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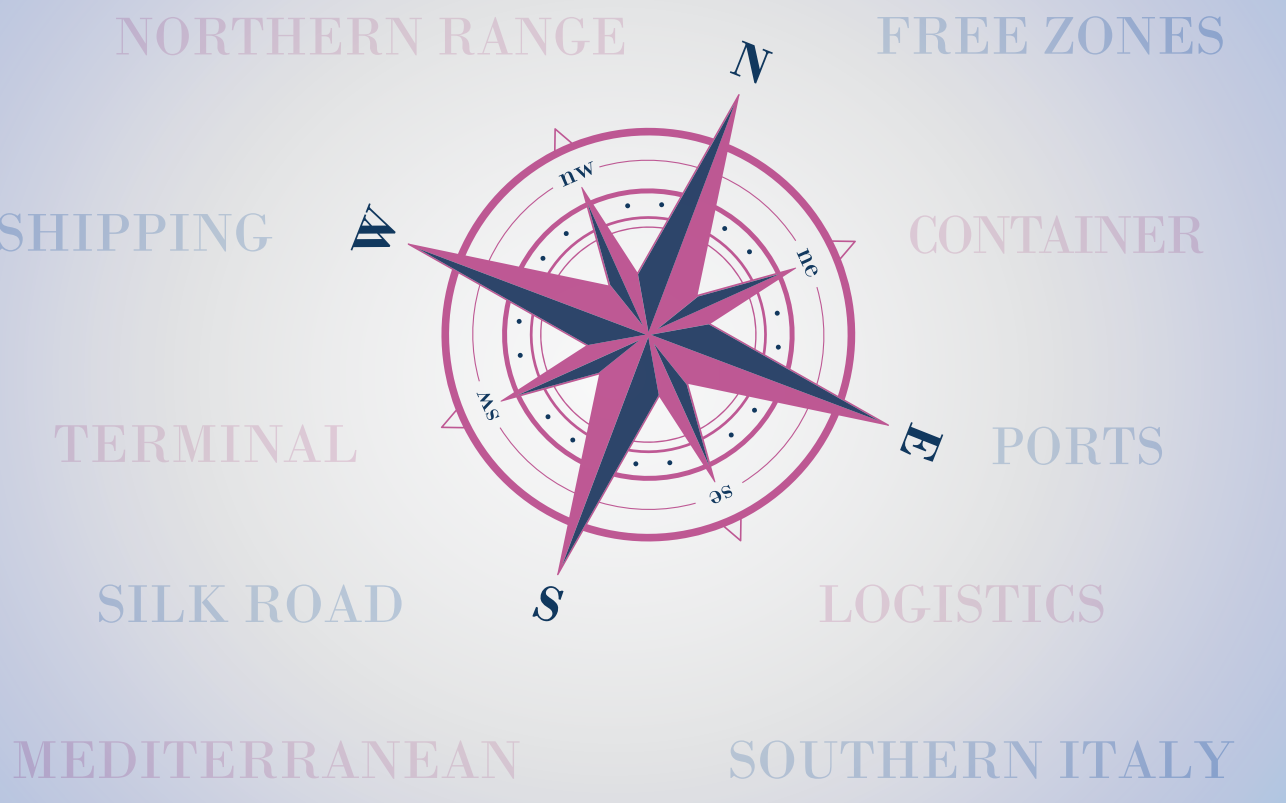
Italian Maritime Economy

China, energy corridors, ports and new routes:
geomaps of a changing Mediterranean

5th Annual Report

2018



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Annual Report 2018

Giannini Editore

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“Joins the sea that separates the countries”
Alexander Pope

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Chapter II of the Report "Energy-geomatics characterization of open-sea energy corridors in the framework of energy security. A case study: LNG from Qatar" has been edited by the Energy Department of the Politecnico di Torino. The authors are: Ettore Francesco BOMPARD, Francesco PROFUMO, Giulia CRESPI, Daniele GROSSO, with the collaboration of Piero BOCCARDO, Interuniversity Department of Regional and Urban Studies and Planning, Politecnico di Torino.

Acknowledgements and Notes

The 2018 Annual Report on *Italian Maritime Economy* is part of a broader research project launched by SRM and called "Permanent Observatory on the Economy of Maritime Transport and Logistics", from which the specialised website www.srm-maritimeconomy.com was born. This has the primary aim of monitoring and analysing the dynamics and economic impact of the sector in the economy of the country with a European and Mediterranean scope.

We wish to thank all **the supporting partners** of the project: Assoporti (Italian Ports Association), Port Network Authority of the Ionian Sea, Port Network Authority of the Central Tyrrenian Sea, Confetra, Contship Italia, Federagenti, Grimaldi Group, Lotras, Unione Industriali Napoli.

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We would like to thank professors Enrico FARDELLA and Andrea GHISELLI of the T-Way (Torino World Affairs Institute) for the support provided in promoting relations with the COSCO centre of studies which has elaborated a monography for this volume.

This work was possible thanks to three important **scientific missions** SRM carried out and which made it possible to sign agreements with prestigious centres of studies and to gather data, information and documents which resulted in considerable value added to this publication.

During the different missions and through direct visits of the ports, it was possible to comprehend the most interesting port models and maritime phenomena currently affecting the ports of Northern Europe, the Mediterranean and the Far East.

The first mission took place in Bremen (Germany) in February 2018 and a special thanks is hereby due to the KLU - Kühne Logistics University for the support it provided SRM's researchers.

We would also like to thank professor Michele ACCIARO for his remarkable efforts in the organization of the interviews and in the preparation phase of the mission.

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The second mission was carried out in Singapore in March 2018, and a special thanks goes to Timothy COSULICH of the firm Fratelli Cosulich and to Federico DONATO, President of the Italchamber of Singapore, for the support provided to SRM's researchers in the organisation of visits and interviews of the mission.

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The third mission took place in Malta in April 2018 and for this a special thanks goes to the International Propeller Club and in particular to its national president Umberto MASUCCI and to the Director at Medsea Shipping Agency Michael CALLUS, for their crucial contribution to the success of the mission, during which a visit to the port of Marsaxlokk was carried out.

This volume features a series of thematic geo-maps about naval routes which made it possible to improve the analyses and information of this Report. Such materials have been produced thanks to the collaboration with ITHACA and to this regard we would like to thank Professor Piero BOCCARDO, Andrea AJMAR and Cristina MONACO for the significant support provided.

Finally, we wish to thank all Italian and foreign Port Authorities for providing up-to-date data on traffic.

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Focus Far East: the Silk Road, port models, shipping and new container routes

Chapter XI – Singapore Maritime Cluster

The Annual Report "Italian Maritime Economy" has reached its fifth edition. This publication has experienced remarkable growth over the last five years and this year we are privileged enough to have the collaboration of an international team including authors from prestigious centres of research located in Germany, China, South Korea and Italy.

SRM is proud of its first-class network of authors belonging not only to the research field but also to the community of operators. They have hereby expressed thoughts, opinions and theories through essays representing original and varied elaborations.

In this research, in fact, we have hosted the work of the presidents of Port Network Authorities of Central Tyrrhenian Sea (ports of Naples, Salerno and Castellammare) and the Ionian Sea (Taranto), as well as the director of international projects of the port of Bremen, a giant in Northern Europe.

These specialists have accompanied us in our growth, providing analyses and food for thought while allowing our researchers to carry out remarkable scientific missions aimed at understanding port models, routes of traffic, issues, current or forecast maritime phenomena.

This has come to be a book providing operators of the sector (academics, institutes, firms, infrastructure) with recent and up-to-date ideas on work, data, statistics and analyses, which is not to be underestimated in the international maritime scenario always hungry for quality information.

Hence, SRM's observatory is still actively and attentively focusing on the Mediterranean in the global maritime sector, investigating its dynamics and phenomena. Many of these, both positive and negative, occurred at the end of 2017 or at the beginning of 2018: further development of naval gigantism, Chinese investments in the Belt and Road Initiative, the evolution of port models towards innovation and policies for the attraction of investment, the creation of Special Economic Zones (SEZs).

In particular, the recently introduced SEZs have given Italian ports a great opportunity for development by allowing them to utilise a new tool aimed at attracting more companies and making port and dry-port areas more appealing in terms of investment prospects. Many Mediterranean, Moroccan, Turkish and Egyptian ports have based their development on Special Economic Zones, promoting manufacturing plants of multinationals, with the result being new and more intense import-export traffic.

Besides the aforementioned phenomena, the Mediterranean is increasingly more strategic. SRM's elaborations, carried out using geolocation methods, illustrate that over the last five years the presence of containerships in the Mare Nostrum has increased by 24% and that big carriers are passing through Suez with increasing frequency (+11% transits on 2016).

SRM has been on the field again this year to verify what lies behind the statistics, the data we usually read in this wide topic. We have always maintained that a complete picture of a phenomenon can only be built through direct observation. Hence, the researchers have visited Germany, China, South Korea, Singapore and Malta with the aim of observing and analysing the most interesting and diverse aspects of the portuality

of these countries, which has provided this volume with a quality range of direct testimonies collected on the field.

The Italian Port Reform has been a significant step forward, however, more has to be done in order to carry the project through to its final stage. This has become even more important in light of the fact that our logistic-maritime competitiveness needs to be guided towards excellence.

We shall not forget that we have always been a maritime country, that we are located in the middle of the Mediterranean in a privileged position and that our ports and ship owning sectors are still economic symbols for our country.

Furthermore, our maritime import-export amounts to over €240 billion, we have exceeded half a billion tonnes of goods handled yearly and, finally, we are still first in the sector of Short Sea Shipping in the Mediterranean. Implications of these achievements concern Italy but, even more importantly, the Mezzogiorno, a region contributing significantly to the aforementioned figures.

Investment in infrastructure, intermodality and development of human capital – while betting on the sea as a resource – represent the three pillars on which our country needs to work if it wants to take full advantage of its privileged geographic position and intellectual abilities.

This report hereby presented has also opened a new frontier of investigation: energy. A special mention must be made to the team of the Department of Energy in the Politecnico di Torino which have collaborated with SRM. This topic has been analysed with a maritime scope and represents a strategic argument because our port system is considered to be a global energetic platform.

The increasing number of partners participating in this research project is a testimony to the fact that our Observatory has been growing.

Our great ambition is that the Observatory will become the point of reference for operators, institutions, associations and obviously the banking sector, of which SRM is a member. We will provide food for thought, analyses and reflections contributing to increasing knowledge and awareness of the importance of this sector for Italy. This will always be done with the Mezzogiorno as a protagonist.

Paolo SCUDIERI

Objectives and structure of the Annual Report

The *Italian Maritime Economy*, one of SRM's main research projects in the Observatory on Transportation and Logistics, has reached its fifth edition and this year's issue is based on four mainstays.

Firstly, there is a consolidated section where a perspective is provided on the main data of the sector both nationally and internationally, with analyses of port traffic and transits through big canals, as well as fleet figures, trends and forecasts on the global maritime economy.

Secondly, we can find the continuation of a topic that SRM has been following closely, namely China's investment in ports and logistics in the Mediterranean, the Middle East and Northern Europe. SRM has been investigating this complex phenomenon in its diversified aspects, which is still crucial in the Mare Nostrum and in the North Sea. This trend will probably continue for a long time, since the impressive investment plan envisaged by the Chinese Dragon to complete the Belt and Road Initiative, including the construction of a maritime route, as well as a land-rail one. These will allow China to expand its trade relations towards Europe and Asia thanks to the implementation or strengthening of all sorts of transport infrastructure. Debate is open as to whether such a big player's strong presence could be a risk or an opportunity for Italy and its ports.

The third mainstay are the energetic corridors, one of the topics often discussed this year. Ports in our country are a platform for the energy serving the continent and the entire Mediterranean. Suffice to say that in 2017 liquid bulk traffic of Italian ports reached almost 200 million tonnes (37.5% of the overall goods traffic) with a 3.3% increase on 2016. Southern ports account for 47.4% of the country's total for this kind of traffic. Additionally, it needs to be pointed out that there is a new and impressive impact of new fuels for ships such as LNG, a type of fuel used by many megaships currently in the order book.

The fourth mainstay of this report is SRM researchers' hands-on experience which, as always, enriches the volume. Since the end of 2017 we have been travelling to countries where remarkable investment projects have been implemented or planned in maritime and port sectors. This was accomplished with the aim of building a clearer picture of the operations that will most likely affect the global economy. Our missions have taken place in Hong Kong, Singapore, Bremen (Germany) and Malta. They were conducted in order to analyse port and logistic models in different countries, with their strategic choices in relation to economic and maritime phenomena that occurred at the time, while focusing on the initiatives aimed at receiving new routes and increased traffic. For instance, the mission to Hong Kong not only allowed us to visit the port and understand its functions and operations, but it also provided the chance to visit the Shenzhen Free Zone, in South-East China, one of the biggest and most thriving in the world.

Moreover, in the port of Singapore we could verify that a new terminal in Tuas is being constructed, and this will be able to handle up to 65 million TEUs per year, which is testimony to the local government's belief that the Strait of Malacca will continue

to increase its competitiveness for future traffic. Furthermore, Bremen in the Northern Range is strengthening the Ro-Ro and container areas with the aim of becoming more competitive in Northern Europe. Finally, the port of Marsaxlokk in Malta is planning to expand and strengthen its role as a hub of transhipment in the middle of the Mediterranean.

Hence, the maritime economy is becoming a crucial topic not only in terms of the quantity and operations of its companies but, also, for the infrastructure projects and the scale of investment, as well as the fact that it continues to shape the global geo-economic context.

Nevertheless, this is not the only phenomenon investigated by the current research project. In fact, there are also other important events currently influencing the global economy and which will affect the Mediterranean and, consequently, Italian portuality. One of these is the unstoppable growth of ship sizes: in 2019, there will be 118 new mega containerships in the 10,000-23,000 TEU category, and 47 of these will belong to the 18,000-23,000 TEU class. As a consequence, it seems that, at least in the container sector, competitiveness will be achieved by ports and terminals capable of using equipment and quays suitable for the aforementioned vessel sizes.

Furthermore, SRM continues to monitor the dynamics of Suez and Panama. The two canals, as widely predicted, have affected traffic routes displaying impressive growth rates. For instance, in 2017 over 900 million tonnes of goods transited through the Egyptian canal, a figure accounting to an 11% increase on 2016. These data confirm the forecast elaborated by SRM in the past few years. As the Mediterranean grows, simultaneously transits through Suez increase.

This report also takes a closer look at Shortsea traffic, one of Italy's excellence points. Our country has a market share in this kind of traffic amounting to 36% of the Mediterranean. Ro-Ro traffic (50% of which takes place in the Mezzogiorno), is still one of Italy's strengths and our country has globally renowned ship owners in this sector who operate all over the world. This sector needs to be supported with the aim of preventing the loss of market shares, here where our know-how is consolidated and recognised.

The idea of a "portuality 5.0" is the new key of interpretation offered by this 2018 Report. A modern port, one step ahead of the industrial system for fulfilling its needs adequately and efficiently. What is more, a port which is capable of contributing to the growth of the region by attracting investment that can create jobs and boost the economy.

This is where the concept "portuality 5.0" stems from, precisely because there are currently five mainstays underlying the port apparatus:

1. *The ability of the port to help the growth of companies:* through efficiency, in fact, the port must guarantee timeliness in the process of internationalisation, allowing ships to reach destinations in brief times while providing first-class services and thus playing the role of engine for a country's import-export. SRM has always depicted the MENA area as an opportunity for our national system in terms of increase in economic relations, which is only possible if there is a state-of-the-art maritime system, due to the fact that 80% of our import-export with such countries is carried out by sea.

2. *The ability to encourage the creation and start-up of companies:* port models, in particular those in Northern Europe, are becoming not only places where companies are helped to grow in terms of business, but also incubators for new companies. Port XL is an example of the so-called *Port Accelerator* aimed at strengthening the creation of new innovative enterprises serving port operations in crucial aspects such as environmental issues and safety.
3. *Intermodality:* this idea has long been promoted, however, its implementation has been unsuccessful in Italy, where few specific excellence instances are an exception. For many reasons, we have never been able to create an intermodal system capable of allowing a complete integration between port, dry-port, railways and roads. This is a key point to our logistics system.
4. *Collaboration between ports and academic research in economics:* a modern port needs to be aware of the dynamics of traffic and of the phenomena that surround it, in order not to isolate itself and to avoid implementing strategies not in line with those of the whole country. SRM, alongside its partners, has long supported the whole maritime system in carrying out work and research aimed at increasing understanding and discovery of how trade in the Med is changing and of new frontiers of development.
5. *A key role for the port as a regional driver of development:* the recent introduction of Special Economic Zones in our regulatory system has required portuality to take on the role of backbone in the crucial connection between industry and logistics. In this sense, the port has become a catalyst for regional import-export and thus one of the main drivers of economic development.

Italian ports, after a difficult period during which a reform was being developed, are currently attempting to find a renewed competitiveness drive, with the new presidents involved in the design and implementation of common strategies, where the role of each Port Network Authority is clearly identified within the whole national context. Our ports must be re-vitalised, also thanks to new individuals who understand the importance of logistics and intermodality, while holding the idea that the port must be reliable instrument for the functioning of industry and tourism. An ally on which operators can count in order to develop and grow.

In this context, if we consider that 50% of the national port traffic occurs in the Mezzogiorno and that two thirds of this region's international trade is seaborne, we can understand why Southern Italy needs to be given a key role with suitable investments and strategies. The South of Italy has a position close to the Suez Canal and in the direction of the main global routes towards the Northern European and Middle-Far Eastern markets. This clearly shows that the whole region can be crucial to the economic development of the entire nation.

It is with this vision that SRM intends to contribute to the understanding of the aforementioned complex and continuously evolving phenomena. The world of the sea is developing rapidly and economic-maritime aspects need constant monitoring alongside the great changes that they can bring about.

This report, in fact, is only a part of numerous in-depth analyses, papers, interviews carried out by our Observatory and which will be continued in the future with the aim of maintaining the focus on the maritime sector.

Our country is in the middle of the Mediterranean and therefore needs to implement the right policies to face the competitive challenges of this sea. Our research project is inspired by this motto: 'analysing and monitoring the dynamics, routes, projects and players for which the Mare Nostrum is becoming increasingly attractive and strategic'.

Once again, for this issue of the report, SRM has operated in synergy with national and international centres of study which have contributed their specialised know-how, thus enriching the content of this volume.

This is the case, for instance, of the partnership with the *SISI-Shanghai International Shipping Institute* and the *KMI-Korea Maritime Institute*, which have written two of the essays hereby contained. In 2016, an agreement with these centres of research was signed and it included eleven other research centres in Europe, the United States, the Far East, with the aim of developing joint analyses of the maritime sector.

In 2018, for the first time after the two meetings in Shanghai and Seoul, the *Global Shipping Think Tank Alliance* has chosen a European country for its annual conference, which will be hosted by SRM in Naples.

Collaboration projects are also in place with the *KLU-Kühne Logistics University* of Hamburg, one of SRM's historical and consolidated partners, which has contributed with a paper on *bremenports*.

Another important agreement SRM is currently building is that with the Department of Energy of the Politecnico di Torino, aimed at analysing new global energy routes. The Politecnico has a specialised team of experts in this sector and it will be interesting to analyse how the synergy with our centre of research can be developed in the future.

This year, as a further confirmation of the Report's growing reputation, two Port System Authorities have also taken part in the project: the Central Tyrrhenian Sea and the Ionian Sea. These have authored two papers sharing with us the sense of the message we have intended to send, as specified in the title of this volume, with the Mediterranean as a protagonist.

In conclusion, it is crucial to our research policy to be linked to and to network with the main centres of research in Italy and abroad. We also deem important to keep a close relationship with operators, who complete this report with their direct experience and testimonies, so as to make this research project an increasingly important point of reference for the sector of ports and shipping.

As far as the organisation of the Report is concerned, its structure is as follows: the first chapter is an analysis of the current situation with the most important data regarding the economy, international and national port traffic, transits through canals, the fleet, the short-sea and a focus on the oil sector; the second chapter has been elaborated by the Department of Energy of the Politecnico di Torino and its focus is on maritime energetic corridors with a case study on Ras Laffan in Qatar.

After that, the third chapter has been written by the Port Network Authority Central Tyrrhenian Sea with analyses and reflections on the future of port networks in the Mediterranean and the ports of Campania.

The analysis contained in the fourth chapter, elaborated by the Port Network Authority of the Ionian Sea concerns the «Portuality of the Mezzogiorno: evolution of regulations and functions», with a focus on Italian ports and analyses of routes and traffic.

In the fifth chapter the KLU of Hamburg, together with bremenports, looks at the consequences of the new arctic route and provides some future forecasts in this sense.

The last chapter of the first part is an analysis of the cruise sector with a focus on the Neapolitan port, one of the main in the country for this kind of traffic.

The second part of the report is a monography and it is dedicated to the Far East, which is analysed from different points of view as clearly illustrated by the titles of the chapters listed in the index.

***

We wish to conclude this introduction to the volume with a special thanks to SRM's researchers and to the partners of the project who demonstrate their belief in our work and support us in this adventure we have embarked upon. A special thanks goes to all the authors who have contributed to adding to the value of this research.

Hoping we have been able to provide factual support to those convinced that the development of the economy of maritime transport and logistics is a priority for our entire country. The challenge is still ongoing.

Massimo DEANDREIS

Part One

Economic and competitiveness scenarios of maritime transport

Chapter I

Scenario of maritime transport. Italian ports within the challenges of the global shipping framework

1. The macroeconomic scenario and evolution of freight traffic

The aim of this chapter is to outline the competitive profile of the Italian port system through in-depth analyses of the macroeconomic situation, as well as the transport system in an international context. Maritime transport embraces a global dimension by definition and thus its analysis cannot be carried out without considering the global economy and trade.

Almost ten years have passed since the last great economic and financial crisis, and prospects of growth for the world economy are positive, with a noticeable contribution of the emerging Asian countries and of the MENA regions. Potential risks for the global economy derive from the possibility of a sharp rise in volatility on financial markets, which is currently at a historical low, and from the possible intensification of geopolitical tensions. World GDP in 2016 recorded a 3.2% increase, in line with the figure of 2015. The latest projections offered by the IMF[1] forecast higher growth for both 2017 (+3.6%) and 2018 (+3.7%). The economic recovery is consolidating thanks to strengthened manufacturing sectors in advanced economies and to a revival of emerging markets. The US remains the most important economy in the world with 25% of the world's GDP while China is second (15%) and Japan ranks third (7%). The EU taken as a whole would be in second position with a 22% share. What stands out is the high growth trend of the Indian economy, currently forecast at 6.7% (2017) and 7.8% (2019).

A closer look at the Euro Zone reveals forecasts that are not particularly optimistic, with an estimated GDP growth of 1.7% in 2019 (it was over 2.1% in 2017). This is mainly due to issues related to high public debt and high unemployment rates, as well as limits to tax policies of member countries which currently hinder the implementation of effective measures of economic expansion. In particular, in Italy GDP growth is expected to amount to 1.5% in 2017 mainly due to the recovery of industrial production, the strengthening of investments and exports.

Similarly to the general economic trends, international trade has grown less markedly since 2012, showing an opposite trend to that of the pre-crisis period when the increase in global exchanges recorded a figure double than that of GDP. According to the IMF, in fact, the volume of exchanges in 2016 showed a 2.4% growth due to decreased expenditure on investments (highly trade sensitive assets) in the US and China. The less marked increase of the volume of exchanges took place alongside a decrease in the value of global trade (-3% in 2016 according to the WTO), which mainly depends on a reduction in the price of raw materials (especially energy).

[1] International Monetary Fund (2017, October). *World Economic Outlook Database*.

It has been estimated that international trade will grow by 4.2% in 2017 (when it will be again higher than GDP growth), by 4% in 2018 and by 3.9% in 2019.

However, it is important to highlight that estimates of growth for trade and transport are characterised by the typical uncertainty of the current historical period, which makes it extremely hard to identify elements of systemic stability. Alarming factors of destabilization are emerging, both on a political scale (i.e. the 'Trump-effect' and Brexit) and on a socio-economic one (i.e. instability in some countries of Northern Africa and the Middle East).

All estimates relating to the evolution of international trade and maritime transport must also take into account other factors that could have significant influence. These are related to innovation and technological development, such as cloud computing, three-dimensional printers, the rapid expansion of e-commerce that continues to grow at considerable rates. With regard to the last, enormous development opportunities are accompanied by changes for transport and trade chain and, in particular, for shipping. We are witnessing the growth of strategic distribution centres for cross-border and domestic e-commerce transactions, as well as an increase in business models that favour shipping as the main mode of transport. Products that are highly time sensitive and can rapidly lose value between production and delivery will continue to be transported mainly via air. For goods that are less time sensitive and whose distribution is based on storage, shipping remains the preferred mode of delivery. This e-commerce supply chain model is more efficient and allows specific e-commerce services to be better integrated with logistics. It is therefore crucial for ports to be located along these routes while acting as aggregators of flows and services in synergy with metropolitan areas.

2. Maritime transport: features of demand and offer in the sector

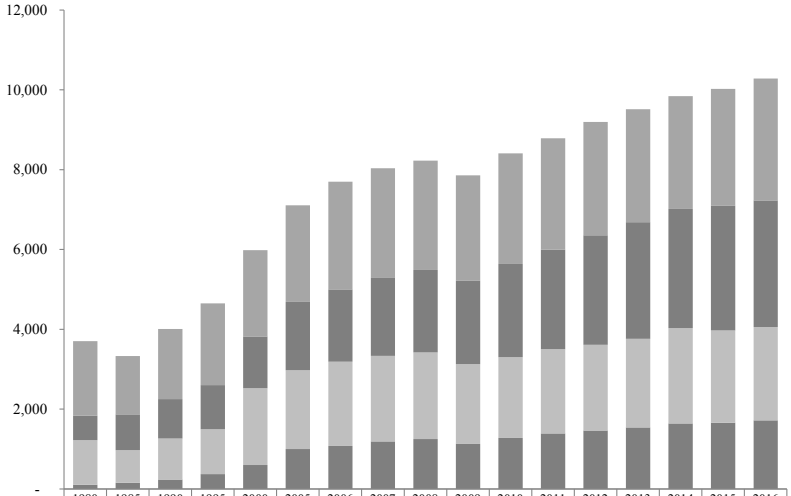
The weakness of the international economy could not but affect the trend of trade by sea, which account for 80% of global trade in volume and over 70% in value. In addition, there is evidence of the development of some trends that have significant implications on maritime transport such as digitization, the rapid growth of e-commerce and the increasing concentration in the liner shipping sector. It was precisely the continued consolidation in the maritime markets in 2017 that led to a healthier market and stronger prospects for 2018. All in all, more volumes of transactions (demand) and more controlled quantity (supply) lead to the conclusion that 2018 could be increasingly more balanced.

Unctad[2] has estimated that volumes of seaborne trade grew by 2.6% in 2016, reaching the 10.3 billion tonnes mark and showing a higher growth rate than that of 2015 (1.8%) even though still below the 3% average recorded in the previous four decades.

Estimates in the medium-long term forecast an average annual increase of 3.2% between 2017 and 2022, which will cover all segments of maritime transport and in particular, containerized traffic and solid bulk cargoes.

[2] Unctad (2017). *Review of Maritime Transport 2017.*

International seaborne trade (millions of tons). 1980-2016



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Oil and gas	1,871	1,459	1,755	2,050	2,163	2,422	2,698	2,747	2,742	2,642	2,772	2,794	2,841	2,829	2,825	2,932	3,055
Main bulk commodities	608	900	988	1,105	1,295	1,711	1,814	1,953	2,065	2,085	2,335	2,486	2,742	2,923	2,985	3,121	3,172
Dry cargo other than main bullk commodities	1,123	819	1,031	1,125	1,928	1,975	2,112	2,141	2,173	2,004	2,022	2,112	2,150	2,218	2,393	2,310	2,339
Containers	102	152	234	371	598	1,001	1,076	1,193	1,249	1,127	1,280	1,393	1,464	1,544	1,640	1,661	1,720

Graph 1 - Source: SRM on Unctad, 2017

In addition to the performance of the overall volume of traffic, the composition of the same is also changing due to the adjustments taking place in the economic structure of emerging countries, with an ever-decreasing share of the trade of raw materials and a growth in the exchange of manufactured goods and finished products. Emerging economies continue to represent the most significant part of maritime transport by size, with a 59% share of exports and 64% of imports; in particular, Asia accounts for 40% of exports and 61% of imports.

