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**PROJECT DEVELOPMENT & FUTURE SCOPE  
OF EURO-MEDITERRANEAN MARITIME  
NETWORK**

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EMLIN CYRIAC

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## **ABBREVIATIONS AND ACRONYMS**

• EU	:	European Union
• MENA	:	Middle East and North African Countries
• GDP	:	Gross Domestic Product
• TEU	:	Twenty Foot Equivalent Unit
• SSS	:	Short Sea Shipping
• TEN-T	:	Trans-European Transport Networks
• CEC	:	Central European Countries
• MPCs	:	Material Processing Center
• UE	:	European Union
• PCC	:	Pure car carrier
• UFM	:	Union for the Mediterranean
• BCTC	:	Beirut Container Terminal Consortium
• LFZ	:	Logistic Free Zone
• ASCAME	:	Association of Mediterranean Chambers of Commerce
• CIREM	:	University of Cagliari
• LNG	:	Liquid Natural Gas
• SECA	:	Sulphur Emission Control Area
• PPP	:	Public and Private Partnership
• GEPB	:	Gestion et Exploitation du Port de Beirut
• CAN	:	Customs Authority Number
• CFR	:	Cost and Freight
• CFS	:	Container Freight Station
• ETA	:	Estimated Time of Arrival
• ETD	:	Estimated Time of Departure
• GST	:	Goods and Services Tax
• GP	:	General Purpose
• CIF	:	Cost, Insurance and Freight
• CT	:	Combined Transport

- COD : Cash on Delivery
- IMO : International Maritime Organization
- L/C : Letter of Credit
- NVOC(C) : Non Vessel Operating (Common) Carrier
- MMO : Multi Modal Operator
- Lo/Lo : Lift On/ Lift Off
- RO/RO : Roll On/ Roll Off
- SOB : Shipped on Board

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# **1. INTRODUCTION**

The whole purpose of maritime transportation is to support trade, business and commerce – whether global or domestic. It has the highest capacity in terms of transferring loads from one place to another.

The growth, numbers and the volume involved makes the maritime industry one of the most globalized industries in the world in terms of ownership and operations. The vision of EU Leaders is to build a Union that is well- connected and will contribute towards a more competitive and resilient union. An enhanced connectivity is essential to achieve the EU Community, namely the EU Political-Security Community, EU Economic Community and EU Socio- Cultural Community.

As a key step towards continued economic growth, reduced development gap and improved connectivity among Member States and between Member States and the rest of the world is by enhancing regional and national physical, institutional and people-to-people linkages.

## **1.1 Scope of the Study**

The present study intends to provide a contribution to the literature in the maritime logistics field by presenting a case study focused on the performance evaluation of a Mediterranean transport network. Specifically, the performance of a newly designed Mediterranean ro-ro network developed in the framework of a past Euro- Mediterranean cooperation project is assessed in order to investigate the potential margin of improvement that would result from its entry into operation in place of the existing system.

## **1.2 Research background**

There is naturally maritime trade between Mediterranean countries and the rest of the world, but above all trade takes place between the entire EU and countries of Asia and the Middle East via the Mediterranean Sea.

The Mediterranean basin has always been a desirable market for shipping operators, mainly because of its geographical location at the centre of the major international trade routes. Moreover, not only does it play a key role in international East-West trade but, following the development of MENA (Middle East and North-Africa) countries, it is gaining increasing

importance as a trade area for intra- regional Mediterranean traffic. Note that MENA countries have seen their GDP increase by 4.4% per year during the period 1995-2016, while in the same period the average increase in the EU28 was 1.9% (EUROSTAT statistics). The 2001-2014 traffic data further confirm this growth trend, showing an increase of about 160% in north-south maritime freight flows from the Mediterranean to the Middle- and the Far East- Gulf, and a 92% increase in the opposite direction. Such a seamless flow of goods across the Mediterranean basin clearly requires a well-functioning maritime transport system. However, integration among the countries on the northern and southern shores still appears to be inadequate in terms of stable and sustainable commercial relationships, and of maritime connections able to support such development.

An issue that cropped up when analysing maritime transport was transshipment. Transshipment is the operation through which containers are transferred from a larger ship (calling at a major port) to a smaller one (calling at the port of destination) and vice versa, implying a temporary storage in the hub maritime terminal where transshipment occurs. This practice allows the container fleet and the port equipment to be used in a more efficient way. It was effective comparatively because it made the best utilization of resources, drew places closer resulting in increased accessibility and was a huge success in terms of costs and efficiency.

Trans-shipment was initially developed to service smaller ports unable to accommodate large containerships, which is commonly because of limited draft and port infrastructure. However, as maritime networks became increasingly complex, specialized transshipment hubs emerged. In 2012, the share of trans-shipment reached 28% of all the TEUs handled by ports around to world, double of what it was 20 years earlier.

In particular, the focus is on a project funded under the last 2007/2013 ENPI CBC MED - European multilateral Cross-Border Cooperation Programme, the so-called OPTIMED project, whose primary aim was to optimize the trade network between the north-western and the south-eastern shores of the Mediterranean based on the hub and spoke system. The objectives to be achieved with the OPTIMED project focused both on improving the efficiency of the Mediterranean shipping supply system in terms of reducing journey times, of regularity and frequency of connection services as well as rendering it more sustainable from an environmental perspective, and more effective in relation to its ability to attract new demand and improve commercial relations and trade between the countries on the two shores.

### **1.3) Study Objective**

This paper is intended to review the Euro-Mediterranean maritime network connecting countries in the EU area and MENA area through Mediterranean Sea and to determine the future scope of OPTIMED project.

The study has the following fourfold objectives:

- To provide a comprehensive vision for need of integration and linkage of the European Mediterranean maritime networks, as well as measures to increase efficiency, competitiveness and safety of integrated port hubs;
- To collect and analyse a series of maritime transport data/information in euro-mediterranean countries to develop efficient and reliable services;
- To analyse Optimed project and determine future scope and development. To recommend necessary expansion initiatives to ensure RO-RO shipping services among the countries;
- To highlight missing sections for the maritime linkage between these countries.

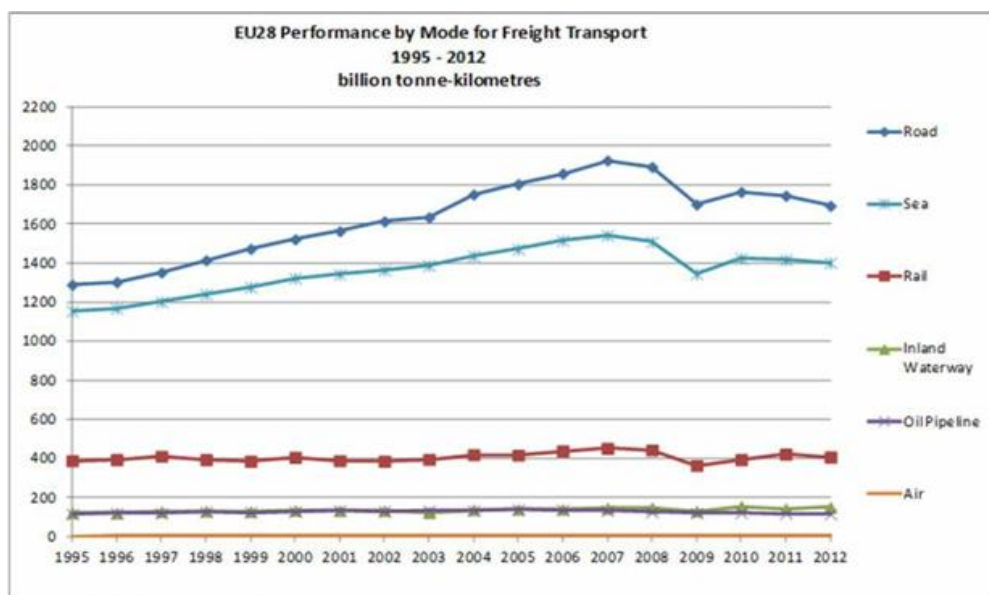
Considering, the very objective of this project, which is to serve traffic, and the other, the economic and social scope of the maritime network, which will serve as integration of the regional economies, favouring trade exchanges and human mobility, the Optimed Project was proposed.

The integration of maritime increases the accessibility to these regions from the Mediterranean part of Europe through the Mediterranean Sea and on the other part to form a linkage to the Middle East North African maritime network, thus helping in the development of these countries. This improves the travel time, travel distance, frequency, efficiency and travel costs directly affecting the mobility and accessibility of the region.

## **2. ANALYSIS OF EURO-MED MARITIME INDUSTRY**

### **2.1 Analysis of EU Maritime Industry Internationally**

The EU is highly dependent on seaports for trade with the rest of the world and within its Internal Market: 74% of goods exchanged (imported and exported) with the rest of the world and about 37% of exchanges among EU Member States transit through seaports. Ports guarantee territorial continuity of the EU by servicing regional and local maritime traffic to link peripheral and island areas. They are the nodes from where the multimodal logistic flows of the trans-European network can be organised, using SSS, rail and inland waterways links to minimise road congestion and energy consumption. Based on overall transport figures within the EU, including domestic transport, seaborne traffic accounts for around 20% of transported goods (over 3 billion tonnes).



[Fig 1: EU Performance by mode for Freight transport \(billion tonne-kilometres\)](#)

When considering the split between national and international seaborne traffic, Member States exhibit very different figures, depending on their geography: countries characterized by the presence of islands and/or a long coastline

The 2011 White Paper on Transport states that more and efficient entry points into European markets are needed, avoiding unnecessary traffic crossing Europe. Seaports play a major role as logistics centers and require efficient hinterland connections. Their development is vital to handle increased volumes of freight both by SSS within the EU and with the rest of the world.

Inland waterways, where unused potential exists, must play an increasing role in moving goods to the hinterland and in linking the European seas.

### **2.1.1 Short Sea Shipping**

It involves the movement of cargo and passengers for relatively short distances, for instance within the EU. By sea between ports situated in geographical Europe or between those ports and ports situated in non-European countries having a coastline on the enclosed seas bordering Europe. Short sea shipping includes domestic and international maritime transport, including feeder services, along the coast and to and from the islands, rivers and lakes. The concept of SSS also extends to maritime transport between the Member States of the Union and Norway and Iceland and other States on the Baltic Sea, the Black Sea and the Mediterranean.

According to recent figures, 37.7 million TEU equalling roughly 400 million tonnes of short sea combined transport cargo (container and ro-ro) were moved between ports within the EU or between ports in the EU and neighbouring third countries.

Most of the links have been developed decades ago and successfully operated by private ferry and container liner operators. On coastal routes, where modal shift from road or rail to sea is possible, there is direct competition by land-based modes of transport. The commercial operation of coastal short sea routes hence depends much more on the competitiveness of seaborne transport vis-à-vis other modes of transport. In general, the longer the distance, the more attractive short sea transport becomes because the cost per kilometre and unit is particularly low.

Conversely, ro-ro transport is essentially a co-modal transport involving an inland stretch by road and a maritime transport which, with some exceptions, is run over short distance ranges (and is therefore attributed to short sea).

### **2.1.2 Inland Navigation**

It is transport with ships via inland waterways (such as canals, rivers and lakes). Around 500 million tonnes of freight is transported on inland waterways annually in the EU. In 2012 a volume of almost 150 billion of tonnes-km was recorded. 13 Member States have an interconnected waterway network.

Compared to other modes of transport which are often confronted with congestion and capacity problems, inland waterways are characterized by its reliability, energy efficiency and major capacity for increased exploitation. It offers an environment-friendly alternative in terms of noise emissions.

The largest volume of traffic in Europe is registered as flowing from the North Sea maritime ports (Rotterdam, Antwerp, Amsterdam, Ghent) bound for Germany and Switzerland, largely generated along the Rhine axis.

### **2.1.3 Rail**

Rail is still underdeveloped in many cases. Except for bulk commodities, for which it is widely used to connect plants in the hinterland, railway transport is used only in certain cases, mainly in those ports that attract high volumes and with strong and large hinterlands (German ports of Hamburg and Bremen, Northern Range ports of Rotterdam and Antwerp) and in some particular cases in the Baltic Sea (Goteborg, Gdynia, Gdansk) and in the Mediterranean (e.g. La Spezia, Koper, Trieste).

## **2.2 Shipping in European Seas**

In terms of cargo flows in the European seaport system, five main markets can be distinguished: the container market, the ro-ro market, the market for conventional general cargo, the liquid bulk market and the dry bulk market. Each market has its own dynamics: the routing of different types of maritime freight through European ports to the hinterland is guided by complex interactions between a large set of factors and actors.

Over 300 ports are active in ro-ro, general cargo, liquid bulk and/or dry bulk handling. There are about 130-140 seaports handling containers, of which around 40 accommodate intercontinental container services. The number of European ports handling containers is, however, increasing. This, combined with the overall concentration of traffic in large gateways and driven by increasing infrastructure requirements to accommodate large vessels, indicates that the role of ports is changing and that there is a tendency to bring the goods closer to their final destination.

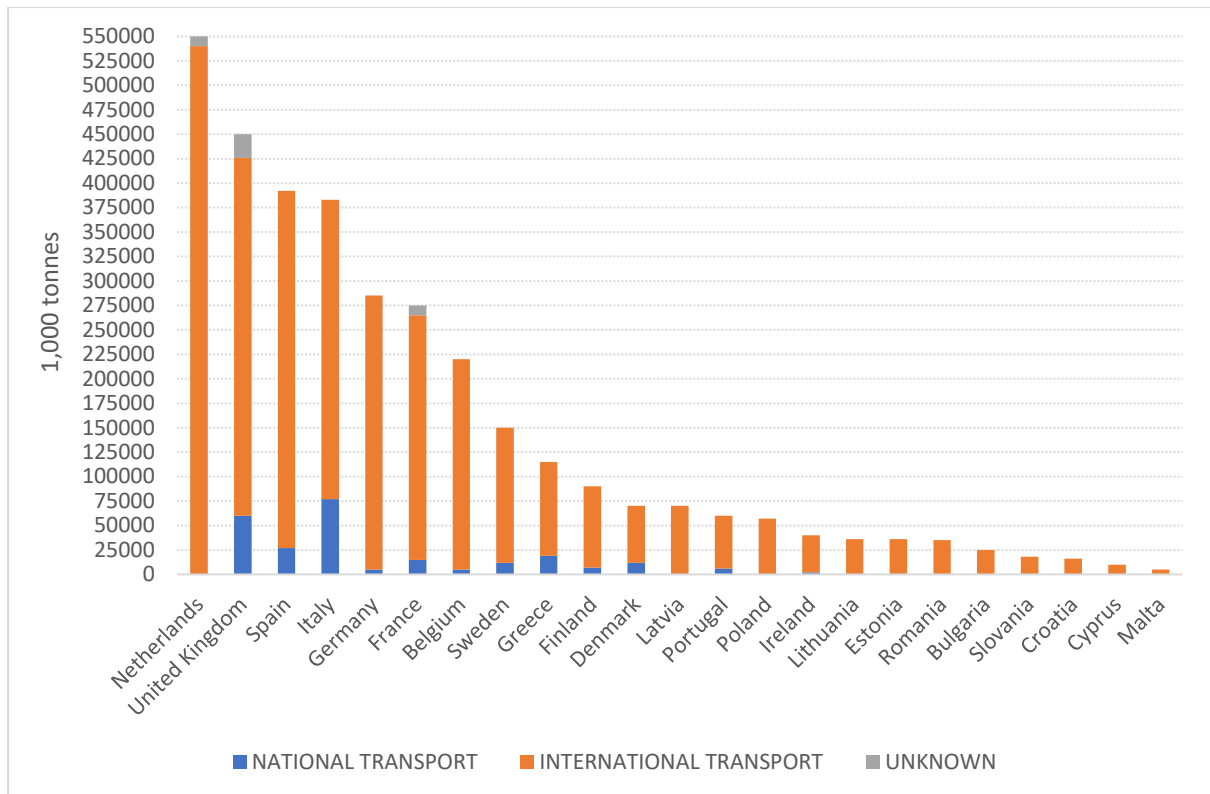


Fig 2: Shipping by type of Load and Country wise

In order to analyse sea-trade flows, the EU is often divided into different maritime basins. In this note the following are identified: North Sea, Mediterranean, Baltic Sea, Black Sea, Other (including UK and Atlantic).

