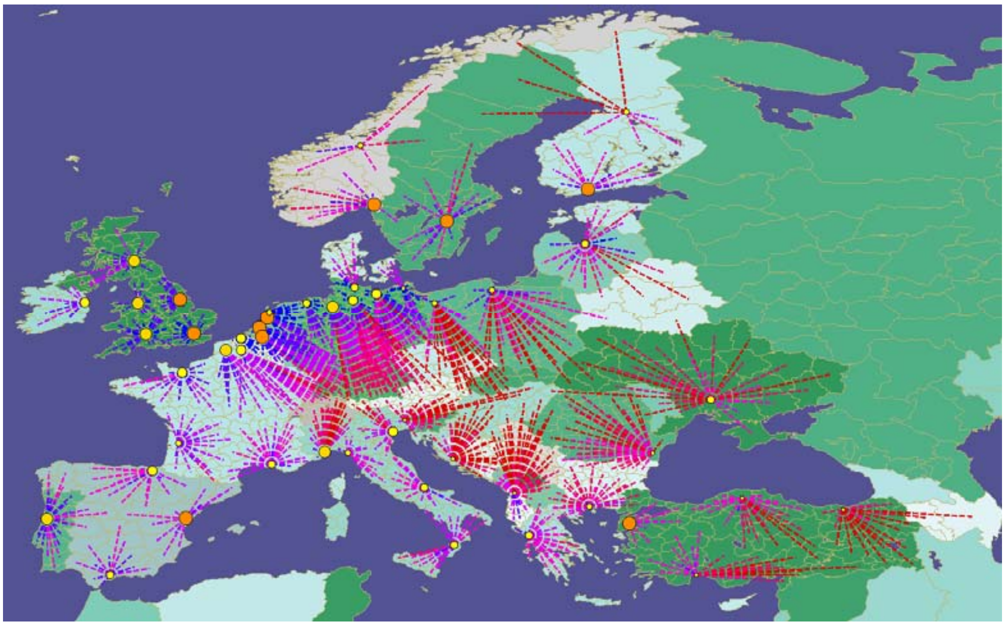
Figure 25: Distribution with 40 Ports



With forty iterations the changes are more subtle, but still important. In Finland, Helsinki is selected, and in Sweden, the port choice shifts Northwards to reduce the otherwise high impedances incurred to access the most Northerly regions.

In Britain, Liverpool is added on the Western side, and London in the South East. In Spain, a port is added on the North coast and Italy the most Southerly location shifts towards Sicily. In the Aegean, the location near Kavala (GR) to the East of Thessaloniki re-appears, and Turkey is represented with three sites.

Figure 26: Distribution with 50 Ports



After fifty iterations there are indications that the distribution is starting to fragment, and that the new ports added to the distribution are adding only small benefits in terms of accessibility. No new coastline areas are being added, with the exception of Ireland. It might be possible therefore to regard this distribution as the upper boundary of the estimation, i.e. that accessibility is not improved significantly, although there would be a user benefit in terms of choice for shippers.

This can also be seen with reference to the accessibility scores. These are calculated for the whole traffic set, with the quantity of traffic being multiplied by the distances from each zone to the nearest nodes. In the iteration process, the object is to minimise this total score.

Results can be seen in figures 27 to 29. Figure 27 shows the total score for the full set of fifty model runs. It appears to show relatively little change after eight iterations, but the shape of the curve is distorted by the very large improvements from the first iterations. Figure 28 shows the range between iteration eight and iteration fifty in more detail. It shows that improvements are occurring up to approximately iteration forty. Figure 29 shows the relative improvement from one scenario to another. It shows that improvements of 2.5% are still being found up to iteration 40.

In figure 30, an attempt has been made to translate the literal model results (figure 26) into a balanced list of candidates for the Core Network. The result with 50 iterations has been modified by hand with manual clustering (grouping nearby ports together). In addition, two extra locations are included in Cyprus and Malta.