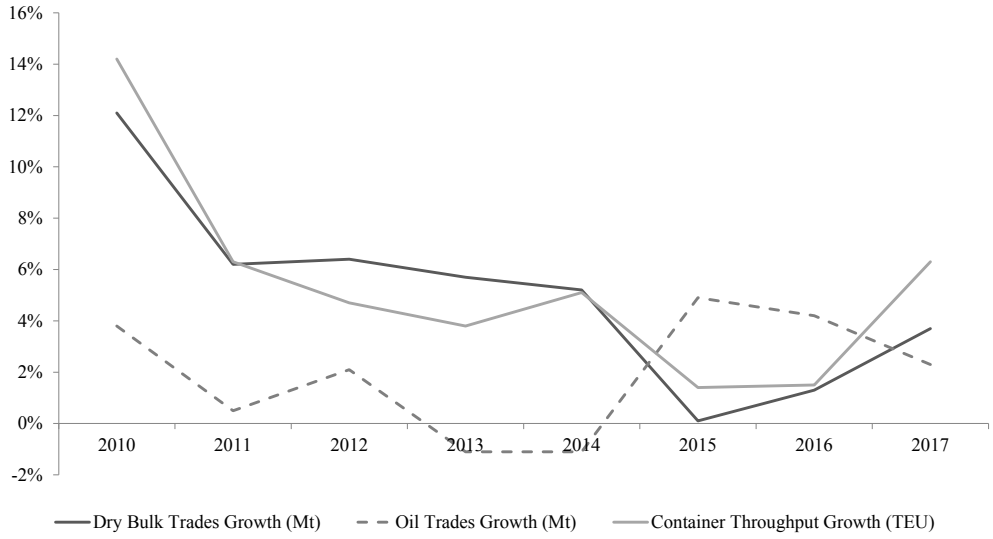
Graph 2 shows the growth trend of the main segments of maritime transport in the period 2010-2017.

The increase in volumes and the different composition of commercial flows also affect the Mediterranean. This region attracts intercontinental routes linking major production poles and consumers (the Far East, mainland Europe and North America), as well as regional itineraries reaching non-core territories which are nevertheless relevant and sometimes growing significantly both economically and demographically.

Traffic along the Suez Canal, thanks to the recent enlargement of its infrastructure, is growing and has exceeded 900 million tonnes annually with a simultaneous increase in the number and in the tonnage of transiting vessels. Consequently, the great maritime route Suez-Gibraltar appears increasingly more characterized by bigger sized ships serving intercontinental services between core Europe and the Far East.

Conversely, regional routes fall into the scope of Short Sea Shipping in the Med Area, a sector where Italy excels and which demonstrates the potential of diversification and further development of traffic.

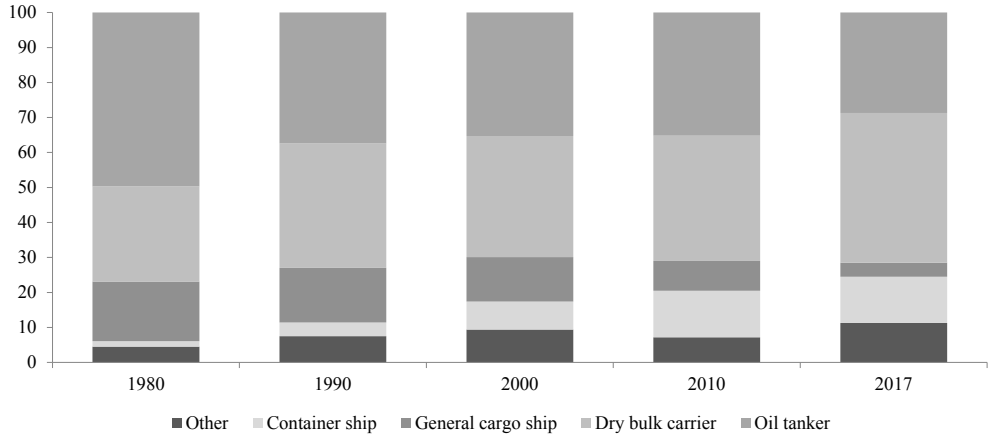
Growth trend of maritime trade



GRAPH 2 - SOURCE: SRM on BRS Group

As far as offer is concerned, within the maritime transport sector, tonnage capacity of the global commercial fleet increased in the period 2009-2017 at a rate of over 50%. This development, which has not found an adequate match in the growth of global transport demand, is posing the risk of excess supply, with negative repercussions on the trend of sea freight rates. These remained low despite the increase in ship scrapping and a large share of unused vessels (idle fleet). In 2017, the world fleet increased by 3.1%, reaching 93 thousand ships equal to 1.86 billion dwt. In terms of vessel types, bulk carriers are in first place, followed by oil tankers. Graph 3 shows the growth of container ships, in particular since 2000.

Global fleet by main vessel type, 1980-2017 (percentage of Dead Weight Tonnage)



GRAPH 3 - SOURCE: Unctad, 2017

If we consider that today 65% of the world fleet is less than ten years old and that only 9% have a service age of more than twenty years[3], it can be easily deduced that oversupply will also negatively affect the sector in the future. Precisely with the aim of easing the pressure on freight rates, the sector is increasingly characterized by the phenomenon of naval gigantism which is not a novelty in the evolution of global shipping. Nevertheless, in recent years this has gained renewed centrality in function of the rapid evolution which especially concerns the container and cruise sectors. In fact, there are significant implications in terms of adaptation of port infrastructure, the performances required of the entire transport system and the dynamics of the geography of flows.

The growth of load capacity of ships and the concentration of traffic in the hands of the main operators of international transport are having significant effects on the demand of port services that is characterized by a rationalization of calls and a significant increase of the volumes connected to single ship arrival. This puts pressure on ports and on port and logistic communities that must always be able to effectively handle large ships as shipowners are highly reactive and can quickly reposition themselves. In addition, gigantism seems to be related to two other phenomena, namely excess of capacity (and consequent decrease in freight rates) and the consolidation of the sector. So far, in fact, it was precisely on the routes with higher presence of megaships that the tension on freight rates has been higher, which has put the financial performance of carriers under pressure.

3. Containerized traffic: trends and structure

Over the last 5 years, global container traffic has grown at rates of between 1% and 4% annually. The 2017 final result showed an increase of around 5% on the previous year, which however, proved complex for this type of transport, reaching a total volume of 147 million TEU handled. The mapping of the main routes[4] shows the greatest growth of the Europe-Asia route, with an increase of 3.1% on 2016, followed by the transatlantic (+2.9%) and, finally, by the trans-Pacific (+1.2%) which still remains the busiest with 26.1 million TEU. Major infrastructural investments and recent economic developments are helping to redesign the routes and dynamics of world shipping, with potentially important consequences also on the Italian port system.

Amongst the main challenges for the "ports of the future", international observers identify compatibility with the ever increasing size of vessels. The phenomenon of gigantism, as already mentioned, found its most vivid expression in the container segment: if in 2012, ships of over 10,000 TEUs were "only" 13% of the total in circulation, in the seas today this percentage has already grown to 31% and forecasts say it will reach 37% in 2021[5].

Parallel to the huge capacity increase and dimensional growth, there was a considerable concentration of supply: in 2000 the top 20 companies controlled less than 50% of the available hold capacity, while in 2008 this percentage had risen to almost 70%, and at

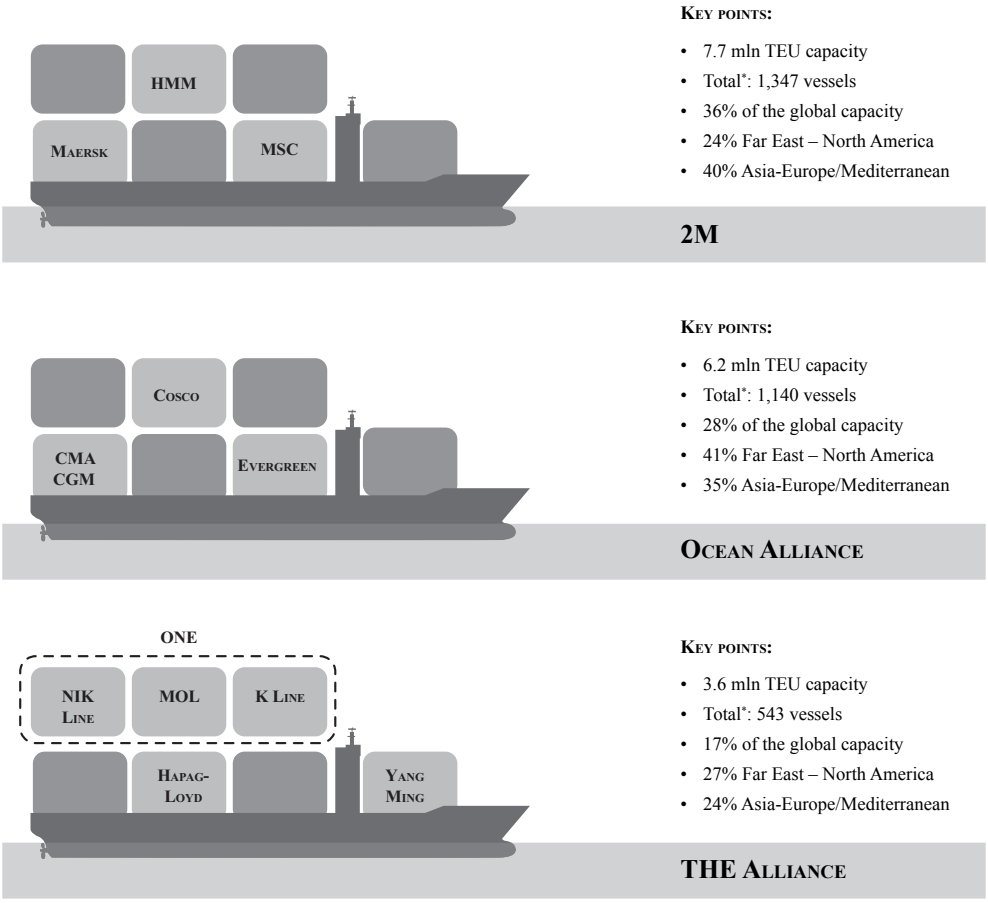
[3] Danish Ship Finance A/S (2017, November). *Shipping Market Review.*

[4] Unctad (2017). *Op. cit.*

[5] Alphaliner, *Cellular Fleet Forecast*.

the end of 2017 it reached 90%. If we solely consider the top 10 liners, the percentage is 79%. The strategy of the great alliances – 2M, THE Alliance, Ocean Alliance – which now cover 81% of global capacity, continues to be pursued. In particular, on East-West routes, these control 99% of total traffic.

The 3 Big Alliances



* Entire fleet of the carriers participating in the alliance.

FIGURE 1 - SOURCE: SRM on Alphaliner

2017 was characterized by the acquisition of Hamburg Sud by the Maersk Group and the merger of Hapag Lloyd and UASC container operations into a single entity. This concentration will continue also in 2018 following the completion of the purchase of OOCL by COSCO Shipping and Shanghai International Port Group, and with the start of the activities of ONE, the alliance formed by the 3 Japanese carriers (K Line, MOL and NYK).

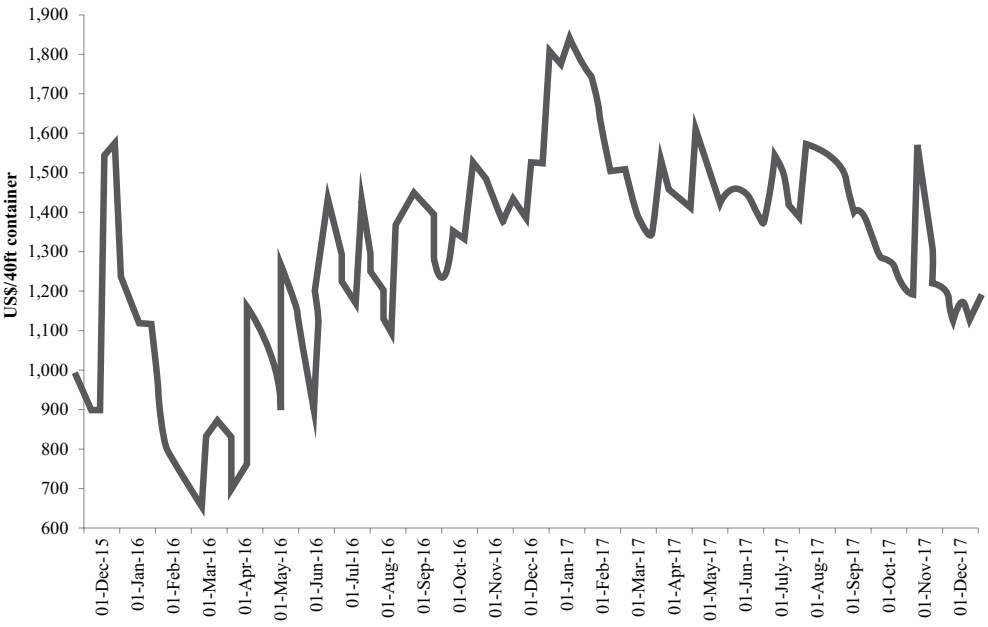
These were the reactions of a market that is adapting to a "new normal" phase in which trade flows are growing more slowly than GDP, differently than in the past, and

the weakness of demand is accompanied by an oversupply situation characterized by the presence of mega ships (over 18,000 TEUs). In fact, the imbalance between demand and supply has had repercussions on freight rates, so the strategy of gigantism, consolidation and alliances contributes to the optimization of capacity and to the reduction of costs.

Examination of ship deliveries suggests an improvement in the balance between supply and demand: in 2017, 153 new container ships were delivered, that is -41% on the peak recorded in 2008 (in 2016 even fewer ships were delivered: 134)[6]. Furthermore, demolition activity in 2018-2019 should remain high considering both the orderbook and stringent environmental regulations.

In general, in 2017 there was a recovery and a lower volatility of freight rates on the main routes at a global level, to which a progressive realignment between transport demand and hold capacity is correlated. The average of the World Container Index calculated by Drewry, which takes into account freight rates on the 8 major routes to / from the US, Europe and Asia, throughout 2017 was $1,461 / 40ft container, higher than the previous year, as can be seen from the following graph.

Two-year spot freight rate trend for the World Container Index (2016-2017)



Graph 4 - Source: Drewry, World Container Index

2016 was a very difficult year for carriers and the tension on freight rates was such that it triggered the disappearance of Hanjin Shipping and to put pressure on the balance sheets of the other companies. These, at the same time, also had to face an increase in oil price and therefore make bigger efforts to save fuel.

[6] Alphaliner (2018). *Alphaliner Weekly 6/2018*.

Alphaliner analysts are predicting a strong new capacity increase in 2018 which could still drive freight rates downwards. In fact, it is estimated that there will be an increase in supply of 5.6% on 2017, which, for the first time since 2015, will exceed the estimated growth in demand (the average annual growth rate is expected to be 5% in the period 2017-2022).

The concentration of maritime carriers led to a reorganization of routes and a rationalization of ports with a significant increase in movements for each vessel. The combination of these elements has increased the negotiating power of carriers towards ports, subjected to the urgent need for investments to always offer innovative and flexible infrastructure and solutions tailored to the needs of an increasingly sophisticated and concentrated demand.

The consequences of gigantism also manifest themselves on the configuration of trade routes: due to the so-called cascade effect, for example, the average and maximum size of vessels used in relations with the Mediterranean will presumably continue to grow and it cannot be excluded that the current top class, at the moment mainly on the Far East-North Europe route, in future could also be used on these relationships. Looking at container services, up until 10 years ago the Far East-Europe route had some services dedicated to the Mediterranean area and many others that, passing through Northern Europe (or North America for the so-called pendulum services), made one, two or even more calls in Mediterranean ports, mainly in the large transhipment hubs located along the Suez-Gibraltar route. Today, as a result of the consolidation and rationalization of services, the Far East-Med relationship is served almost exclusively with dedicated services, while transit lines tend to make at most one call in the Mediterranean. Furthermore, the tendency to use dedicated services has made it possible to identify the so-called regional hubs serving a specific area. This is the case, for example, of Trieste which, with an incidence of transhipment of over 40%, has clearly assumed this role for the Adriatic, but there are now numerous gateways or regional ports with a transhipment share of at least 30% (Livorno, Barcelona, Valencia, etc.). Hence, if the rationalization of services tends to increase the use of transhipment, on the other hand the consolidation of operators reduces the number of hubs needed in each area which, moreover, can be chosen with fewer constraints, with a greater variety of options and, where capacity allows it, in correspondence with ports already characterized by significant inland volumes.

These trends, as already mentioned, have important repercussions on the ports that have seen new growth opportunities over time, even in the segment of containers no longer essentially linked to their nature as hubs. The choices of strategies to implement in order to attract and manage the volumes of goods transported by large ships cannot be made without taking into due consideration, on the one hand, the demand expressed by the reference territory and, on the other, the absorption capacity by the 'whole port and logistic system. This includes not only the sea side infrastructures and the internal terminals of the port, but also the transport networks to / from the internal territory not only local but, also, national. In other words, large ships involve large volumes, and these are obtainable by acting either as a transhipment hub or important gateway, which indirectly implies the availability of efficient intermodal links, or even better the joint development of the two market segments.

In response to global trends in the container segment, the world's major ports are investing in large infrastructure projects, potentially capable of redesigning sea routes. Additionally, we have to consider the change in the global infrastructural context dictated by major projects such as the expansion of the Suez Canal and the new Panama Canal.

Therefore, the greater traffic in pure transit through Suez and also the traffic destined to the catchment area in the Mediterranean basin are channeled on larger ships. This makes it clear that there is a need for infrastructural adjustments both on sea and land. These are the necessary requirements so that the aforementioned kinds of traffic can translate into an impact on the ports of the Med basin and therefore of Italy. The Mediterranean remains the main transit route between Europe and Asia and its ports are working to achieve further improvements in productivity, reliability and quality of service in order to increase their competitiveness.

The goal of improving average efficiency has already been achieved, and infrastructure is also growing and adapting to support additional traffic. Investments in the ports of the area are numerous and significant: the resources are aimed at the creation or improvement of the infrastructures dedicated to accommodating megaships and to managing cargo. This is even more important today because Mediterranean ports have an important element of attractiveness for maritime traffic that is potentially provided by the strategy of China called Belt & Road Initiative, to which a monographic part in this volume dedicates ample space.

Ports in Egypt (Port Said, Alexandria), Turkey (Kumport), Spain (Noatum in Valencia), Israel, as well as Greece (acquisition of the majority of Piraeus), have all benefited from Chinese investments. The general increase in traffic in the area is destined to have an impact on Italian ports, which, being the first European outpost for the ships that cross the Suez Canal coming from Asia, may be urged to act as terminals for goods directed towards Central and Northern Europe.

As regards the global distribution of containerized traffic, Asia – and in particular China – continues to play a predominant role in the export of containerized goods, representing 56% of the total in 2017; Europe is second with 17% and North America follows with 10%. Asia also represents the largest share of container imports, 39% of the total, before Europe (20%) and North America (17%).[7] It is no coincidence that 2017 was a record year for Chinese ports: last year overall handling accounted to 236.8 million TEUs, an increment of 8.3% on the previous record of 2016. This new peak was reached thanks to the record-breaking traffic of containers handled in maritime ports, which amounted to 209.9 million TEUs, and the record of traffic handled by domestic ports, which stood at almost 27 million TEUs, figures that mark a 7.7% and 13.0 increase respectively on 2016, when both previous record annual highs had already been recorded. The good performance was also confirmed in the first three months of 2018 with a traffic of 57.1 million TEUs, an increase of 6.4% on the same period of the previous year.

China also clearly confirmed itself first in the LSCI Index calculated by the Unctad, which measures maritime connectivity of a country; the first non-Asian country ranked is the Netherlands, in 6th position.

[7] Banchero Costa (2018, January). *Containership Market Outlook*.

The ranking of the top 20 world ports for container handling reflects this situation, testifying to the presence of 9 Chinese ports, including Shanghai – 1st in the world – and 6 other ports of the Far East.

Top 20 world ports by container traffic (TEU)

Rank	Port	Country	2015	2016	2017	Var.% 17/16	Var.% 16/15
1	Shanghai	China	36,537,000	37,133,000	40,230,000	8.3%	1.6%
2	Singapore	Singapore	30,922,400	30,903,644	33,666,556	8.9%	-0.1%
3	Shenzhen	China	24,205,000	23,979,000	25,210,000	5.1%	-0.9%
4	Ningbo-Zhoushan	China	20,627,000	21,561,000	24,610,000	14.1%	4.5%
5	Hong Kong	China	20,073,000	19,813,000	20,760,000	4.8%	-1.3%
6	Busan	South Korea	19,468,725	19,456,291	20,470,000	5.2%	-0.1%
7	Guangzhou	China	17,624,900	18,857,700	20,370,000	8.0%	7.0%
8	Qingdao	China	17,436,000	18,050,000	18,300,000	1.4%	3.5%
9	Jebel Ali	UAE	15,592,000	14,772,000	15,370,000	4.0%	-5.3%
10	Tianjin	China	14,111,000	14,519,000	15,070,000	3.8%	2.9%
11	Rotterdam	The Netherlands	12,234,535	12,385,168	13,734,334	10.9%	1.2%
12	Port Klang	Malaysia	11,886,685	13,169,577	11,980,000	-9.0%	10.8%
13	Antwerp	Belgium	9,653,511	10,037,318	10,450,897	4.1%	4.0%
14	Xiamen	China	9,182,815	9,613,700	10,380,000	8.0%	4.7%
15	Kaohsiung	Taiwan	10,264,420	10,464,860	10,270,000	-1.9%	2.0%
16	Dalian	China	9,450,000	9,614,000	9,700,000	0.9%	1.7%
17	Los Angeles	USA	8,160,458	8,856,783	9,343,193	5.5%	8.5%
18	Hamburg	Germany	8,821,481	8,906,817	8,815,469	-1.0%	1.0%
19	Port Tanjung Pelepas	Malaysia	9,117,025	8,280,710	8,380,000	1.2%	-9.2%
20	Laem Chabang	Thailandia	6,821,335	7,227,430	7,784,498	7.7%	6.0%
	Top 20		*312,189,290*	*317,600,998*	*334,894,947*	*5.4%*	*1.7%*

TABLE 1 - SOURCE: SRM on Alphaliner and Port Authorities

In these ports, 335 million TEUs were handled in 2017, which marked an increase of 5.4%. Therefore, the growth rate records a percentage increase on the previous year, when the increase was 1.7%. Also, data show an increasing concentration of global container traffic as the top 20 ports control 45% of the total while the top 10 handle 31% of global containers.

4. DEVELOPMENT OF CONVENTIONAL TRAFFIC: ROLLING AND VARIOUS GOODS

This market sector has experienced a progressive and generalized change in recent years. The downsizing of the general cargo and of the refrigerated sector must be highlighted, which was due to the substitution effect of containers, while the rolling stock sector, following the economic crisis of 2009, recorded significant increases in traffic.

The extreme diversity of the goods that make up general cargo also affects the ports that handle it, as this requires a specific approach for each shipment. The configuration of services and infrastructures for the general cargo sector is different from the traditional one, as there is a progressive specialization of traffic, which requires investments in fixed capital suitable to the handling of diversified bulk cargoes.

There is a need for specialized terminals that offer tailor-made loading and storage services using advanced technologies.

While various goods transported as bulk cargo, have lower sensitivity to timeliness and to diversification of services, bulk break goods with higher added value generate a need for activity and involve higher quality levels along the entire chain.

New cars represent a perfect example of this, as they have primary and secondary terminal services requiring controls imposed by the manufacturers, of the conditions of transfer and protection of the vehicles between and within the logistics areas. The critical parameter is therefore not the availability of spaces and labour for the provision of services, but rather the quality of each individual operation and the spaces being equipped according to indications from the sector. The provision of areas, if not structured and organised to optimize the flows and standards set by the operators, is not a sufficient condition to obtain and maintain this traffic.

Also, emerging in this sector is the tendency of a concentration among increasingly specialized operators who prepare more modern and advanced vessels to offer increased possibilities for modal exchange in favour of the container (i.e. the new Con-Ro ships).

A confirmation of the general cargo trend can be seen in the latest data available on the evolution and consistency of the world fleet, which show the continuous decline of ships designed for various goods (4% of the entire fleet compared to 13% of 2000).

Forecasts for this sector of traffic are uncertain because, on the one hand, it is affected by the container sector, while on the other, it is also true that there are some markets where the type of goods and the port infrastructures do not yet allow the replacement effect of general cargo ships with containerships: this is particularly true for Short Sea Shipping (SSS) and for the transport of heavy loads.

The most commonly used ships for SSS are known as RO-ROs (Roll-on/Roll-off), designed to carry loads on wheels, such as automobiles, trucks, lorries, trailers, semi-trailers, rail cars, etc. They are equipped with hatches that lower to platform level allowing vehicles to get on (Roll-on) and get off (Roll-off) from the ship independently. This type of ship is used for the transport of both new cars and lorries or trailers whose traffic is diverted from the road to the sea. The latter fully falls within the objective pursued by the European Union for "sustainable mobility" which aims to reduce road transport in favour of a rebalancing capable of optimizing the results of the individual modes and their combined use. In this context it is envisaged that by 2030, 30% of road freight transport will be transferred by other modes, such as railways and waterways, for journeys of over 300 km[8].

[8] European Commission (2011, March). *White Paper. Towards a competitive and resource efficient transport system*.

It is in this context that the EU's efforts to develop Short Sea Shipping should be taken into consideration, as this is believed to be a sector of the shipping market which, in the European region, involves sea connections between national and international ports, as well as services to and from the islands of mainland Europe and other countries bordering the Baltic Sea, the Black Sea and the Mediterranean Sea.

The core of the European Short Sea Shipping promotion strategy is the "Motorways of the Sea" project, which aims to directly move a significant share of freight traffic from the road to short sea shipping. In particular, the term "Autostrade del Mare" indicates the combined road-sea transport of goods and, where appropriate, also passengers, carried out essentially through the use of Ro-Ro, Lo-Lo, and mixed Ro-pax vessels[9].

Over the last decade, short sea shipping within the Southern Range has experienced a particularly positive results, marked by the significant increase in flows, goods and passengers, and by a significant development of the system of activated routes. The available statistics confirm this trend: with around 1.86 billion tonnes[10], the SSS accounts for 60% of the total maritime transport of goods in the EU28 and the Mediterranean represents the region where concentration is highest (29%).

5. Liquid bulk traffic

The liquid bulk market continues to grow and to be characterized on the one hand, by lower oil prices and on the other, by a situation of oversupply, which keeps freight rates under constant pressure.

In 2016 the transport of Oil&Gas amounted to 3.1 billion tonnes, +4,2% on the previous year. Also, oil tankers reached 570 million tonnes dwt, while the capacity of Crude Tankers was 407 million and that of Product Tanker amounted to 163 million tonnes. This last figure represents 29% of the global fleet, recording a 5.1% increase on 2016[11]. Gas carriers, with 60 million tonnes, recorded a 10% increase.

The demand for transportation of crude oil remains at high rates, supported by the increase in imports from developing and emerging countries, in particular India and China. A similar trend is shown by the demand for refined products which, after recording a 4.4% increase in 2016, grew by 3.4% in 2017, with the Asia-Pacific region concentrating over 40% of global imports. In particular, Singapore is a trade hub attracting 11% of these. In China there are many factors that drive a strong increase in imports: the great growth in consumption, the increase in exports of oil products, the semi-liberalization of crude oil imports and above all, taking advantage of low oil prices, the acceleration of imports destined to create strategic reserves.

Another aspect that affects the global demand for maritime transport is the lifting of international sanctions against Iran, whose oil exports increased in 2017. The growth

[9] With the development of transhipment, short sea shipping also acquires the function of distributing containers transported from one continent to the other, from a hub port to another, by deep-sea ships. Feeder transport, but also the mere short-haul container, shows a tendency to fall within the scope of the concept of Motorways of the Sea.

[10] Eurostat (2018, April), *Maritime transport statistics - Short Sea Shipping of goods.*

[11] Unctad (2017) and Banchero Costa (2018).

of Iranian exports would be good news for the sector, but due to oversupply in the oil market, these new flows allow it to replace with much shorter routes a good part of the exports from the Atlantic Ocean to the Far East, offering new demand in terms of tonnes/miles. The sanctions against Iran recently reinstated by the Trump administration will have effects to be evaulated in the future.

In such a dynamic context of demand the Baltic Dirty Tanker Index recorded an average 787 points in 2017, showing an 8% growth. Also, the average of the Baltic Clean Tanker Index in 2017 amounted to 606 points, showing a 24% increase on 2016.

As for estimates of the sector, demand for transport will be positively affected by longer routes, some of which will be new and inaugurated due to new refineries operating in the Middle East and Asia. Also, it will be important to consider the improved competitiveness of the refineries located in North America. All these elements add up to the increasing need for energy of South-Central American and African countries[12].