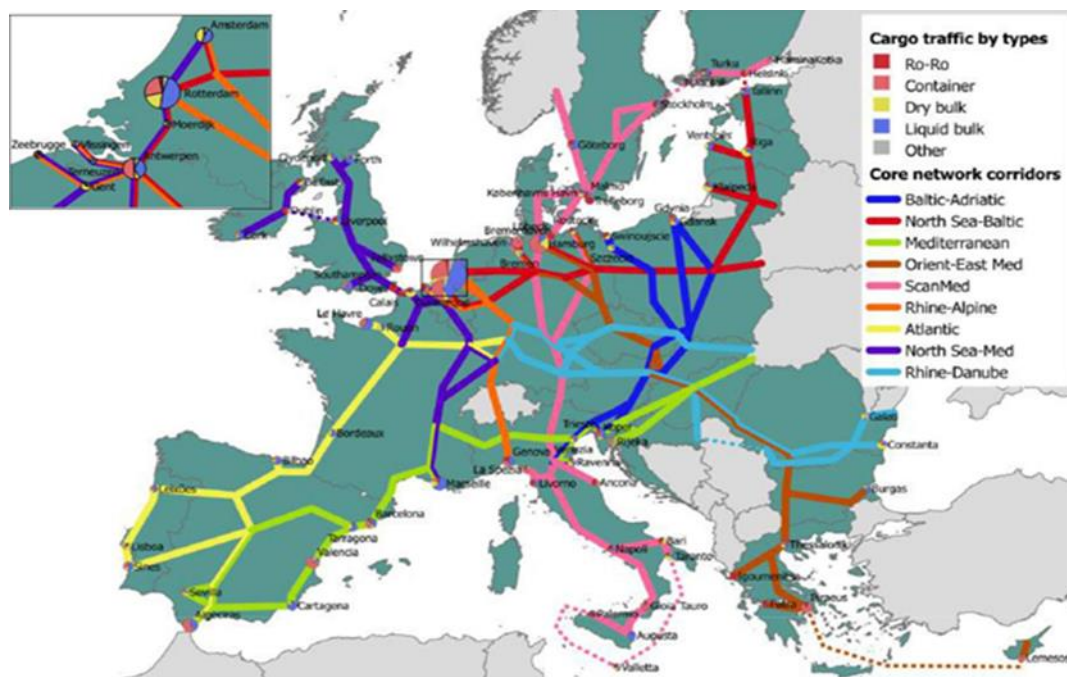


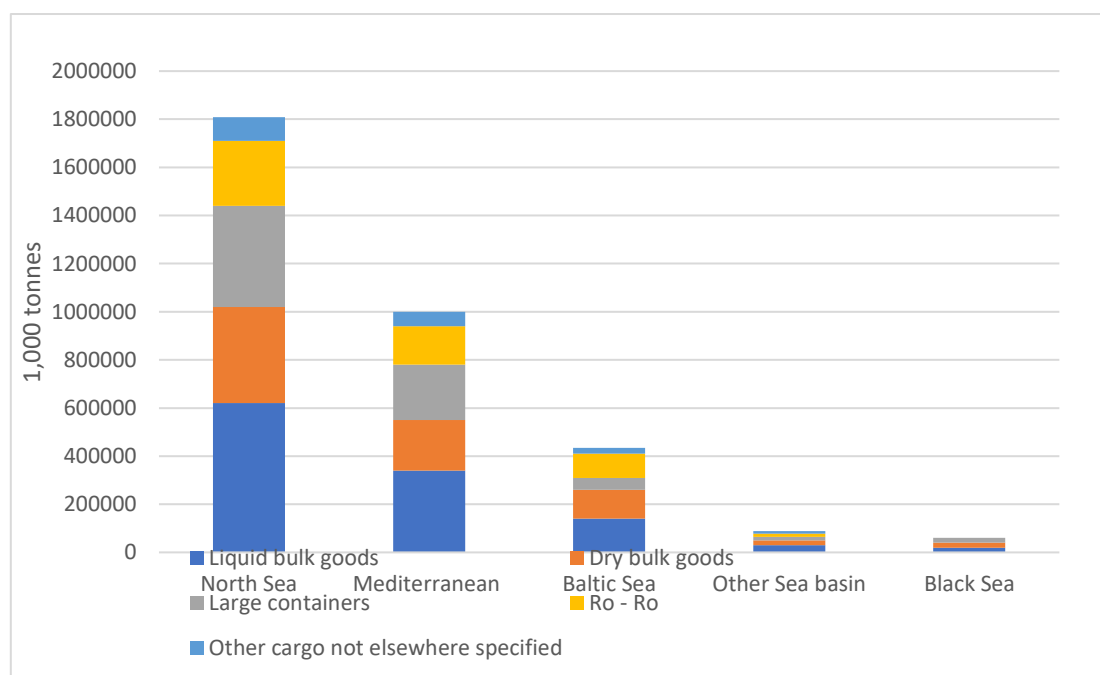
Fig 3: Total Cargo Traffic (billion tonnes)

The biggest share in total EU seaborne freight traffic is held by North Sea region ports (31.7%). The second biggest region is the Mediterranean Sea region (only EU ports) with a share of 28.2%. Baltic Sea ports (excluding Russian ports) account for 17.3% of total throughput in EU ports followed by UK & Irish ports (15.3%). The smallest share is held by EU ports along the Atlantic Ocean coast (5.9%) and EU ports along the Black Sea coast (1.7%).

The 83 seaports included in the TEN-T core network handle approximately 70% of the cargo passing through all EU seaports. The greatest number of core seaports (35) is concentrated in the Mediterranean Sea region. These seaports account for 58.4% of the throughput of all seaports within the EU Mediterranean region. 14 of those ports are located along the coastline of Italy. This is due to Italian seaports handling the greatest volume of cargo within the Mediterranean Sea region (460 million tonnes) followed by Spain and France.

The market share in total European volumes differs depending on the market segment considered:

- 48% or 40.3 million TEU in the container business
- 7% or 269 million tonnes in relation to dry bulk
- 25% or 391 million tonnes in relation to liquid bulk
- 20% or 62 million tonnes in relation to conventional general cargo
- 18% or 82 million tonnes in relation to ro-ro



[Fig 4: Shipping in different basins by type of load](#)



The network of European sea services is vast and diverse. There are high-frequent ferry services bridging small distances, e.g. across the English Channel, the Fehmarn belt, or the Strait of Gibraltar. On longer sea distances, unaccompanied trailers and containers are shipped and often combined with rail or barge hinterland transport.

Several short sea operators insisted on the fact that no support is required for establishing new routes or services. The reason for that is that if a route is economically viable in the long run, it is the role of the market to realize any such link. According to several operators, EU support could end up subsidizing a new route which is not sustainable in the long run or a link which is deviating volumes from other, nonsubsidised routes. In general, a negative impact of subsidies on competition is perceived.

### **2.3 Analysis of Exports and Imports Internationally**

In 2007, the European Commission adopted its plan to place and implement an integrated, horizontal and cross-sector maritime policy. In 2009, the Commission updated its strategic goals and recommendations and issued a Communication that outlined the main strategic goals for EU maritime transport up to 2018.

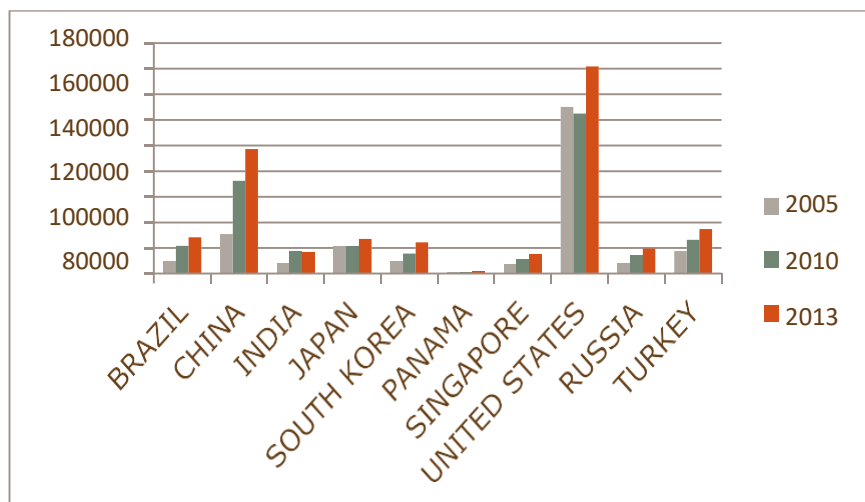
Two main issues are referred to in the strategy. The first is the ability of the sector to offer cost-efficient maritime transport services that are in line with the EU's needs to achieve sustainable economic growth. The second issue addresses the long-term competitiveness of the shipping sector in the EU and the increase in the capacity needed to generate both value and working places in the EU, directly as well as indirectly.

There exist 99 agreements, which cover the EU's maritime trade relations with 109 countries across the globe. This makes maritime transportation an important cornerstone for the EU's economy, and an important incentive for it and its Member States to enter into bilateral and multilateral agreements with other countries in order to facilitate maritime trade.

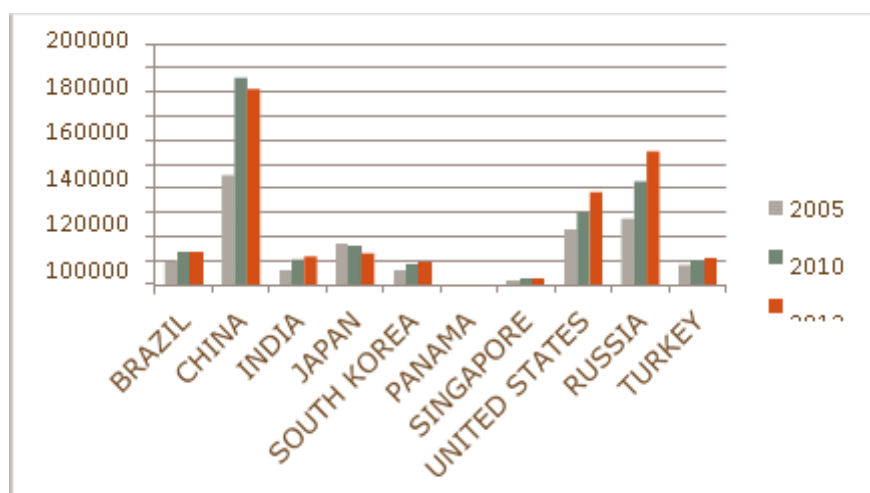
The EU has been active in concluding various types of agreements with these ten countries. The EU signed a detailed maritime agreement with China in December 2002, the first purely maritime agreement concluded at EU level. The EU has also concluded an agreement with Central America, where Panama is one of the signatories to the treaty. Furthermore, a free trade agreement exists with South Korea, and negotiations have been finalized for an

agreement with Singapore. Furthermore, the EU has concluded a partnership and cooperation agreement with the Russian Federation. Negotiations are currently ongoing with several countries. The EU and the USA are undertaking negotiations as part of the Trans-Atlantic Trade and Investment Partnership (TTIP), where maritime transport-related aspects will also be addressed. A free trade agreement is currently being negotiated with Japan as well. Negotiations with India for a comprehensive free trade agreement were started in 2007 and are currently ongoing. The relationship between Brazil and the EU is governed by the EU-Brazil framework cooperation agreement signed in 1992, but this instrument only deals with maritime issues to a limited extent.

The following figures show the export and import trends between the EU and these ten countries in maritime transport.



[Fig 5: EU export to top ten countries \(in million euros\)](#)



[Fig 6: EU import from top ten countries \(in million euros\)](#)

The figures above indicate the value of goods moved by ship based on the Eurostat Comext database. They also show that in terms of EU exports, the US and China are the most relevant trading partners for the EU. In terms of EU imports (total values in million Euros), the most relevant partners are China, the US and Russia (for the latter, the statistics also include the value of oil and gas transported by sea to Europe).

China is the EU's second largest trading partner, while the EU is the largest for China. Considering that more than 80% of global trade is carried by sea, maritime transport is the backbone of the Sino-EU economic relations. The USA is the second biggest partner of the EU (for 2013), in terms of gross weight of goods handled (inwards and outwards) for EU-28 main ports.<sup>121</sup> Furthermore, the US ranks second behind China for overall containerised port traffic in the world.<sup>122</sup> As for Russia, it holds the world's largest medium-payload fleet, capable of navigating both inland waterways and sea routes.

The EU is the biggest trading partner and investor for Turkey. Nearly 40% of its imports come from the EU, and just over 50% of its exports go to the EU. Another country that relies heavily on maritime transport for conducting trade is Japan. In terms of value, the maritime sector was responsible for 88.1% of the imports and 71% of the exports for the country, in 2012. Furthermore, the Japanese fleet (both the nationally flagged and the beneficially owned fleet) ranks second in the world, after the Greek fleet.

Between 2008 and 2012, there has been a steady increase of 15% in the trade flow in goods between the EU and Central America, which makes this region and its countries of growing importance to the EU. Panama, being part of this region, is of great relevance, especially the country's maritime sector with its Panama Canal. The Panama Canal is the nerve centre for global maritime transport that generates a variety of economic activities. Panama was ranked first among the countries for the registration of vessels of the world merchant fleet, which is composed of 8,221 ships and a total of more than 223 million gross tonnes.

In Singapore, there are over 5,000 maritime service companies, including more than 120 international shipping groups. As of 2011, Singapore was the busiest port in the world in terms of annual vessel arrival tonnage (2.12 billion gross tonnes) and the world's top bunkering port (43.2 million tonnes).

## **2.4 Study Area: The Euro-Mediterranean Region**

Maritime transport is a priority action in the Euro- Mediterranean region between the 15 European Union (EU) countries (EU: Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, UK, Sweden) and their 12 Southern and Eastern Mediterranean partners (MED: Algeria, Morocco, Tunisia, Egypt, Jordan, Lebanon, Syria, Israel, the Palestinian Authority, Cyprus, Malta, Turkey).

### **2.4.1 Geography**

The MED countries are a very diverse group. There are considerable differences in terms of size, geography, population and GDP. The largest country in terms of area is Algeria (2.4 million square kilometres) that accounts for close to half the total MED area, but population-wise Turkey and Egypt are twice as big (68 and 65 million respectively, against 31 million in Algeria). The MED region covers 5.3 million square kilometres and is home to about 241 million people, as compared to the 3.1 million square kilometres of the EU populated by 378 million.

Moreover, Israel and Turkey alone represent more than half of the total GDP of the region (124 and 164 billion Euro). Malta is the smallest country in terms of area (316 square kilometres) and population (395 thousand) but its GDP (4 billion Euro) is comparable to that generated by the Palestinian Authority for a population nearly ten times larger.

The MED region features about 57 ports handling over 1 million tonnes per year, of which 17 are in Turkey, 8 in Algeria and 8 in Morocco. In Lebanon and in Jordan there is only one major port. The number of major MED ports does not compare with the 293 scattered across the EU, but it is nearly three times the number of those operating in the CEC.

### **2.4.2 History**

Traders have forged the history of the Mediterranean and they maintained that thread of continuity that links land and agricultural civilizations which over the centuries have conquered other lands and expanded their dominions, inevitably falling victim themselves in turn to a new foreign civilization. The word "Phoenician" is Greek for "People of the Sea." They determined their direction by looking at the sun and the stars. For many years the North Star was known as the Phoenician Star. They become the greatest traders and the best sailors and navigators of

the pre-classical world. They are also the first people to establish a large colonial network based on seafaring.

Their broad-bottomed single-sail cargo ships transported goods from Lebanon to the Atlantic coast of Africa, Britain, and even the Canary Islands, and brought goods back in the opposite direction, stopping at trade centre's anywhere else between. The Phoenician sailed mostly during the day and only in good weather between March and October. They headed to shore the first sign of a storm or some other problem. They traveled around five knot an hour. They could make 100 miles in 24 hours but usually traveled around 25 to 30 miles.

The Phoenicians were merchant marines. Their ships traveled under many flags. From what can best be ascertained Phoenician ships had crews of about a half dozen sailors and the typical meal was fish stew. Seamen carried images of god to protect them from storms and pirates. Incense offerings to the gods were made at the beginning and end of every voyage. They might also have also been lit on voyages during violent storms.



[Fig 7: Phoenetic Punic ship](#)

Trade and the search for valuable commodities necessitated the establishment of permanent trading posts and, as the Phoenician ships generally sailed close to the coast and only in daytime, regular waystations too. These outposts became more firmly established in order to control the trade in specific commodities available at that specific site. In time, these developed further to become full colonies so that a permanent Phoenician influence eventually extended around the whole coastline of the ancient Mediterranean and the Red Sea.

The Phoenicians, based on a narrow coastal strip of the Levant, put their excellent seafaring skills to good use and created a network of colonies and trade centres across the

ancient Mediterranean. Their major trade routes were by sea to the Greek islands, across southern Europe, down the Atlantic coast of Africa, and up to ancient Britain. In addition, Arabia and India were reached via the Red Sea, and vast areas of Western Asia were connected to the homeland via land routes where goods were transported by caravan. By the 9th century BCE, the Phoenicians had established themselves as one of the greatest trading powers in the ancient world.