Figure 27: Total Score for whole iteration

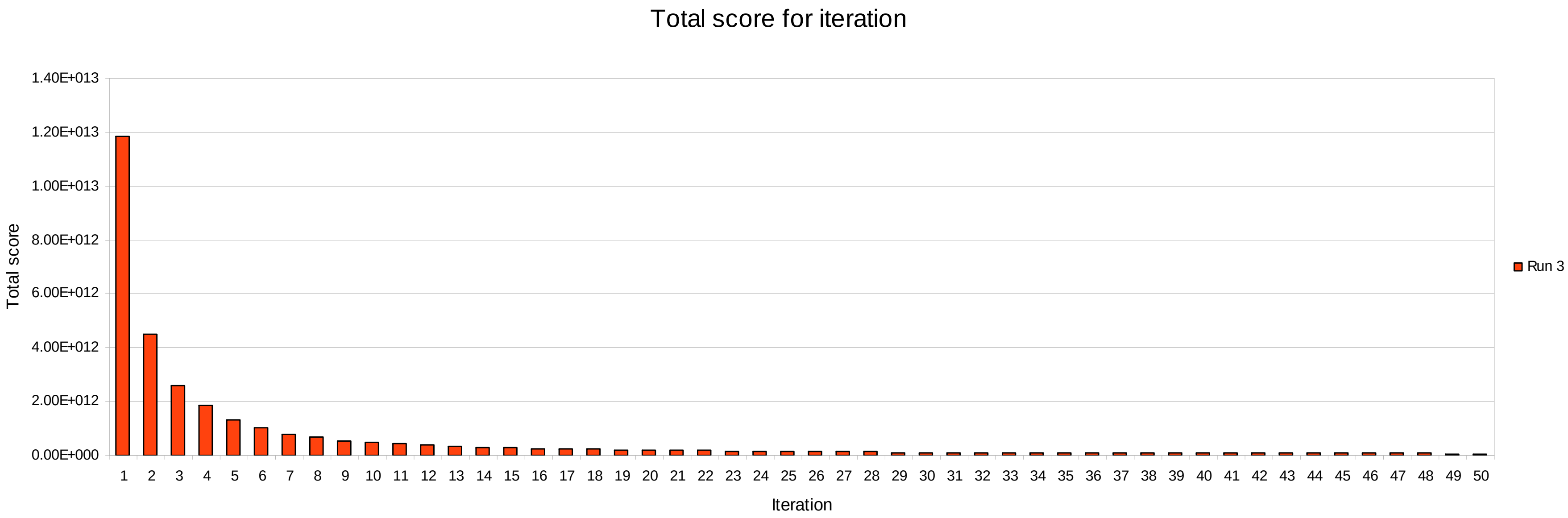


Figure 28: Detailed view of Scores from Iteration 8 onwards

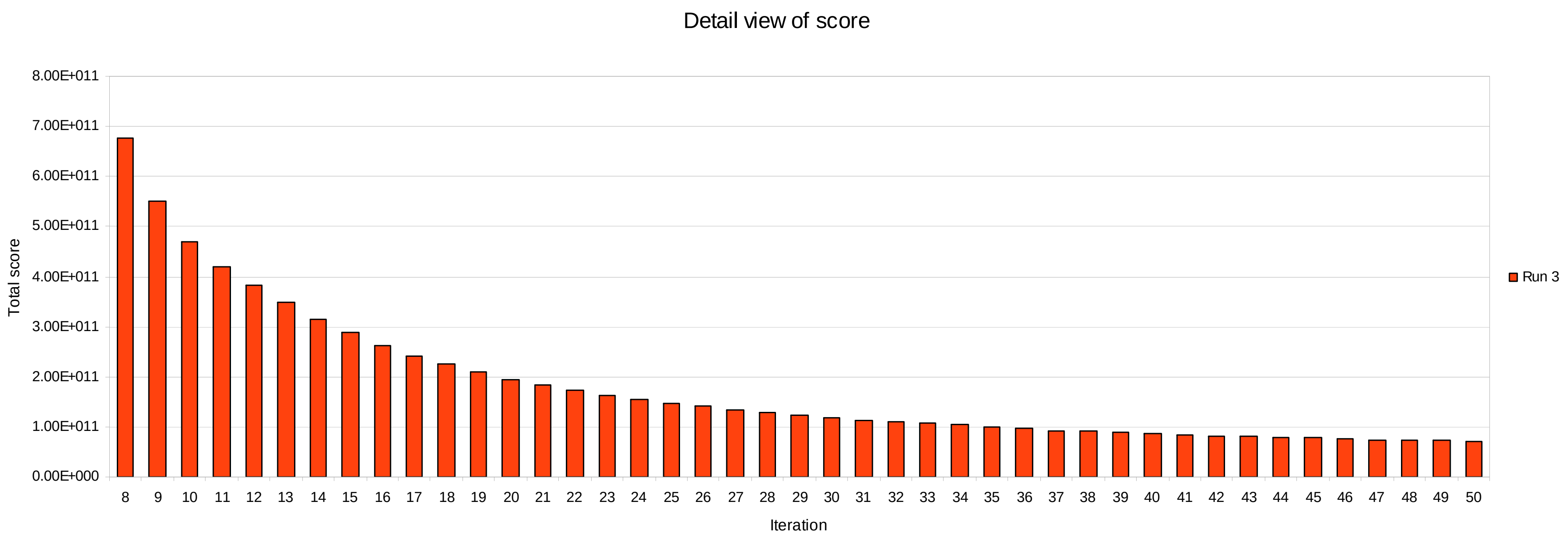


Figure 29: Relative Improvement in Score

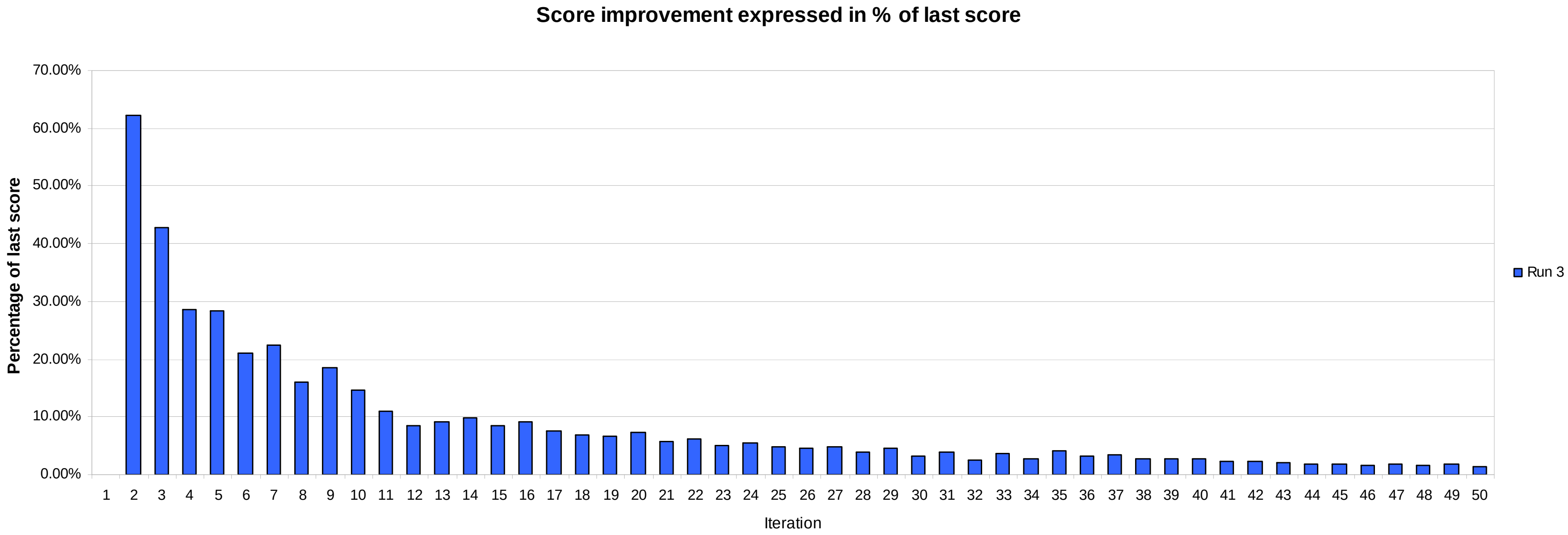


Figure 30: Port Selection Based on 50 Locations

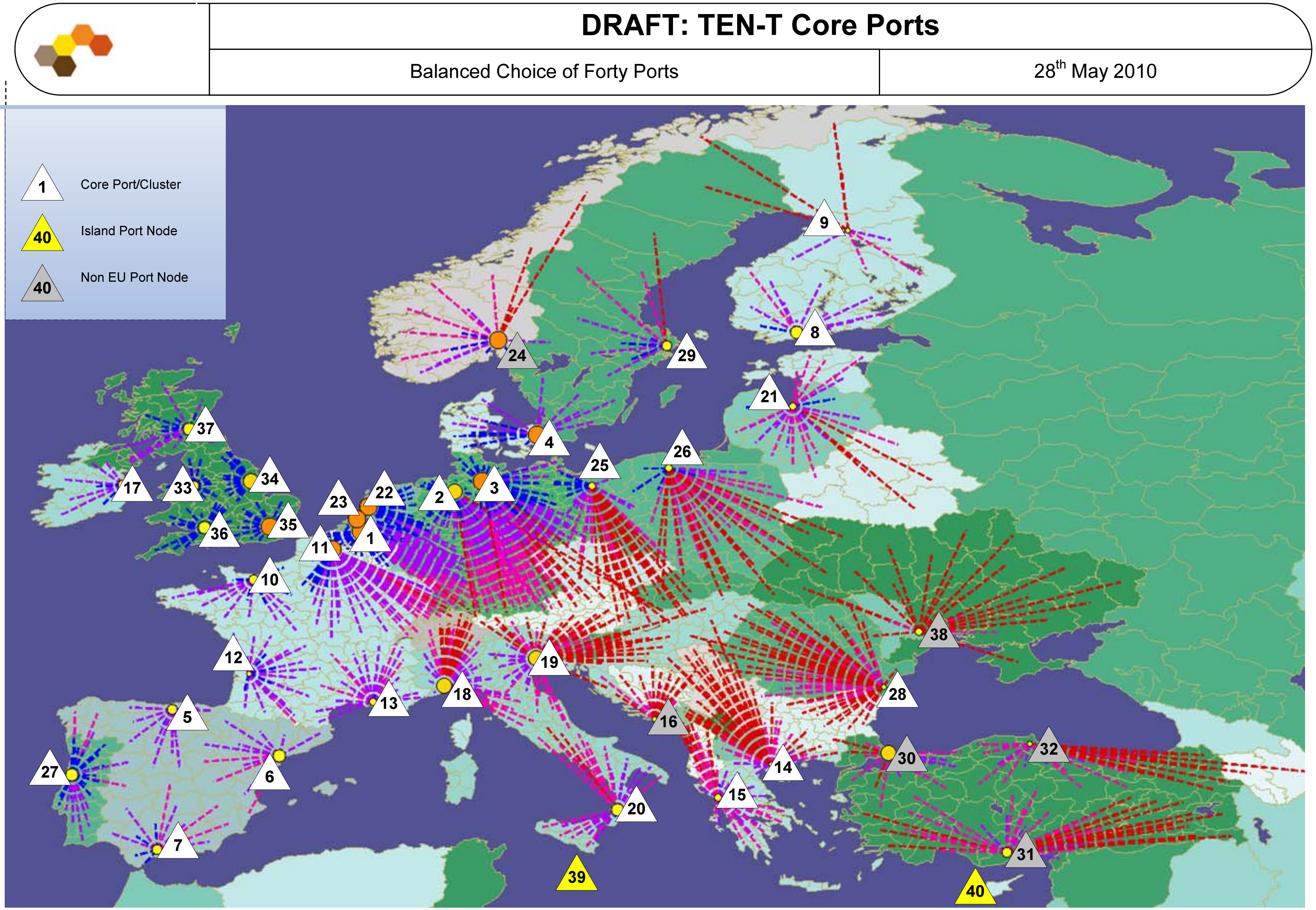


Table 8: Draft set of core port candidates.

No.	Name	Country
1	Antwerp	BE
2	Bremerhaven	DE
3	Hamburg	DE
4	Copenhagen/Malmo	DK/SE
5	Gijon/Bilbao	ES
6	Barcelona/Valencia	ES
7	Algeciras	ES
8	Helsinki/Tallinn	FI
9	Oulu/Vaasa/Gulf of Bothnia	FI
10	Le Havre/Seine	FR
11	Dunkerque/Calais/Zeebrugge	FR
12	Bordeaux/La Rochelle	FR
13	Marseille	FR
14	Thessaloniki/Kavala	GR
15	Patras/Piraeus	GR
16	Ploce/Bar/Dubrovnik	HR/ME