An improvement in the market, though, is usually accompanied by higher risk in investments on ships by shipowners.

Other factors that could potentially shape the future of the sector regard the environmental restrictions envisaging regulations on low sulphur fuel whose price will probably increase. These regulations might as well be an incentive to the scrapping of older vessels while also encouraging orders of new eco-design ships.

Unctad's forecasts for this sector in the period 2017-2022 show a growth of 1.2% for crude and 1.7% for refined oil, both representing slower increases than in the past due to cuts to production in the major producing countries and to the recovery of the oil price.

As far as supply is concerned, the fleet of Crude Tanker[13] is dominated by 714 Very Large Crude Carriers offering a total hold capacity of 220 million dwt. Also, there are 973 Aframax (106 million dwt) and 518 Suezmax (81 million dwt).

According to actual orders, and considering scrapping and delays in deliveries, the fleet of tankers will increase by 4% in 2018, by 1.9% in 2019 and fall by 1.2% in 2020.

As concerns the transport of refined oil products (petrol, naphtha, refined oils, etc.), the Product Tanker[14] fleet sees the prevalence of MR2, both in terms of number (1,520 units) and in terms of capacity with 73.5 million dwt. Then there are the 715 MR1, (26.6 dwt), the 366 LR1 (26.9 million dwt) and, finally, the LR2 with 326 units and 35.6 million dwt.

[12] Venice Shipping and Logistics (2017, December). *Market Overview Tanker Sector.*

[13] The Crude Tanker fleet is composed of ships used to move large quantities of crude oil from the place of extraction to the refineries. eIts composition is as follows (ships bigger than 78,000 dwt):
- *Aframax*: from 78,000 to 119,998 dwt.
- *Suezmax*: from 120,000 to 199,999 dwt.
- *VLCC (Very Large Crude Carriers) /ULCC (Ultra Large Crude Carriers)*: from 200,000 dwt.

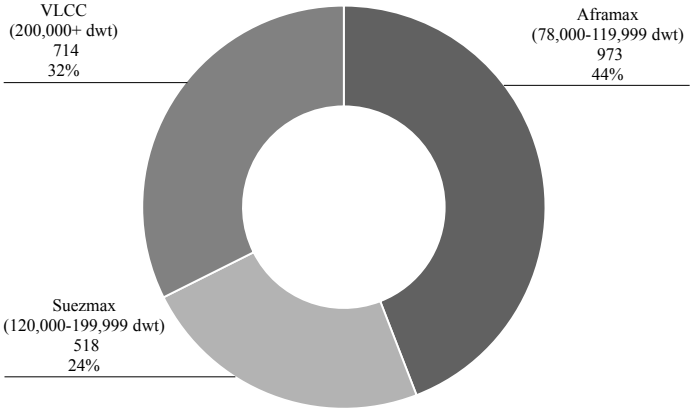
Banchero Costa (2018). *Crude Tanker Market Outlook*.

[14] The Product Tanker fleet is composed of generally smaller vessels used to transport petroleum products from refineries to end markets. Its composition is as follows:
- *Medium Range 1 (MR1)*: from 30,000 to 41,999 dwt.
- *Medium Range 2 (MR2)*: from 42,000 to 59,999 dwt.
- *Long Range 1 (LR1)*: from 60,000 to 77,999 dwt.
- *Long Range21 (LR2)*: from 78,000 to 119,999 dwt.

Banchero Costa (2018). *Product Tanker Market Outlook*.

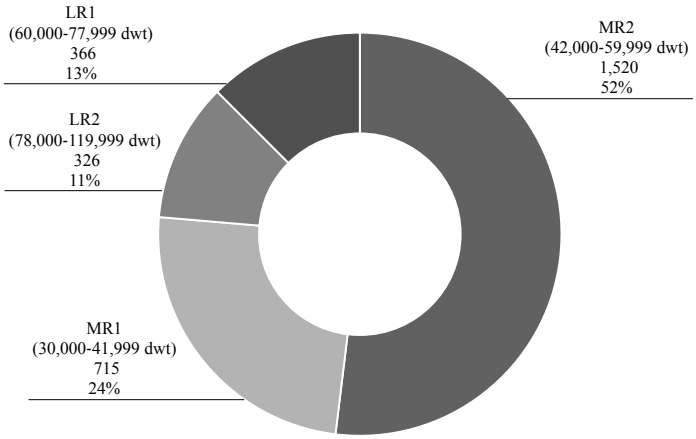
According to actual orders and considering also scrapping and delays in deliveries, the fleet of tankers will increase by 3.1% in 2018, by 1.7% in 2019 and fall by 0.8% in 2020. The LR2 sector will have the most significant growth: +5.2% in 2018, +1.5% in 2019 and -0.5% in 2020.

Crude Tanker fleet by size (number of ships). January 2018



GRAPH 5 - SOURCE: SRM on Banchero Costa, 2018

Product Tanker fleet by size (number of ships). January 2018



GRAPH 6 - SOURCE: SRM on Banchero Costa, 2018

6. Dry bulk traffic

Dry bulk continues to be the most significant macro category of goods in international maritime trade. In particular, in 2016 the main five bulks (coal, iron mineral, wheat, bauxite, phosphate) reached 3.2 million tonnes, equivalent to 31% of global maritime transport. This sector has a high level of diversification and the relative volumes are heavily influenced by the trend of the main industries operating in the reference markets (construction, cement plants, glassmakers, chemical plants). China remains the most influential country for the trend in this sector, since it is the main importer of iron mineral and coal as well as being a major exporter of various dry-bulk products. In 2017 its strong demand, higher than expected, generated a growth of dry bulk transport of 3.7% and an increase in the global fleet lower than in previous years (2.2%)[15].

Once again, it was the iron and steel industry that dominated this development. Imports of iron mineral have grown by 7% on 2016 and the production of steel has increased by 6.3%[16].

This trend has allowed freight rates to reach good levels of profitability for dry bulk vessels in all size categories. The Baltic Dry Index showed an average of $1,145 in 2017, representing a 70% increase on that of 2016 which amounted to $673.

Forecasts for the sector are optimistic, also with reference to infrastructure projects linked to the BRI, which should generate an increase in the demand for steel in the next 10 years: in the period 2017-2026 Lloyd's list intelligence forecasts an average increase of 3.6% while BIMCO estimates that the fleet will grow by a mere 1%. Furthermore, higher costs of fuel than in 2015 urge shipowners to operate with slow-steaming speed. Consequently, this contributes to a reduction in the offer of hold capacity on the market and to a higher balance within the sector.

Graph 7 illustrates the composition of the dry bulk[17] fleet bigger than 20,000 dwt (9,698 ships) by size.

As far as ports are concerned, infrastructures dedicated to dry bulk are set up differently according to their function, i.e. if they are primarily used for import, export or both, which represents a difference with other types of terminal (container or general cargo). Exporter terminals are usually located closer to the sources of materials (i.e. mines), so as to favour outgoing flows, and they tend to handle a limited number of products.

[15] Unctad (2017). *Op. cit.*

[16] BIMCO (2018). *2017 was year of change in shipping – caution required in 2018.*

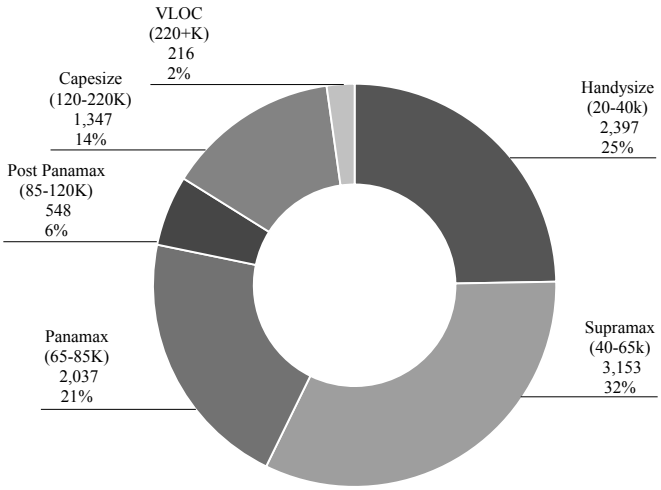
[17] The bulk fleet is composed of the following ships types:

- *Handysize*: from 20,000 to 40,000 dwt.
- *Supramax*: from 40,000 to 65,000 dwt.
- *Panamax*: from 65,000 to 85,000 dwt.
- *Post-Panamax*: from 85,000 to 120,000 dwt.
- *Capesize*: from 120,000 to 220,000 dwt.
- *Vloc*: more than 220,000 dwt.

Banchero Costa (2018, January). *Dry Bulk market Outlook*.

Conversely, importer terminals need to combine seaside and landside logistics, which poses challenges such as the arrival of a ship and the landside services required by a receiver client. All of this requires efficient planning of spaces and operations. The perfect location of this kind of terminal is influenced by maritime factors such as the length of quays and depth of seabed which have to be combined with ease of transport via land (road/railway) and availability of vast storage areas. The concentration of handling operations on one or few products in high quantities positively correlates with high economies of scale due to a better use of space, equipment and personnel specialisation.

Dry bulk fleet by size (number of ships). January 2018

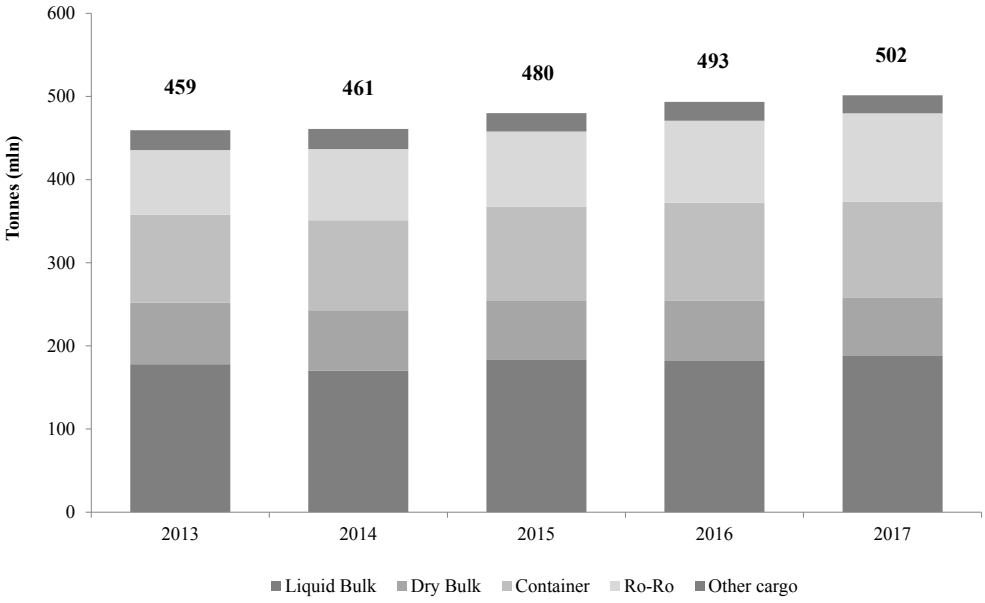


GRAPH 7 - SOURCE: SRM on Banchero Costa, 2018

7. ITALY IN THE GLOBAL MARITIME SCENARIO. PROFILE OF A COUNTRY SEEKING RECOVERY

In the Mediterranean, on the Asia-Europe route, which is confirmed as one of the cornerstones of international freight traffic, Italy occupies a privileged geographical position. In this context, the national port system recorded positive growth in 2017 related not only to the offer of services on international long-haul routes, but also to inter-Mediterranean relations and with the Middle East, which represent a consolidated market with further potential of growth. All Italian ports managed a volume of freight traffic that exceeded the threshold of 500 million tonnes, +1.8% on 2016.

Tonnes of goods handled by the Italian port system. Trend 2013-2017

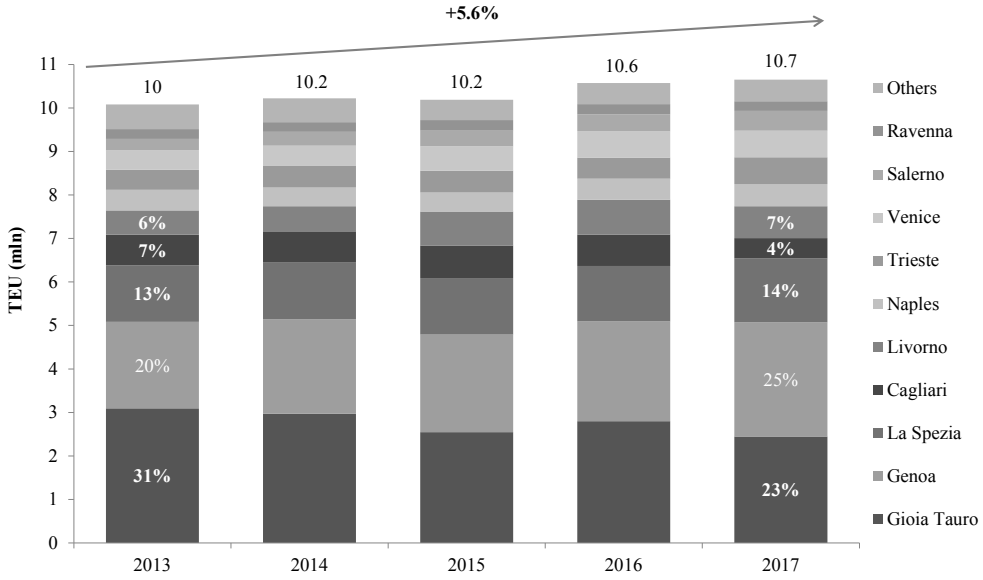


GRAPH 8 - SOURCE: SRM on Assoporti and Port Authorities

The only negative data regards transhipment traffic due to the losses recorded by the two hubs of Gioia Tauro and Cagliari, while the performance of large gateways such as Genoa, La Spezia, Trieste, Naples and Salerno is excellent.

Graph 9 shows the trend in the last five years of container traffic in our country, highlighting how Italy, although showing an upward trend, has always maintained the overall handling at around 10 million TEUs, reaching 10.7 million (+0.7%) in 2017. The most interesting information that emerges from the graph is how the importance of the ports in the last five years has changed. In fact, data confirm: a) a difficult moment for Italian transhipment, b) in 2017 Genoa is the first container port and c) the importance of gateway ports is constantly increasing.

Trend of container traffic in Italy by port. 2013-2017

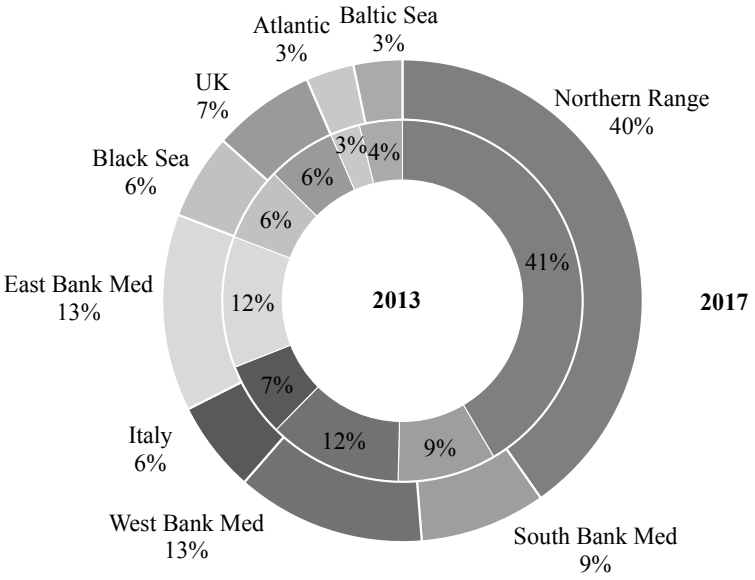


GRAPH 9 - SOURCE: SRM on Port Network Authorities, 2018

In 2013 our hubs handled 4 million TEUs, equal to 40% of overall traffic. In 2017 this datum amounted to 2.9 million, equal to 27%.

Performances shown in the container sector suggest that the Italian port system has failed to take advantage of its position in the Mediterranean to attract increasing flows of goods and strengthen its market share. This was mainly due to the supremacy of Northern Range ports, which are currently reaching their saturation level, but also to the strengthening of other ports in the Mediterranean.

Shares of container market by port area (TEUs). 2013-2017



Explanatory note: 100% is the sum of all the shares of the port range starting from the Black Sea and passing through the Med, the Atlantinc, the Northern Range and terminating in the Baltic Sea. Italy, despite belonging to the West Bank Med, has been considered separately with the aim of highlighting its share more clearly.

GRAPH 10 - SOURCE: SRM on Port Authorities, 2018

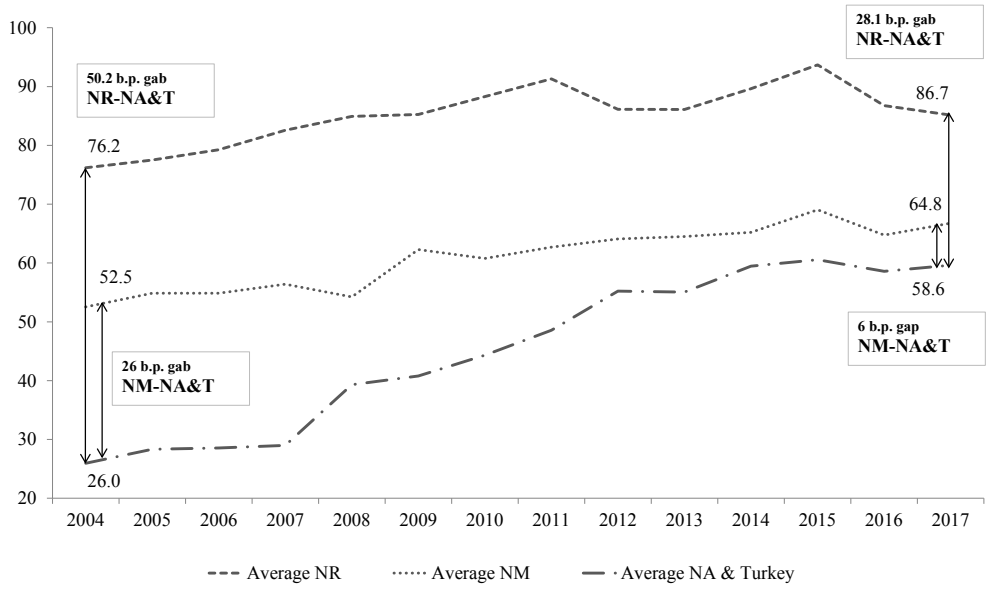
In Alphaliner's world ranking of the top 100 ports for container traffic in 2017, Genoa (in 63rd place), is the first among Italian ports followed by Gioia Tauro in 69th position. The percentage of transhipments in Genoa is around 14%, so the port is configured as a gateway which, unlike Gioia Tauro, has a hinterland behind it embracing a potential market formed by the Po Valley, south-eastern France, Switzerland and Southern Germany. In order to more closely monitor its catchment area, the Ligurian port is planning, on the one hand, investments in new port infrastructures that will allow the docking of large container ships, and on the other a railway infrastructure with the acceleration in the construction of the Third Pass between Genoa and Milan, whose inauguration is scheduled for 2021. In the same year the Monte Ceneri Tunnel between Lugano and the Gotthard will also be inaugurated.

Gioia Tauro is a pure transhipment port (100%) and over the last few years has been suffering with the presence of competitors on the South bank of the Med, of Spanish ports and of Piraeus, the Chinese outpost in Europe. The Calabrian hub also suffers from the effects of the new strategies undertaken by carriers that, driven by the need to rationalize and consolidate routes, tend to serve the Mediterranean with dedicated services and to reduce the number of stops in the area for pure transit traffic from Suez.

Moreover, an OECD[18] study also highlights the threat represented by the dependence on alliances of hub ports which makes them more vulnerable. This is the case of Gioia Tauro which depends only on 2M.

Another point illustrating how competitiveness is changing on the portuality chessboard is offered by the following elaboration by SRM, comparing the average of the Liner Shipping Connectivity Index[19] in the period 2004-2017 of three different port areas: Northern Range (NR), North Africa+Turkey (NA+T) and North Mediterranean (NM)[20].

Growth of the Liner Shipping Connectivity Index in the 3 port areas



GRAPH 11 - SOURCE: SRM on Unctad, 2017

This graph clearly shows that the gap between the ports of the South-Eastern bank and North bank has reduced considerably over the last 14 years analysed by Unctad. This confirms the growing competitiveness of ports in those areas, which, despite political and social instability, continue to see their position in the market strengthened.

It is also necessary to highlight that maritime transport in Italy is not made up only of containers: out of the total 500 million tons handled, more than half (258 million) is bulk, and the role of Ro-Ro is also important.

[18] MERK O. (2017, April). *Le sfide globali per il sistema portuale.*

[19] The *Liner Shipping Connectivity Index* is calculated by Unctad and measures competitiveness of a port and logistics system (it takes into account 157 countries) based on network and on the quality of liner services offered by ports. China 2004 = 100.

[20] Il Northern Range (NR) includes Germany, The Netherlands and Belgium. The North Mediterranean is made up of Spain, France, Italy and Greece. North Africa + Turkey includes Morocco, Egypt and Turkey.

In particular, this last sector constitutes a valuable element of the national portuality. The Italian Port System, due to its central and strategic position, has consolidated and developed its competitive position in the Ro-Ro sector through the provision of high quality and specialized services (especially for various goods), as well as of terminals able to accommodate the increasing shares of rolling goods of the Motorways of the Sea. In fact, net of container traffic, Ro-Ro traffic is by far the main mode in the sector of miscellaneous goods and, in general terms, amongst the most significant in the overall transit. The combined maritime market is not limited to cabotage, but expands to Short Sea Shipping between the shores of the Mediterranean. EU and non-EU road haulage companies have been using Italian ports for years as access routes to the markets of South East Europe, the Middle East, North Africa and the western part of the Mediterranean. In this regard, both the Adriatic ports, in particular Trieste, Ancona, Bari and Brindisi, and those of the Tyrrhenian Sea, in particular Genoa, Livorno, Civitavecchia, Naples and Salerno, can count on significant road traffic from countries that overlook the shores of the Mediterranean.

36% of the traffic of rolling stock in transit in Italian ports comes from abroad. This percentage is close to 100% in the ports of the Adriatic shore where cabotage traffic is residual and limited to a few stable lines[21].

Euro-Mediterranean trade and its development prospects outline a scenario in which, despite the variability that characterizes exchanges with the countries of the southern shores of the Mediterranean, the Italian port system has strengthened its market share. This consolidation, given the specific features of the rolling stock sector and the type of routes operated (national and Mediterranean cabotage), can be facilitated by national policies such as Marebonus and Ferrobonus for the development of new services. In particular, the Marebonus allocates a total expenditure of 128 million euro (79.1 in 2017 and 48.9 in 2018)[22] for the implementation of shared projects between shipowners and hauliers that improve the intermodal chain and decongest road networks.

It is no coincidence that our country is the absolute leader in Europe, for freight transport in SSS both in the Mediterranean Sea and in the Black Sea. Italy also boasts the presence of shipping companies that are among the world leaders in the sector.

In 2017, with over 106 million tonnes of goods in Ro-Ro, Italian ports reached their all-time high with an 8% increase on the already impressive result for 2016.

With reference to bulk, the solid ones feed various industrial chains, and in recent years have experienced a decreasing trend, handling volumes of about 70 million in 2017 (-5.3%).

Most of the traffic is based on industrial ports, for which the demand derives directly from on-site production (see for example ILVA of Taranto) and the current trend mainly depends on the degree of use of the plants.

As in the case of liquid bulk, the current and potential demand for solid bulk cargo is also characterized by large volumes of goods managed mainly by a few large shippers linked to specific activities (power plants, iron and steel plants, wheat supply chain,

[21] Confcommercio & ISFORT (2015). *Sviluppo dell'intermodalità*.

[22] Decree 13.9.2017 No. 176 on G.U. N. 289 (12th December 2017) and Decree 13.12.2017 on G.U. N. 293 (16th December 2017).

etc.). This is flanked by many so-called minor bulk flows, which are usually managed by specialized terminals.

The liquid bulk for Italy represents the most important commodity category in terms of volumes and is therefore very strategic (high income for port activities). In 2017, with a marked prevalence of imports, around 188 million tonnes were moved, and these were mainly related to the demand for refining petroleum products and for energy.

The market is mainly characterized by large volumes of goods handled by a limited number of shippers, who concentrate around points of origin of raw materials flows (extraction / refining) and supply flows to refining plants and coastal deposits.

Various non-containerized goods (general cargo) tend to become residual over time but remain vital for the supply chain of various industrial districts. This category includes, for example, the project cargo in which Italy has a leading position on the international scene, with a high progression in regards to the export of technology, know-how and specialization of operators.

Figure 2 shows traffic volumes, categorised by type, managed by the 15 Port System Authorities.

8. Conclusions

The forecasts for maritime transport elaborated by Unctad for the period 2017-2022 estimate an annual growth for all the traffic sectors of 3.2%. The increase in seaborne trade could be reasonably supported by major infrastructure development projects ranging from the BRI to the International North-South Transport Corridor (India, Russia and Central Asia), from major works such as Suez and Panama, as well as by regional trade agreements, such as the one signed between the European Union and Japan. However, we cannot ignore the possible effects on transport trends deriving from the protectionist policies implemented by two giants of the world economy, namely China and the US. The impact these will certainly have on the costs of maritime trade and on the routes will be better understandable only once the measures are fully operational.

The development factors that guide choices of public and private investment are influenced by changes in production and consumption profiles, with the spread of electronic commerce and the continuous expansion of international trade.

Ports should not only attract goods and ships, but also the available capital and funding that allow the development and maintenance of traffic flows, creating a link between investors and the port community for the benefit of the surrounding region.

As previously stated, the Italian port system began to show the first signs of recovery in 2017 but it has not yet managed to strengthen its market share in a Mediterranean where competition for goods flows is becoming increasingly tense both in the in the East-West and North-South directions. The consequences are important, because they also affect the competitiveness of our manufacturing companies in a historical phase in which exports have assumed the role of almost the only engine for economic growth: the port sector is “the main distribution partner of a country’s manufacturing industry”, due to the fact that 38% in value of Italian import-export travel by ship.

Type of goods handled by the 15 Port Network Authorities in 2017

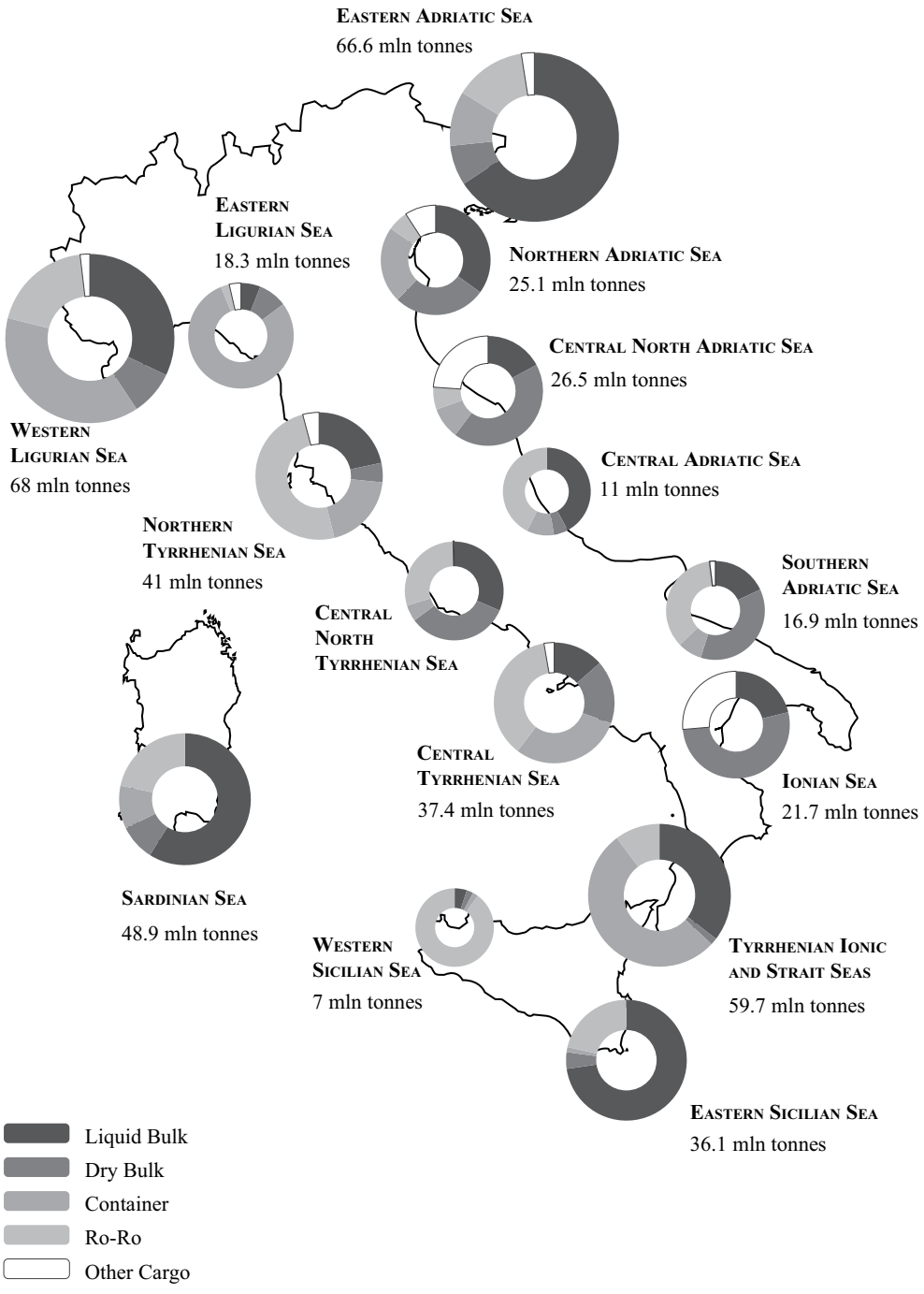


Figure 2 - Source: SRM on Assoporti and Port Authorities, 2018

Since 2015, Italy has adopted plans and programmes that have redefined the policy, the objectives and the relevant instruments for Italian portuality. Italy, with the reform launched in 2015, offers our port system new opportunities to take advantage of the general growth of the sector. The declared objectives of rationalization, reorganization of governance, administrative and bureaucratic simplification, already showed its first results in 2017.