[Fig 8: Trade route followed by Phoenicians](#)

### **2.4.3 Commodity flow in Ports of Euro-Med**

The great majority of the EU imports and exports to and from the MED countries are transported by sea. Maritime transport was the vehicle for the 143 833 thousand tonnes worth 77 billion Euro exchanged in 2001, characterizing 76.4% of the total flows in terms of tonnage and 53.1% in terms of value (the tonnage exported from the EU to the MED region by sea is even higher than the imports, with close to 90% against 71%).

Among the EU countries, Italy, France, Spain and Germany are leading partners in Euro-Mediterranean trade. In fact, 34% of the total tonnage of goods imported from the MED region is directed towards Italy, 19% towards Spain, 16% towards France and 10% towards Germany. These countries also represent respectively 21%, 11%, 19% and 13% of the exports absorbed by the MED region.

Over 80% of the exports of individual EU countries to the MED region are shipped by sea; the only exceptions being Germany (71%) and, obviously, Luxembourg (37%) and Austria (33%) given that these two countries do not have any direct access to the sea. However, 63% of the imports to Italy are by sea and only 52% of those to the Netherlands. The figure for Germany

might also seem lower than expected (13%) but this is also a consequence of the large part of sea-to inland waterways transport.

		Mio tonnes	loaded/ unloaded	% change previous year	Number ports with over 1 Mio tonnes	Number passengers (1000)	% change previous year
<b>MED</b>		477.3	0.9	-2.2	57	9 667	1.6
<b>EU</b>		2 998.9	0.5	0.5	293	299 988	-10.3
<b>CEC</b>		221.3	2.8	3.5	21	10 319	-14.5

Table 1: Maritime transport indicators in the MED, EU and CEC regions

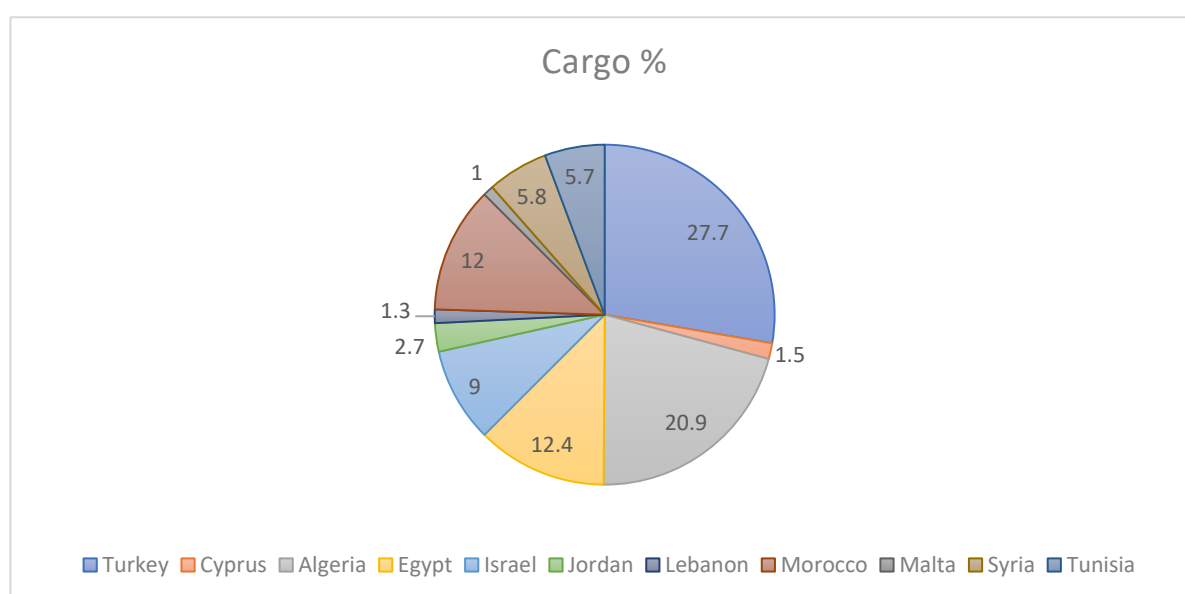


Fig 9: Share of goods handled by sea in MED countries

In the EU around 2/3 of the goods handled are unloaded and one third loaded. All EU member states unload more than they load. The same does not hold in MED ports; the overall tonnage loaded within the region is slightly smaller than the tonnage unloaded, but the pattern varies largely from one country to another.

The total volume of cargo loaded and unloaded in MED ports reached over 473 million tonnes in 2001, increasing annually by at least 1.7% since 1997. Overall, more rapid growth is reported between 1994 and 1997. As compared to 2000, in 2001 tonnage has increased in some MED countries but not all. A slight decrease in the volumes is reported in Cyprus, Algeria, Israel, Syria and Turkey which have contributed to a negative growth rate between the two years. The overall positive trend observed during the last few years is confirmed by most of the individual

MED countries; growth was nevertheless more rapid during the second period (1997-2001) in countries like Malta, Morocco and Egypt. In Lebanon, maritime freight saw a peak in 1995, then declined steadily until 2000, but seems to be recovering in 2001. In Cyprus traffic dipped between 1995 and 1998 but has been slowly rising since. The three Maghreb countries (Algeria, Tunisia and Morocco) have experienced a stable increase since 1990.

In 2001 the EU channelled just over 6 times more goods by sea than the MED countries, reaching close to 3 billion tonnes of freight loaded and unloaded. Maritime transport in the EU has expanded from 2 912 million tonnes handled in 1997 to 2 999 million tonnes handled in 2001, at a slower rate (0.7% per year) than that experienced in the MED region. Total tonnage remained stable between 2000 and 2001. The Central and Eastern European major ports totalled about 221 million tonnes.

With a turnover of about 132 million tonnes Turkish ports account alone for close to 28% of the total MED maritime trade, followed by Algeria (100 million), Egypt (55 million in 2000) and Morocco (58 million). These volumes are similar to those achieved by EU countries like Denmark, Finland and Portugal, with respectively 94 million, 96 million and 56 million tonnes in 2001, but they are smaller than the leading EU maritime economies, such as the United Kingdom, Italy, the Netherlands and France with tonnages ranging from 566 million to 317 million tonnes.

Country	Name of main port	Tonnage handled at main port	% share over total	Number of ports with over 1 Mio tonnes
<b>CYPRUS (CY)</b>	Limassol	2 878 795	41.0	3
<b>ALGERIA (DZ)</b>	Bethiouia	34 918 745	35.1	8
<b>EGYPT (EG)</b>	Alexandria	32 246 900	54.6	5
<b>ISRAEL (IL)</b>	Haifa	16 719 000	38.9	4
<b>JORDAN (JO)</b>	El Akaba (Aqaba)	13 043 059	100.0	1
<b>LEBANON (LB)</b>	Beirut	5 464 441	88.5	1
<b>MOROCCO (MA)</b>	Casablanca	20 161 354	35.1	8
<b>MALTA (MT)</b>	Marsaxlokk	2 765 038	57.6	2
<b>SYRIA (SY)</b>	Baniyas	16 865 000	58.2	3
<b>TUNISIA (TN)</b>	La Skhira	5 483 629	20.1	5
<b>TURKEY (TR)</b>	Izmit	34 621 444	26.2	17
<b>TOTAL MED</b>		<b>185 167 405</b>	<b>38.7</b>	<b>57</b>

[Table 2: Name, tonnage and share handled at main ports](#)



#### **2.4.4 Sea passengers and Cruises**

It is worth noting that while EU-MED maritime passenger transport is limited to a small number of regular ferry routes, there is a growing interest for cruises within the region. Maritime passenger transport (excluding transportation performed in sheltered waters) is small phenomenon as compared to other modes, and it is limited mostly to Egypt, the Maghreb region and Turkey. In the EU about 335 million passengers were serviced in 2000, although it must be kept in mind that being intra-EU ferry connections the most relevant part of this traffic.

Faster growth is expected in European demand increasing the market of short cruises and boosting the Mediterranean as a strategic destination, packed with historical interest in addition to sun and bathing.

The main ports by traffic and investment in cruise facilities within the north shores of Mediterranean basin are Piraeus (Greece), Barcelona and Palma de Mallorca (Spain), Civitavecchia and Livorno (Italy), and Marseille (France). On the southern shores of the Mediterranean basin cruise passengers are a relevant business not only for islands like Cyprus and Malta, but also for tourist destinations in Israel, Tunisia, Morocco and, most probably, in some Turkish ports. The port of Limassol in Cyprus hosted over 1 thousand cruises in 2000 carrying close to 200 thousand tourists in transit and most of the passengers embarking or disembarking are tourists starting or ending a cruise.

#### **2.4.5 The Busiest ports in the Euro-Mediterranean region**

The 15 biggest ports in the MED region based on the gross weight of goods handled achieved freight turnovers of well over 11 million tonnes each. The list includes three Algerian ports, four Turkish ports, two Egyptian ports, two Moroccan ports and two Israeli ports. A Syrian and the sole Jordanian port also appear, but there are no Lebanese, Tunisian, Maltese or Cypriot ports represented. The top-5 performances were achieved by the ports of Bethioua in Algeria (34.9 million tonnes), of Izmit in Turkey (34.6 million tonnes), of Alexandria in Egypt (28 million tonnes; 2000 figure), of Skikda in Algeria (24 million tonnes) and of Aliaga in Turkey (21 million tonnes). They accounted for 30% of the total tonnage of the region.

In 2001 the five most important EU ports (Rotterdam, Antwerp, Marseille, Hamburg and Le Havre) were responsible for 22% of the total tonnage handled in the EU. Rotterdam alone

accounted for 297 million tonnes, a volume of cargo about 8.5 times greater than the leading MED port of Bethioua. Although they do not appear among the top-5 ports, there are four United Kingdom ports which are rated in the EU list of the 15 biggest.

#### **2.4.6 Main types of Cargo and Commodities**

Maritime activity in the MED countries is still strongly related to bulk cargo and this characterizes the flows, the vessels and the type equipment available in the ports. Algeria hosts three of the biggest oil terminals in the region (Bethioua, Skikda and Arzew) which in 2001 largely contributed to the 83% share of liquid bulk dominating in this country's maritime economy. The same occurs in Syria.

- 1) Liquid bulk is also predominant in Turkey (51 million tonnes in 2001) where it accounts for 38% of the total tonnage performed. Another 25% of the overall activity of Turkish ports is made of dry bulk, with solid mineral fuels, iron ore and cement being the most the relevant commodity categories. In Tunisia, 12 million tonnes of liquid bulk represent 44% of the country's maritime traffic turnover and nearly half of it is generated by the port of La Skhira.
- 2) Dry bulk is the first cargo type for Jordan's only port, Aqaba (63%), and it is mainly attributed to the carriage of over 6 million tonnes of phosphates, potash and fertilizers. In the Israeli ports, where agricultural products (mainly citrus fruits) and solid mineral fuels are predominant products, dry bulk is again a predominant cargo category (40%), also thanks to the specialized terminal in Hadera that is importing close to 7 million tonnes of coal per year. Morocco features 54% of dry bulk (mostly phosphates, cereals and crude and manufactured minerals) and 28% of liquid bulk (generally petroleum and chemicals). In the major Egyptian ports, dry bulk accounts for 41% of the goods handled.

About 44% of the cargo handled in the EU (excluding Greece) is made up of liquid bulk and 26% of dry bulk; however, close to half of the remaining 30% is channelled through EU ports by container (13%) and 11% by ro-ro units. Container transport is particularly significant in EU countries like Germany (27% of total tonnage) and Belgium (23%) whereas the share of ro-ro units is high in Denmark (26%), Sweden (25%) and Ireland (19%).

Count r		Liquid bulk	Dry bulk	Container s	Ro-ro		Other general cargo	Not classified		TOTAL
<b>CYPRUS (CY)</b>		3 177	1 616	1 511		163	555		2	<b>7 024</b>
<b>ALGERIA (DZ)</b>	(1)	82 262	8 236	2 145	:		6 932	-		<b>99 575</b>
<b>EGYPT (EG)</b>	(2)(3)	7 281	22 449	:	:		16 111		8 936	<b>54 777</b>
<b>ISRAEL (IL)</b>		9 233	17 099	13 054	:		3 597			<b>42 983</b>
<b>JORDAN (JO)</b>		429	8 139	218		179	3 963		115	<b>13 043</b>
<b>LEBANON (LB)</b>	(4)	1 435	326	1 764	:		1 963		685	<b>6 173</b>
<b>MOROCCO (MA)</b>	(5)	16 244	30 829	3 628		3 002	3 801			<b>57 504</b>
<b>TUNISIA (TN)</b>	(2)	12 095	9 916	1 714		879	2 628	:		<b>27 232</b>
<b>TURKEY (TR)</b>		50 726	33 002	11 692		5	2 389		4 501	<b>132 316</b>

Table 3: Main cargo types handled in MED ports (in thousand tonnes)

Whereas for Algeria, Tunisia and Lebanon the share of maritime routes with the EU has been more or less stable during the last few years, a slight decline can be appreciated in Jordan and a clear increase can be observed in Turkey. When the Central and Eastern European countries, shares rise from an additional 0.9% in Algeria to an additional 4.6% in Tunisia.

With its central position in the Mediterranean basin, Italy is the leading partner for MED ports. It attracts 31% of the total tonnage unloaded in the EU and 27% of the tonnage directed from the EU ports to the MED region, for a total volume of 71 thousand tonnes.

Goods coming from/carried to the EU generally absorb over 27% of total tonnage handled in each country's ports. The only exceptions are Jordan (13%) and Turkey (19%). Jordan's main maritime partners are the Indian sub-continent (28%) and the Far East (23%); while the main relations for Turkish ports are those with Central and Eastern European countries and the Balkans (44%). The weight of the MED countries in the EU maritime traffic is much smaller and represents in average no more than 8% of the overall tonnage handled. Nevertheless, 72% of cargo unloaded in the Netherlands comes from MED ports, as well as 27% of the goods unloaded in Spain, 17% of the goods unloaded in Italy and 16% of those unloaded in France. The share of MED-directed traffic in EU outward flows is however always under 12%.

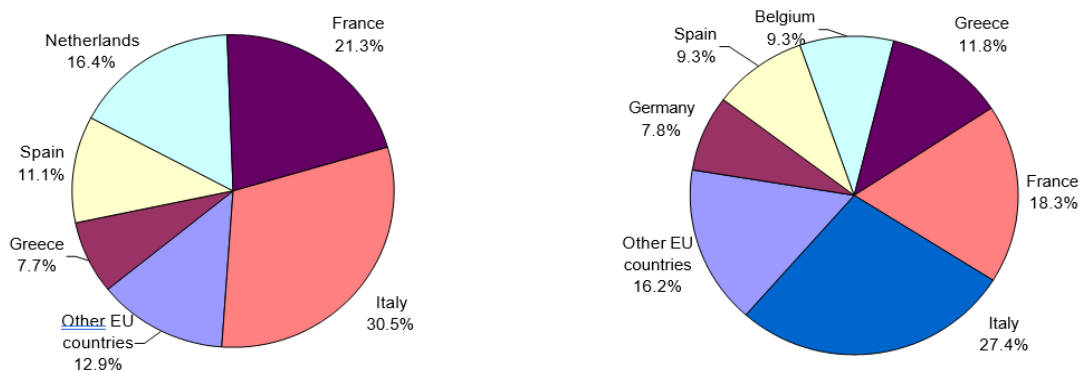


Fig 10: Main EU countries loading & unloading goods to and from MED ports

About 25 million tonnes were conveyed by sea between Egypt and Italy in 2000; 23 million between Egypt and the Netherlands, and 18 million between Algeria and France. These three most important corridors accounted for 27% of the total flows. There were in total 25 maritime routes between an EU and a MED country carrying atleast 2.4 million goods during the year. Seven of these corridors ended on the EU side in Italy, five in France and 4 in Spain. On the MED side, Egypt and Algeria attracted the major routes in seven cases each, while Turkey appears only three times.

## **2.4.7 Logistics in the Mediterranean**

Logistics constitutes a decisive factor for Euro-Mediterranean integration and is present in all value chains. Studies on Euro-Mediterranean trade and integration reveal the strategic importance of logistics. Optimization of logistics chains is a component of competitive advantage in the Mediterranean Region. Based on appraisal of the situation, macro-logistic, meso-logistic and micro-logistic decisions have been taken and applied. It is in this dynamic that logistics policies have emerged in South Mediterranean countries to accompany those of their North Mediterranean counterparts. To grasp what is at stake with these policies and ascertain the perspectives of logistics in the Mediterranean, an appraisal of the (in south shore countries) is essential.