17	Dublin	IE
18	Genoa/La Spezia	IT
19	NAPA: Venezia/Trieste/Ravenna/Koper/Rijeka	IT/SI/HR
20	Gioia Tauro/Taranto/Bari/Brindisi	IT
21	Riga/Klaipeda	LV/LT
22	Amsterdam	NL
23	Rotterdam	NL
24	Oslo/Goteborg	NO/SE
25	Szczecin/Swinoujscie	PL
26	Gdansk/Gdynia	PL
27	Porto/Lisbon	PT
28	Constanta/Varna	RO/BG
29	Stockholm	SE
30	Istanbul/Marmara	TR
31	Mersin	TR
32	Samsun	TR
33	Mersey	UK
34	Humber	UK
35	Thames/Haven/East Kent	UK
36	Avon/Solent/S. Wales	UK
37	Forth/Clyde	UK
38	Odessa/Illichivsk	UA
39	Marsaxlokk	MT
40	Limassol	CY

8 Stakeholder Consultation

The results presented here are provisional. In the final stages of the project input from stakeholders will be integrated into the project's methodology and results.

During the stakeholder conference, the provisional results will be presented and discussed. However, we would also like to receive detailed inputs in writing, relating to the main project results:

- Analysis of current maritime freight flows, and their relation with hinterland networks.
- Forecast of freight flows/ impact of crisis and expected outlook.
- Analysis of demand and supply in ports.
- Methodology for selecting candidate ports for the core TEN-T network.

To this end, we hereby invite you to send your comments relating to the main content of this document to the project team, for the attention of Sean Newton (sne@nea.nl), and Nina Nesterova (nne@nea.nl). Comments will be treated in confidence, and the main conclusions will be summarised in the final report and not attributed to a source.