From the studies carried out by SRM on transport demand and on the ports of the Mediterranean, it emerges that the trends in the development of world trade draw diversified paths, interweaving geographic dimensions and logistic relationships on several levels involving global trade flows that run along the east-west routes and the intraregional ones that cover the north-south directions.

The realistic planning of a significant development of the Italian port system must have at its base competitiveness in the Mediterranean and European context, as well as the most current interpretation of the role of ports (large or small) in global logistics. In order to respond to the needs expressed by the national market and with the aim of working on a progressive penetration of European markets, the need arises to focus on logistics. This has to be understood as respect for delivery times (goods return), which can only be ensured through important interventions in the cycle of controls and on all the phases that accompany and follow the port cycle, as well as on the improvement of the last-mile rail service between ports and hinterlands.

It is precisely thanks to a coordinated and integrated approach along the entire distribution chain transiting through Europe that it will be possible to strengthen the Italian market share in comparison with Northern European ports. Enlarging the market towards Switzerland and Germany will not be possible without utilising railways in an increasingly competitive manner.

The development strategy of our port system, due to its characteristics, should not seek to compete with the great Mediterranean hubs such as Piraeus. Conversely, it should bet on their role of access ports to Europe. It is no coincidence that China is interested in Trieste, a European port of extraterritorial customs and linked to Central and Eastern Europe via rail. In this way, it is easy to explain the $450 million investment made in the Terminal of Vado Ligure by COSCO and Qingdao Port International Development, who have acquired 40% and 9.9% respectively of the new terminal under construction.

The Chinese investors' aims and our ports' ambitions correspond to the enlargement of the competitive scope of our port system, which may offer an alternative from the South to import-export traffic travelling from Switzerland and Southern Germany (Bavaria, Baden-Württemberg).

This could be made possible thanks to the implementation of efficient intermodal services capable of taking advantage of the avenues created by the completion of rail infrastructures of the Rhine-Alps corridor.

The ports of Southern Italy are naturally attractive, due to their strategic position which makes it possible to avoid detours of route. The intermodal aspect, though, needs to be improved. In particular, Naples-Salerno on the Tyrrhenian and Bari-Taranto on the Adriatic, can become the logistic base for the entire Italian industry up until the Po Valley.

Successful experiences in the Mediterranean basin highlight that a focus on infrastructure needs to be accompanied by the development of dry-port areas, where industrial and manufacturing activities happen alongside numerous logistic functions with value added in SEZ (Special Economic Zones with total or partial tax discounts for export, import and re-export flows). This is the strategy that many ports in the Mediterranean have chosen to adopt.

This is the real challenge for Italian portuality. The implementation of the reform is only the first step: without the construction of networks of efficient land connections and dry port areas fitted with logistic areas, there is a risk of getting stuck in the process of developing port logistics in the following few years. The establishment of SEZ envisaged by the Italian regulations could potentially benefit our regions. Campania, for example, has been the first to pass the 'Plan of Strategic Development of the Special Economic Zone' and this will be operative after a Decree of the Prime Minister.

Italy can also seize another opportunity linked to its relevance in the Ro-Ro sector: our country is leader in the global fleet of Ro-Ro cargo and passenger/cargo by number of ships and tonnage. Besides point-to-point relations, it is important to analyse the potential of triangulations of traffic, involving other Mediterranean countries such as Spain and France. Our port system can intercept volumes of traffic coming from these nations' coastal productive regions.

Intra-Mediterranean maritime exchange, despite the crisis that affected the area and the decline in trade of petroleum products, has remained generally stable and for some countries it has even shown positive trends (i.e. Turkey, Morocco, Israel). Thus, it is crucial to the Italian port system to strengthen relations with countries of the South Bank of the Med. Also, in this case the experience of competitor countries such as Morocco and Spain can offer examples of best practice in terms of port innovation and adaptation to global competition (i.e. Tanger Med, Valencia, Barcelona). The successful intuition was to change the nature of the ports from pure hubs to mixed ones where Ro-Ro is carried out alongside transhipment, which produced some Short Sea Shipping traffic both for goods and passengers to/from the port.

It will also be important to be able to integrate deep-sea and short-sea shipping in this category of traffic. The development of combined transport is therefore closely linked to the presence of an infrastructure network capable of efficiently organising the complex logistic process of both the transport system and of the services for handling goods.

Focus

Energy flows: Maritime transport of liquid bulk

This focus on the Scenario aims to provide an in-depth analysis of a sector that significantly affects maritime flows, represented by the transport routes of liquid bulk. Maritime traffic, in fact, is strongly linked to the demand for raw materials for energy production and to fuel costs, both factors related to the industrial policies and energy strategies of the countries concerned

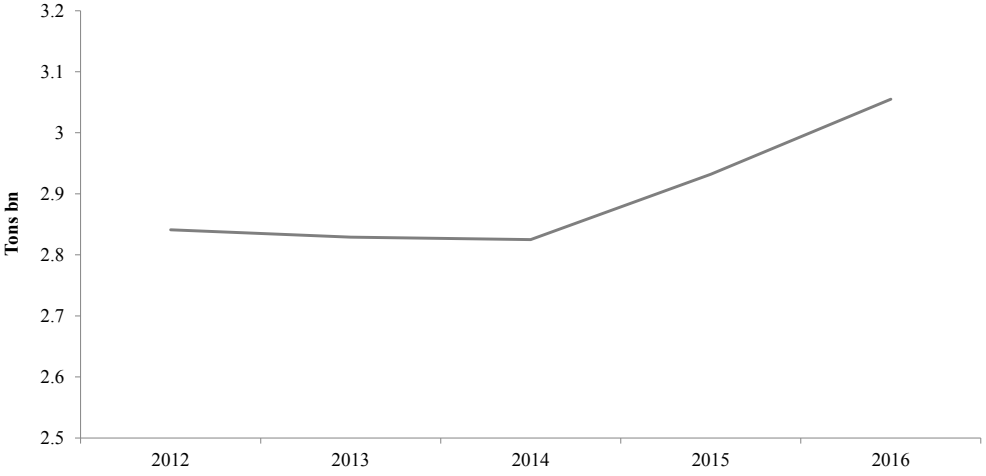
World "liquid" maritime transport

Liquid bulk transport concerns the handling of different cargo and accounts for more than 30% of international maritime traffic, in terms of tons. It mainly includes the transportation of crude oil, refined petroleum products, gas and chemical products.

In 2016, "Oil&Gas" seaborne trade volumes reached 3.1 billion tons, of which crude oil with 1.8 billion tons accounts for 60%, refined oil products and gas for the remaining 40% with 1.2 billion tons.

Focusing on the latter, 8.7% involves the transport of liquefied natural gas (LNG) equal to 268 million tons, while 2.9% is concerns liquefied petroleum gas (LPG)[23].

World seaborne Oil and gas trade. Trend 2012-2016



Graph 12 - Source: SRM on Unctad, 2017

After the almost constant trend experienced in the period 2012-2014, maritime transport of crude oil and refined products grew by 4% in the last 2 years. In particular, on the one hand China – reflecting additions to refinery capacity –, the United States

[23] Unctad (2017). *Op. cit.*

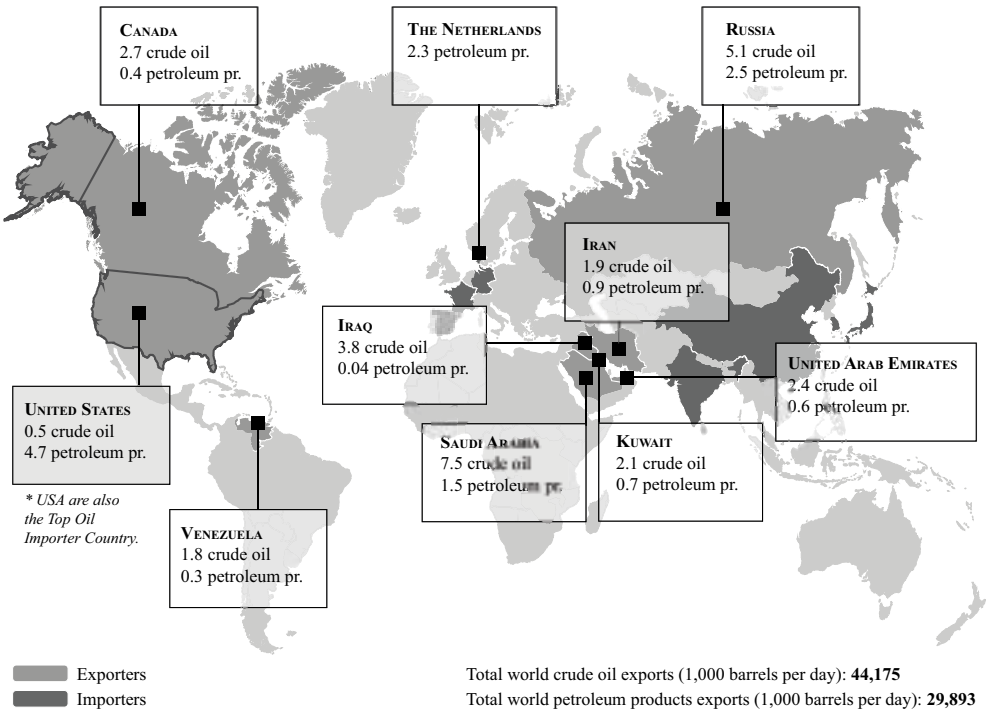
– reflecting reduced domestic production – and India recorded a very strong import demand for oil. On the other hand, there was a high level of exports of oil products from Saudi Arabia and the United States.

Once again, the contribution to the recovery came mainly from the developing countries which continued to grow and increased their demand for energy products.

According to OPEC,[24] medium-term oil demand outlook for the period 2016-2022 shows an average annual increase of close to 1.2 mb/d; demand in developing countries is expected to be strong, increasing from 43.2 mb/d in 2016 to 49.6 mb/d in 2022.

The "distance" between oil and petroleum products exporters and importers shapes and encourages maritime transport of liquid bulk.

Top 10 Oil exporters and importers Countries (thousand barrels per day)*



* "Oil" includes crude oil and petroleum liquids in 2016. Data are related to oil exports.

Figure 3 - Source: SRM on OPEC

The figure shows that the first places among oil and petroleum products exporters belong to countries in the Middle East, which generate one third of total exports, followed by Russia and North America. The main importers are the regions of Asia-Pacific, North America and Europe. The United States, China and India today make up the main share of demand for crude and refined products.

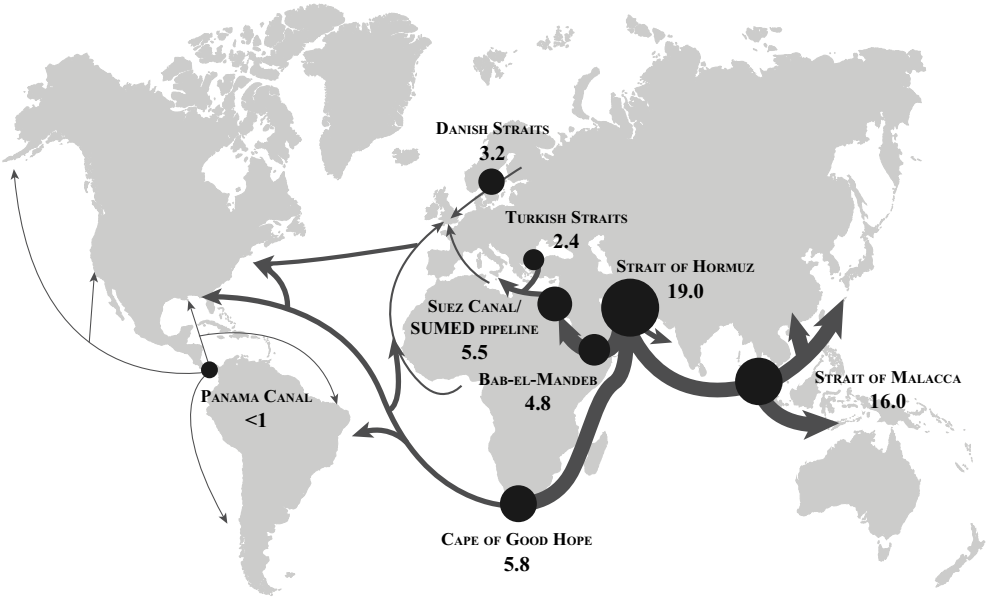
[24] OPEC (2017). *World Oil Outlook 2040.*

These rankings reflect the new balances defined at a global level, with the countries of Asia-Pacific demanding quantities of ever-increasing energy products, whereas advanced economies, with the exception of the United States, despite being among the first consumers, continue to lose relative weight. From the supply point of view, it is interesting to note that in recent years the export of oil products has also increased. In the past, refineries were located in importing countries or in neighbouring nations. Today, however, there are countries rich in oil, such as Saudi Arabia, Kuwait and Russia that have installed refineries on their territory and even tend to export refined products.

Therefore, the Middle East, which continues to represent the area from which the highest oil export originates, is geographically far from the economies that require more energy: the United States, Asia (in particular China, India and Japan) and Western Europe. It is precisely this distance that increases transport, and therefore maritime traffic, of oil. According to EIA (U.S. Energy Information Administration)[25] data, about 61% of the world's petroleum and other liquid production, 58.9 million b/d, moves on maritime routes.

The major trade routes for global seaborne oil transportation are shown in the following diagram.

Daily transit volumes through world maritime oil[*] chokepoints in 2016 (million barrels)



[*] Includes crude oil and petroleum liquids.
Figure 4 - Source: SRM on EIA, 2017

[25] EIA (2017, July). *World Oil Transit Chokepoints.*

Global sea routes that are commonly used for oil transport pass through chokepoints, channels in some cases so narrow, that restrictions are placed on the size of the vessel that can navigate through them. International energy markets depend on reliable transport routes. Blocking a chokepoint, even temporarily, can lead to substantial increases in total energy costs and world energy prices as this adds thousands of miles of transit in alternative routes and ships have to travel longer, which is therefore more expensive.

Volume of crude oil and petroleum liquids transported through world chokepoints, 2011-16 (million barrels per day)

Location	2011	2012	2013	2014	2015	2016
Strait of Hormuz	17	16.8	16.6	16.9	17	18.5
Strait of Malacca	14.5	15.1	15.4	15.5	15.5	16
Suez Canal and SUMED Pipeline	3.8	4.5	4.6	5.2	5.4	5.5
Bab el-Mandeb	3.3	3.6	3.8	4.3	4.7	4.8
Danish Straits	3	3.3	3.1	3	3.2	3.2
Turkish Straits	2.9	2.7	2.6	2.6	2.4	2.4
Panama Canal	0.8	0.8	0.8	0.9	1	0.9
Cape of Good Hope	4.7	5.4	5.1	4.9	5.1	5.8
World maritime oil trade	*55.5*	*56.4*	*56.5*	*56.4*	*58.9*	*n.a.*
World total oil supply	*88.8*	*90.8*	*91.3*	*93.8*	*96.7*	*97.2*

TABLE 2 - SOURCE: SRM on EIA, 2017

Major trade routes for global seaborne oil transportation: characteristics and traffic data

Having identified the main maritime chokepoints in the world involved in global oil trades, we analyze characteristics and transits of the most important ones, which if closed could heavily influence world shipping, its costs and times, and therefore energy costs.

The Strait of Hormuz is the world's most important chokepoint, with an oil flow of 17 million b/d in 2015, about 30% of all seaborne-traded crude oil and other liquids during the year. In 2016, total flows increased to a record high of 18.5 million b/d. Located between Oman and Iran, it connects the Arabic Gulf with the Gulf of Oman and the Arabian Sea.

EIA estimates that about 80% of the crude oil that moved through this chokepoint went to Asian markets, based on data from Lloyd's List Intelligence tanker tracking service. China, Japan, India, South Korea, and Singapore are the main destinations for oil moving through the Strait of Hormuz. Qatar exported about 3.7 trillion cubic feet per year of liquefied natural gas (LNG) through this Strait in 2016, according to BP's Statistical Review of World Energy 2017. This volume accounts for more than 30% of global LNG trade. Furthermore, Kuwait imports LNG volumes that travel northward through the Strait of Hormuz.

It is deep and wide enough to handle the world's largest crude oil tankers with approximately two-thirds of oil shipments carried by tankers in excess of 150,000 deadweight tons coming through this Strait.

Most potential options to bypass Hormuz are currently not operational. Only Saudi Arabia and the United Arab Emirates (UAE) have pipelines that can ship crude oil outside of the Gulf and have additional pipeline capacity to circumvent the Strait of Hormuz. At the end of 2016, the total available crude oil pipeline capacity from the two countries was estimated at 6.6 million b/d, while they also had roughly 3.9 million b/d of unused bypass capacity.

Saudi Arabia has the 746-mile Petroline, also known as the East-West Pipeline, which runs across Saudi Arabia from its Abqaiq complex to the Red Sea. The Petroline system consists of two pipelines with a total nameplate (installed) capacity of about 4.8 million b/d. The 56-inch pipeline has a nameplate capacity of 3 million b/d. The 48-inch pipeline had been previously operating as a natural gas pipeline, but Saudi Arabia converted it to an oil pipeline. The switch increased Saudi Arabia's spare oil pipeline capacity to bypass the Strait of Hormuz from 1 million b/d to 2.8 million b/d, but this volume is only achievable if the system operates at its full nameplate capacity. In 2016, a plan was announced to expand the capacity of the East-West pipeline to 7 million b/d, which is due to be completed by the end of 2018. To date, there has been little progress on the pipeline expansion.

Saudi Arabia also operates the Abqaiq-Yanbu natural gas liquids pipeline, which has a capacity of 290,000 b/d.

The UAE operates the Abu Dhabi Crude Oil Pipeline (1.5 million b/d) that runs from Habshan (a collection point for Abu Dhabi's onshore oil fields) to the port of Fujairah on the Gulf of Oman, which allows crude oil shipments to circumvent the Strait of Hormuz. The government plans to increase the capacity of this pipeline to 1.8 million b/d.

Saudi Arabia has two additional pipelines that run parallel to the Petroline system and bypass the Strait of Hormuz, but neither of the pipelines has the ability to transport additional volumes of oil if the Strait of Hormuz is closed.

The 1.65 million b/d, 48-inch Iraqi Pipeline in Saudi Arabia (IPSA), which runs parallel to the Petroline from pump station 3 (11 pumping stations run along the Petroline) to the port of Mu'ajjiz, just south of Yanbu, Saudi Arabia, was built in 1989 to carry 1.65 million b/d of crude oil from Iraq to the Red Sea. The pipeline closed indefinitely following the August 1990 Iraqi invasion of Kuwait. In June 2001, Saudi Arabia seized ownership of IPSA as compensation for debts Iraq owed and converted it to transport natural gas to power plants.

Operating pipelines that bypass the Strait of Hormuz, 2016 (million barrels per day)

Pipeline name	Country	Status	Capacity	Throughput	Unused capacity*
Petroline (East-West Pipeline)	Saudi Arabia	Operating	4.8	1.9	2.9
Abu Dhabi Crude Oil Pipeline	UAE	Operating	1.5	0.5	1
Abqaiq-Yanbu Natural Gas Liquids Pipeline	Saudi Arabia	Operating	0.3	0.3	0
Iraqi Pipeline in Saudi Arabia (IPSA)	Saudi Arabia	Converted to natural gas	0	--	0
Total			6.6	2.7	3.9

* Unused capacity is defined as pipeline capacity that is not currently used but can be readily available.

TABLE 3 - SOURCE: SRM on EIA, 2017

Other pipelines, such as the Trans-Arabian Pipeline (TAPLINE) running from Qaisumah in Saudi Arabia to Sidon in Lebanon or a strategic oil pipeline between Iraq and Turkey, have been out of service for years because of war damage, disuse, or political disagreements. These pipelines would require extensive renovation before they could transport oil. Relatively small quantities, several hundred thousand barrels per day at most, could also be transported by truck if the Strait of Hormuz were closed.

The Strait of Malacca, linking the Indian Ocean and the Pacific Ocean, is the shortest sea route between the Middle East and growing Asian markets. Flows through this Strait rose to 16 million b/d in 2016, compared with 14.5 million b/d in 2011, retaining its position as the second busiest transit chokepoint in the world.

Oil shipments through the Strait of Malacca supply China and Indonesia, two of the world's fastest-growing economies. Crude oil generally makes up between 85% and 90% of total oil flows per year, and petroleum products account for the remainder.

At its narrowest point in the Phillips Channel of the Singapore Strait, it is only about 1.7 miles wide, creating a natural bottleneck with the potential for collisions, grounding, or oil spills. According to the International Maritime Bureau's Piracy Reporting Centre, piracy, including attempted theft and hijackings, is a threat to tankers in this Strait, and ships saw an increasing number of attacks in 2015.

If Malacca were blocked, nearly half of the world's fleet would be required to reroute around the Indonesian archipelago. Rerouting would tie up global shipping capacity, add to shipping costs, and potentially affect energy prices.

Several proposals have been made to build bypass options and reduce tanker traffic through this Strait. In particular, China and Myanmar (Burma) commissioned the Myanmar-China natural gas pipeline in 2013 that stretches from Myanmar's ports in the Bay of Bengal to the Yunnan province of China. The pipeline has a capacity of 424 billion cubic feet per year. The oil portion of the pipeline was completed in August 2014 and it is now operational at full capacity since the 260,000 b/d refinery in Yunnan, China, began operating in June 2017. The Myanmar-China oil line transports Middle Eastern oil, allowing it to bypass the Strait of Malacca.

It is also an important transit route for liquefied natural gas (LNG) from Arabian Gulf and African suppliers, particularly Qatar, to East Asian countries with growing LNG demand. The biggest importers of LNG in the region are Japan and South Korea.

Strait of Malacca oil and liquefied natural gas (LNG) flows, 2011-16 (Million barrels per day)

	2011	2012	2013	2014	2015	2016
Total oil flows through the Strait of Malacca	14.5	15.1	15.4	15.5	15.5	16
crude oil	12.8	13.2	13.3	13.3	13.9	14.6
refined products	1.7	1.9	2.1	2.2	1.6	1.4
LNG (Tcf per year)	2.8	3.5	3.9	4.1	3.6	3.2

Tcf = Trillion cubic feet.

TABLE 4 - SOURCE: SRM on EIA, 2017

The Suez Canal and the SUMED pipeline are strategic routes for Gulf oil and natural gas shipments to Europe and North America. These two routes combined accounted for about 9% of the world's seaborne oil trade.

The Suez Canal is located in Egypt and connects the Red Sea with the Mediterranean Sea. In 2017, crude oil and refined products and LNG accounted for 24% and 3% of total Suez cargoes, measured by net metric tonnage, respectively. The Suez Canal cannot handle Ultra Large Crude Carriers (ULCC) and fully laden Very Large Crude Carriers (VLCC) class crude oil tankers. The enlargement of the Canal that took place in 2015, allows more than 60% of all tankers to transit the Canal.

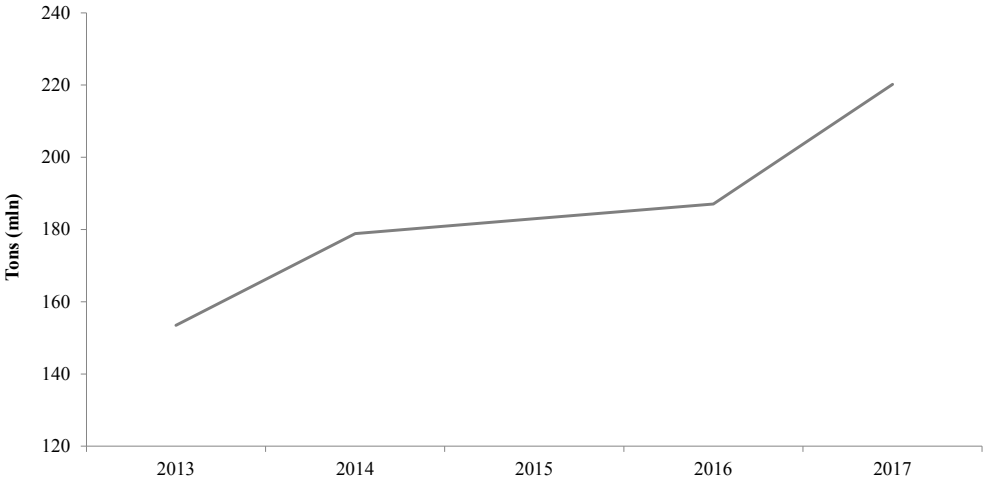
In 2017 Oil&Products (crude oil and refined products) northbound flows increased by 2.3% to 117.4 million tons, and southbound grew by 42.3% to 102.7 million tons: increased refined products exports from Russia to Asia contributed to higher southbound traffic.

Oil exports from Russia accounted, in fact, for the largest share (23%) of Suez Canal southbound oil flows, followed by Netherlands (13%) and by Turkey (10%). The largest importers of Suez southbound oil flows were Asian countries, with Singapore, China and India accounting for more than 58% of the total.

Oil exports from Gulf countries (Iran, Iraq, Saudi Arabia, United Arab Emirates, Kuwait, Qatar, Oman) accounted for 86% of Suez Canal northbound oil flows. The largest importers of northbound oil flows through the Suez Canal in 2017 were European countries (62%) and the United States (9%).

The graph below shows that after a few years of stability in oil shipments, in 2017 total traffic through the Canal increased significantly (+18%). It reflects increases in OPEC production and exports, including Iraq and Saudi Arabia, as well as the growth in exports from Iran following the lifting of sanctions.

"Oil & Products" traffic through the Suez Canal. Trend 2013-2017



GRAPH 13 - SOURCE: SRM on Suez Canal Authority, 2018

The 200-mile long SUMED Pipeline, or Suez-Mediterranean Pipeline, transports crude oil through Egypt from the Red Sea to the Mediterranean Sea. Crude oil flows through two parallel pipelines that are 42 inches in diameter, which have a total pipeline capacity of 2.34 million b/d. Oil flows north starting at the Ain Sukhna terminal along the Red Sea coast, to its end point at the Sidi Kerir terminal on the Mediterranean Sea. SUMED is owned by the Arab Petroleum Pipeline Company, a joint venture between the Egyptian General Petroleum Corporation (50%), Saudi Aramco (15%), Abu Dhabi's International Petroleum Investment Company (15%), multiple Kuwaiti companies (15%), and Qatar Petroleum (5%).

The SUMED Pipeline is the only alternate route to transport crude oil from the Red Sea to the Mediterranean Sea if ships cannot sail through the Suez Canal. Closure of the Suez Canal and the SUMED Pipeline would require oil tankers to divert around the southern tip of Africa, the Cape of Good Hope, which would add approximately 2,700 miles to the transit from Saudi Arabia to the United States. The increased transit time would also increase costs and shipping time, according to the U.S. Department of Transportation. The IEA points out that shipping around Africa would add 15 days of transit to Europe and 8–10 days to the United States.