### Overview of the current state of logistics in the Mediterranean

The Mediterranean Partner Countries (MPCs), particularly those in the South Mediterranean, display numerous logistics-transport weaknesses. The proximity to the European market of countries such as Morocco and Tunisia, well-integrated into Euro-Mediterranean trade, lends

them a competitive advantage in responsiveness for time-sensitive sectors with respect to areas offering lower costs (low-cost countries) but that are farther away. This relatively competitive advantage is unfortunately hampered by logistics underperformance on all levels.

- An elevated logistics cost equivalent to 20% of the average GDP in South Mediterranean countries;
- Warehousing infrastructures underdeveloped or not developed at all, a dearth of logistics platform networks and skills networks throughout the global logistics chain; a weak supply of logistics services with little diversification, absence of real national logistics service providers, the presence of multinational operators together with the emergence of a few national operators, above all in Morocco;
- Maritime and port transport fully in process of restructuring: port reform with transfer of terminals management to private materials handlers, often multinationals; active private-public partnership with concession of materials handling to private operators, often multinationals (Tanger Med, Casablanca, Port of Bejaia, Algiers, etc.); fleet privatisation (Morocco) or its strengthening in the public sphere (Algeria, Tunisia, Libya, etc.).

Industrial and commercial agents generally prefer insourcing logistics activities. Only some out-source transport and warehousing operations. Logistics insourcing is due to the reluctance of these operators to trust third parties with in-company business information. Transport and warehousing represent a substantial share of the market for logistics service providers. Unfortunately, the level of services offered is relatively low in quality, with sub-standard technical conditions.

Logistics subcontracting of the 3PL type (Third- Party Logistics: warehousing, inventory management, order picking, organisation of physical distribution, information and value-added services) are provided primarily by foreign companies or companies oriented towards international trade, whereas Maghreb company offers only cover transport or simple warehousing. Finally, institutions and often legislation are not adapted to the dynamics of logistics.

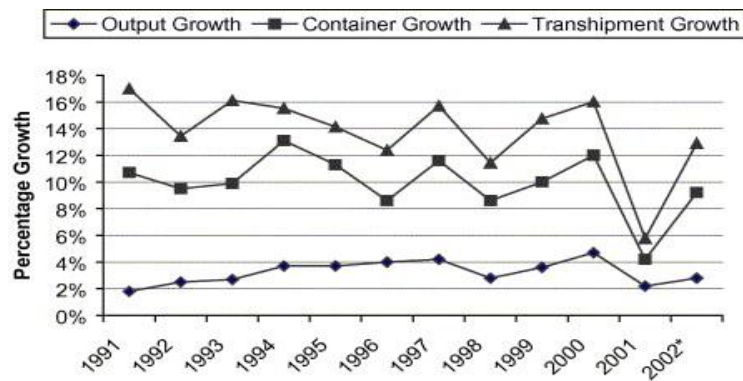
Conferences and events have taken place in several Mediterranean countries, organised by national governments, the European Union (UE), professional associations, study or research centres and universities. Trade fairs dedicated to logistics and transport have become meeting places for national and international logistics providers, both public and private, as well as other stakeholders. All of these gathering places and events have served as spaces for reflection, study and proposals regarding the development of the logistics sector in the MPCs.

### **3. Gateways to Hubs**

Rapid increase in container port traffic worldwide led to higher demands for port capacity. As an economical mode of transportation, the significance of liner shipping grew. It was complex because of multiple ports. Major container ports were evaluated, highlighting the growing importance for transshipment. It was evident since the beginning of containerization.

#### **3.1 Concept of Transshipment**

“Transshipment” refers to the shipment of goods or containers to an intermediate destination before being taken to their destination. A ship can undergo more than one transshipment from its journey from origin to destination.



[Fig 11: Transshipment Growth](#)

Transshipment was initially developed to service smaller ports unable to accommodate large container ships, which is commonly because of limited draft and port infrastructure. However, as maritime networks became increasingly complex, specialized transshipment hubs emerged. Unlike air transportation, transshipment requires significant yard space since containers are stored up for to a few days while waiting for the connecting ship(s) to be serviced. The growth in global trade has involved greater quantities of containers in circulation, which incited maritime shipping companies to rely more on transshipment hubs to connect different regions of the world.

#### **3.2 Transshipment Hubs**

Geography plays an important role in the setting of a transshipment market, which is often at the crossroads of shipping routes and where there is a bottleneck such as a strait or a canal. A

look at the map below underlines that they are dominantly located along the main circum-equatorial maritime route that goes through Panama, the Strait of Malacca, Suez and Gibraltar. This route is particularly used for the Asia–Middle East–Europe trade. Major transshipment hubs usually have a low maritime deviation (distance from main shipping lanes) and many provide connectivity (intersection) between north-south and east-west shipping lanes.

The degree of transshipment activity of a port can be measured by their transshipment incidence, which is the share of the total port throughput that is “ship to ship” compared with the total throughput that includes hinterland traffic as well. The higher it is, the more a port can be considered as a transshipment hub. For ports with low transshipment incidence (less than 25%), transshipment is an incidental activity, while ports having a transshipment incidence above 75% can be considered as “pure” transshipment hubs (particularly if their transshipment incidence is above 90%).

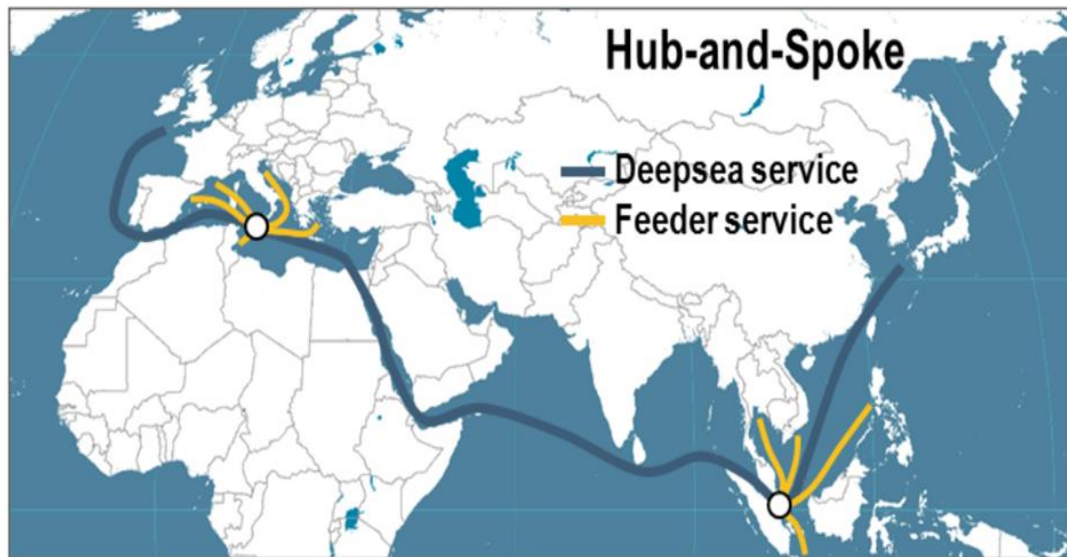
The main rationale of using transshipment hubs is to improve the overall efficiency and geographical coverage of maritime container shipping networks. A transshipment alternative enables to link ports to the global maritime shipping system in a more effective manner considering existing ship assets. The insertion of a transshipment hub within existing networks takes three major forms for different purposes, namely Hub-and-Spoke, Intersection transshipment and Relay transshipment.

### **3.3 Forms of Transshipment**

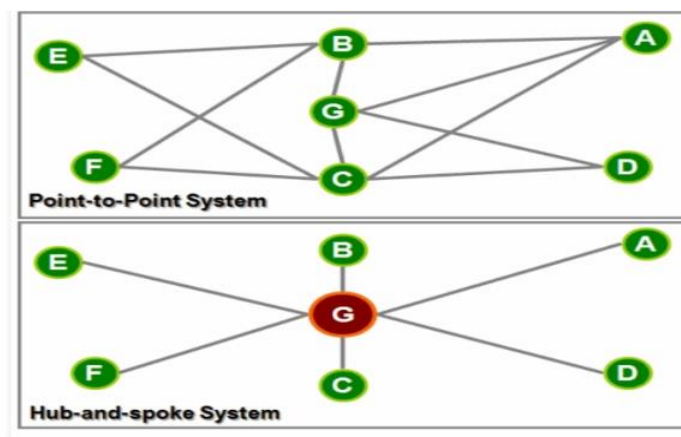
1) **Hub-and-Spoke Transshipment**, which connects short distance feeder lines (and ports) with long distance deep-sea lines, linking regional and global shipping networks. The transshipment hub is usually a central location commanding access to a region such as for the Caribbean or the Mediterranean. Ship capacity differs significantly between deep sea and feeder services. While the former usually involve the largest ships technically possible, feeder vessels are usually much smaller.

Transshipment was initially developed to service smaller ports that had poor nautical accessibility or limited infrastructure, which lead to the setting of hub-and-spoke networks. At a later stage, intersection and relay forms of transshipment were introduced, enabling different levels of connectivity within global maritime shipping networks.





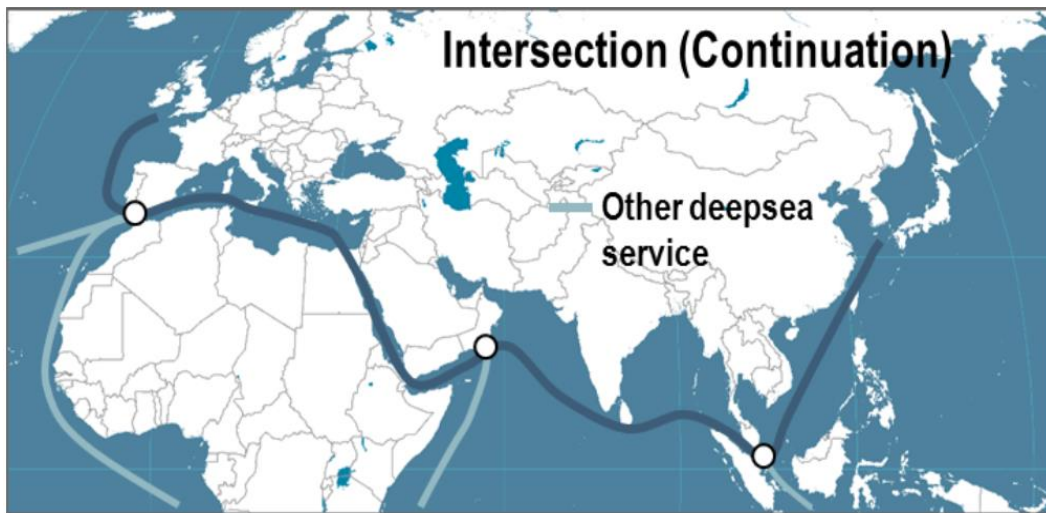
[Fig 12: Hub-and-Spoke](#)



[Fig 13: Hub and Spoke & Point-to-Point](#)

The above figure illustrates the difference between the point-to-point system and the hub and spoke system. The hub system is more advantageous if the countries have mutual dealings. It will help serve better and reduce unnecessary travel.

**2) Intersection Transshipment**, where the hub acts as a point of interchange between several long-distance shipping routes. It usually involves the movement of cargo between large ships since deep sea routes are prone to economies of scale. Ship capacity between routes are relatively similar but can vary depending on the ranges being serviced. The most suitable locations tend to be bottlenecks such as Singapore, Algeiras or Tangier Med.



[Fig 14: Intersection Hub](#)

3) **Relay Transshipment**, where the transshipment hub connects shipping routes along the same region but servicing different port calls. Ship capacity can differ since regional routes can be serviced by smaller ships. Some regional services may call the same port, permitting additional opportunities for relay forms of transshipment.



[Fig 15: Relay Hub](#)

While the hub-and-spoke function accounts for about 85% of all transshipment activities, intersection and relay functions account for about 15%.

Because of geographical considerations, transshipment markets are unlikely to change, but which ports are the dominant transshipment hubs of these market could. Maritime shipping companies also elect for transshipment to use more rationally their networks; more ports are serviced without increasing ship assets. In a conventional deep-sea container service, a

maritime range such as the American East Coast or Northern Europe involve several port calls. If the volume is not enough, this may impose additional costs for maritime companies that are facing the dilemma between market coverage and operational efficiency.

### **3.4 Scope of Transshipment Hubs**

There are several factors why transshipment hubs are used, particularly with the growing size of container ships that forces a lower number of port calls.

- By using an intermediate hub terminal in conjunction with feeder shipping services, it is possible to reduce the number of port calls and increase the throughput of the port calls left.
- The intermediate hub enables a level of accessibility that incites them to look beyond their conventional transshipment role. This includes actions to extract more values out of cargo passing through and, as such, get more economic rent out of transshipment facilities. Such strategies have led to some transshipment hubs, such as Gioia Tauro and Algeciras, to develop inland rail services to capture and serve the economic centers in the distant hinterlands directly.
- A more common strategy is the development of port-centric logistics zones. The multiplying effects of being an intermediate hub in terms of frequency of port calls and connectivity to the global economy can thus be leveraged for developing hinterland activities. The port and its geography therefore continue to adapt to technological and economic changes, leading to a variety of location factors and associated port functions such as manufacturing ports, industrial ports, gateway ports and transshipment ports.
- The transshipment region could be stable in its level of transshipment activity while its individual transshipment hubs could experience fluctuations in their market share. The usage of transshipment hubs remains a decision made by maritime shipping companies that do so to organize their shipping networks. Such decisions can change if a company revises the allocation of its assets and its commercial strategy.
- There was a steady demand for small ships, which can collect the freights from neighboring ports to the hub ports. As for the Asian region where there are many islands, the utility of small vessels will become even greater due to the region's

characteristics. Another reason for the increased demand for small ships is the lack of ports that could accommodate large vessels.

### **3.5 World's Main Intermediate Hubs, 2007-12**

Transshipment emerged in the 1970s as trade with Asia increased but volumes were not enough to justify direct connections to many ports. Ports such as Singapore, Busan, Tokyo and Kaohsiung emerged as the first transshipment hubs. This eventually led to the setting of pure transshipment hubs at key locations along major shipping routes, such as Colombo, Salalah, Gioia Tauro, Algeciras and Kingston.

The emergence of major intermediate hubs favored a concentration of large vessels along long distance high capacity routes while smaller ports could be serviced with lower capacity ships. Economies of scale over long distances are thus reinforced, permitting liner services that would otherwise be economically unfeasible. However, there is a limit to the hub-and-spoke network configuration and consequently also to the size of the vessels being deployed on the trunk routes.

Seven major transshipment markets accounting for the bulk of the transshipment activity. They are referred as markets since transshipment is an activity that is not tied to a specific port, unlike gateway traffic linked with a hinterland and inland freight distribution. Therefore, transshipment hubs compete for the traffic related to a region / market.

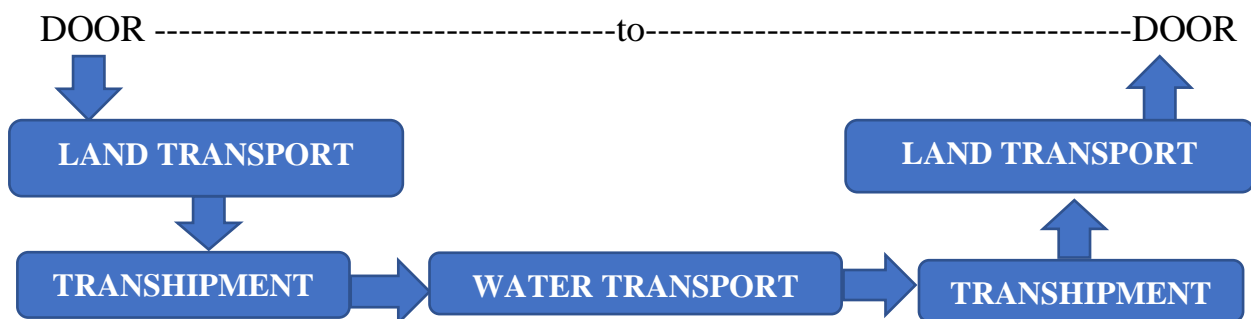
1. The world's most important intermediate hub is Singapore where 85% of the traffic is transshipment, which accounted for more than 26.9 million TEUs of transhipped containers in 2012. The major Asia – Europe shipping lanes are constrained to pass through the Strait of Malacca, which incited to setting of an adjacent transshipment hub competing with Singapore; Tanjung Pelepas.
2. There can be also a shift in the transshipment dynamics due to the changing commercial environment. For instance, transshipment incidence levels in the Japanese ports of Tokyo and Yokohama used to be in the 20% range but have declined to less than 10% as Japan was losing its role as a manufacturing center with many transshipment activities shifting to Korea or China.
3. The Mediterranean has only two points of entry (Suez and Gibraltar), both of which

have significant transshipment activity, as well as ports that are at the center of the basin (e.g. Marsalokk and Gioa Tauro).