Fully laden VLCCs going toward the Suez Canal also use the SUMED Pipeline for lightering. Lightering occurs when a vessel needs to reduce its weight and draft by offloading cargo to enter a restrictive waterway such as a canal. The Suez Canal is not deep enough for a fully-laden VLCC, and therefore, a portion of the crude oil is offloaded at the SUMED Pipeline at the Ain Sukhna terminal. This partially-laden VLCC then goes through the Suez Canal and picks up the offloaded crude oil at the other end of the pipeline at the Sidi Kerir terminal.

In 2016, 1.6 million b/d of crude oil was transported through the SUMED Pipeline to the Mediterranean Sea, and then loaded onto tankers for seaborne trade. Flows via SUMED were relatively unchanged compared to 2015. Total oil flows via SUMED and the Suez Canal were 5.5 million b/d in 2016, 100,000 b/d more than in 2015.

Suez Canal and SUMED pipeline flows of oil and liquefied natural gas (LNG) 2011-16 (million barrels per day)

	2011	2012	2013	2014	2015	2016
Total oil flows via the Suez Canal and SUMED pipeline	3.8	4.5	4.6	5.2	5.4	5.5
Suez Canal total flows:						
crude oil	0.7	1.4	1.5	1.8	1.6	1.8
refined products	1.4	1.6	1.7	2	2.2	2
Total oil	*2.2*	*2.9*	*3.2*	*3.7*	*3.8*	*3.9*
LNG (Tcf per year)	*2.1*	*1.5*	*1.2*	*1.2*	*1.3*	*1.2*
SUMED pipeline crude oil flows	*1.7*	*1.5*	*1.5*	*1.5*	*1.6*	*1.6*

Tcf = Trillion cubic feet.

TABLE 5 - SOURCE: SRM on EIA, 2017

LNG flows through the Suez Canal in both directions were 1.2 trillion cubic feet (Tcf) in 2016, accounting for about 9% of total LNG traded worldwide. Southbound LNG transit mostly originates in Nigeria, France (as re-exports), and Trinidad and Tobago,

mostly destined for Egypt, Jordan, and Japan, which, when combined, account for more than 65% of the total southbound LNG imports through the canal. Nearly all of the northbound transit (99%) is from Qatar and is mainly destined for European markets. The rapid growth in LNG flows through the Suez Canal after 2008 is due to the expansion of LNG exports from Qatar.

LNG flows through the Suez Canal in both directions have declined from their peak of almost 2.1 Tcf in 2011. The decrease mostly reflects the fall in Northbound LNG flows and is consistent with LNG import data for the United States, which show that total LNG imports fell dramatically between 2011 and 2016. U.S. LNG imports from Qatar fell from 91 billion cubic feet in 2011 to zero in 2014 and have remained at this level since then. The changes reflect growing domestic natural gas production in the United States, a decrease in LNG demand in some European countries, and strong competition for LNG in the global market. As a result, Suez LNG flows as a share of total LNG traded worldwide fell to 9% in 2016, compared to 18% in 2011.

Liquid bulk throughput in major European and Italian ports

In general, with reference to liquid bulk, a high level of specialization corresponds to the presence, near port terminals, of refinery plants or access points to hydrocarbon transport infrastructures. According to some studies conducted on Rotterdam[26] there are a number of reasons why liquid bulk is such an important cargo type for the port. These reasons are summarized in three areas; production, tank storage and trade.

Top 10 European ports by liquid bulk throughput (thousand of tonnes)

Port	Country	2012	2013	2014	2015	2016	Var.% 16/15	Var.% 16/12
Rotterdam	NL	210,461	200,167	196,661	216,571	216,130	-0.2%	2.7%
Antwerpen	BE	44,367	58,606	62,378	66,123	68,282	3.3%	53.9%
Botas	TR	52,363	47,677	48,345	67,212	66,974	-0.4%	27.9%
Marseille	FR	56,053	49,452	47,544	49,933	49,208	-1.5%	-12.2%
Amsterdam	NL	43,508	43,359	44,923	43,861	45,691	4.2%	5.0%
Bergen	NO	46,681	46,988	37,756	39,199	40,735	3.9%	-12.7%
Le Havre	FR	36,502	39,080	37,904	40,070	37,580	-6.2%	3.0%
Milford Haven	UK	39,052	40,265	33,424	36,746	33,243	-9.5%	-14.9%
Trieste	IT	28,984	33,473	33,669	34,527	32,539	-5.8%	12.3%
Wilhelmshaven	DE	22,815	19,150	19,419	16,668	17,070	2.4%	-25.2%

TABLE 6 - SOURCE: SRM on Eurostat, 2017

As regards Italy, the main ports for the handling of liquid bulk experienced a fluctuating trend between 2013 and 2017, which led them to manage 188 million tonnes, equal to 38% of total Italian traffic. These types of goods are therefore confirmed as a primary and strategic sector (high revenues for port activities) managed by Italian ports.

[26] JAAP RAYMANS, ERASMUS UNIVERSITY ROTTERDAM (2015). *The impact of global refinery upgrade programs on the fuel oil throughput in Port of Rotterdam*.

Liquid bulk handled in the Italian ports (million of tonnes). 2013-2017

GRAPH 14 - SOURCE: SRM on Assoporti, 2018

At the moment imports clearly dominate, mainly due to demand for refined petroleum products and energy demand to be met. The market is mainly characterized by large volumes of goods managed by a limited number of shippers, with a concentration in the points of origin of the extraction / refining flows of raw materials and supply flows to refining plants and coastal deposits.

The main Italian ports for liquid bulk have all registered an increase compared to 2016, as shown in the following table.

Top 5 Italian ports by handling of liquid bulk (million of tonnes). 2017

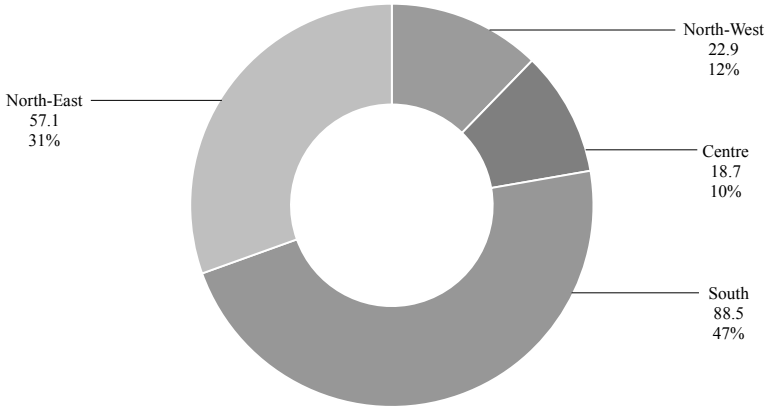
Top 5	2017	Var. on 2016%	Inc.% on Italy
Trieste	43.7	2%	23%
Cagliari	27.8	4%	15%
Augusta	26.2	5%	14%
Milazzo	20.1	21%	11%
Genoa	15.2	4%	8%
Total Top 5	133	6%	71%

TABLE 7 - SOURCE: SRM on Assoporti, 2018

The Top 5 ports account for 71% of total national liquid traffic and Trieste, with 43.7 million tons, is confirmed as the Italian port that handles the highest volumes; Julian port, in fact, is the supply point of the TAL oil pipeline (Transalpine pipeline that connects Trieste with Bavaria). Next in the ranking are Cagliari and Augusta, third in terms of volumes, but which is the port that has the highest degree of specialization, dedicating 95.7% of the total throughput in 2017 to liquid bulk.

As regards regional details, the following graph shows the concentration of liquid bulk traffic in Southern Italy, which accounts for almost half of national traffic and in the North-East, which makes up 31%.

Concentration of liquid bulk traffic by region



GRAPH 15 - SOURCE: SRM on Assoporti, 2018

A detailed analysis of the traffic of liquid bulk in Southern Italy, as shown in the table below, highlights the performance of the main ports for the handling of liquid goods, located in this area.

Top 5 Southern Italy ports by handling of liquid bulk (million of tonnes). 2017

Top 5 Southern Italy ports	2017	Var.% on 2016	Inc.% on Italy
Cagliari	27.8	4.1%	15%
Augusta	26.2	5.2%	14%
Milazzo	20.1	21.1%	11%
Naples	5.1	-0.4%	3%
Taranto	4.6	-94%	2%
Total Top 5 Southern Italy ports	83.8	6%	45%

TABLE 8 - SOURCE: SRM on Assoporti, 2018

This data show that for this type of goods traffic is very concentrated: 40% of the total national is attributable to the Top 3 Southern ports.

Conclusions

Liquid bulk traffic is a very important part of total maritime transport and its performance depends on factors related to energy policies pursued by economically developed countries as well as environmental regulations that are having an effect both in terms of energy sources used and also of emissions of the same ships, which are becoming more restrictive. Naturally, the political and social situations of the main Oil&Gas exporting countries can affect trade balances and international relations must also be taken into account.

In this sense, the signals of long-term trends are already observed, with forecasts of an increase in global energy needs of 35% in 2040, as a consequence, mainly, of the

doubled needs of China and India. In contrast, the energy mix of individual countries is also undergoing variations that are potentially significant for maritime transport (for example, the USA is no longer the main importer of methane but they are exporter). Furthermore, in the oil sector, the trend is to transport more refined products (refinery capacity shift), and there will be growth in demand for LNG (Liquified Natural Gas) due to the diversification of supplies and its use as fuel (for navigation and for motor vehicles).

The sea, for the transport of energy flows, assumes an important role and therefore also the chosen routes, because any changes could generate variations in the costs and use of energy, and therefore have an immediate economic impact.

The port then becomes an important infrastructure for the smooth functioning of this market as it becomes a priority site for the same production, storage and trade of oil and gas.

The Mediterranean is once again one of the privileged routes for these products because the Suez Canal is a crucial chokepoint through which 9% of the world's "Oil&Gas" total traffic passes. For Italy, liquid bulk cargo is one of the most important categories of goods and our country boasts the presence of ports specialized in this type of traffic such as Cagliari, Augusta, Milazzo and of course Trieste, which is the terminal of an important pipeline linking our country with Bavaria.

This focus is the first step of a SRM new path of study and analysis on this sector that is a priority for our economy and for our maritime system. As reported in a Confcommercio study[27], the ships bring to Italy almost three times the volume of goods traveling abroad. The explanation lies in the type of cargo transported: the goods landed in our ports are mostly liquid bulk, that is, in large part, oil and liquid gas that are used in our country by the process industries to produce semi-finished products which are then used by the manufacturing industry.

The development of alternative products, such as LNG for regasification, introduction into the national gas network, as well as for the shipping and automotive sectors, could change the demand structure and pose new challenges for our ports while creating new opportunities for economies of the region.

[27] Confcommercio (2017). *Analisi e previsioni per il trasporto merci in Italia.*

Chapter II

Energy-geomatics characterization of open-sea energy corridors in the framework of energy security. A case study: LNG from Qatar

1. National energy scenario

The *Italian gross energy consumption* is around 170 Mtoe (2015), of which only 24.8% is produced at a national level. In 2015, the consumption of each commodity was 57.3 Mtoe (crude oil), 50.7 Mtoe (natural gas), 34.7 Mtoe (renewables), 13.7 Mtoe (solid fuels) and 9.6 Mtoe (electricity, net imports). Oil and gas play a major role, representing 51.3% and 32% of the total consumption, respectively[1].

In 2015, the *Italian energy dependency*, defined as the ratio between the net imports and the sum of the gross inland consumption and maritime bunkers, was 77.1% (2015), a relatively high value compared to other European countries and to the European average (Germany 61.9%, France 46%, the UK 37.4%, Spain 73.3% and EU28 54.1%). In 2015, the Italian dependence on natural gas imports was 90.4%, of which 42.7% arrived from Russia, the largest national supplier of energy commodities, with a share of 24.3%.

In this context, *open-sea corridors* (routes for the supply of energy commodities by sea) play a crucial role, especially as far as liquefied natural gas (LNG) and crude oil are concerned. In 2015, *9.5% of the imported natural gas* (equal to 61.3 Gm^3, corresponding to 50.2 Mtoe) and *100% of the imported crude oil* was delivered to Italy via open-sea corridors.

These data highlight the importance of analysing the corridors used for energy commodity supply and the related security, using an integrated scientific approach, from both a physical (in terms of energy flows) and a geomatics (in terms of spatial representation of the origin/destination and routes) perspective.

2. Energy security fronts

The term energy security refers to the possibility of *guaranteeing energy to fulfil the final energy uses, where it is requested, in the needed quantities and according to the power profiles required by the final users*, under normal conditions and when a reasonable series of *adverse events* occur. The latter are generally classified in three main categories: *natural, accidental and intentional*. Natural threats are linked to meteorological events (such as floods, earthquakes and fires) that can affect infrastructures and corridors. Accidental threats are linked to unexpected technical failures or incorrect, but unintentional, operations, which may lead to the unavailability of an infrastructure or a corridor and involve the technical and economic instability of energy systems.

[1] Ministero dello Sviluppo Economico (2015). *National Energy Balance* [www.dgsaie.mise.gov.it/dgerm/ben.asp].

Finally, intentional threats are due to malicious actions (sabotage or physical and cyber-attacks) against infrastructures, corridors or energy fields.

The energy security of a country generally depends on the availability of primary energy sources (gas, oil, renewables), which can be made available through corridors, transformed, when necessary, into secondary commodities (electricity, petroleum products), and then transported and distributed to the final users. In this context, it is possible to define two fronts for national energy security: an *external front*, from the source to the national entry point, through different corridors (oil pipelines, gas pipelines, open-sea corridors, power grids, railways), and an *internal front*, represented by the transmission and distribution infrastructure of energy commodities (national gas networks and power grids, local systems for natural gas, power and refined petroleum product distribution). Although the internal front is important for all countries, the external one is particularly relevant for countries with a high-energy dependence, such as Italy; in these cases, the need to ensure the supply and delivery of energy commodities to national entry points can be particularly critical, and requires a diversification of sources and corridors.

3. Open-sea corridors

A synoptic view of energy corridors, articulated in terms of typology, transport infrastructure and commodity, is depicted in Figure 1. Different corridors are possible for the same commodity (among them, open-sea corridors, as highlighted in Figure 1).

The Italian imports of crude oil and LNG, through open-sea corridors, are represented in Figures 2 and 3. LNG imports come from a limited number of countries (Figure 2), with a predominant quota from Qatar (98.7%[2]), and are connected to a limited number of national entry points. On the other hand, oil imports are characterized by a higher degree of diversification (Figure 3): in 2015, Iraq contributed by 18.6% to the total oil imports (62.9 Mtoe), Azerbaijan by 17.9%, Russia by 12.9%, Saudi Arabia by 8.8%, Kazakhstan by 8.6% and Libya by 6.3%.

While LNG is used entirely to cover the internal natural gas requirements, a share of imported oil is re-exported to other countries (from the Port of Trieste to Central Europe via TAL, the 'Transalpine pipeline').

[2] Eurostat (2015). *Statistical database* [www.ec.europa.eu/eurostat/data/statistics-a-z/].

Scheme of corridors, transport infrastructures and energy commodities

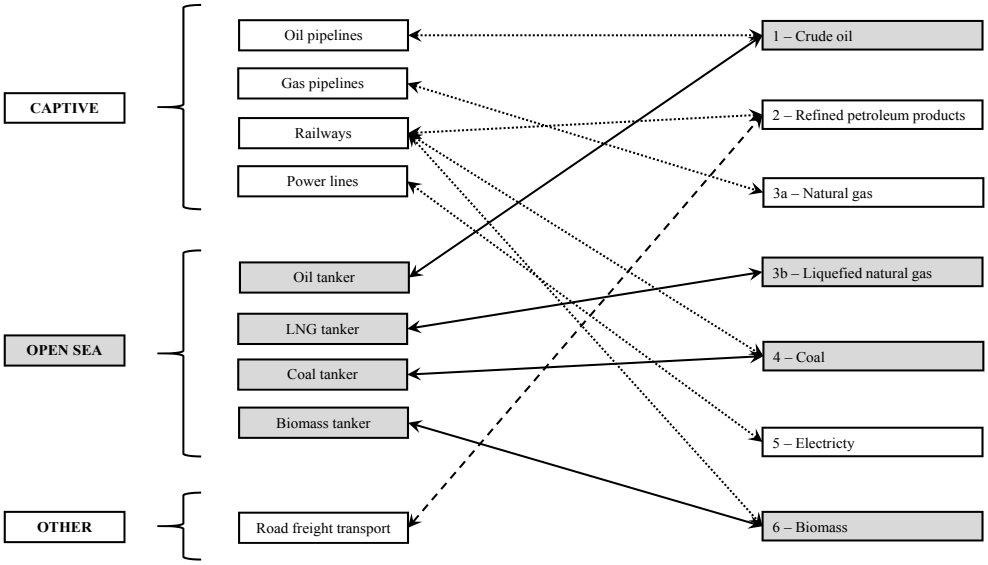


FIGURE 1 - SOURCE: PoliTO

Oil imports via open-sea corridors

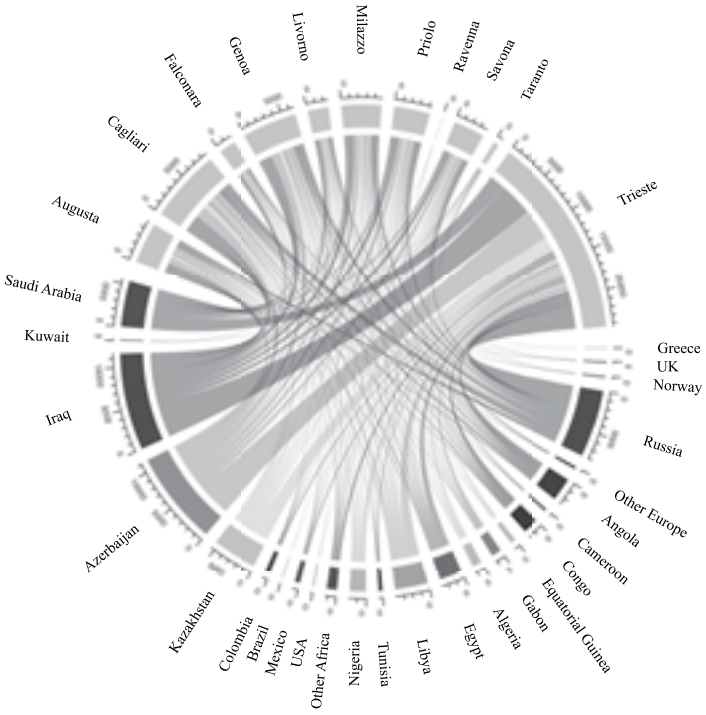


FIGURE 2 - SOURCE: PoliTO processing from Eurostat

LNG imports via open-sea corridors

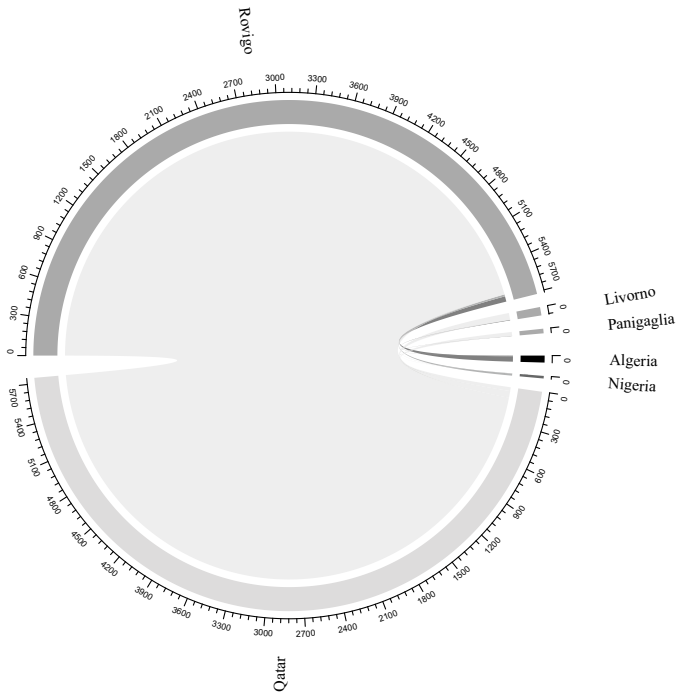


FIGURE 3 - SOURCE: PoliTO processing from Eurostat

Each open-sea corridor is connected to at least one national entry-point (ports, oil terminals or regasification terminals, Figures 3 and 4). The national entry points for crude oil and the respective quantities for each year (values relative to 2016[3]) are: Trieste (41,100 kt), Cagliari (14,600 kt), Genoa (11,000 kt), Augusta (8,180 kt), Milazzo (8,060 kt), Priolo (7,230 kt), Savona (6,260 kt), Livorno (4,220 kt), Falconara (3,300 kt), Taranto (1,040 kt) and Ravenna (0,090 kt). As regards LNG imports, the national entry points and respective quantities for each year (values relative to 2016)[4] are: Rovigo (5439 Mm^3), Livorno (509 Mm^3) and Panigaglia (207 Mm^3).

The main infrastructures are: the Trieste oil port (which received 39.1% of the Italian oil imports in 2016)[5] and the Rovigo regasification terminal (88.4% of the Italian LNG imports in 2016)[6].

[3] EUROSTAT (2015). *Op. cit.*
[4] UNIONE PETROLIFERA (2016). *Annual report 2016.*
[5] EUROSTAT (2015). *Op. cit.*
[6] UNIONE PETROLIFERA (2016). *Op. cit.*

4. Characterization of open-sea corridors

The characterization of an open-sea corridor should be based on a synthesis of hybrid physical-geographical models, which allow the physical dimensions of an infrastructure to be coupled, in a holistic way, to a spatial representation. Therefore, the characterization of an open-sea corridor has two main dimensions: geospatial (related to the definition of a representative trace of a corridor) and physical (related to the associated transferred energy flows). The physical dimension allows the operational properties and the analysis of any possible failures, malfunctioning and unavailability, caused by different typologies of adverse events, to be defined, while the geospatial dimension allows the infrastructure spatiality to be considered and its interaction with the environment and its effects on security to be studied and monitored, from different perspectives (geopolitical, climatic, etc.).

Marine routes are time-variable, both in terms of plurality of the routes connecting two ports and in terms of possible changes in the origin and destination ports; the former generally takes place over the short-term, while the latter occurs over the medium and long-term. This feature makes open-sea corridors different from captive ones, which instead have fixed routes.

The study of marine routes, from the export port to the entry-point, and the identification of a reference route in a given time horizon could be performed through geomatics methodologies, resorting to the use of maps and images (aerial or satellite, with optical or radar acquisitions in the microwave, visible or infrared spectrum fields). This georeferenced information has to be associated to the energy flows of different commodities. The use of vessels on marine routes allows discrete quantities of energy commodities to be transferred between two or more countries. It is possible to associate energy flows (energy transferred per time unit, $\Delta E/\Delta t$) to them, in terms of power. In the same way as for captive corridors, physical constraints also exist for open sea corridors, as maximum flows, related to a vessel's transportation capacity, as well as the average route times between the origin and destination, are imposed:

- Identification of the corridors for a specific commodity.
- Identification of the ports of origin and the national entry points.
- Selection of a vessel typology.
- Selection of appropriate time horizons.
- Identification and representation of the routes.
- Abstraction of the representative route.
- Computation of the energy flows associated to the corridors.

It is in fact possible to perform different data searches for the study of a marine route, such as: acquiring the position of a set of vessels each day for a reference year (current time), to monitor the position for short intervals, i.e. 15 minutes (real time), or analysing a time series, i.e. the last 5 years, in order to assess the possible evolutions due to different reasons, such as geopolitical events (historical analysis).

The International standard StatCode5 (developed by IHS Maritime[7]) is particularly useful for classifying vessels employed for energy commodity transportation, in terms of classes, subclasses and typologies; it in fact gives a code and a description to each vessel. The alphanumeric identifier used in this code is made up of seven elements:

1. A first letter, which defines the typology of vessel. Letter A is used for cargo ships: all the ships used for the transportation of energy commodities fall into this category.
2. A number that is used to better specify the typology of use of the ship. For example, the A1 code corresponds to tanker vessels (such as oil or gas tankers), while the A2 code corresponds to bulk carriers (such as the ones used for solid fuel transport).
3. A number that identifies the macro-category of the transported goods. For example, A11 refers to tankers used to transport liquefied gas, while A12 refers to tankers used to transport chemical products.
4. A number that details the typology of goods. For instance, A11A corresponds to LNG transport tankers, while A11B refers to Liquefied petroleum gas transport tankers.
5. A number that defines the typology of hull.
6. Two letters that synthetize and code the specific nature of ship. For example, BC is used for a generic bulk carrier, while TG is used to indicate a tanker designed to transport liquefied petroleum gas.

For example, LNG transport tankers are identified with the A11A2TN code, while bulk carriers for transporting coal are defined as A21A2BC. As far as oil ships are concerned, several differentiations exist, depending on the typology of transported source and of the ship (e.g. A13A2TV for crude oil tankers, A13B2TP for refined petroleum product tankers, A12B2TR for chemical product tankers and A11B2TG for liquefied petroleum gas tankers). A description is associated with each code to complement the characterization of a ship.

Such data providers as 'marinetraffic.com' or 'vesselfinder.com' may be accessed for marine routes. These websites allow the current position (or historical position) of all the vessels to be visualized on maps and, for each of them, they provide information on the typology, year of construction, flag, dimensions, gross tonnage and deadweight tonnage, IMO[8] and MMSI[9] codes, speed, course, draught, departure time and expected arrival time (or real time, in the case of already docked vessels), as well as the followed or expected route. The provided data are generally organized in two file typologies, named 'movements' and 'port calls'. Both provide general information, including the date and hour of detection, location (latitude and longitude) and the identification codes (MMSI, IMO). Furthermore, the former provide the daily positions of vessels, while the latter track a vessel's entrances and exits from ports, and provide the timestamps and status of the vessels (entrance/exit).

In order to identify the routes connected to the transport of a commodity from a home port to a particular national entry-point, data on vessel typologies and geo-referenced

[7] IHS Maritime [www.maritime.ihs.com/].

[8] The IMO (International Maritime Organization) code is a unique sequence of seven numbers assigned to each vessel at the time of construction.

[9] The MMSI (Maritime Mobile Service Identity) code identifies a sequence of nine numbers, which uniquely identifies a vessel during on-board radio broadcasts.

positions (in terms of latitude and longitude, using the WGS reference system 1984) are needed with a certain acquisition frequency. This kind of information is obtained from the 'movement reports', and it allows the corresponding positions of different acquisitions to be visualised on a georeferenced map, through either commercial (ArcGIS from ESRI) or open-source (QGIS) GIS software. After having acquired a set of positions for different vessels between the selected port of origin and the entry-points, it is possible to define a representative trace of a reference course, using an interpolation algorithm.

As regards the physical (or energy) dimension of an open-sea corridor, it is necessary to estimate the powers associated with the previously identified representative route. This calculation is done starting from 'port call' data, which is used to estimate the mean shipping time over the time horizon considered for the analysis, and considering the vessel's physical characteristics (deadweight tonnage and mass load of energy commodities). The theoretical power of the corridor is calculated as the ratio between the transferred load, in energy units, carried by the set of vessels that have crossed the examined route in a certain time interval, i.e. a year, and the time itself.

5. Case study: LNG open-sea corridors from Qatar

The approach described so far has been applied to the characterization of the LNG corridors from Qatar, which is the dominant supplier to Italy of that commodity (98.7%, Figure 3). The port of origin for all the open-sea corridors is the Port of Ras Laffan, while the national entry points are the regasification terminals in Rovigo, Livorno and Panigaglia. The characteristics of the principle regasification terminals and the LNG imported quantities are reported in Table 1.

LNG imports per national entry-point

	Regasification terminals		
	Rovigo	Livorno	Panigaglia
Company	Adriatic LNG	OLT Offshore LNG Toscana	GNL Italia
Typology	Offshore	Floating offshore	Onshore
Location	15 km from Porto Levante (Porto Viro, Rovigo)	22 km from the coast between Livorno and Pisa	Panigaglia (Porto Venere, La Spezia)
Regasification capacity	8.00 Gm^3/year	3.75 Gm^3/year	3.50 Gm^3/year
Total imports (2016)	5,439 Mm^3	509 Mm^3	207 Mm^3

Table 1 - Source: PoliTO processing from MISE

The study considers the vessels identified as LNG Tankers, by means of StatCode5, with the A11A2TN code.

In order to define the routes of the selected vessels from Qatar to the Italian regasification terminals, data from 'movements' and 'port calls' were used, relative to September 2017. The 'movements' Excel file contains information on the daily positions (latitude and longitude, in WGS 1984 coordinates) of each vessel, and provides one position per day, unless a ship is too far from land, which would cause the loss of signal.

The available data, which cover all the LNG tankers, were preliminarily filtered to select the vessels which have the Italian regasification terminals (Rovigo, Livorno and Panigaglia) as their destinations.

Single points were subsequently connected to create the vessels' routes, which were graphically modelled with geospatial representation software (ArcGIS, Figure 4). Figure 4 represents all the routes that connect the Italian terminals with Qatar and with the exporting African countries (Algeria and Nigeria). Via interpolation of the daily registered positions of the tankers, representative traces of reference courses, which normalize the tankers' flows towards the Italian regasification terminals, were defined (Figure 5). Among these interpolated traces, some define routes that visit the aforementioned regasification terminals as destinations; others have other terminals in the Mediterranean basin, the Nord Sea or the West African Sea as their final port of call.

The analysis focused on the reference route from Qatar to Rovigo.

Physical (energy) information has to be associated to the geographical information of routes (usually characterized to represent the minimization of the pathway, in terms of nautical miles, from the origin to the destination). In order to estimate the flows associated with the routes, the distance (in km) and the average speed (in km/h) were calculated for each of them. The mean shipping times (expressed in hours) for the considered routes were calculated considering these results. The deadweight tonnages (DWT) were derived from marinetraffic.com, once the tankers' names and identification codes (IMO and MMSI) were known, assuming that 20% of the total tonnage was not strictly related to the energy commodity. Considering an energy content per mass unit of 55 MJ/kg for LNG, the load was converted into energy units. Finally, the flows were calculated as the ratio between the transferred loads in energy units and the mean shipping times. Figure 5 reports the obtained results: the mean shipping time from Qatar to the Rovigo regasification terminal is around 6 days, and the theoretical equivalent power of the corridor is equal to 233 GW.

Complete courses

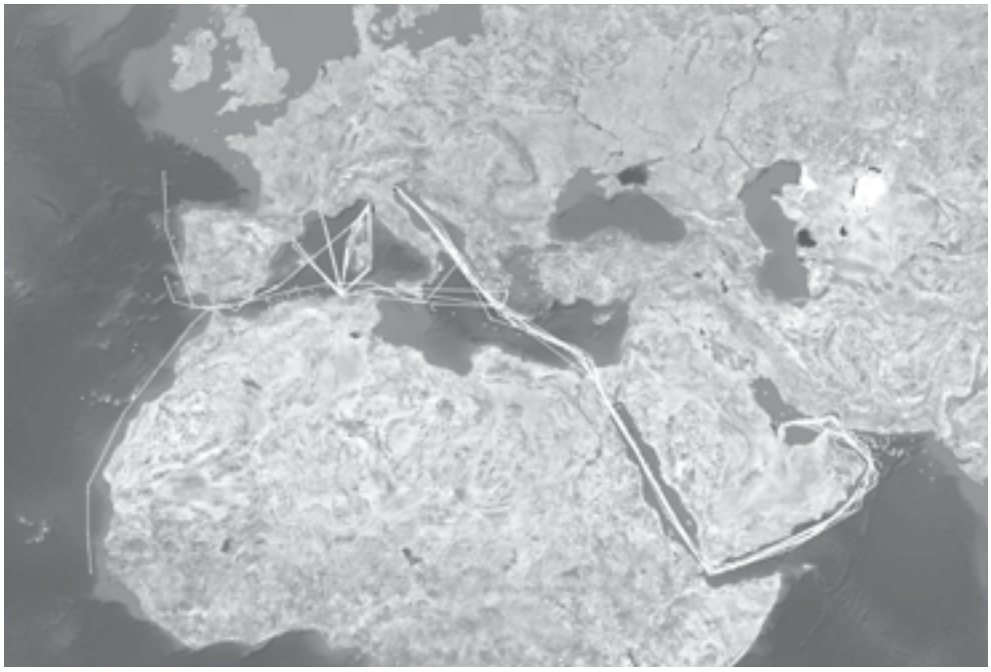


FIGURE 4 - SOURCE: PoliTO

Representative trace of a reference course

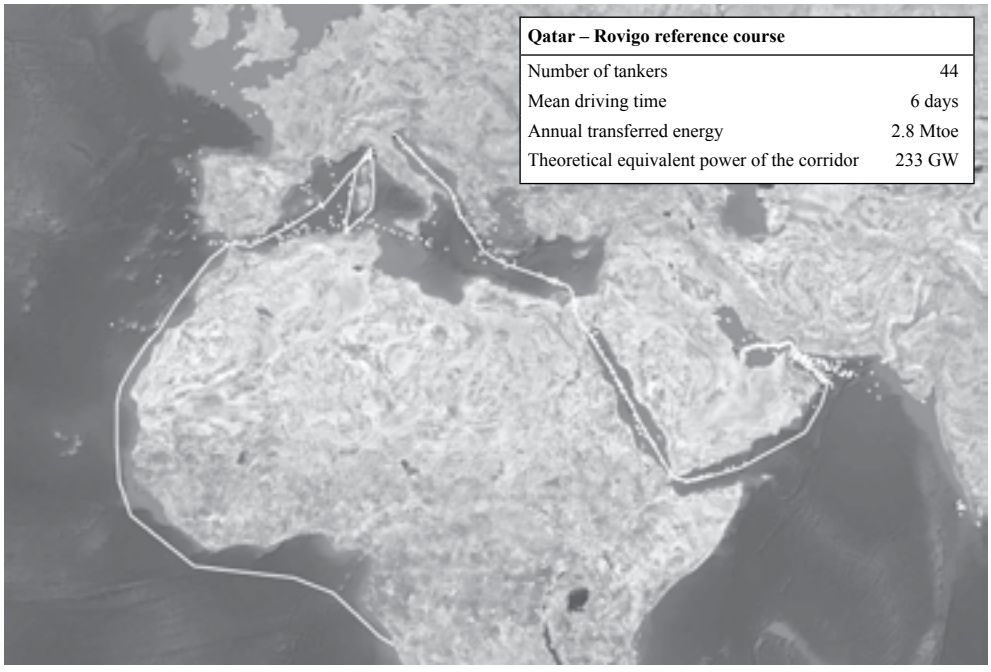


FIGURE 5 - SOURCE: PoliTO

Chapter III

The future of port networks in the Mediterranean and Campania

1. Changes in the Mediterranean scenario

The destiny of humanity and the evolution of civilisation are increasingly linked to the sea. «Those who can control the sea and the ports hold the economic, political, military, social and cultural power. […] It is through the sea that ideas and goods have been circulating for thousands of years, it is through the sea that competition and division of labour are organised; still today more than ninety per cent of goods and communications transit on the sea» (Attali, 2017). The sea has also attracted an increasing number of people: «in 2017, 60% of the world population lives within 150 km from the coastline, a figure which amounted to only 30% one hundred years ago» (Attali, 2017).

Maritime transports have made globalization possible by significantly reducing the costs of connections: once we consider the great impact that innovations in maritime logistics have had, it is easy to debunk the stereotype that it was only due to the low cost of labour that manufacturing activities were delocalized to emerging countries.

For instance, a $1,000 television produced in Shanghai and sold in Antwerp will cost $10 to transport by sea and $70 by air. Without the economies of scale granted by the reorganization of maritime services and without an efficient network of communications, with decreasing prices, globalization would have remained a lame duck.

In the context of this new 'maritimisation' of the economy and of Mediterranean society, the sea is playing a key role again, after centuries of being overshadowed by the Atlantic and Pacific Oceans. The Mediterranean has always been both a meeting point and a battlefield for numerous civilisations.

The history of the predominant cultures and religions springs from the complex events that characterized the relationship between land and sea. «It is not one landscape, but numerous landscapes, It is not one sea, but a complex of seas. It is not one civilisation, but a number of civilisations, piled one above the other» (Braudel, 2017). The overlap of civilisations piled one above the other in a region full of relations and in spaces that are often points of contention for the control of traffic and raw materials is a concept often repeated when the history of the Mediterranean is told.

«Millenary space of civilisations piled one above the other, each coming from a triumph and preluding a fall, the Mediterranean knows the game of chasing, overlapping and contrasting truths that seek immortality to win the most important victory, that against time» (Migliorini, 2017).

The millenary roots of civilisation spring from the Mediterranean basin which has always been a place of encounters and confrontations leading to significant changes in the advance of knowledge. «The Mediterranean is a very ancient crossroads on which, for thousands of years, everything has converged - men, beasts of burden, vehicles, merchandise, ships, ideas, religions and the arts of living. Even plants» (Braudel, 2017).

The royal park of Capodimonte and the gardens of Caserta Royal Palace would have never been what they are if there had not been the spread of crops and essences that are part of the genetic heritage of Mediterranean regions.

The Mediterranean has escaped homogenization as a consequence of different civilisations and origins: «the Mediterranean is composed of several subsets that defy or refute several ideas received» (Matvejevic, 2008). Nevertheless, within a framework of respect and conservation of differences, the fusions and intersections that have taken place have also modified the sense and course of history.

The Bronze Age would not have existed without navigation in the Mediterranean. «Bronze is in fact an alloy of two metals whose mines are located at opposite ends of the great sea and even beyond its basin: copper, present in abundance between Cyprus and the Arabian desert, and pond, of which are rich the Iberian peninsula and Cornwall» (Cardini F. , 2014, p. 11).

Therefore, the economic dimension is not the only one to take into consideration, if we want to understand the potentialities that could arise if the Mediterranean returned to be a central place in the organization of the social and productive life of our times. The displacement of maritime barycentres in history is one of the main keys for analyzing the geostrategic perspectives between peoples and states: the centuries of the Atlantic and Pacific oceans have overshadowed the Mediterranean centrality that had characterized the cradle phase of civilizations.

Today we live a moment of radical discontinuity in geostrategic structures: «We happen to live in one of those moments of history where everything moves, creaks, flickers and, suddenly, old customs collapse and new bizarre phenomena emerge from the cracks that change produces» (Fagan, 2017, p. 17). We must be able to grasp the signals of transformation that appear on the horizon, and which are destined to change sooner than we imagine.

Instead, we often continue to interpret the phenomena through the lens of a rearview mirror, carefully interpreting the facts with schemes that are not able to decode reality instead of trying to imagine the new ways through which economic and social forces are combined. The strategies of the contemporary world – and the geopolitical scenarios that open up – simultaneously push towards a territorialization of the high seas and a maritimeisation of conflicts. In the past, victory in wars were determined by the control of ports, gulfs, straits: that is to say all the maritime spaces bordering the mainland. Thus, in the past, «conflicts over control of the Mediterranean must be seen as a struggle for dominance over coasts, ports and islands, rather than as battles for supremacy over the open sea» (Abulafia, 2013, p. 16).

Today, this ancient constraint of strategy is transforming dramatically: strategic resources reside in the high seas (i.e. communication systems and the control of raw materials), and route management takes on a much greater importance, considering the continuous evolution of globalization and maritime traffic.

The result of these transformations will be the maritimeisation of conflicts, not only on the surface of the sea, but also in submarine spaces, due to the importance of transmission cables for images and data, another resource of utmost importance in contemporary society.

«In 2017 there are 263 submarine telecommunication cables stretching over one million kilometres through which almost all internet transactions and 95% of global communications and images pass» (Attali, 2017, p. 181). It is no coincidence that the conflicts over the ownership of extraterritorial waters represent some of the events that have emerged in recent years throughout the international chessboard, including the Mediterranean.

The conflicts of the next decades will again see the sea as a protagonist: «the war at sea is always a dispute that has as its object the lines of maritime communication, ie the routes used for trade, for the projection of power on the territories next to the sea and as a source of profits to be obtained by force or thanks to the protection against the use of force» (Glete, 2010). Today, the commercial fleets of naval gigantism run for the seas: to protect navigation from piracy, security systems operate silently.

In short, the game is becoming increasingly complex: the sea is once again the main protagonist of competitive supremacy among nations, political aggregations, economic actors. In this context, we need to place the Mediterranean in a perspective which, in the alternation of the historical phases, has sometimes been the driving force of transformations whereas, in other moments of time, it took on the role of a secondary theatre of events with focal points located far from our nearest theatre of operations.

This is the moment when a new opportunity is arising for the Mediterranean, due to a more liquid society, which bases the quality of competitiveness also on connections. Ports are a privileged observatory of these dynamics, as they constitute a connection between territory and horizon. «Observing the Mediterranean from the point of view of a port means scrutinizing it in its nature as a viable space, a territory of exchange not only for goods, but also for culture and society» (Masciopinto, 2016).

Every port overlooking the Mare Nostrum feels as if it were in the middle of the Mediterranean. This expression has become a ritual reference, but it risks to lack strategic significance, just as the redesign of international routes and the doubling of the Suez Canal are consolidating the importance of Mediterranean maritime traffic, which currently accounts for over 20% of the total world volume, 25% of container line services, 30% of oil traffic.

About 10% of the world's maritime traffic passes through Suez. In the first nine months of 2017, around 668 million tons of goods passed through the canal, with an increase of 9.8% compared to the same period of the previous year. It was precisely due to the construction of the Suez Canal, in the mid-nineteenth century, that the Mediterranean, albeit for a limited time, reacquired an important strategic role: «A new era was inaugurated for the Mediterranean which, after having been decentralized due to ocean navigation since the sixteenth century, was now returning to the centre of the world. The Suez Canal conferred a new meaning, and finally an important task to the control of the rock of Gibraltar» (Cardini F., 2014).

In the future, we will have to face a Mediterranean polycentrism that will be one of the keys to the strategic confrontation between the international economies of our time: the conquest of a Mediterranean centrality will probably remain an Arab Phoenix, dependent more on the legacy of a history where the Med was the major player, and in contrast with the complexity that characterizes contemporary history, characterized by a plurality of architects.

The game played on the Mediterranean chessboard is extremely important. The economic weight of maritime activities generated by the Mediterranean Sea is equal to an annual value of 450 billion dollars, which, compared to the different regional GNP, makes this sector the fifth most important economy in the region after France, Italy, Spain and Turkey: "this value represents about 20% of the world maritime product, in an area that makes up only 1% of the world's oceanic space. Furthermore, the economic assets of the Mediterranean Sea are conservatively estimated at 5.6 trillion dollars» (WWF, 2017, p.9).

In the generation of gross marine product, Italy is top of the Mediterranean ranking, followed by Spain, France and Turkey. With respect to this indicator, there is no consequential awareness to organise consolidation and development policies that could generate positive results for growth in Italy's production system. The spread of traffic between the countries of the southern shore and the northern shore of the Mediterranean is decreasing, due to the attractiveness and more intense competitiveness of the ports of North Africa.

The Mediterranean is therefore a strategic area of utmost importance: «it is surrounded by 11 European countries, 5 African countries and 5 Asian countries, with a current population of 425 million people» (Attali, 2017, p.257). There is a lack of national and European strategies and policies for the Mediterranean, which risks to jeopardize not only the record that has been consolidated over time but also the prospects for important opportunities related to the future growth of other regions overlooking the Mare Nostrum. Nevertheless, «Italy and its Mediterranean can play an increasingly important role in the whole area: it is crucial to start from the data of growing trade flows in the Mediterranean and from the position that can be acquired by the southern ports and the other Italian ports» (De Vincenti, 2018).

2. The ports of Naples and Salerno and their role in the Mediterranean

The ports of Campania, in particular Naples and Salerno, can be among the protagonists of this opportunity for development, in different market segments that are fundamental for the maritime economy: cruises, motorways of the sea, the energy sector, the commercial traffic of containers and various goods. «In addition to the main commercial ports of the peninsula, some ports defined as 'intermediate' are potential attractors of freight flows, which could play a decisive role in a Euro-Mediterranean model as opposed to a euro-centric one» (Forte, 2017, p.36).

The portuality of southern Italy has recorded, in recent years, the crisis of the ports of pure transhipment, Gioia Tauro and Taranto in particular. The competition of North African ports, the Chinese design based on Piraeus, and the crisis of the ports of pure transshipment determine a necessary redesign of Mediterranean port bases. The gateway function is taking a leading role again, bearing out the fact that port systems can be competitive on the condition that they can build a dialogue between the territory behind them and the system of maritime connections.

Playing within the Mediterranean scope means overcoming a short-term vision based on port provincialism that has characterized the maritime economy of our country over

the past few decades. Intermodal cooperation and interchange axes must be built and designed to serve the industrial and productive community.

The Adriatic and The Tyrrhenian are the port systems that should build strong Mediterranean relationships, towards the East Med and the West Med respectively. In the perspective of strengthening the railway connection between Naples and Bari, collaboration between the port systems of the Tyrrhenian and Adriatic becomes essential to build a logistic structure able to offer the market an adequate network of efficient connections via collaboration with the shipping companies.

«Italy finds the meaning of its own destiny: it is the median axis of the sea, and it has always been divided, much more than is usually said, between an Italy turned to the West and another that looks to the East» (Braudel, 2017, p.10). The Mediterranean horizon of our times should encourage our country to mend this mediumness, finding cooperation between the two western and eastern axes, to affirm its own strengthened presence on the Mediterranean chessboard.

In this context, also the ability to invest in routes of motorways of the sea from the ports of Southern Italy to the ports of the North African shore becomes a necessary path to offer the manufacturing economy of the southern regions an opportunity to access markets that are due to grow substantially over the next decades.

Nowadays, about 50% of the overall Italian import-export departs from or arrives at a Southern port. This strength needs to be turned into a system and has to be considered a strategic lever of action aimed at strengthening the Mediterranean component, which already represents a significant asset for our economy. In the MENA area Italian exports account for 10% of the total while those of Southern Italy account for 15%. This is clearly a significant game worth playing.

In order for this to happen, however, we need not only an awareness of maritime operators but also, and maybe more importantly, some political and institutional initiatives aimed at restoring a more prominent role for Italy and Southern Europe on the Mediterranean chessboard. Furthermore, it is necessary to start from the strengths that have made it possible for our country to hold an advanced position in different market sectors: in particular, Italy handles 36% of the overall volume of Short Sea Shipping in the Mediterranean.

«The short sea sector appears to be a strategic lever for the development of the Italian economy and its Mezzogiorno» (Forte, 2017). Instead of continuing on a pointless competitive race with the Northern Range ports of Europe on the deep sea, it is better to enhance an existing specialization, a strength on which to leverage in order to consolidate a maritime leadership.

Choosing an attack strategy to focus on the Mediterranean development of Italy and of the ports of the South is possible on the condition that the competitive framework is clear, setting objectives that are achievable. There are some structural features of the Mediterranean portuality that should not be left out: «a navigation that for centuries and millennia would be carried out mostly by cabotage, near the coast; making the Mediterranean gradually punctuated with ports, often small, but placed at a day of navigation from each other, to ensure a shelter from storms or the pirates» (Cardini & Vanoli, 2017).

This articulated design of Mediterranean portuality, which has resulted in fragmentation and internal competition, weak in the phase of globalization and economies of scale, must now be redesigned according to paradigms that allow to generate a network of maritime and intermodal connections able to support a new economic development of the region. Unfortunately, so far, this horizon is hard to see, and the Mediterranean is likely to be a transit for traffic directed elsewhere rather than a protagonist and a generator of connections. In their recent publication Mario Caligiuri and Andrea Sberze state that «on paper we are a Mediterranean country. Indeed, the Mediterranean country par excellence. But in fact, the awareness of our Mediterranean centrality, on which the Roman empire was based for centuries and which our maritime republics profited from […] seems to have disappeared» (Caliguri & Sberze, 2017).

3. The Chinese strategic design towards the Mediterranean

We are all fascinated by the tale of the Silk Road which quite openly contains a Chinese hegemonic strategy, not only on maritime routes but also on land. This is being deployed as an instrument for commercial penetration and economic presence mainly through the special economic zones that are spreading across Asian countries.

The history of the world is also built with stories and metaphors. «It was the German traveller Ferdinand von Richthofen who coined the name Seindenstrasse, the Silk Road, with reference to one of the most precious goods exchanged there. In reality, there was no such road but rather quite a vast network of itineraries that stretched from the heart of China through Asia, towards the Mediterranean, with links to cross roads that led north and south» (Cardini & Vanoli, 2017). This metaphor has today become a fundamental engine for moving global economic balances. For China, the maritime economy is worth 970 billion dollars annually, accounting for 9.4% of its GDP. Leveraging this power, the maritime system becomes for China the main instrument of international politics, with the aim of gaining greater control over routes, terminals and commercial flows.

The design of political and economic development of the Asian giant is based on three pillars: the Silk Road, for the construction of an axis of land connection to Europe, the logistical presence in the Mediterranean, to make it a gateway to the Balkan and Central European markets, the commercial penetration in Africa, to seize the opportunities for development of the aforementioned continent.

While on the Silk Road the rhetoric of international geopolitics is wasted, the other two front lines of Chinese strategy remain in the shadow, although they are essential elements in the construction of the new imperial design, which is strongly based on hegemony in controlling routes, terminals and maritime traffic.

With the recent acquisition of the Port of Piraeus, China has made a fundamental move to build a Mediterranean hub, the bridgehead for managing the new Chinese-led Mediterranean centrality. Europe has clumsily allowed this design, by withdrawing its support for Greece at the time of its economic-financial difficulties, and even forcing the Greek government to hand over control of the country's strategic maritime and airport infrastructures.

The Chinese expansionist strategy is also aided by investments in North African ports, with the maritime companies controlled by the Chinese state expanding their scope of influence. In the Chinese strategy towards the Mediterranean there has been a change of pace: «for this country the Mare Nostrum has shifted from transit sea for the ships to a real permanent logistic platform» (SRM, 2017).

This is a strategic plan supported by an international policy action: «a fundamental strategic target of Chinese foreign affairs is Africa. In December 2015, a meeting was held in Johannesburg between China and almost all the African countries where Xi Jinping presented a package of 60 billion dollars for cooperation and development» (Fagan, 2017, p.).

Recently, a timid European response came from Germany: the Merkel plan for African development was presented in Berlin on 12th June 2017. This is based on three pillars: economy, trade and employment; peace and security; democracy and respect of law. The operation foresees an allocation of 300 million euros of public development aid to stimulate employment – above all youth – and to reduce criminality in Africa. The resources put in place are not comparable to the deployment of financial resources invested by China, and the political value of Europe as a whole is not made clear.

The Asian colossus is still in the lead, while EU countries are still struggling to give an overall response to the complex Chinese strategy: they proceed in a random order, with an attempt to activate bilateral relations rather than to build a collective response.

The same thing happened during the Libyan crisis, when France and Great Britain worked more to reduce Italian influence in that country than to assert an EU policy direction. Proceeding in loose order, or generating competition within the Union to better control the markets according to the principles of individual nationalities, is the precursor to losing further ground in the international context.

In the meantime, China has invested heavily in the Mediterranean area in recent years, starting from 2015: in addition to the acquisition of Piraeus, «the shareholdings in Port Said and Alexandria (Egypt) and in Kumport (Turkey) fall within the same action plan» (SRM, 2017, p.53).

Control of the Haifa terminal in Israel and Vado Ligure are also part of this plan. If we then add minority holdings in the Khalifa Port Container Terminal 2 (UAE) and in the Suez Canal Container Terminal, the picture is complete.

Obviously, these elements cannot be attributed to randomness: these strategies represent not only the desire to build direct ways to control the Mediterranean traffic, but also outposts to exploit the future potential deriving from the growth of African countries. It would be a mistake to read the African countries overlooking the Mediterranean as an indistinct mass of homogeneous realities. The situation of the weaker economies of the Maghreb countries, still undergoing a demographic transition and with a composition by age of the population in which young classes prevail, contrasts with the advanced economies of the North Bank, which show phenomena of demographic regression and an aging population (ISSM-CNR, 2017).

«Seven out of the top ten fastest growing economies are already operating in Africa and in particular in the Sub-Saharan area. Important and modern energy projects are being developed and revolutionary urban areas are being designed (i.e. the Tech-City of Konza in Kenya)» (SRM, 2017, P. 37).

Also in terms of Foreign Direct Investments Africa is playing a key role, of which some clear signals can be recognised: «In 2015 Africa received seven hundred and five FDIs amounting to $54 billion, 15% of the world total» (SRM, 2017, p. 37).

At the same time, in the Middle East and North Africa (MENA), Italy recorded an increase in foreign direct investment: between 2010 and 2015 they tripled in Algeria and the Emirates, doubling in Egypt. It is precisely the companies that are the potential of our country's roots in this geographic chessboard, provided that the logistics are able to ensure greater competitiveness.

China is also increasing its commercial presence in the Mediterranean area: in the MENA area, Chinese trade has increased from $16.2 billion in 2001 to $185.6 billion in 2015, with estimates predicting a growth that will reach $203 billion.

Italy recorded an unbalanced maritime trade with China in 2016: it imports €20.7 billion, and exports €7. The basic foundations of the Silk Road for our country lie above all in balancing these numbers, which determine an inevitably negative situation for our trade balance, considering above all that China, with the One Belt One Road initiative intends to increase the importance of its commercial penetration, until reaching the goal of exporting goods and services amounting to about $700 billion and importing $573.6 billion.

We still consider China to be a primary producer of low quality products, and of the basic industry, which in the past decades was far behind the strong economies of the world. This paradigm is changing rapidly, with China now presenting itself as a protagonist of the cultural and high technology industries. This is the point of view from which we should read the new role that the Chinese colossus will intend and be able to play in the Mediterranean and in North Africa.

4. The lack of European policies for the Mediterranean

Europe is the stone guest in this great game. So far, the EU portuality game has been characterised by a contrast between the Northern Range and the Mediterranean ports, in the scope of the competition to attract traffic directed to the European market. It is necessary to highlight that «in the EU at the beginning of our century the centre of gravity of Europe is still located in the north» (Abulafia, 2013).

Nevertheless, while the Northern European port system does not have any extra-Community competitors in serving our markets, the ports of the southern EU shore suffer the competition that comes from the North-African shore. The Mediterranean strategy of the European Union has struggled to establish itself. Only recently are we beginning to draw institutional cooperation and intervention paths that seek to remedy the gap filled by the Chinese hegemonic design. A change is finally taking place. On 30th November 2017, in Naples, a declaration was signed for the partnership between the European Commission and the Mediterranean Union signed by the Ministers of Maritime Affairs of the ten states participating in the initiative for the sustainable development of the blue economy of the Western Mediterranean (Algeria, France, Italy, Libya, Malta, Mauritania, Morocco, Portugal, Spain, Tunisia).

The «initiative for the sustainable development of the blue economy of the Western Mediterranean» was approved on 19th April 2017 by the European Commission setting itself the following goals:

1. A safer and more secure maritime space
2. The promotion of smart and resilient growth of the blue economy and employment
3. The preservation of the ecosystem and biodiversity of the Western Mediterranean.

These objectives need concrete means to be achieved: on the one hand, we need infrastructural funding for the strengthening of networks and technologies and on the other we need to increase our maritime connections.

So far, the flows have mainly concerned the tragic phenomenon of migration from Africa to Europe, and the encounters are more connected to the terrible events of Islamic terrorism that undermines security. «The Mediterranean is now a word that is scary, that divides us and outrages us. Its millennial history does not seem to matter anymore: we only see the desperate people who drown every day, the economic crisis that for years has been going through it like a storm, the madmen and the murderers who covered its coasts with blood» (Vanoli, 2015, p.8).

If approaches related to fear and closure prevail in interpreting social phenomena that must instead be governed and managed, the Mediterranean loses its horizon and loses its opportunity. Economic protectionism, which stands out on the horizon, risks being affected by social protectionism.

While terrorism must be fought with the weapons of international cooperation, in regards to demographic dynamics we are in the presence of irreversible phenomena. «Africa is still a continent out of control: if in 2015, with 1.2 billion people, it represented 16% of the world's population, in 2050 it will have 2.5 billion men and women, almost 26% of the world's population, and in 2100 could reach 4.5 billion, 40% of the total» (Giovannini, 2017, p.10).

Not detecting these phenomena of a demographic nature which were bound to completely change the nature of social relations, has been a strategic error for Europe. So, we decided to focus exclusively on fuelling people's fears without leading a process of transformation. «The Mediterranean is an area of intense debate and reflection in the contemporary geopolitical scenario; a public space able to unveil the limits and criticality of political and institutional actions on a fragmented and incoherent territory where beautiful images of the coasts, the sea and the beautiful landscapes contrast with those of the boats loaded with migrants and the corpses that float on the shore and lie on the beach» (Masciopinto, 2016).

And yet, as often happens when phenomena of a strongly discontinuous nature have occurred throughout history, they can be looked at according to perspectives of risk or opportunity: knowing how to turn potential risks into opportunities becomes the decisive strategic advantage factor in international competition. As Constantine Kavafis wrote in one of his poems (*Waiting for the Barbarians*): «Now what's going to happen to us without barbarians? Those people were a kind of solution». After all, the United States of America have built their power and economic growth precisely on the capacity to welcome immigration.