4. Although the Caribbean has a large exposure on the Atlantic side, it has one outlet for the Pacific; the Panama Canal which has significant transshipment activities both on the Atlantic and Pacific coasts. The Caribbean generates limited cargo demand, but neighboring regions are substantial generator of traffic, some of which is being transshipped in the region (East and Gulf coast of the United States, Central America and northern South America).
5. The North Sea and the Baltic are another transshipment market, but of lower incidence since the Baltic generates less freight volumes. Since the Baltic is a dead-end, it is subject to tail-cutting with its ports serviced by feeder services from northern Europe (e.g. Antwerp, Hamburg).

### **3.6 Container v/s Ro-Ro**

Intermodal Freight Transport: It is the transport of goods in one loading unit, using two or more modes of transport successively, without handling the goods themselves.



**Door-to- Door Delivery Flowchart**

In both cases (container and Ro-Ro technology) the first and last links (land transport) are the same and are unavoidable. Therefore, further consideration is limited only to the rest of the transport chain, i.e. two transshipments and waterborne transport. Thus, both links of intermodal chain, the waterborne part and transshipments to/from container and Ro-Ro vessels should be compared.

The transshipment of containers to/from the container vessels has to be done vertically (hence the abbreviation Lo/Lo), contrary to the horizontal transshipments (Roll on/Roll off).

### Significance of Ro/RO

Lo-Lo transhipment of containers is efficient only if dedicated equipment is used, as for instance spreaders, expensive gantry cranes (for massive transhipment of containers), reach stackers (for smaller terminals), etc. Otherwise, transhipment will be relatively slow and therefore unacceptable. Furthermore, for successful utilization of container technology it is often necessary to have transhipment equipment also at destination and origin points, in the hinterland, rather than just in the ports, with the necessary expertise.

Contrary to Lo-Lo, the Ro-Ro transhipment of trucks and trailers is simple and fast, and there is no need for expensive cargo handling equipment either in the ports or places of cargo origin/destination. So, Ro-Ro ports, or better Ro-Ro terminals, are large parking places; necessary transhipment equipment – the ramp – usually belongs to dedicated Ro-Ro vessels. Once ashore, the wheeled cargo can immediately move away from congested port area, which is one of the advantages of Ro-Ro service.

In the recent years, demand for Ro-Ro is evident and is steadily increasing. Container and Ro-Ro is got its own significance. It is chosen according to the purpose and facilities available.

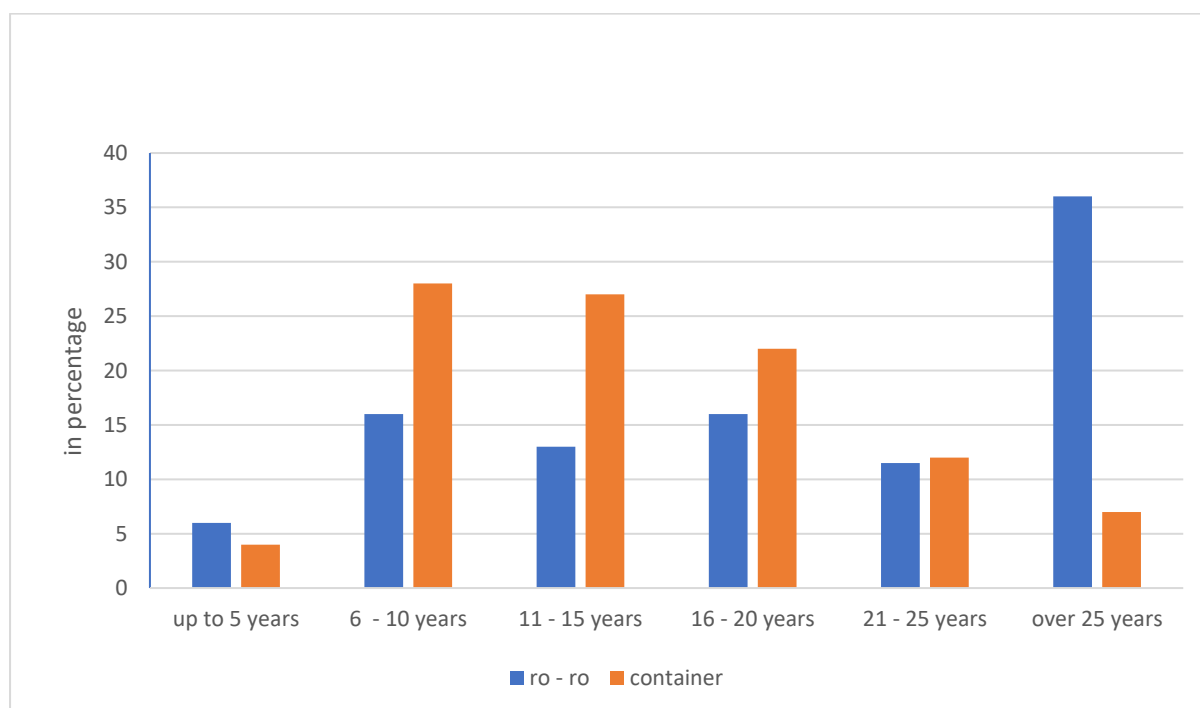


Fig 16 : Age Structure of the Ro-Ro and Container Fleet Employed on Regular European Short Sea Services

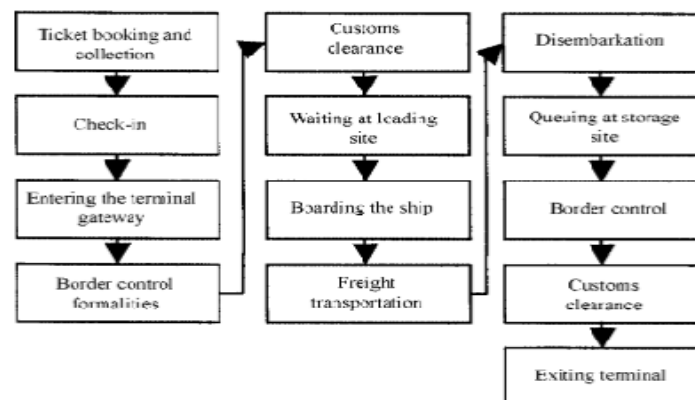
### 3.7 Practise of Ro-Ro shipping in EU

At first, wheeled vehicles carried as cargo on oceangoing ships were treated like any other cargo. Automobiles had their fuel tanks emptied and their batteries disconnected before being hoisted into the ship's hold, where they were chocked and secured. This process was tedious and difficult, and vehicles were subject to damage and could not be used for routine travel.

An early roll-on/roll-off service was a train ferry, started in 1833 by the Monkland and Kirkintilloch Railway. Designed to carry rotating loads on wheels such as cars , trucks or rail cars , the Ro / Ro unlike standard merchant ships , sometimes improperly called Lo-Lo ( lift-on / lift-off ) that use a crane to embark or disembark a load, have slides or ramps that allow the cars to go up (roll on) and get off (roll off) from the boat when it is in port . They are generally equipped with multiple garage bridges connected with access ramps.

Types of RORO vessels include ferries, cruise ferries, cargo ships, barges, and Ro-Ro service for air deliveries. New automobiles that are transported by ship are often moved on a large type of RORO called a pure car carrier (PCC) or pure car/truck carrier (PCTC).

Elsewhere in the shipping industry, cargo is normally measured by the metric tonne, but RORO cargo is typically measured in lanes in metres (LIMs).



[Fig 17: Flow chart of Freight transportation by ro-ro ships](#)

#### 1) ConRo:

The ConRo vessel is a hybrid of a RORO and a container ship. This type of vessel has a below-deck area used for vehicle storage while stacking containerized freight on the top decks. ConRo ships, such as the G4 class of the Atlantic Container Line, can carry a combination of



containers, heavy equipment, oversized cargo and automobiles.



Fig 18: ConRo carrier

## 2) RoLo:

A RoLo (roll-on/lift-off) vessel is another hybrid vessel type, with ramps serving vehicle decks but with other cargo decks only accessible when the tides change or using a crane.



Fig 19: RoLo carrier

## 3) LMSR:

Large, Medium-Speed Roll-on/Roll-off (LMSR) refers to several classes of Military Sealift Command (MSC) roll-on/roll-off type cargo ships. Some are purpose-built to carry military cargo, while others are converted.





**Fig 20: LSMR carrier**

#### **4) ROPAX:**

The acronym ROPAX (roll-on/roll-off passenger) describes a RORO vessel built for freight vehicle transport along with passenger accommodation. Technically this encompasses all ferries with both a roll-on/roll-off car deck and passenger-carrying capacities, but in practice, ships with facilities for more than 500 passengers are often referred to as cruiseferries.



**Fig 21: ROPAX carrier**

#### **Ro-Ro in European Seas**

RoRo short-sea shipping in EU is better integrated and better utilized today and offers a step towards sustainable and in addition more efficient supply chains from both an economic and social perspective.

One EU initiative is the Marco Polo Programme which shifts freight from the road to sea, rail and inland waterways at some designated routes and areas. Now the Marco Polo II Programme (2007-2014) where several inter-state RO-RO shipping routes or ‘Motorways of the Sea’ are

planned is put into practice with an annual budget of around 60 million euro.

The Baltic Sea, North Sea, and Mediterranean Sea are known as the waters where RO-RO shipping services are quite active in Europe.

Ro-ro is especially relevant in Europe, where over 65% of the total Ro-Ro fleet by vessel capacity operates. For intra-European maritime transport, Ro-Ro volumes in 2013, the last year for which statistics are available, were approximately 235 million ton. This is comparable to containerized volumes of 250 million ton.

<u>No.</u>	<u>Country</u>	<u>Cargo (min ton)</u>
<b>1</b>	Italy	88.5
<b>2</b>	Greece	19.9
<b>3</b>	Spain	13.2
<b>4</b>	Turkey	8.5
<b>5</b>	France	6.0
<b>6</b>	Slovenia	0.9
<b>7</b>	Malta	0.6
<b>8</b>	Croatia	0.3
<b>9</b>	Romania	0.3
<b>10</b>	Bulgaria	0.2
<b>11</b>	Cyprus	0.2
	<b><u>Total</u></b>	<b><u>130.6</u></b>

Table 4: Ro-Ro Cargo Turnover by Countries

In 2015, a total of 464 million tons of wheeled cargo was carried on-board ferries and ro-ro's to and from the EU's main ports, an increase of 4.3% year-on-year against 2014's 445 million tons.

<u>No.</u>	<u>Country</u>	<u>Port</u>	<u>Cargo (mill ton)</u>
<b>1</b>	<b>UK</b>	Dover	27.1
<b>2</b>	<b>FR</b>	Calais	19.5
<b>3</b>	<b>UK</b>	Immingham	16.1
<b>4</b>	<b>BE</b>	Zeebrugge	13.9
<b>5</b>	<b>DE</b>	Travemunde	12.8
<b>6</b>	<b>IE</b>	Dublin	11.7
<b>7</b>	<b>NL</b>	Rotterdam	11.7
<b>8</b>	<b>SE</b>	Trelleborg	10.9
<b>9</b>	<b>IT</b>	Livorno	9.5
<b>10</b>	<b>SE</b>	Gothenburg	8.7
		<b><u>Total</u></b>	<b><u>141.9</u></b>

[Table 5: Europe's top 10 ro-ro freight ports \(2015\)](#)

## **4. REVIEW ON OPTIMED PROJECT**

An International Conference on "Infrastructure and Transport Systems" was organized by AIIT (Italian Association of Traffic and Transport) in Rome for three days.

An idea was put forth by Paolo Fadda, Gianfranco Fancello, Claudia Pani and Patrizia Serra, under the name of “Optimed Project: A New Mediterranean Hub-Based Ro-Ro Network”, whose main objective was to design a new optimised corridor between the two shores of the Mediterranean Sea. The new corridor based on the hub-based concept composed of two hub ports: Porto Torres (Italy) and Beirut (Lebanon) serving the north-western area and the south-eastern area, respectively.

The purpose of this project was to overpower the limitations of the current ro-ro networks. It was not highly reliable, irregular and took long duration to reach the destination (because of many intermediate stops in between). The departures and arrivals were uncertain and not coordinated in a good way. To overcome such limits, the OPTIMED project was formulated to connect the Mediterranean shores of north-west and south-east countries. It arose to improve trade and accessibility between the countries and eased the trade saving time, money, and efforts.

Hub based network facilitated regular services at regular intervals. The management and coordination activities at hubs promoted trade. A data collection process was conducted to identify the current scenario in order to frame a new network with defined nodes (ports) and arcs (links). The new structure that could support the ever-changing demand rates was built-up. Environmental study was conducted to ensure a network that's environmentally friendly.

### **4.1 Project Objective**

The main objective of the project is the optimization of maritime trade network between northern shores of high tyrrhenian arc and the southern eastern shores of the Mediterranean Sea around ports strengthened as Ro-Ro hubs. It can be achieved by developing connections between public and private operators in the maritime and logistics sector.

In order to achieve this goal, the six organizations which are part of the project propose an innovative hub-based Mediterranean transport option characterised by scheduled and reliable

new hub-based port facilities and a virtual logistics platform able to enable users to plan shipping services



[Fig 22: EU & MENA Regions](#)

A trade between north-western and south-eastern shores facilitated easy flow because of its geographical location. It brought together few EU and MENA countries that shared the Mediterranean basin.

It aims to promote a harmonious and sustainable cooperation process in the Mediterranean, addressing the common challenges and enhancing the area's endogenous potential. This is a multilateral cross-border cooperation initiative funded by the European Neighbourhood and Partnership Instrument (ENPI) which involves 14 countries: Cyprus, Egypt, France, Jordan, Greece, Israel, Italy, Lebanon, Malta, Palestine, Portugal, Spain, Syria.

## **4.2 Background**

The development of maritime transport and logistics sector in the Mediterranean still needs to be improved in order to ensure more efficient and sustainable trade relations between the northern and south-eastern shores of the Mediterranean Sea.

## The Mediterranean: A Landlocked Sea

In this area, three types of flows can be identified:

- 1) Trade between the EU and SMCs
- 2) Trade among the SMCs themselves
- 3) Trade among EU Member States bordering on the Mediterranean.

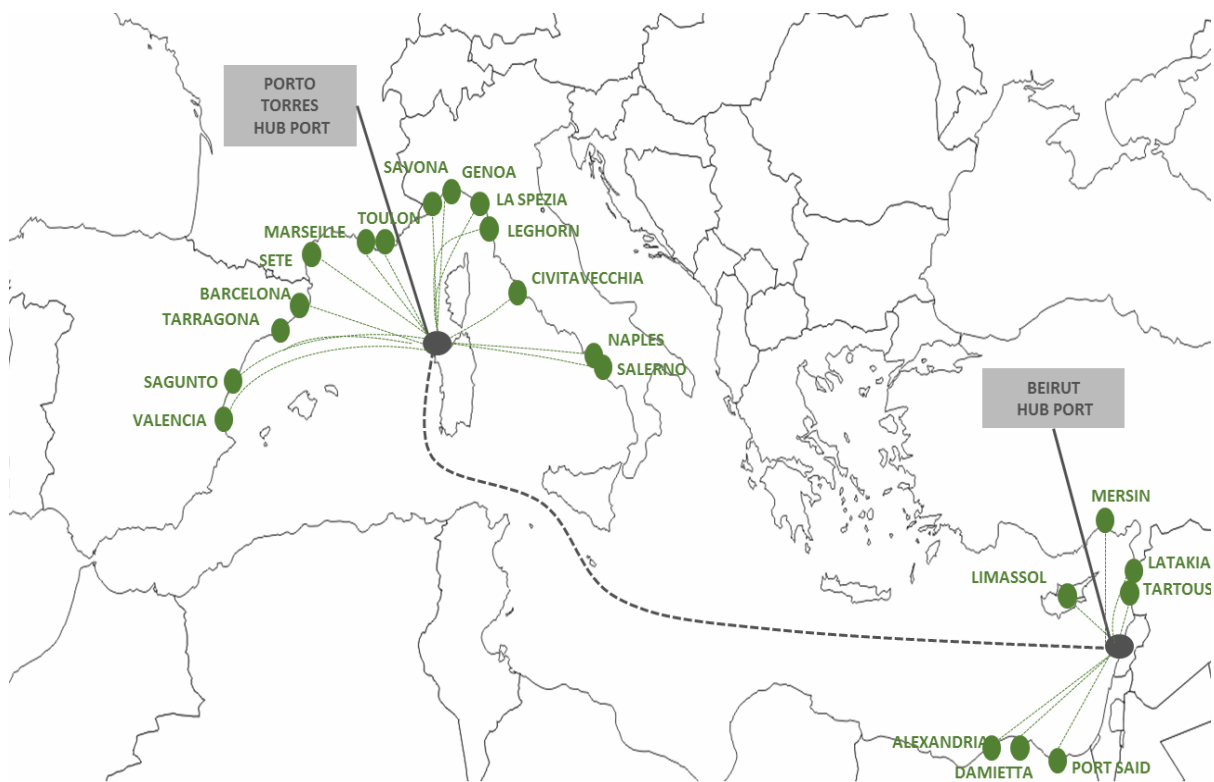
The flow of exported-imported goods between the countries involved is estimated in around 38.000 thousand tons (2012), of which more than the 90% is transported by inefficient maritime routes. The existing Mediterranean maritime transport supply presents several and well-known problems that make the land transport option still preferable on several routes. From the perspective of logistics operators such problems typically concern the high uncertainty and low reliability of delivery times together with very long shipping times and the related high logistics costs that all these factors entail. From the perspective of a port operator main problems concern instead the congestion of the Ro- Ro yards at the port side, because of the high number of waiting trucks, and the unproductive use of large port areas as parking areas for trucks.