Europe has instead decided to leave the initiative to the others in this game therefore fostering an unconscious fear of 'the other' that is polarizing consensus towards populist options of protectionism. That risk which some time ago was called 'fortress Europe' is becoming real and is completely transforming the original meaning of 'Europe'.

«From Africa, very large migratory flows will be generated, especially towards Europe, due to both climatic factors and political upheaval» (Giovannini, 2017, page 11). Little has been done to integrate freight and passenger traffic between the two shores of the Mediterranean commercially. North Africa is a frontier of development which is the main opportunity not only for Southern Europe but also for the whole of the EU.

The route between Shanghai and Naples takes 21 days of navigation, while that between Tunis and Naples only 15 hours. Time remains a strategic variable of competition. Moreover, the variable geometry of globalization will shift the frontier of the future to Africa. If we are able to understand and direct this challenge, using the Mediterranean as a strategic axis, we will be in the position to change the destiny of southern Europe, and of our Southern Italy.

The Mediterranean already plays an important role in the structure of economic exchanges for our Mezzogiorno. The area shows, even between political crises and social conflicts, a growth potential that deserves attention. The countries of the Middle East and North Africa grew, in the period 1995-2016, an average of 4.4%, which is significantly higher than the rate of the EU-28 (1.9%). Turkey recorded the highest value (4.9% per annum). The population of the area will reach 730 million inhabitants in 2050, with a growth rate that is less marked than that of GDP.

«Trade between Southern Italy and the countries of the MENA area amounted to €13.6 billion in 2016, a much lower value than that recorded by the North-West (€25.3 billion). […] In 2001 trade between the Mezzogiorno and the MENA area amounted to €14.6 billion. […] The 2009 crisis caused a sharp decline in trade» (SRM, 2017, p.33).

For Southern Italy, trade with the MENA area accounts for 15.7% of global foreign trade: this figure reached its peak in 2005 (26.7%), while from 2012 to 2016 it fell constantly, with a trend that should reverse over the next few years (SRM, 2017).

We can build an intensification of trade and maritime relations between southern regions of our country and the Mediterranean region, with two main aims: a) consolidating the recovery of the manufacturing industry in Southern Italy and b) adding further competitiveness to the maritime economy of the Mezzogiorno.

Factor productivity is generated by better use of labour and capital. Too often we focus on work performance, while we are distracted by capital optimization. The rotation of ships on the short-range in the Mediterranean arch can generate an unparalleled intensity of connections compared to the long routes of globalization between Asia and Europe.

Development is close to us, and the best use of capital can make it even more intense, through a net of connections that enhances the Mediterranean trade. In the age of the new globalization, long trans-oceanic networks can be connected to short-distance networks, which can make it possible to boost economies that are still not influenced by the logic of economic growth based on high-tech industries. We will need fewer and fewer arms and more and more brain to produce value.

5. The potential role of Special Economic Zones (SEZ)

This is the strategic front on which one of the most delicate axes of geopolitics will be played in the coming decades. The development of ports in the countries of the northern shores of the Mediterranean is primarily based on the ability to be protagonists of the flows of passengers and goods in the area. In this context, Naples and Salerno have excellent potential. Furthermore, the establishment of the special economic zone, which cannot be postponed for too long, represents a differential advantage from which we need to profit.

Through manufacturing investments in ports and dry-port areas aimed at optimizing logistic costs, SEZs are one of the critical variables to generate competitive advantages in comparison with international competition and to restart the production machine, after the long crisis that began in 2007. It was precisely special economic zones that represented one of the elements of positive innovation in the Mediterranean area (i.e. the cases of Tanger Med in Morocco and Port Said in Egypt).

The ability to generate supply chain relationships among dimensionally different companies is also very important: «the attraction of larger, national and foreign companies, potentially interested in the best conditions offered by the SEZ can determine the construction of supply chains rooted in the territory which can foster the growth of small and medium-sized southern companies, encouraging the shift towards activities with a high technological content» (Servidio & Prezioso, 2018).

It is necessary «not to make the mistake of considering the SEZ the remedy of all the evils of growth. This in fact is only the hammer of a toolbox that must also contain solid nails (the companies), the anvil (an efficient and effective port with excellent terminal operators and inter-ports and / or well-structured dry-port areas), the wrench (a solid bureaucratic system), lubricating oil (a first-class logistic system), a screwdriver (the incentive system) and the pincer (the support of the institutions). These are the tools that must be run together in order to be able to assert the Special Economic Zone in the reference area» (SRM, 2017, pp. 145-146).

Industrial policy, logistics and port systems are a triangle within which the competitive set-ups of the commercial scenario will be established for the coming decades. If, until now, the total productivity of the factors has been played mainly on capital and labour, today it is much more important to consider the "residual" value that represented the "black box" which economists have long been discussing for decades.

The manufacturing hinterland is the backbone that establishes the attractiveness of port systems. The border between logistics and manufacturing becomes much more permeable, as the strategic match in the big economic areas moves on the ability to combine these factors. Also, in the Mediterranean we will see an overall review of competitive balances. Moreover, the fault between Southern Europe and Africa will be one of the battlegrounds from which the future of the international economy will emerge in the coming decades.

In this delicate interstice, axioms must be brought into question that take into due account the transformations that have been determined by the effects of globalization.

The boundary between manufacturing and logistics has been attenuating, and the value chains are generated according to patterns of operation that cannot be interpreted with the logic of the past: as Adriano Giannola writes, «the meridionalist thinking on the economy of Southern Italy, so rich of contributions, has neglected the driving force that maritime economy can have to employment and development […] Logistic innovation of industrial processes and the renewed portuality will have to contribute to the recovery of the South in a new vision of the industry no longer linked to simple industrial plants but to the mobility of inputs and the generation of value in the import-export flows managed in specific areas dedicated to dry-port operations, such as distri-parks, logistic poles and districts» (Forte, 2017, p.22).

The centrality of logistics is a platform of competitiveness that is still underestimated in the definition of the intervention axes aimed at redesigning the factors of competitiveness, both on the microeconomic front of companies as well as on the macroeconomic front of production systems: «Generating policies to improve logistic competitiveness is one of the decisive factors of a new industrial policy» (Spirito, 2018, p.149).

Until now, the rhetoric of the geographical and positional advantage of Italy has been privileged over the implementation of policies and interventions able to make the difference in the choices of operators and the market. «Paradoxically, despite the position of Italy and its Mezzogiorno in the Mediterranean undoubtedly being an important asset, such as to make it the crossroads of a very high number of commercial exchanges, Italy loses on logistics» (Forte, 2017, p. 60).

Without a qualification of the logistic offer, intermodality, interconnections and network and system effects, the Mezzogiorno risks missing out on another opportunity for its own development, this time creating not only a disadvantage for itself but a detrimental effect for the entire economy of our country. The Mezzogiorno of Italy is joined by the other 'Mezzogiornos' of the Mediterranean, which can be a system constraint or, instead, an opportunity for development. So far «the Euro-Mediterranean space has not yet become reality […] The Mare Nostrum is dominated by the immense problem of the South» (Cardini F., 2014).

The crisis that started in 2007 has exacerbated the difficulties and has widened the gap between North and South, due to a dramatic decline in investments. However, it is not all gloom, so much so that since 2015 some signs of a Southern recovery have timidly risen on the horizon: «In recent years, the ability to be resilient has been clearly visible in some companies in the South, which have used many of the tax incentives made available by the government, investing in new products, new machinery and sophisticated services that were competitive on national and international markets» (Lagravinese, 2018, p.47). Supporting the competitive recovery of the existing manufacturing fabric and expanding the production base are the main challenges for restarting southern development: from this point of view, connection services and outlets to international markets are major levers, especially in the economic region closer to our maritime borders.

There is no desert around us. Among the companies that recorded a growth in sales and employment of more than 20% for a period of three consecutive years, the province of Milan leads the ranking with 109 companies, followed by the province of Naples with as many as 64 companies (Lagravinese, 2018).

According to the latest Censis-Confcooperative report, in Campania digital companies have grown three times more than in Piedmont. Ten percentage points behind we find Veneto, Tuscany, Emilia Romagna and Lombardy. Between 2011 and 2017, the most significant growth of digital companies was recorded in Campania, with 26.3%, immediately followed by Sicily with 25.3% and Puglia with 24.2%.

Also, there is still a medium and large enterprise fabric that must be considered strategic to organise a manufacturing renaissance of the southern regions. If we look at the territory of Campania, the sectors in which there are dimensionally relevant companies are: automotive, pharmaceutical, aerospace, the canning industry, bakery products. There are 14 companies with more than 500 employees in Campania, and 5 of these exceed 1,000 workers (Ramazzotti & Pirro, 2018).

In short, «the South is far from being an industrial desert; it has a product of capacity, of manufacturing added value of 27 billion. If we looked at the South as if it were a State, this added value of manufacturing, not of GDP, would place it between Finland and Norway» (Deandreis, 2018, p.101).

These signs of vitality and industrial persistence should be put in the perspective of a strategy and in an international approach, taking into account the markets with the greatest growth potential in the coming years and decades. We must understand that the Mediterranean challenge concerns Italy and Europe at least as much as our southern regions.

The attractiveness of manufacturing investments and the ability to generate value from the logistics economy in the coming decades also depend on the strength and clarity with which the strategic games will be played on the Mediterranean chessboard. China has already begun to move its pieces. Europe and Italy are still struggling to make their opening move.

There is not much time left to avoid crying over the spilt milk. Structuring a strategic design requires cohesive strength, availability of resources and implementation time. Timeliness in the execution of these phases represents one of the elements that will influence the results of the competitive confrontation between the great economic blocs of the world.

Within this overall framework, national and territorial institutions must make their moves consistently, with the ability to build a careful and smart management of all the components that affect international positioning: business, finance, bureaucracy, foreign policy, economic and social forces. In the contemporary world, only team games can achieve ambitious goals.

6. The Mediterranean perspective of the Mezzogiorno

The Mediterranean, which has long been the cradle of civilization and also of economic development, can be re-implemented provided that the connections between its regions are effective: «The decadence, crises and illnesses of the Mediterranean coincide with the failures, inadequacies and fractures of the circulation system that crosses it and surrounds it, and that for centuries had placed it above itself » (Braudel, 2017, page 56).

The integration of this cultural, social and economic space depends on a development project that is able to weaken the fractures that risk tearing the elements of potential cooperation: «The Mediterranean is a space for relations between countries that present strong differentials of growth, economic development and democracy.

Therefore, like in a microcosm, the Mediterranean region reflects all the great challenges of the new millennium: population growth, unemployment, migration, reform of welfare policies, poverty contrast, effects of climate change on development, management of the conflicts for the control of natural resources» (ISSM-CNR, 2017, p. 28).

That the destiny of the Mediterranean is that of a new centrality and a consolidated development is not certain. Many even think the opposite. «This is no longer a sea for dreams and adventures. It is now a sea of exiles, refugees, oilmen, last minute cruisers, smugglers, bloodthirsty madmen» (Vanoli, 2015, pp. 195-196).

Yet, this is not necessarily the case and much will depend on the resumption of a political and economic initiative to design a Mediterranean scenario of integration and cooperation between Europe and North Africa. It will be decisive not to be subject to the initiative of China, which is positioning itself in the Mediterranean to establish a bridgehead towards Central Europe and North Africa. We cannot stand by: we need an initiative capable of mobilizing institutional, economic and social forces.

Italian ports will play a positive and proactive role, as links between territories and the sea, as well as generators of connections. The ports of Campania are in a position to be primary actors in a path of proposals, if they are able to utilise the advantage card of the special economic zone not only as an attractor of productive investments, but also as a mechanism to build a network of links with the Mediterranean economies.

«The ports of the South have a natural attraction factor that is their strategic position that avoids deviations of routes but the intermodal aspect needs to be improved. In particular, the lines Naples-Salerno on the Tyrrhenian and Bari-Taranto on the Adriatic can become the logistic base for the whole of Italian industry up to the Po Valley» (SRM, 2017).

The Mediterranean scope of our productive development represents a possible platform for sustainable growth in a global framework which offers a significant share of maritime routes and a strategic potential for economic growth. Nothing is certain without actions of industrial and logistic strengthening of the territory.

We could be passive spectators of the transformations awaiting us or we could be protagonists of the changes that will take place. The borders of development are constantly being reshaped. Only those who can export knowledge and quality will be able to attract value.

After a long economic crisis that caused a more marked strategic weakness in southern regions, we are finally witnessing some encouraging signs deriving from industrial capacities and professional competences rooted in the Mezzogiorno. Portuality can be one of the elements that encourages openness and generates maritime connections while also offering opportunities for a logistic improvement that will benefit all the companies of the area.

Over the last difficult years, Campania has proven to undoubtedly be the «most resilient region of the Mezzogiorno» (Lagravinese, 2018). This trait needs to be consolidated and made structurally solid in order to build a bridge between the Mezzogiorno and the Mediterranean which might become one of the axes to rethink the industrial and logistic future of Europe. If supported by institutions, the territory and the economic and social forces, the ports of Naples and Salerno will be able to play the role of catalyst for sustainable growth.

Chapter IV

Portuality of the Mezzogiorno: evolution of regulations and functions

1. Main trends of development

Within the international maritime sector, the Mediterranean has been playing an increasingly strategic role, which has further consolidated and developed over the last few years. This is dependent on a series of economic, political and social factors. Firstly, on the geo-economic side, the Med represents a crossroads between the great Atlantic/North European market and the Asian/African one. Secondly, in terms of development perspective, the Med is becoming more important, thanks to its link with the route along which the main global economies are developing their growth strategies.

These aspects, along with the incentive provided by the enlargement of the Suez Canal, which has been increasing the centrality of the Med on the international scene[1], give the *Mare Nostrum* solid factors of attractiveness to both public and private investment in the sectors of transport and logistics. These, in fact, continue to grow despite situations of social and political instability. For instance, the Suez-Gibraltar route is commonly recognised as a privileged one for the transit of containers (it concentrates 25% of global liner services) and is also considered a crucial business environment for North-South short-haul traffic, in particular Ro-Ro.

The containership flows along the main East-West global routes seems to confirm the aforementioned renaissance of centrality: in 1995, 53% of global transits travelled along the Trans-Pacific route and 27% on the Asia-Europe (via Suez and Mediterranean), while in 2015 the two routes reached similar shares (45% and 42% respectively).

An overview of the performance of Med ports also seems to confirm the aforementioned positive trend. In fact, these ports have increased their market share in the container sector from 33.5% in 1994 to 43.8% in 2017. Similarly, EU ports on the Med grew from 6.3 million TEUs in 1994 to 33.7 million TEUs in 2017, showing a 433% increase. Conversely, in the same period Northern Range ports grew from 12.6 million TEUs to 43.3 million TEUs, showing a 334% increase. This demonstrates that Mediterranean ports have recovered in terms of competitiveness and vitality, and that they are playing the role of 'gateways' to access EU regions.

2. Strategic repositioning starting from the sea

The increase in traffic and routes, as well as the growth of strategic relevance of the Mediterranean basin in the sectors of maritime transport and logistics, have directly

[1] Investments made alongside the overall recovery of maritime transport have positively affected Suez traffic which, between 2001 and 2016, recorded a 120% increase of transit goods. Approximately 75% of these goods travel along the Far East-Europe routes.

affected the policies of development of port systems in the countries overlooking its coasts. These are currently at the core of economic and political agendas due to increased awareness of the importance that they can have to the economy, the development and the foreign projection of the entire region. In particular, dramatic growth is has been recorded in the ports of the South and East shores of the Mediterranean and the Black Sea.

Ports, which have always been one of the most important components of a country's transport system, nowadays not only play the mere role of connectors of maritime and land transport but they also represent vital centres for logistic and entrepreneurial activities. After all, the globalisation of production activities and the expansion of global trade require ports to develop their intermodal vocation. This is mainly aimed at facing the growing need for an integrated transport system where the convenience and special features of each mode of transport can be effectively exploited. In this context, gauging a port's performance only in terms of sea-land movements is not sufficient to describe a competitive port system, and it is increasingly useful to consider the availability of efficient connections with the hinterland. The development of competition among ports is becoming fiercer in the dispute over hinterlands as fewer of these are still 'captive' and most of them have become 'contestable'.

Therefore, port infrastructures and activities must be placed in logistic chains and take on the role of intermodal direction centres. Also, they have to contribute to the creation of logistic value through a series of factors, such as offers of different modes of transport, efficiency of port operations, availability of information, etc.

3. Where competitiveness of port systems is played

The financial and economic crisis of the EU has limited the ability to maintain competitiveness in several sectors, and transportation is not an exception. Ports in the South East Med have been increasing their market share due to their favourable commercial conditions and the transhipment of goods directed towards the EU market, as this tends to move to non-EU ports or to ports controlled by non-EU operators (see Piraeus). All this happens in a context where, as many studies highlight, growth of traffic is forecast in the Mediterranean thanks to the aforementioned enlargement of the Suez Canal. Therefore, the growth of potential demand is on the horizon and this must be met by an increase in the competitiveness of Italian ports.

Over the last few years national hub ports have experienced some difficulties and have lost traffic, while gateway ones have grown at significant rates. In particular, it is the ports of the Mezzogiorno (where hubs are located) that suffer with infrastructural and logistic inadequacies. Additionally, they show lower saturation levels and are negatively affected by the competition of Southern and Eastern Med ports which offer better tax and commercial conditions.

4. Italian and European portuality as seen from Brussels

The recent EU and national plan gives an important role to all ports, including those in Southern Italy which, in particular, are considered as access/exit doors for goods and/or passengers linked to the European corridors.

Regulation (EU) No 1315/2013 envisages that the trans-European transport network n. 1315/2013 should be developed through a dual-layer structure consisting of a global network ('comprehensive') and a central network ('core').

The global network is the base of the Trans-European Transport Network (TEN-T) and it should be completed by 2050, while the year forecast for the completion of the core network is 2030.

The first level (TEN-T comprehensive network) has a function of territorial cohesion within single member states since it is formed by a network of roads, railways, ports, airports and intermodal centres. On a national level, this network has the function of connecting the country both economically and socially, contributing to the elimination of divergences in the infrastructures of the regions.

The second level (TEN-T Core network) serves the purpose of connecting the 28 EU member states with each other and with neighbouring countries. From the point of view of transport infrastructure, this network represents the necessary prerequisite to achieve the objective of a Single Market.

The multimodal core network (TEN-T) with its corridors will contribute to increasing cohesion between the EU Member States and to strengthening the internal market. Furthermore, a rise in competitiveness is forecast, which is also expected to bring about economic and employment growth.

The TEN-T network will allow it to operate a significant modal change from road to rail, which will result in: a) positive consequences in terms of road congestion, b) a reduction of emissions and c) improvements in safety.

Ports are considered vital gateways linking the aforementioned corridors to the rest of the world (74% of European import-export transits via sea). Also, they play a strategic role in the exchange of goods within the internal market and in the connection of insular and outermost regions with the mainland.

The Italian peninsula is crossed by four corridors:

1. *Scandinavian-Mediterranean*, a crucial north-south axis crossing the Baltic Sea from Finland and Sweden and passing through Germany, the Alps and Italy.
2. *Baltic-Adriatic*, which connects the Baltic Sea to the Adriatic Sea through industrialized areas ranging from southern Poland to Vienna and Bratislava, the Eastern Alps Region and northern Italy.
3. *Alpine-Rhine* linking the North Sea ports of Rotterdam and Antwerp with the Mediterranean Sea in Genoa through Switzerland.
4. *Mediterranean*, that of the Turin-Lyon railway, which connects the Iberian Peninsula with the Hungarian-Ukrainian border along the Mediterranean coast of Spain and France and then crosses the Alps eastwards in Northern Italy, passing through the Adriatic coast in Slovenia and Croatia, and continuing to Hungary.

The Mezzogiorno is, therefore, affected by one of the 9 main corridors of the Ten-T network envisaged by the EU Commission, called Scandinavian-Mediterranean. This unites Northern and Southern Italy on the Brenner axis, passing through Verona, Bologna, Florence, Rome, Naples, Reggio Calabria, and then moving to Sicily and terminating in Malta. In Naples, a corridor leading to Bari and Taranto branches off (the other branches go from Bologna to Ancona and from Florence to Livorno), with a maritime connection also from Livorno to Malta.

The route of this corridor is the result of long political negotiation between the European Commission and the countries concerned, which inevitably entailed a compromise solution, that clearly and understandably does not satisfy the different local and regional entities it passes through.

An important decision in this regard was reached in 2015 by the European Parliament, with an amendment to the final document of the "EU Strategy for the Adriatic-Ionian region" including the extension of the entire Ionic-Adriatic backbone. This falls within the scope of the completion of the Baltic-Adriatic corridor, filling a gap that was difficult to understand relative to the route that connects Ancona to the ports of Puglia.

5. National strategic planning of ports in Italy

If we take a look at national strategic planning and programmes, we notice that the Ministry of Infrastructure and Transport has taken action through the National Strategic Plan for Portuality and Logistics (PSNPL), aimed at promoting national economic growth with a systematic and integrated approach based on the strengthening of competitiveness of the Italian port and logistic system. The integrated strategy envisaged in this plan includes measures to be taken in ports and accessibility from land and sea, with the aim of giving further importance to Italy's role in the Mediterranean and in international exchanges.

In order to design an efficient 'Sea System' and also boost freight traffic and passenger transfers via sea, the plan includes numerous measures of: a) bureaucratic simplification, b) control and customs efficiency, c) promotion of intermodality, d) improved last-mile connections, e) attraction of investment for the modernisation of infrastructure. All of these are to be implemented through increased coordination on a national level and rationalisation of maritime policies.

Furthermore, the National Strategic Plan for Portuality and Logistics focuses on aspects suggesting positive future developments for Italian portuality and it states that the logistic and port system must be: a) a key contributor to the economic recovery of the country, b) an active tool of Euro-Mediterranean policy, c) the backbone of the cohesion and growth of the Mezzogiorno, d) warranty and motor of the promotion of sustainability.

Moreover, this plan also focuses on: a) prioritising all sectors of port traffic according to their potential to contribute to social and economic growth, b) promoting the maintenance and safety of our infrastructure, c) favouring innovation and technological development.

Finally, the aforementioned plan also offers a vision for the port and logistic sector in 10 objectives:

1. Simplification and streamlining of procedures and controls.
2. Increased efficiency of port services and higher competitiveness of operators.
3. Improvement of transport services and accessibility to ports;
4. Promotion of the integration of logistic chains.
5. Infrastructural strengthening of ports and their land connections.
6. Promotion of technological innovation of national portuality.
7. Increased energy efficiency and environmental sustainability of ports.
8. funding of management and investments in Port Networks.
9. National coordination, programming and promotion of the 'Sea System'.
10. Adjustment of port governance (implemented through Decree Law 169/2016).

Hence, the plan has designed an institutional and regulatory project capable of responding to the EU institutions' requirements in terms of policies for the European Transport Network. This is mainly aimed at supporting infrastructure projects of common interest in the sector, thus enhancing Italy's role in the construction of a Euro-Mediterranean transport network and favouring the recovery of trade traffic between Europe and the East.

6. The new governance and the Port Network Authorities

The 57 Italian national ports have been reorganised into the 15 new Port Network Authorities, strategic decision-making centres with headquarters in major cities, which is to say the ports defined as 'core' by the European Union.

These Port Network Authorities are located in the following regions:

- Western Ligurian Sea (ports of Genoa, Savona and Vado Ligure);
- Eastern Ligurian Sea (ports of La Spezia and Marina di Carrara);
- Northern Tyrrhenian Sea (ports of Livorno, Capraia, Piombino, Portoferraio, Rio Marina and Cavo);
- Central North Tyrrhenian Sea (ports of Civitavecchia, Fiumicino and Gaeta);
- Central Tyrrhenian Sea (ports of Naples, Salerno and Castellammare di Stabia);
- Tyrrhenian Ionic and Strait Seas (ports of Gioia Tauro, Crotone, Corigliano Calabro, Taureana di Palmi, Villa San Giovanni, Messina, Milazzo, Tremestieri, Vibo Valentia and Reggio Calabria);
- Sardinian Sea (ports of Cagliari, Foxi-Sarroch, Olbia, Porto Torres, Orange Gulf, Oristano, Portoscuso-Portovesme, Santa Teresa di Gallura);
- Western Sicilian Sea (ports of Palermo, Termini Imerese, Porto Empedocle, Trapani);
- Eastern Sicilian Sea (ports of Augusta and Catania);
- Southern Adriatic Sea (ports of Bari, Brindisi, Manfredonia, Barletta, Monopoli);
- Ionic Sea (port of Taranto);
- Central Adriatic Sea (ports of Ancona, Falconara, Pescara, Pesaro, San Benedetto del Tronto, Ortona);

- Central North Adriatic Sea (port of Ravenna);
- Northern Adriatic Sea (ports of Venice and Chioggia);
- Eastern Adriatic Sea (port of Trieste).

The 15 Port Network Authorities have been entrusted with a strategic role of guiding, planning and coordinating the port system of their area. They have the function of attracting investments to the various ports and connecting public administrations.

There is a close relationship with the Ministry of Infrastructure and Transport, in particular for the Port System Regulatory Plan and infrastructure programmes with national or local funding. The Port Network Authority is led by a small board, restricted to few people, namely the "Management Committee" with the role of institutional public decision-maker. The Management Committee is led by a president/manager, with proven experience in the transport and port economy and with broad decision-making powers. This figure is chosen by the Minister of Infrastructures and Transport in agreement with the Region or the Regions affected by the Network Authority.

Representatives of operators and companies are part of the "Sea Resource Partnership Organisations" with advisory functions.

To ensure consistency with the national strategy, a "National Conference for the coordination of Port Network Authorities" was set up, institutionalized and chaired by the Minister, with an important role in national planning of strategic and infrastructural choices.

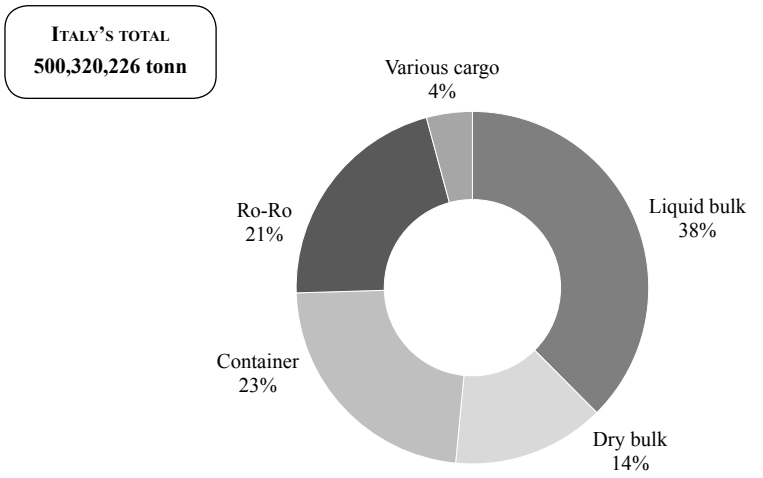
The recent reform of law n. 84 of 1994 foresees, among various innovations, the establishment of two procedures that will drastically reduce customs clearance times: the 'Customs and controls single window', under the coordination of the Customs Agency, and the 'Single administrative window', a front office dealing with all administration and authorization for non-commercial activities.

7. Traffic trend after the Port Reform

In 2017 port movements in the ports managed by Port Network Authorities and by the Port Authorities of Gioia Tauro and Messina, amounted to 500,320,226 and were made up of: 37.5% liquid bulk,13.9% dry bulk, 23% containers, 21.2% Ro-Ro, 4.2% various cargo.

The Spanish port system is currently our main competitor in the Northern Mediterranean. Overall handling of goods reached a total of 532 million tonnes in 2017, a 7.4% increase. Therefore, it was in 2017 that the Spanish port system overtook the Italian one.

Port movements (2017)



GRAPH 1 - SOURCE: Port Network Authority of the Ionian Sea on Assoporti data, 2017

Certainly, one of the reasons for this event can be found in the fact that from 2000 to 2016 the Spanish port system benefited from over €12 billion worth of public funding. In particular, in that period, the allocation of funds was as follows: about €900 million to Algeciras; about €2 billion to Barcelona; around €1.5 billion to Valencia. In addition to this, are the investments made by the Spanish Port Authorities with their own resources derived from taxes, fees and services.