Looking at the existing East-West Mediterranean services today there exists a limited number of regular and scheduled ro-ro services connecting the two Mediterranean shores. Besides, in most cases such services appear fragmented, not integrated and characterized by high service's time and low frequencies. In addition to these services based on scheduled departures and established itineraries, it is possible to resort to on-demand maritime services in which departures and itineraries depend on the specific transport requests of the period. On-demand services start only when the demand of transport reaches a level that justifies the cost-effectiveness of the service provided. Because of their nature, they are typically characterized by not scheduled boarding times, uncertainty and low reliability of delivery times and consequent high logistics costs. On the other side, land transport mode continues to appear attractive on several itineraries because of the reliability of its door to door services and the temporal continuity of its links. However, the dependence of several Mediterranean areas from the road transport brings several well-known problems related to high carbon emissions, road congestion and safety issues.

In order to overcome such issues, the existing maritime transport service was re-thought and rationalized. This was done by transforming the logic of distribution of goods by sea: from spot connections to an innovative integrated network option based on the hub and spoke paradigm

and characterized by scheduled, regular and reliable frequencies and more competitive delivery times.

Considering the above context, by means of new port layouts and a web-based logistics platform, the project proposes a new Ro-Ro hub-based multimodal (land/sea) network in the mentioned Mediterranean test-area and promotes its implementation. The new network, based on the hub-based concept, is composed by two hub ports: the port of Porto Torres, located in Italy, serving the European area and the port of Beirut, located in Lebanon, serving the Southern Mediterranean region.



[Fig: Network Structure](#)

## Relevance to UFM

The Union for the Mediterranean works towards the development of logistic platforms and motorways of the sea in the Mediterranean region in order to improve relations, enhance regional trade and ensure the prosperity and development of the involved countries.

Moreover, in accordance with the UFM strategic objectives, the project aims at boosting inter-regional integration and stimulating the long-term growth of the concerned area.

Furthermore, the project complies with the implementation of similar projects aimed at developing the Motorways of the Sea concept within the Mediterranean basin. In particular, the project Design of “Motorway of the Sea” services between the Ports of Mersin and Izmir (Turkey), the Ports of Bari, Brindisi and Taranto (Italy) and the Ports of Tunes and Rades {Tunisia} aims at developing a new transversal Mediterranean transport corridor which could be complementary with the proposed longitudinal one.

### **4.3 Project Description**

OPTIMED project, is one of the 95 projects funded by the ENPI CBC MED 2007-2013 Program, which under the leadership of the Autonomous Region of Sardinia as the Managing Authority.

For the period 2014-2020 the countries have confirmed the “Autonomous Region of Sardinia” as the Managing Authority of the Program. It fosters the economic growth and sustainable development on the area, including planning and financial management of the interventions for the development and requalification of an integrated transport system.

The project. aims to strengthen the trade connections among the ports of the Mediterranean area by promoting new opportunities, facilities, tools and skills that can lead to the enhancement of commercial connections amongst public and private operators of the countries lying in the north-western Mediterranean shore (Spain, France and Italy) and the countries of the south-eastern Mediterranean shore (Lebanon, Egypt, Turkey and Cyprus).

More specifically, the project involves the following ports:

- Porto Torres (Italy) and Beirut (Lebanon) as new ro-ro hub-ports;
- Valencia, Tarragona, Barcelona, Marseille, Sete, Toulon, Civitavecchia, Savona, Genoa, La Spezia, Livorno, Naples and Salerno, for the High-Tyrrhenian arc;
- Mersin, Lattakia, Tartous, Tripoli, Damietta, Alexandria, Port Said and Limassol, for the eastern shore.



EU area	Country	Centroid	Ports Belonging To The Centroid
	Spain	Valencia Barcelona	Valencia, Sagunto, Castellon Barcelona, Tarragona
	France	Marseille Sete	Marseille Sete, Toulon
	Italy	Genoa La Spezia Naples	Genoa, Savona La Spezia, Livorno Naples, Salerno
MENA area	Turkey	Mersin	Mersin
	Syria	Latakia	Latakia, Tartous
	Lebanon	Beirut	Beirut, Tripoli
	Egypt	Alexandria Port Said Damietta	Alexandria Port Said Damietta
	Cyprus	Limassol	Limassol

Table 6: Network Centroids

#### 4.4 Port Hubs

The port of Porto Torres is the hub serving the EU area, the western side of the Mediterranean basin and the port of Beirut in Lebanon, covers the MENA area, the eastern side of the Mediterranean basin. The distance between the hubs being 1420nm. There exist regular services between the spokes and the two hub ports.

Both ports benefit from a barycentric position within the basin of reference and from useful port and back-port areas to be used for cargo handling operations. They were identified depending on their location and traffic volumes. The 24 spoke ports included have facilities that can serve ro-ro shipping.

MOTHER SERVICE NAME	MOTHER VESSEL CAPACITY (lm)			WEEKLY FREQUENCY	WEEKLY CAPACITY (lm)
	SMALL 4600	MEDIUM 6350	LARGE 7700		
Porto Torres – Beirut – Porto Torres	5	0	0	5	23.000

\*The average service speed of mother vessels is 21 knots.

Table 4.4.1: Mother feeder services

#### **4.4.1 Port of Porto Torres**

The port of Porto Torres is the second port of Sardinia, after the port of Olbia, for passenger traffic. Built as a Phoenician port, Porto Torres was later controlled by Carthaginians and Romans.

#### **Geography**

Coordinates: 40.8334° N, 8.4023° E

Location: The port is in the northern part of the island, a few kilometers from Alghero and the only port to reach the North West of the island by ferry.

Population (town): 23,000.



Fig 24: Porto Torres

The city is well connected to the cities Barcelona, Genoa, Civitavecchia, Marseille, Propriano, Tolone and Porto Vecchio as well as the island Asinara by the shipping companies Tirrenia, SNCM, and Grimaldi Lines. It is composed of two sectors, one commercial and one industrial.

The first liquefied natural gas hub by ship in Sardinia can be born in Porto Torres, where the structural characteristics and strategic conditions already exist to accommodate a medium-sized warehouse capable of supplying other small businesses and service stations for use of liquid or compressed methane in the industrial, civil, transport (maritime, land and rail) and thermoelectric sectors.

## **Industrial Zone of the Port**

It has a dedicated industrial port, originally distinct from the commercial port. The industrial port, born almost specifically for the needs of the petrochemical center, has over time seen its use vary (also becoming a coal terminal) and has required two variants of the original plan for its completion, which began in 1974. The port area covers an area of 104 hectares and represents the most important logistics platform at the service of industry for the central-northern part of the island.



Fig 25: The Hub of Porto Torres

The Industrial area is served by regional railway lines, with the terminus at the Porto Torres Marittima station.

It uses technological infrastructures and services for a total of 521 hectares, in addition to 355 hectares committed to infrastructure.

The industrial port is formed by several docking teeth and is divided into two parts; one part is accessible to all while the other, for security reasons, is accessible only to authorized personnel.

- The accessible part is that used for the mooring of passenger ferries bound for Genoa, Civitavecchia and Barcelona: this part is formed by a docking tooth in which three or more ships can moor at a time. In this area, in addition to the disembarkation of passengers from Genoa, Civitavecchia and Barcelona, goods, containers, sands and minerals are unloaded.

- The inaccessible part is that part of the port where oil tankers, gas carriers, coal miners dock and for the transport of chemical products used in the nearby industrial area and in the petrochemical pole. It is the largest part of the port, formed by two docking teeth and a breakwater equipped with two large cranes. Large cargo ships dock there; the quay is 800 meters long.

Eight ships to Beirut every 7 days and around 30 to other destinations is the future scenario of Porto Torres hub in the Mediterranean. The services on the western side are as follows: -

FEEDER SERVICE NAME	FEEDER VESSEL CAPACITY (lm)			WEEKLY FREQUENCY	WEEKLY CAPACITY (lm)
	SMALL 1350	MEDIUM 2520	LARGE 3320		
Barcelona – Porto Torres - Barcelona	0	1	0	1	2.520
Genoa – Porto Torres - Genoa	2	0	0	2	2.700
La Spezia – Porto Torres – La Spezia	1	0	0	1	1.350
Marseille – Porto Torres - Marseille	5	1	0	6	9.270
Naples – Porto Torres - Naples	1	0	0	1	1.350
Sète – Porto Torres - Sète	1	0	0	1	1.350
Valencia– Porto Torres - Valencia	1	0	1	2	4.670

*\*The average service speed of feeder vessels is 18 knots.*

Table 7: Western feeder services

#### **4.4.2 Port of Beirut**

The Port of Beirut is the main port of entry into the country. It is one of the largest and busiest ports on the Eastern Mediterranean.

Port of Beirut is among the top 10 seaports in the Mediterranean Sea and is considered the gateway to the Middle East. This artificial port was transformed through self-financing from a local port to a regional and a transshipment hub for the region.

#### **Geography**

Coordinates: 33°54'10.62"N 35°31'4.04"E

Location: The Port of Beirut is the main port in Lebanon located on the eastern part of the Saint George Bay on Beirut's northern Mediterranean coast, west of the Beirut River.

The Port of Beirut lies within a longitude of 35 57' E and a latitude of 35 15'N, forming the midpoint of three continents: Europe, Asia and Africa that makes the Port a passage for ship fleets between East and West. During the mid-70's, the Port of Beirut was an important international trading station with the surrounding Arab countries and up until today it has preserved its commercial nature.

Area: The Port of Beirut has a total area of 1,200,000m<sup>2</sup> and has 4 basins, 16 quays, and a new container terminal at quay 16 capable of handling 745,000 twenty-foot equivalent units (TEU) per year.

Governance: The port is operated and managed by the Gestion et exploitation du port de Beyrouth (GEPB), which is French for Port Authority of Beirut. Container terminal operations are subcontracted to a private consortium called the Beirut Container Terminal Consortium (BCTC).

The Free Zone includes three industrial buildings with warehouses covering a total area of 32,400m<sup>2</sup> and a commercial building with 46 duty-free shops covering an area of 11,200m<sup>2</sup>. In 2007, the Logistic Free Zone (LFZ) was established containing several logistics warehouses where goods can undergo transformations before being exported via land, sea, and air or imported into Lebanon.



Fig 26: Port of Beirut

The port lacks a railway connection, however, as part of long-term plans to reinstate the railway system in Lebanon, plans are to have a railway link to the port.

The services on the eastern side are as follows: -

FEEDER SERVICE NAME	FEEDER VESSEL CAPACITY (lm)			WEEKLY FREQUENCY	WEEKLY CAPACITY (lm)
	SMALL 1350	MEDIUM 2520	LARGE 3320		
Mersin – Beirut - Mersin	1	4	1	6	14.750
Lattakia – Beirut - Lattakia	1	0	0	1	1.350
Damietta – Beirut - Damietta	0	1	0	1	2.520
Alexandria – Beirut - Alexandria	1	0	0	1	1.350
Port Said – Beirut – Port Said	1	0	0	1	1.350
Limassol – Beirut - Limassol	1	0	0	1	1.350

*\*The average service speed of feeder vessels is 18 knots.*

[Table 8: Eastern feeder services](#)

## 4.5 Beneficiaries

For the period 2014-2020 the countries have confirmed the “Autonomous Region of Sardinia” as the Managing Authority of the Program. The work was opened by the Regional Transport Councillor Massimo Deiana and the Rector of the University of Cagliari, Prof. Giovanni Melis. The project has a total budget of around 2 million euros with a community contribution of 90%.

Through the different phases of analysis, testing, promotion, training and implementation the project wants to contribute to achieve a better competitiveness of the Mediterranean transport and logistics sector, and therefore trade in general.

The target groups and stakeholders stimulated to develop new business relationships based on the opportunities of new optimized maritime trade network. The target groups are

- 1) public institutions in the field of maritime transport;
- 2) shipping companies;
- 3) business operators;
- 4) ship brokers.

In the coming years, the project results and the capitalization of them will give the opportunity to operators to take rewards of intermodal transport through the promotion of ro-ro hub- based network, SSS and motorways of the sea, as the basis for the development of sustainable logistics within the Mediterranean area.

The final beneficiaries of the new network will be the of European and Mediterranean partner countries for the faster and effective trade services between the two shores of the Med-basin.

#### **4.6 Governance of the Network**

The project is managed and coordinated by the below listed bodies although Autonomous Region of Sardinia” being the Managing Authority of the Program.

- 1) University of Cagliari - CIREM (Italy, Sardinia): It oversees the technical coordination of the project and will play a key role in designing the hub-based port facilities.
- 2) North Sardinia Port Authority (Italy, Sardinia): It is responsible for preparing and managing the tender to acquire technical consulting for the development of the executive design of Porto Torres port.
- 3) ASCAME - Association of Mediterranean Chambers of Commerce (Spain, Catalufia): This body promotes and organizes campaigns addressed to businesses, government bodies and representatives of International and local institutions at the European and Mediterranean levels. ASCAME and Chamber of Commerce together organize B2B meetings in the EU side (Italy, Spain and France).
- 4) European Short Sea Shipping School (Spain, Catalufia): It helps in the ideation of the programme. It was responsible for virtual platform of Porto Torres port.
- 5) Chamber of Commerce, Industry and Agriculture of Beirut and Mount Lebanon (Lebanon): It plays a key role in the elaboration of capitalization of results at Euro-Mediterranean level and in organizing B2B meetings.

#### **4.7 Budget**

Funding and financing became one of the key challenges for the network in the years to come. Investment was needed to adapt port infrastructure and facilities to suit new transport and logistics requirements. About 90% of it was public funding. UFM was mainly responsible for raising funds for the project. Total budget of Optimed project was: 2.000.000€



## 4.8 Virtual Logistics Platform

A new web-based logistics platform is created in order to support the new optimized trade network and to enable users to plan shipping and identify the best transport option. The platform users can identify and evaluate the best transport option considering different itineraries, departure dates, travel times, service frequencies, transportation costs and so on.

The platform shall provide users with all available options in terms of:

- Origin/Destination ports and connections
- Departure dates
- Itineraries
- Times (boarding, travel, delivery)
- Space availability
- Service frequency
- Freight transportation costs

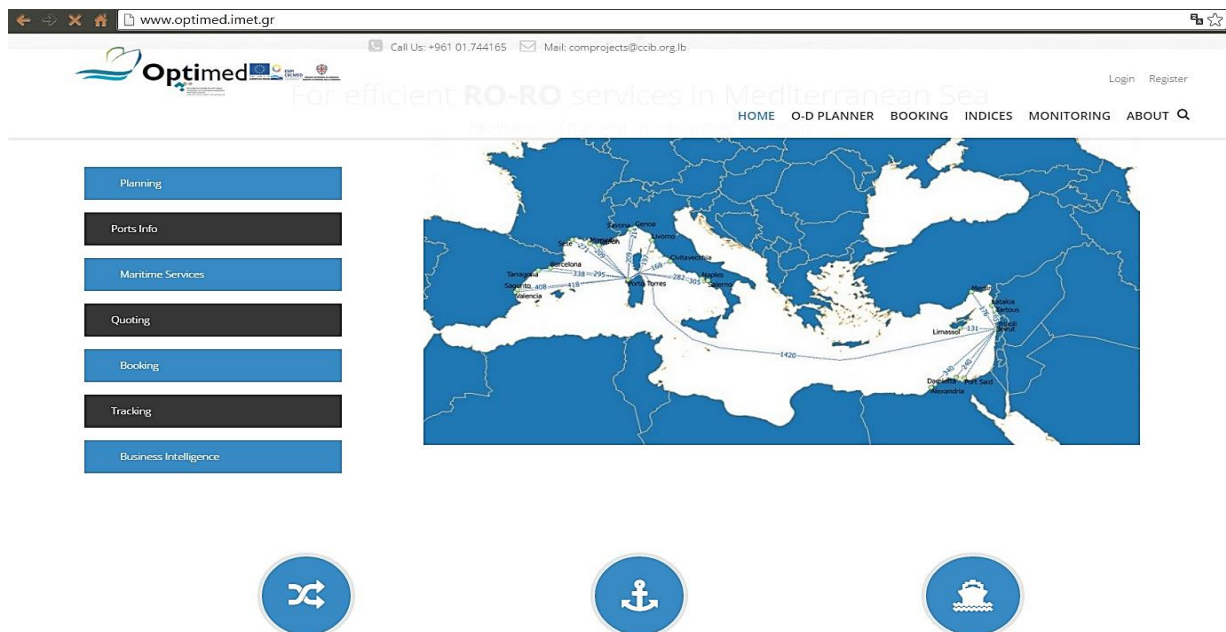


Fig 27: Virtual Logistics Platform

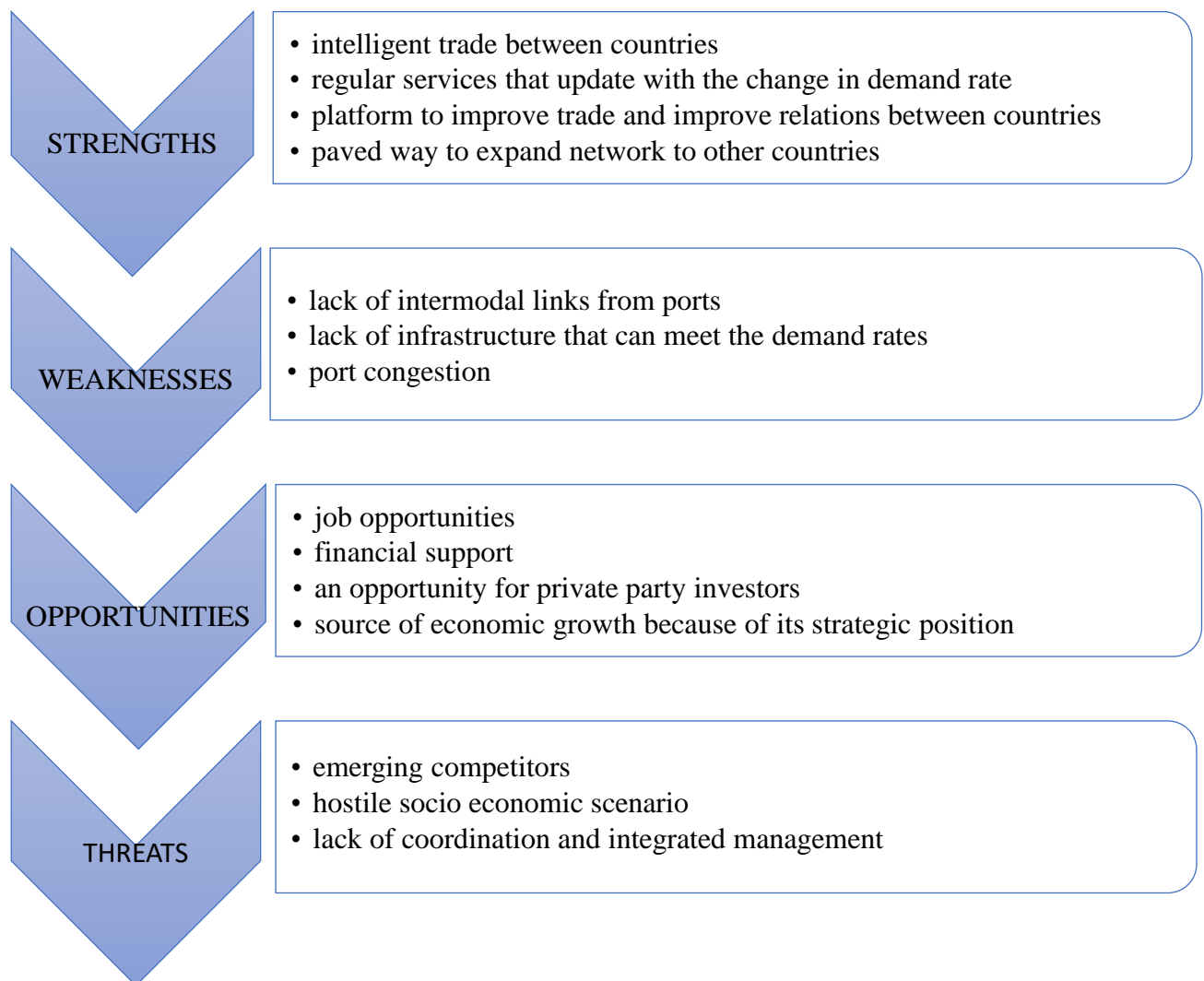
Using the platform, an OD planner was designed in order to discover the best routes possible. It required to enter the names of origin and destination ports and eventually, a plan appears showing the best possible route with all details such as the distance travelled, time taken, interchange ports etc.



## 4.9 SWOT Analysis

A SWOT analysis is an analytical technique used to determine and define several key characteristics: Strengths, Weaknesses, Opportunities & Threats – SWOT.

This SWOT analysis aims to identify those factors, trends, and events internal and external to the environment of the ports, which are essential for achieving the goals for efficiency in its functioning and development. It is necessary for evaluating the efficiency of the project.



## **5. FUTURE SCOPE & DEVELOPMENT**

Over recent years, the global port industry has changed significantly. Ports should be considered international infrastructures, as they are Europe's gateways for trade with third countries and serve a hinterland and a catchment area which go beyond their local and national borders. In 2015, only 9% of the freight handled in European ports was national traffic, while the remaining predominant share represented international transport. Ports are becoming increasingly dependent on technological innovations across the entire logistics chain.

The competitiveness of European ports will depend on their ability to innovate in terms of technology, organization and management. Their critical roles as multi-modal hubs require innovative and efficient ways of cross-modal connections and use of management tools in order to further increase their attractiveness.

### **5.1 Intermodal Accessibility to all Ports**

Intermodal connectivity has always been the base for any successful logistic operation. The better the connectivity of a port, the more value it creates for its users. Road, air, rail, inland waterway links to big ports especially for integrated hubs like Porto Torres and Beirut are a must. The goal set by the European Commission is a transfer 30% of goods transported by road to rail and inland shipping by 2030 and 50% by 2050. Big ports are close to or have already reached this target, but others are still far from it.

The modal share and the choice of non-road modes, which is among the key objectives of the EU transport policy, is driven by a mix of factors that characterise demand and supply of transport services:

- On the demand side, the requests of the shippers for solutions that optimise lead time, reduce costs, and guarantee safe and reliable services. In relation to short distance shipments, these requests are often met by the solutions offered by road transport; however, rail, and even more so, inland waterways have proved to represent strong alternatives for medium to long distance inland ranges;

- On the supply side, characterised by high-quality infrastructures within ports and between ports and inland destinations and, more importantly, an efficient management of existing infrastructures.

The project is trying to revise the ports of Porto Torres and Beirut according to the EU Transport policy. The use of other land modes such as rail and inland waterways is, however, considered a prerequisite for the competitiveness of a port. Though, the port of Beirut is well connected to land, sea and air except for a railway connection. However, it plans to have a railway link to the port.

Road transport is still the predominant choice for freight transport: for a range of reasons including flexibility, reliability, and acceptable cost levels.

Inland waterways, wherever available, are the most cost-effective mode to move goods between ports and inland destinations. Their overall capacity is not currently fully exploited.

For the kind of trade, the ports are involved, the port hubs as well as its spokes must be well built to face the below challenges in future:

- Over the last twenty years of containerisation process, which has characterised the maritime sector, has switched the focus mainly onto the efficiency of inland transport of containers. The sector has evolved towards a higher concentration, granting a competitive advantage to those ports that, for whatever reason, were able to manage large volumes of containers.
- Large ships call not only for seaside investments, but also the capacity to handle increasing and more concentrated volumes of goods.
- In order to avoid accidents, congested road connections and inland waterway facilities (if any), the port should be well equipped. It should be built to manage frequent flows of trains to the hinterland.

Thus, an upgrade of the port hubs at Porto Torres and Beirut are a must to accommodate the huge ships especially when a 50% growth of cargo is predicted in the EU ports.

## **5.2 Increasing the Environmental Profile of Ports by Developing Energy related Infrastructure**

Seaport complexes are often important sites for the storage and production of energy products (crude oil, LNG and petroleum derivatives, but also of electricity) and petro-chemicals, with a substantial impact on climate change, air quality and water quality. This infrastructure category includes pipelines for fuel, LNG, heat, steam, CO<sub>2</sub> as well as (smart) electricity grids, infrastructure for the provision of transport fuels (including LNG) to ships and infrastructure for onshore power supply (cold ironing) to ships.

Experts identified reserves of LNG in Porto Torres. LNG infrastructure can facilitate the greening of vessels. The use of LNG fueled vessels can reduce CO<sub>2</sub> emissions by 15-20%. During the last 10 years, there has been a significant increase in the availability of natural gas at the international market.

Being the cleanest among all fossil fuels, LNG is one of the favorite energy sources in many countries. This is true for Norway which has played the highest influential role in Europe but mainly in the Baltic region. Norway's experience in using LNG as a fuel backs to the year 2000. The demand for LNG bunker in ports will notably increase, particularly after 2020 when current vessels either under construction or in order will be operating.

The first liquefied natural gas hub in Sardinia can be born in Porto Torres, because the structural characteristics and strategic conditions that already exist. LNG is an attractive alternative fuel for seagoing vessels, inland vessels and trucks. When used as a fuel, fewer polluting substances are emitted. Thus, ports will have to play a major role in decarbonizing the economy, beyond the port area and operations, by offering alternative energy solutions.

### **Environmental Benefits: -**

- Lower emission of particulates, sulphur and nitrogen oxides and CO<sub>2</sub>
- Meets the more stringent emission standards (SECA)
- LNG-powered engines require less maintenance
- LNG-powered engines are much quieter
- Cheaper than petroleum-based fuels
- High energy value than other fossil fuels

#### Recommendation for planning LNG supply in the port: -

- 1) Technical feasibility study: First, a thorough feasibility study regarding the market potential for LNG supply in a port and its hinterlands should be made to determine needed volumes and from that different set-ups for LNG storage and sourcing can be suggested. As there is a significant scale of economy in handling of cryogenic gases such as LNG, it is valuable to determine the optimal storage types and suitable bunkering techniques;
- 2) A financial overview is suggested to establish the maturity of the project. Also important is a thorough inventory of all relevant stakeholders and applicable regulations;
- 3) Thereafter a Design Process can be initiated to determine the needed installations. During the design phase, involve stakeholders and possible financiers of the terminal;
- 4) Identify the relevant laws and regulations that apply for the permit process, and in parallel to this a permit process should be initiated to accommodate for any needed alterations and ensure a smooth process;
- 5) Commence a dialogue with the relevant authorities at an early stage. This could be both on local and on national level;
- 6) Safety measures and security aspects.

#### Future scope: -

The liquefied natural gas hub in Porto Torres can easily accommodate a medium-sized warehouse capable of supplying other small businesses and service stations for use of liquid or compressed methane in the industrial, civil, transport (maritime, land and rail) and thermoelectric sectors while steps to transform the Port of Beirut can also be investigated.

Contrarily to what was perceived some years ago, LNG is a serious alternative to other fuels. The LNG powered fleet is gradually increasing and the demand for LNG bunker in ports will notably increase, particularly after 2020 when current vessels either under construction or in order will be operating. The number of LNG import terminals is increasing in Europe, front runner countries are Norway, Spain, France, Belgium, Italy, UK, Netherlands and Portugal.

The harmonization of standards for the safe operations in LNG terminals is still at early stage but major ports are taking initiatives on their own.

### **ANTWERP, Belgium –**

Antwerp Port Authority has purchased the national pipeline company (NMP), who was the owner and developer of a network of pipelines serving Antwerp's port complex, as well as industrial users in the vicinity of the port. Antwerp Port Authority intends to use this pipeline infrastructure to shift liquid bulk flows to pipelines, to free up capacity of other transport modes. In addition, the port managing body explores opportunities to expand pipelines, for instance to be able to transport CO<sub>2</sub> that may in the future be captured instead of being emitted. This case shows the increasing relevance of pipeline infrastructure for port development.

## **5.3 Warehouse for Logistic Operators**

Port management authorities are seeing a flood of cargo arriving ports and harbors. From precise execution to safe practices, they are under enormous challenge on all fronts of port operations and requiring the help of technology more than ever.

At large ports, various independent terminals offer warehouses covered and open storage facilities for breakbulk, dry bulk and liquid bulk. A warehouse may be defined as a place used for the storage or accumulation of goods. The function of storage can be carried out successfully with the help of warehouses used for storing the goods. Warehousing or storage refers to the holding and preservation of goods until they are dispatched to the consumers. Generally, there is a time gap between the production and consumption of products. By bridging this gap, storage creates time utility.

When it comes to logistics, it seems like bigger should always be better. The largest companies can afford the biggest warehouses at airports and the closest warehouses to city centers. As consumers demand faster delivery, industrial companies are focused less on price and more on location and function. E-commerce giants like Amazon, Alibaba or any other logistic operator are on the lookout for setting up warehouses. They will never miss a chance if given an opportunity.

### E-Commerce Giants like Amazon -

Amazon is one of the biggest ecommerce companies in Europe. Even while it's not predominant in most European markets, its influence is huge. Amazon delivers to over 50 countries in Europe and has made its fulfillment by amazon delivery eligible in 26 countries across Europe. It is Europe's largest overseas market – Germany and UK, after US.

Amazon launched its website in the US in 1995 and after three years it opened its digital doors in the United Kingdom and Germany. France followed in 2000. Ten years later, in November 2010, Amazon launched in Italy, while in 2011, Spain became the latest country in Europe where Amazon hosts a dedicated ecommerce website.

In 2015, the retail company shipped over 1 billion units to its customers across the continent. Moving that kind of volume takes an impressive amount of technical sophistication, manpower, and distribution infrastructure. While Amazon does lean on third parties for deliveries and warehousing, the company is also building an increasingly expansive distribution network to manage the entire process. Amazon has been heavily investing in warehouse expansion to meet growing demand for fast delivery. It has got numerous warehouses across the globe and had only three in Europe located in UK, Germany and France. It was only in the recent times that they opened fulfillment centers in Italy and Spain.

Thus, the need for warehouses is evident. Not only Amazon, but other giants like Ali baba and other logistic service providers never miss a chance to expand their network. They look for opportunities that help serve the consumers in a better way, one being faster delivery.

The high-quality connectivity in seaports (both through maritime services and intermodal services to the hinterland) makes ports attractive locations for logistic activities. Thus, ports often develop logistic zones and manufacturing zones in direct proximity to (container) terminals, if the infrastructure meets their demands. As for maritime terminals, logistics and manufacturing require land and associated utilities. Thus, serving their purpose and resulting in overall development of the project.

Few logistics service providers have their own warehouses established. As well as storage and freight transport, logistics services providers can organize the entire logistics process. This includes services such as stock management, packaging, repackaging, labelling, assembly,

mixing and repair of freight. They can also take charge of administrative processing. As consumers demand faster delivery, industrial companies are focused less on price and more on location and function.

#### **ZAL PORT, Barcelona –**

The logistics zone (ZAL) in Barcelona (Spain) ZAL Port is the intermodal logistic platform of the Port of Barcelona, which aims to attract maritime traffic by offering services in logistics. It has been developed in phases responding to the demand.

ZAL Port offers warehouses rental near Barcelona port (and the nearby airport) with intermodal connections to railway and motorway networks, as well as a Service Center building and other facilities designed to meet the needs of the companies located in the platform.

### **5.4 Scope of Attracting PPP Investment**

Investments only make sense if they create value, either for port users, for society at large, or for both. The port managing bodies develop projects using public funds or own resources as well as loans.

The flow of exported-imported goods between the MED countries involved was estimated to be around 38.000 thousand tons (2012), of which more than the 90% is transported by inefficient maritime routes.

Having seen the immense demand for goods and services between the EU and MENA countries, ENPI CBC MED came forward and formulated the project. The OPTIMED project was funded under ENPI CBC MED. The budget contributed by the community was 90% of 2 million euros. The step was taken as a result of obvious outcomes that awaited on commencement of the trade. The Ro-Ro services already attracted trade and improved services.

A project involving such high returns is now attracting a lot of public and private based partnerships (PPP). Attracting both public and private funding requires a clearly defined framework. The lack of transparency of public funding in ports creates uncertainties for investors looking to invest. Greater financial transparency will also ensure a level playing field.

PPPs offer a wide variety of possibilities and management flexibility that distinguish them sharply from public service delegations or concessions, which are more rigid because they are



set in legal frameworks which are difficult to alter. Their guiding principle will be private management within a framework of public oversight to ensure that the interests of society are safeguarded.

The categories of investment are strongly interrelated. For instance, improving maritime access may only be possible, admissible or valuable if it goes hand in hand with an investment in basic port infrastructure and better connections to road, rail and inland waterway networks. Moreover, private sector investments are crucial for achieving such high level of investment.

The project outcomes and the capitalization of them gave operators an opportunity to take advantages and rewards of intermodal transport. The investors clearly perceive profits from the evident outcomes. A call for PPP will thus have the possibility of developing the project beyond its initial phase.

The project could never turn into a nightmare like the failed project in HAMBANTOTA, Sri Lanka. The case is one of the most vivid examples of China's ambitious use of loans and aid to gain influence around the world.

### **HAMBANTOTA, Sri Lanka -**

In the mid-2000s, Colombo (the commercial capital of Sri Lanka) agreed to let Beijing build a new port from scratch in the town of Hambantota, in the south of the island. China has helped finance at least 35 ports around the world in the past decade. It wasn't yet thought of as part of a new Silk Road -- that programme was conceptualised by Xi Jinping in 2012.

At the time, Colombo thought it could make a profit from the operation of the port, while Beijing would get a key point of transit in "the very strategic Indian Ocean, through which a large percentage of Chinese commercial ships travel to Europe.

But in 2015, financial clouds began gathering over the future of Hambantota's port, which cost \$1.1 billion. Sri Lanka was crumbling under the debt and was unable to repay the more than \$8 billion in loans it had taken from China for several infrastructure projects in the country. Furious, Beijing turned up the heat and threatened to cut off financial support to the island nation if it didn't quickly find a solution. In December 2017, after two years of negotiations, Colombo finally agreed to turn over the port to China for 99 years in exchange for the cancellation of its debt.

Sri Lanka had formally handed over its southern port of Hambantota to China on a 99-year lease, which government critics have denounced as an erosion of the country's sovereignty. The \$1.3bn port was opened seven years ago using debt from Chinese state-controlled entities. Though the deal erased roughly \$1 billion in debt for the port project, Sri Lanka is now in more debt to China than ever, as other loans have continued, and rates remain much higher than from other international lenders.

The transfer gave China control of territory just a few hundred miles off the shores of a rival, India, and a strategic foothold along a critical commercial and military waterway.

For Beijing, the Hambantota project is a linchpin of the “One Belt One Road” project, which aims to build a new Silk Road of trade routes between China and more than 60 countries in Asia, the Middle East, Africa and Europe.

It is a controversial construction that the government describes as a technological marvel, but critics say it is part of a crippling debt trap. There exist high chances of Optimized receiving huge investments, the Hambantota project is an example that shows how a project with such huge investments shouldn't be functioning.

## **5.5 Safety & Security**

The fluidity of transportation, and the necessary localisation and security of goods, whether by sea, air, road or rail, need improvement. Passages such as the Suez Canal and the Straits of Gibraltar are the nerve centres of this flow of goods. Because of the richness of the Mediterranean basin, there is a high concentration of commercial exchanges, which makes the careful supervision of movements within the Mediterranean of importance.

Market studies have identified a plethora of tracking systems using different technologies which are mutually incompatible. The study has shown that it is virtually impossible to introduce a global, intermodal and inter-operable tracking system without standards, regulations and legislation, and without the support of transportation lawyers and local and national port authorities.

In general, they are proprietary systems designed to meet a specific need for managing a fleet of trucks, etc. So, each road, port or rail transporter installs and uses different tracking technologies.

This is the case for Grimaldi, CGA/CGM, T  l  pazio, MGPS, TNT, DHL etc., not to mention all the specific systems used by SMEs or SMIs scattered around the various countries of the Mediterranean and the Black Sea.

Such is the case with all tracking systems. Thus, an introduction of the concept called Med-Tracking to the ports of Porto Torres and Port of Beirut can integrate to develop a secure transport of goods by sea.

## **Med-Tracking**

The Med-Tracking Initiative (market survey) is to undertake a survey of the existing Supply Chain Management systems (T. S), and to analyze and assess their performance (strong points and weak points, service / operating cost ratio, etc.) and the available technology used to date. The tracking system lies at the interface between various types of transport of goods: road, rail, sea and river, and air transport.

To achieve this, the market study of tracking systems was deployed, each working on a study with a distinct focus:

- Security/safety;
- management and competitiveness;
- compliance with the prescribed ratio of built areas to undeveloped land;
- green areas;
- traffic routes (road and rail);
- internal water and energy distribution networks;
- equipment for generating renewable energy;
- sewerage, drainage, wastewater collection, reservoirs;
- norms and regulations;
- possible environmental impact and sustainable development.

It will consider the patterns of change and trends in international maritime logistics, observed trends in world trade at euro-mediterranean level, supply chains and logistics, potential changes in the role of EU ports and the new challenges they will have to meet in the context of a rapidly evolving logistics market.

On evaluation, the main activities it carries out include the following:

- Optimisation of port procedures and infrastructure
- Promotion of ports as nodes in efficient intermodal system of transport
- Creation of strategic networks with inland areas
- Management and resolution of problems related to logistical performance by bringing together all the stakeholders.

Tracking Function of Med Tracking can be briefly summarised as follows:

- Register goods (place and date of loading, product, departure date, type of transport and communicate this information, track route taken by goods / container). The wish to acquire more in-depth information on the needs and expectations of end-users has resulted in a clear picture of the priorities:
- Rapidity and fluidity of traffic (administrative procedures, clearing customs, etc.)
- Quality-Service (just-in-time delivery, better management of movements of shipping at the entrance to and exit from ports, and better management of intermodal transport, etc.), which should be realizable by means of new technologies such as Tag, RFI, etc.
- Security-Tracking (real time tracking of goods, satellite positioning systems GPS)
- Security at sea
- Competitiveness of services provided for ships and goods
- Better integration of tracking system (goods, truck, ship and other intermodal fluxes) in world economy
- Development of logistics to cover services linked to integrated transport
- Demonstration of the interest of this system for enabling the Mediterranean region to acquire the infrastructure capacity needed for the rapid development of trade and transshipping.

#### Future trend of Med-Tracking on Optimed:

The Med-Tracking system will facilitate the smooth flow of goods between the EU and MENA areas. It will play a major role in the vicinity of intermodal zones such as ports and will make it possible to predict the arrival of the cargo more easily and to reduce congestion in ports. This will be a unique opportunity for all the Mediterranean countries to develop enhanced political and trading relations and to impose a Mediterranean standard worldwide.

To carry out the experimentation on Optimed, it is particularly important, to associate partners representative of the project and consider the requirements of inter-modality and inter-operability.

The project will serve:

- To properly test the myriad of tracking systems using different technologies
- To draw up a classification of costs in function of the characteristics and performance of the product and the requirements of the end-users
- To develop a classification based on the types of applications targeted, ranging from the simplest to the most complex (high end, medium or bottom of range).
- To consider the legal aspects
- To achieve a broad consensus among the various stakeholders and end-users such as ship owners, shipping companies, etc.
- Cooperation between seaports, and inland ports and terminals

This will be a global system of regulation for the secure transport of goods by sea. Specific developments will be proposed with the aim of improving the inter-operability of the system by means of the development of a platform based on a consensus of key stakeholders in the field of maritime container transport in the Mediterranean.

The Mediterranean, the cradle of western civilization, will become a world reference for secure maritime transport if it is to meet the challenges of the third millennium and contribute to the implementation of a real policy of sustainable development.

## **5.6 To Expand the Network to India**

Since the opening of the Suez Canal in 1869, countries around the pacific, Asia and Europe have greatly benefited since the Suez Canal was first constructed. The distance between India and Europe has been reduced by 7000 kms. It opens an opportunity for direct trade with India.

Having seen the vast trade happenings between EU and India, a route could be directed to connect India with these countries which in turn results in expansion of network to Middle East countries also.



Fig 28: Route to India

Expansion of Optimed network with India is preferred for four noticeable reasons:

- 1) Reduced distance to India: The construction of the Suez Canal reduced the distance between India and Europe significantly. Without the Suez Canal, Indian ships would have to go around the Cape of Good Hope - Southern tip of Africa and all the way up the west coast of Africa - a much longer and expensive route.

Beirut being the nearest amongst port hubs, can be connected to India through Suez Canal. The reduced distance can lead to faster transportation of products saving an estimated 15 days of journey time on average. A hub based in India (Port of Mumbai) can only boost the trade resulting in overall development of the project.

- 2) Security Improvement: One of the major benefits of using the Suez Canal in transporting goods is because it is a secure route. The canal experiences less piracy activities as compared to the other routes like: Strait of Malacca & Bab el-Mandeb.
- 3) Build trade-relations: Immense demand for goods & services between EU and India. This venture will pave way to trade with other Asian and Middle East countries that benefit from the Suez Canal.
- 4) Development: For further expansion of the project since it could pave way to trade with the other neighbouring countries.

Despite trade opportunities between Port of Mumbai and Port of Beirut, connecting the ports is difficult. The extensive distance between the ports being the primary matter of concern which is about 3560nm.



Fig 29: Proposed route to India

The route passes through Mediterranean Sea, Suez Canal, Red sea, Gulf of Aden and the Arabian sea. It takes around 15 days at a stretch when traveling at a speed of 10 knots. A direct connection to India is difficult for ro-ro ships as they don't cover that distance at a stretch.

Under such conditions, an intermediate hub around the red sea can facilitate the purpose of expanding network to India which in turn promotes trade in and around middle east countries based in Saudi Arabia. Over 30% of the world's container volume passes through the Red Sea basin every year. On the Red Sea and in the middle of the main Asia-Middle East-Europe international shipping route lies the Kingdom of Saudi Arabia's commercial capital - Jeddah, the largest and most important port city on the Red Sea basin.

### Port of Jeddah

With 3.4 million inhabitants, Jeddah is the second-largest city in Saudi Arabia. The country's economy is constantly growing, and Jeddah is one of its most important business centers as well as home to many company headquarters and government agencies.

Jeddah Islamic Port is Saudi Arabia's largest seaport, handling approximately 50% of the total containerized volume of the country. With an annual handling volume of 3.956 million TEU, the Jeddah Islamic Seaport holds 37th place in the ranking of the world's busiest ports. Covering over 750,000 square meters, the facility was constructed to set a benchmark advancing other port terminals around the region, exploiting approaches such as intelligent design and layout, cutting-edge technologies and value-added logistics capabilities; ensuring efficiency within whole supply chain, meeting the demands of modern-day trade.

At the port's most modern terminal, Red Sea Gateway Terminal (RSGT), the flagship container terminal at Jeddah Islamic Port, is a world-class facility, spearheaded by the Saudi Industrial Services group (SISCO). Being on a strategic location made it an obvious choice for access into the regional markets.

At RSGT, container ships can moor at four berths, and there is a fifth berth specifically for feeder vessels. In addition, the terminal has space for 2,400 reefer containers and covers a total area of 750,000 sqm. The terminal has boosted the port's handling capacity by 45 percent. Based on the MoU, RSGT will consolidate the container facilities in northern part of Jeddah port and execute a development plan upgrading and adding berth capacity.

Port of Mumbai: Situated on the Western seafront, Maharashtra is a key gateway for the country's exports and imports. The state has a coastline of 720 km on the Arabian seafront. Many important markets of Europe, Middle East and Africa are bridged through the seafront.

The two key ports – Mumbai Port Trust (MbPT), which was set up in the 17th century, and Jawaharlal Nehru Port Trust (JNPT), the relatively new Port – collectively account for 22 per cent of the total traffic handled at 13 major ports across the country. Both the ports are well connected to the other parts of the state and the country by rail and road network and is apt to play the role of a port hub.

Trade in goods between the EU and India increased by 72% in the last decade. The EU is the leading destination for Indian exports (almost 18% of the total) and an important trade and investment partner for the EU. Trade in services between the EU and India increased from €23 billion in 2010 to €29 billion in 2016. It is now the 4<sup>th</sup> largest service exporter to the EU and the 6<sup>th</sup> largest destination for the EU services exports.



The thrust areas of India's exports to EU include iron, cast iron, steel and ferro-alloys; organic basic chemicals, refined petroleum products; plants for the production of beverages; footwear; tanned leather, vehicles; fish, crustaceans and molluscs (processed and preserved); jewellery and related items; plastics in primary forms; dyes and pigments; parts and accessories for vehicles.

Principal items of India's imports from EU include machinery for textile, garment and leather industries (parts and accessories included); general purpose machinery; special purpose machinery; organic basic products; parts and accessories for vehicles; taps and valves; paper and cardboard; Machine tools for metal shaping; Ornamental and building stone, limestone, gypsum, chalk and slate; Tubes, pipes, hollow profiles and related accessories in steel (excluding cast steel); pumps and compressors; chemical products.

A new route could be proposed to India connecting Saudi Arabia. The new route could include trade between Mumbai and the port of Beirut (which is the nearest amongst the port hubs). This would result in improved trade links between India and the MED countries.

## 6. CONCLUSION

A complete overview of the of maritime transport systems in the Mediterranean area is studied. The role of ports and hubs are deeply analysed, from experiences of different countries falling under the EU and MENA regions.

This paper analyses maritime traffic in the Mediterranean Sea among Euro-Med countries. The role of ports has changed over the years from only services to vessels and cargo to a logistics platform with several related services and activities.

Many ports are working on intelligent vessel traffic management as an answer to many issues that ports and vessel operators are facing efficient use of infrastructure, avoiding waiting times, optimizing speed using realtime information, increasing safety through planned route monitoring, etc. The targets rely on an increasing the efficiency of ports. The efficiency of ports varies greatly across Europe: not all EU ports are performing at the same level, and in recent years there has been a widening gap between ports that have adapted to new logistic and economic requirements. The performance gaps result in traffic detours, longer sea and land trips. Port performance could be improved by modernizing ports while respecting the environment, the lack of transparency in the use of public funding and solve issues related to organization in ports.

Huge growth in trade could be analysed between the EU and MENA countries. There existed lack of coordination and proper management. Thus, a hub-based project based on ro-ro ships was proposed in order to ease the trade. The project improves trade links, creating more value for society. The hub plays a key role since certain ports lack infrastructure. It reduces cost of freight, distances and boosts access to wider markets. Considering the comprehensive vision for the need of the integration and linkage of the Euro Mediterranean networks, certain recommendations are suggested in the Optimed project.

- The modal share and the choice of non-road modes is among the key objectives of the EU transport policy. Intermodal links to the ports specially to integrated hubs of Porto Torres and Beirut will improve the efficiency of the ports especially when a 50% growth of cargo is predicted in the coming years.
- Increasing the environmental profile of hubs, using LNG. Experts identified natural reserves of LNG in port of Porto Torres. It can be the first natural LNG based hub in

Sardinia. It can be considered a serious alternative fuel and LNG infrastructure can facilitate the greening of vessels.

- As for ports, logistics operators require land and associated utilities. The warehouses of the port hubs will attract attention of the giant logistic service providers if the framework fulfils their need. They can also progress to set up warehouses.
- Interconnected port operations in hubs of Porto Torres and Beirut mainly revolve around ship operations, cargo handling, warehousing etc. These operations involve full utilisation of existing infrastructure and transport systems and efficient management of operations to be able to meet the demand flow rate. It is vital in a dynamic market environment when a huge growth is expected in the coming years.
- To reduce road congestion by making shortsea shipping more competitive and promoting modal shift reduces the costs for society generated by traffic congestion (increased travel times, unreliability, increased energy consumption and emissions).
- This hub-based venture draws a great deal of attention to its huge growth in trade and immense benefits not only to the port authorities, but also society. For a project of this kind, greater financial transparency will also ensure a level playing field. Investors perceive maximum returns and heartfully fund such pay-off ventures.
- To define the features of Med-tracking and propose special developments of regulation for the secure transport of goods by sea. It aims of improving the inter-operability of the system by means of the development of a logistic platform in the Mediterranean.

In order to monitor the progress of this reviewed project, I have also come to a conclusion that the expansion of the project can bring great development to Euro Mediterranean region, as in future it can bring international relation with the others parts of Asia ( as it has already paved way to North African and Middle East countries) through Mediterranean Sea. Moreover, the introduction of ro-ro hubs to the trade network and connecting the countries is a dynamic approach. The project promotes new opportunities, facilities, tools and skills to improve the commercial connections and relationships between public and private operators in logistic sector.

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