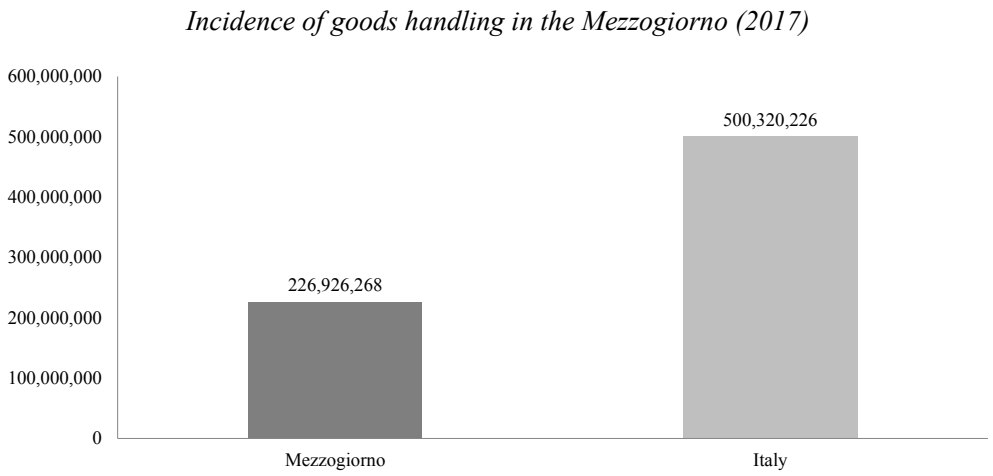
If we take a closer look at data referring to the comparison between the ports of the "northern range" and Italian ports from 1994 to 2017, we notice that the former have maintained over the period a share between 17.3% and 26.7%. In 2017 they had a market share of 19.7%, a decline compared to 2016.

Recent statistical data highlight, therefore, a good vitality of the national portuality, still lagging behind, however, from being what it was before the crisis. Italian ports continue to mainly serve the Italian production / consumption market.

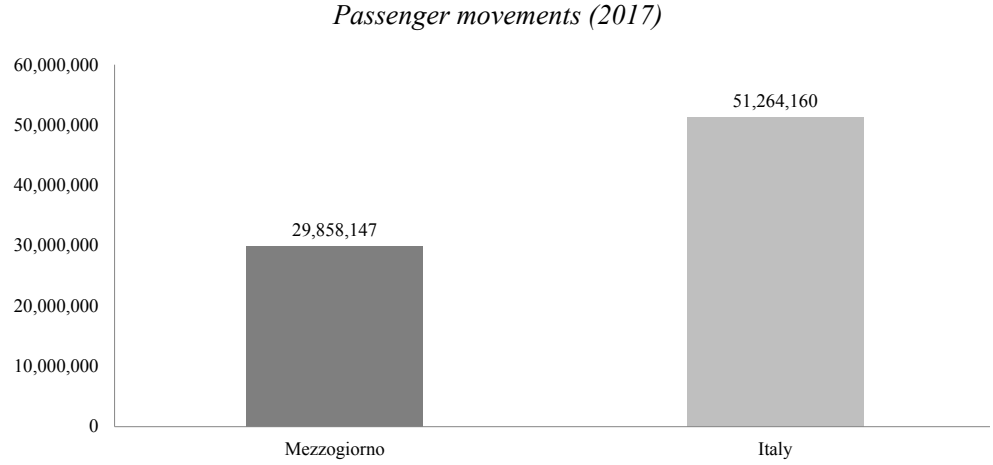
Hence, until growth of the internal market is consolidated and, above all, there is no ability to penetrate other foreign markets with efficient logistics services and aggressive marketing policies (similarly to "northern range" ports), the situation will remain to be affected by internal economic conditions.

Moreover, data confirm the need to re-launch national portuality with investment plans in strategic interventions able to allow a recovery of the infrastructural and logistical gap that this country demonstrates in relation to its competitors. Infrastructural and intangible works, such as innovation and digitalisation of port processes and operations, would allow an overall modernization and improvement of the system.

If we analyse 2017 statistics, we find that there is a complex situation in Mezzogiorno's portuality but this is still important, with a 45.3% of the overall national 'goods' sector and a 58.2% share of the 'passenger'.



GRAPH 2 - SOURCE: Port Network Authority of the Ionian Sea on Assoporti data, 2017

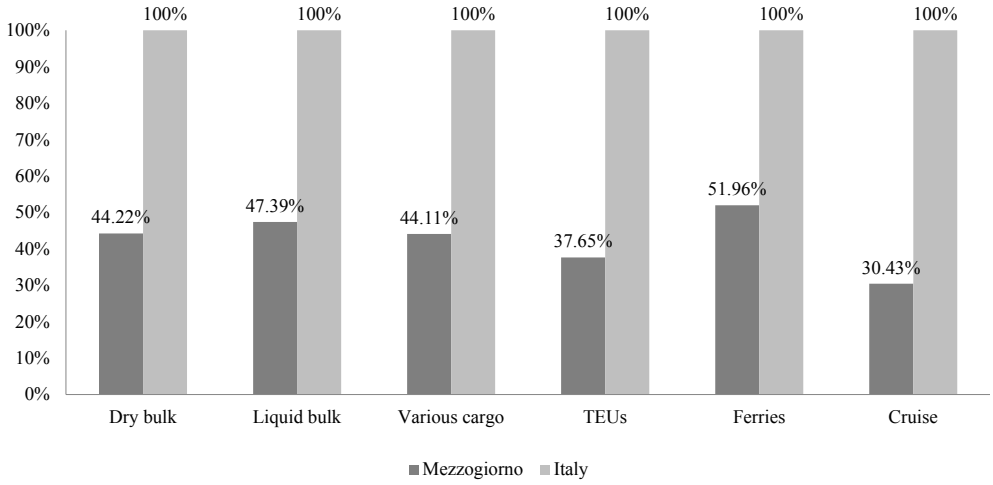


GRAPH 3 - SOURCE: Port Network Authority of the Ionian Sea on Assoporti data, 2017

The almost perfect parity between the port data of Southern Italy compared to those of the Centre-North presents two significant exceptions with reference to container traffic and to cruise traffic (37.5% and 30.4% respectively). With regards to the former, it should be clearly stated that in the North the greatest percentage of gateway traffic is concentrated, while in the South there is mainly transhipment, due to the considerable distance between this region and the main production and consumption markets and because of infrastructural and / or logistic weaknesses.

With regards to cruises, however, the undeniable concentration in the Centre North of a greater number of globally recognised cities and attractions continues to be decisive and, therefore, preferred by operators and passengers. Also, the loss of traffic on the South Eastern Mediterranean side is certified by the most recent sectorial studies.

Incidence of freight traffic in the Mezzogiorno (2017)



Graph 4 - Source: Port Network Authority of the Ionian Sea on Assoporti data, 2017

8. Can Mezzogiorno portuality play a key role?

The Mezzogiorno has a very profitable geographical position within the Mediterranean basin, which once again has returned to the centre of world trade. It is the link between Suez and Europe and a potential port logistics platform serving southern industries. Its ports must increasingly take on the role of facilitators of the international projection of the country. However, it is necessary to invest more and better in intermodality and in port logistics integrated with industrial processes.

The ports of Southern Italy also have the opportunity to play the role of gateway to Europe, representing the nearest entry point for some major routes, and in particular for traffic along the sea routes that reach mainland Europe from the Suez Canal.

This advantage, estimated by international shipping and logistics operators at around 6/7 days of travel less than the main Northern European ports, had contributed - until a few years ago - to the undeniable growth in demand for maritime container traffic in the region.

In fact, these ports are those closest to the main sea routes that cross the Mediterranean and, although transhipment is strongly disputed and directed more towards other ports of the Med, conditions must be created to enable them to fulfil the role of logistic and intermodal hubs, thanks to the enormous port and dry-port areas with which some of them are equipped.

After all, the example of the growth of the port of Piraeus and its development strategy, based on a vision similar to that invoked by some ports in Southern Italy, must make us reflect. In addition to the expansion of port infrastructure – aimed at increasing transhipment maritime traffic – the Greek port has been identified as a logistics platform for distribution in Europe and in the Mediterranean of goods – mainly of Chinese origin,

but not only – through the improvement of road and rail transport, which is not easy to implement because of the need to cross several nations.

While on the one hand the current infrastructural endowment and the results of traffic flows underline a major role of the Mezzogiorno, on the other, the analysis of operational capacity often displays a delay compared to other regions of the country, in terms of railway connections and above all logistics services in dry port areas. This difference in the assessment of the port and logistics infrastructure of Southern Italy – whether it be the overall budget and the provision of maritime services or the operational capacity of berths – is due to the fact that the ports do not fully exploit the potential of freight traffic. Basically, most of the infrastructure of Southern Italy is dedicated to transhipment or local traffic and little to the handling and value of goods. If the ports of Northern Italy are the "gates" to access the markets of Central Europe, the southern ones, with their varied configuration encompassing the entire maritime arch Adriatic-Ionian-Tyrrhenian, are the natural gateways that could serve the Italian industrial system.

9. Development of traffic is still a primary objective

Despite the problems examined, development of maritime traffic is the key factor to ensure economic growth of the area, as this would allow it to reach large international markets therefore making it possible to overcome the peripheral position compared to the European continent. The game is played on land (logistics and intermodal services) rather than on the sea (maritime services).

We need to continue to invest in a system that guarantees these inland connections. Suffice to say that the freight rates between the main European ports and the major ports in the world have become very similar: sending a container by sea from various European ports to Shanghai or New York costs practically the same. The difference in overall shipping cost is linked to the distance on land between the exporting company and the port of shipment. Ships are increasingly calling at regions with a high concentration of production districts and consumer markets, and this makes it even more important to improve the system of internal road-rail-sea connections.

Good infrastructure (i.e. better accessibility) is not sufficient for good logistics, and therefore for greater competitiveness. Amongst the criteria for choosing a port of call or an intermodal service to use, shippers and international logistics operators consider not only the price of services but the quality of these, mainly in terms of timing and reliability.

For the South, as well as for other European regions, these problems are accompanied by the negative effects linked to its "peripheral" geographical position compared to the regions considered as "central" in terms of levels of economic activity, per capita income, employment, etc. A penalizing condition, made worse by long travel times, frequency and quality of services, as well as by lower accessibility compared to other areas of the country. The Mezzogiorno, therefore, suffers from the weakness of the organizational structure of industrial SMEs and of those companies engaged in the logistics and transport sectors, which have difficulty in accessing the market and confronting competitors.

Moreover, cultural factors often prevent collaborative solutions that could have positive effects in increasing efficiency and economies of scale.

The importance of the Mediterranean for our country highlights the need to look not only at the ties with continental Europe, but to look south towards Mediterranean, Balkan and Middle Eastern countries.

Ports in the Mezzogiorno are included in the maritime networks of intercontinental container traffic, as well as in those of the Motorways of the Sea. These, in particular, are concentrated precisely in the region of Southern Italy. Besides transhipment, Ro-Ro traffic is by far the main sector in the category 'various goods' and, generally speaking, amongst the most significant in terms of overall transits. When considering the possibility of Italy becoming a logistics platform in the Med, it is therefore important to take into account not only the handling of containers. In fact, we have to keep in mind that for years EU and non-EU road haulage companies have been using our national ports as gateways to the markets of South-East Europe, Middle East, North Africa and the Western Med.

It is also important to highlight that, while the Tyrrhenian and Adriatic basins are valid options for the Motorways of the Sea in terms of cabotage, these two seas are not on the same level when envisaging an expansion of the MoS to the entire Europe with integration of the railway system, with the aim of reducing travel time and road journeys. It is the Tyrrhenian Sea that still has to overcome difficulties in the rail connections between its ports and Centre-North Europe, whereas the Adriatic basin has already addressed and almost completely resolved these issues.

10. Integrated Logistics Areas as a synthesis of planning and development strategies

Integrated Logistics Areas can boost the recovery of the Mezzogiorno and represent a tool created with the aim of optimizing expenditure for ports and logistics areas within EU planning. Regions are considered as geographical units with several players and different levels of administrative management and regulations. With the 2014 partnership agreement it was made clear that the creation of 5 ALI ('Aree Logistiche Integrate' in Italian) in 5 underdeveloped Southern regions, would be the precondition for activating the funds of the PON Infrastructure and Networks. In the mentioned regions, these ALI must include commercial ports, dry ports, logistics areas, road and rail connections between them and the national network.

Nonetheless, ALIs also have the more ambitious objective of pursuing a more broadly systematic development and planning of the territory. In fact, the idea of creating 'systems' has always been the cornerstone of strategic plans of the Ministry as a necessary means to achieve growth and development of the region.

Amongst policies of the Ministry aimed at boosting integrated and efficient growth of transportation, Integrated Logistics Areas represent a model for the planning of interventions based on EU-funded operative programmes in Southern Italy.

Agreements signed so far have established for each ALI a technical local board with the task of making investment proposals and sharing a particular model of coordinated marketing. Recently, the plan 'Connettere l'Italia' (Connecting Italy) has allocated €49.5

billion to the relaunch of the logistics system of the Mezzogiorno. In particular, €21 billion (€12.1 available) for the railway sector, 14.1 (€12.1) for metropolitan areas, 11.9 (€9.7) for roads and motorways, 1.5 (€1.5) for airports and €957 million (€862 million) for ports. This initiative is aimed at filling the gap created over the last decades.

Investments aimed at improving the two North-South rail axes are particularly important. In fact, the development of Ro-Ro traffic brings about an immediate increase of commercial vehicles on roads and motorways, especially in port cities of transit. Hence, it is crucial to reduce this traffic by transferring semi-trailers by rail. This is precisely the objective of RFI's project for the improvement of the North-South axis: to make it possible for trailers and High Cube containers to travel along the entire Adriatic coastline.

11. Special Economic Zones to relaunch competitiveness and attractiveness of Southern Ports

The relaunch of competitiveness of ports in the Mezzogiorno regions is dependent on Special Economic Zones, with simplified tax system, no bureaucracy and guaranteed efficient logistics systems.

In other areas (i.e. Tanger, Spain, Egypt etc.) the establishment of Special Economic Zones or Free Zones has attracted significant investment and logistics production plants, as well as increased traffic. Finally, the expected pacification of North Africa could represent a great opportunity for trade with this region, which experts now define as the market of the future.

Conversely, ports of the Mezzogiorno can play an important role of direct support to the import-export of production systems and industrial districts of the South, as well as favouring logistics of the national supply chain.

It was precisely with the aim of implementing the aforementioned function and of allowing ports of the Mezzogiorno to recover their competitiveness that Special Economic Zones were established through Law 03.08.2017 n. 123, conversion with amendments of Decree Law 20.06.2017 n. 91 indicating "Urgent Measures for the economic growth of the Mezzogiorno".

A Special Economic Zone is defined as a geographically limited and clearly designated area, located within the nation's borders, possibly made up of non-adjacent areas provided that these have a functional economic link. A SEZ must also include at least one port with the conditions set out by Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11th December 2013 on Union guidelines for the development of the trans-European transport network (TEN-T).

The same national law regulates the tax benefits and other benefits that are given to pre-existing companies and to the new ones that are set up to start a programme of entrepreneurial economic activities or investments in the Special Economic Zone (SEZ). In particular, companies that make investments within the SEZs can use tax credit for the purchase of new equipment in the South, within a maximum limit, for each investment project, of €50 million. In addition, benefits for these areas have been extended until 31st December 2020.

Special Economic Zones – SEZs in Italy

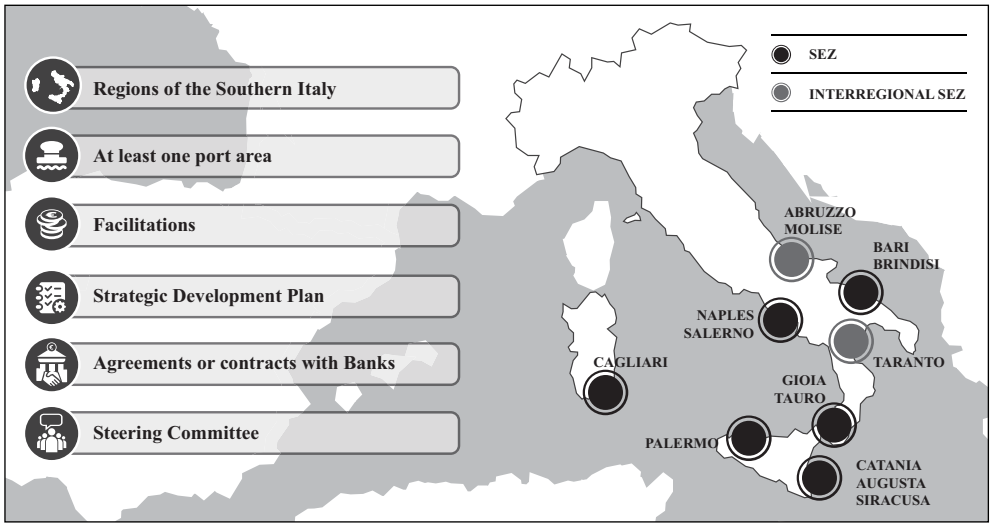


FIGURE 1 - SOURCE: SRM

The conditions will be withdrawn if the companies do not maintain their activity in the SEZ for at least seven years after completion of the investment (this term was originally 5 years but it was increased by the Commission).

Companies that initiate a programme of entrepreneurial economic activities or investments of an incremental nature in the SEZ can take advantage of simplified procedures and special procedural regimes, which reduce procedural deadlines and simplify compliance with current legislation. The simplified procedures can also be identified by means of protocols and agreements between the local and state administrations concerned, while the special procedural regimes are identified on the basis of derogatory criteria and procedures defined by decree of the President of the Council of Ministers, to be adopted upon proposal of the Minister for territorial cohesion and the Mezzogiorno (if appointed), subject to resolution by the Council of Ministers. It is also envisaged that companies can have access to the existing and planned infrastructure of the SEZ Strategic Development Plan, under the conditions defined by the Steering Committee (see Article 4), in accordance with the port regulations contained in law n. 84 of 28th January 1994 and subsequent amendments, in compliance with European legislation and current safety regulations, as well as current provisions on simplification provided for in Articles 18 and 20 of Legislative Decree 4th August 2016, n. 169.

This provision widens, in relation to investments made in the SEZ, the extent of the tax credit for the purchase of new equipment destined to production facilities in areas located in Southern regions, as envisaged by the 2016 Stability Law. Firstly, for investments in the SEZ, the possibility of using this incentive has been extended by one year, until 31st December 2020. Secondly, the maximum amount of each investment project to which tax credit is commensurate has been raised to €50 million.

Companies must maintain the assets in the SEZ for at least seven years after the completion of the investment subject to the benefits, under penalty of revocation of the

privileges granted and enjoyed; moreover, the companies themselves must not be in a state of liquidation or bankruptcy. The subsidy concerning tax credit for the purchase of new equipment is granted in compliance with all the conditions set by the Commission Regulation (EU) No 651/2014 of 17th June 2014 declaring certain categories of aid compatible with the internal market and, in particular, by Article 14 of the same regulation on regional investment aid. The President of the Council of Ministers or the Minister responsible for territorial cohesion and the Mezzogiorno must provide the Commission with summary information on aid measures within twenty working days of their entry into force, as well as an annual report (pursuant to article 11 of the Regulations).

The Decree of the President of the Council 25th January 2018. n. 12, defined the procedures for the establishment of a SEZ, its duration, the general criteria for the identification and delimitation of the area, the criteria regulating access and special conditions, as well as the general coordination of development goals.

The aforementioned legislation establishes that the governance of the SEZ is entrusted to the subject for the administration, identified in a steering committee composed of: the President of the Port Network Authority (who presides), a representative of the Region, or of the Regions in the case of inter-regional SEZ, a representative of the Presidency of the Council of Ministers and a representative of the Ministry of Infrastructures and Transport. The Steering Committee avails itself of the Secretary General of the Port Network Authority for the exercise of administrative management functions. This figure, upon authorization of the steering committee, can sign framework agreements with banks and financial intermediaries. The port is a key player of a SEZ for two reasons: firstly, because a SEZ is 'a geographically limited and clearly designated area, located within the nation's borders, possibly made up of non-adjacent areas, provided that these have a functional economic link and that there is at least one port'. Secondly, because the governance is entrusted to the steering committee chaired by the president of the Port Network Authority supported by the Secretary General.

This role of the port is crucial because of the mission of the SEZ, which is as follows:

a. Promoting the economic, financial and administrative conditions necessary to the development of companies already operating, as well as to the creation of new companies.
b. Encouraging foreign investment.
c. Redeveloping rural and urban disadvantaged areas.
d. Increasing the efficiency of trade operations and the territory's competitiveness.

In fact, following Law No 84/94 recently modified by Decree Law 169/2016 as cited in Article 5 of Law No 123/2017, the Port Network Authority is provided with a 'Single administrative window', a front office for all authorised port operators to carry out administrative procedures and requirements linked to their economic activities. The other window, the 'Customs and controls single window', is under the control of the Customs Agency and deals with customs clearance and security.

Also, the president of the Port Network Authority needs to coordinate activities carried out in the port by public administrations, except for the ones included in the provisions regarding the Customs and controls single window, the coordination and control of activities subject to authorisation and concession and port services. In particular, this figure, with the aim of better liaising and speeding up procedures, promotes collaboration

between different administrations operating in ports and in the whole reference system. The president also manages the areas and assets of the maritime state property that fall within the correspondent territorial municipality.

The liaising function with which the Port Network Authority is entrusted by the regulations is crucial because of the benefits for companies operating in the region: simplified procedures – also identified by means of protocols and agreements between the local and state administrations concerned – and special procedural regimes. These, in particular, entail acceleration of procedures and simplified requirements compared to the normally applicable regulations, on the basis of derogatory criteria and procedures defined by Decree of the President of the Council of Ministers, to be adopted upon proposal of the Minister for territorial cohesion and the Mezzogiorno (if appointed), subject to resolution by the Council of Ministers. The Port Network authority is also responsible for managing access to existing infrastructure and to that included in the Strategic Development plan of the SEZ.

In conclusion, the aforementioned considerations show how Mezzogiorno portuality, despite its already significant contribution to overall national traffic, has not yet taken advantage of its full potential in a fiercely competitive Mediterranean market. This has been mainly due to an infrastructural and logistic gap, as well as to the historical lack of efficient and modern transportation policies.

Recent regulatory and planning measures have eventually envisaged numerous actions aimed at providing Southern Italian ports with the necessary tools to overcome the issues that are currently having a detrimental effect on growth: infrastructure, logistic renewal, new governance, coordination, Special Economic Zones, digitalisation, etc.

The gradual implementation of these important initiatives will have to be accompanied by an organic and objective vision of the Mezzogiorno and its ports. A vision which needs to start precisely from these and then be supported and promoted by all institutions.

Chapter V

Maritime sustainable development in the High North: green finance, alternative fuels and the Northern Sea-Route

1. Foreword

The chapter explores how maritime transport can offer valuable opportunities for innovative sustainable development. The paper explains how ports and the maritime sector can benefit from new business models based on the growth of alternative fuels, such as hydrogen, green finance and the possibility of connecting Europe and Asia through the Northern Sea Route, now included in the *One-Belt-One-Road* (OBOR) strategy, promoted by the Chinese Government. The theoretical insights of the first part of the chapter are complemented by an extensive case study base on the Finnafjord (Iceland) greenfield port project, developed by bremenports. The chapter illustrates how innovative and forward-looking practices for ports can contribute to profitable investment ventures and promote sustainable local development.

2. The external effects of maritime transport

The importance of the maritime industry cannot be overstressed and shipping and ports internationally are one of the pillars of globalisation (e.g. Hoffmann & Kumar, 2013). By facilitating the movement of cargo and people they play a very substantive role to the wellbeing of communities, countries and the world. Shipping and ports, however, are also responsible for conspicuous negative environmental impacts, ranging from the movement of microorganisms and algae in ballast water tanks, to noise and local air pollution (Talley, 2003; Eyring *et al*., 2010). Shipping is also responsible for 3% of global greenhouse-gas (GHG) emissions (Smith *et al*., 2015); a small but not negligible portion of garbage and sewage releases at sea (Stöfen-O'Brien & Werner, 2018); local congestion on major hinterland transport routes to and from the ports (Wan, Zhang & Li, 2018); and long-term impacts on natural ecosystems. Social and economic impacts related to shipping and port activities are also substantial and are associated with industries such as shipbuilding, ship recycling, tourism and or other port-related industries, such as the oil and chemical industry, smelters, power generation facilities and logistics infrastructure, that are often located in the proximity of ports (Shan *et al*., 2014; Acciaro, 2008).

Efforts have been carried out over the years to reduce the negative external impacts associated with shipping and at port. Some of those efforts are the results of a tightening national and international regulatory regimes, that tend to create, when enforced, strong incentives for the industry to reduce its impacts and often are the only viable way to address certain externalities, as in the case of the IMO double hull regulation, that has successfully reduced oil spills from ocean going vessels (Yip *et al*., 2011).

An important contribution to the reduction of negative externalities is also the result of the necessity for the sector to increase efficiency and service quality. The shipping and port sectors tend to operate often in highly competitive environments and the pursuit of operational efficiency can in many cases, although not necessarily, result also in the reduction of negative external effects. This is the case for example of slow steaming, i.e. speed reduction aimed at reducing fuel consumption, or the adoption of accident prevention measures (e.g. Maloni *et al*., 2013; Knapp *et al*., 2011). Besides, in the last decades some shipping firms and an increasing number of ports globally have also engaged proactively in corporate social responsibility (CSR) actions aimed at reducing their environmental and social impacts and indirectly improve brand performance and reduce reputational risk (Acciaro, 2015). These efforts, although highly commendable, are still limited and are often difficult to justify in a B2B context, where pressure on freight rates in the shipping sector and limited resources in the port sector do not allow for more radical actions needed to reduce some of the negative externalities associated with the sector.

Competitive pressure makes it often virtually impossible for owners, terminal and ship operators, as well as port authorities, to carry out more radical measures aimed at reducing environmental and societal negative impacts, beyond what is demanded by the regulator or what is acceptable according to the dominant moral and ecological standards of the countries where they operate. While competition in these industries takes place primarily at a global level, regulation is often confined to territorial waters, the port areas or the legal jurisdiction of flag states, and efforts of developing global regulatory instruments are marred by bureaucracy and lengthy political discussions within the designated international bodies (Mickwitz *et al*., 2008).

A particularly important role is played by innovation (Acciaro *et al*., 2014). New technologies, in the form for example of alternative fuels, have the potential for radically improving the environmental and social footprint of the sector (Jenssen & Randøy, 2006), maintaining its competitiveness and often generating additional economic growth, such as in the case of the offshore wind sector. However, notwithstanding the substantial degree of innovation that can be observed in the industry in terms of ship technology and operations, shipping and ports compared to other sectors tend to take a rather conservative stance on new technologies (Hermann & Wigger, 2017). This is not surprising, as innovation in its initial stage is risky and can result in substantial cost increases or loss of market share, a risk that many in the industry cannot afford to run.

In addition, the industry is rather heterogeneous, with some shipping segments operating in a highly competitive global market (Grammenos & Choi, 1999), where regulation is often hard to enforce and at times conflicting, and other dominated by small local players with little of no means to innovate, and other again enjoying geographical quasi-monopolistic rents (Luo *et al.*, 2014; Sys, 2009). In such an environment, incentives for innovation are limited and the lack of a coordinated global technology development and uptake strategy does not favour reaching that critical level necessary to make some new technologies affordable. Negotiation and agreement on as well as implementation of maritime regulation often hindered by supra-national nature of the shipping industry and the fragmentation of responsibilities along the value chains. On the High Seas only international law applies, which is set by the International Maritime Organisation (IMO).

The IMO is a body of the United Nations (UN) and thus bound to follow the customary rules of international law making. On board of the vessels the national law of the flag state applies. However, providing flag state legislation has become a business on its own with competition for applicable standards and implications on the level of enforcement.

Many countries and regions globally lack an overall vision on how innovation could respond to the sustainability challenges of the shipping and port sectors, and even in those cases where a strategy exists, it is underfunded, lacks an implementation roadmap or is not harmonised with the strategy of other regions. In some cases such strategies are motivated by the wish to foster the economic competiveness of some of the country industrial manufacturing sectors, more than a genuine desire to mitigate or remove the consequence of the negative social and environmental external effects of the shipping and port sectors. Besides, these effects are often negligible at a local level or are global in scope, making it very difficult to be addressed by a country individually.

A meaningful reduction in the industry environmental and social impacts requires a comprehensive strategy that combines innovation with regulation ideally at a globally coordinated level. Such strategy needs not be at a cost and does not necessarily have to be unprofitable. It requires, however, a new perspective that is not only centred on economic profitability but also accounts for societal wellbeing and the preservation of natural capital. It requires, in other words, overcoming the dichotomy between private and public interest. While developing such vision might be challenging at first, there are multiple examples of successful sustainable businesses that have been able to combine economic profitability with societal development and environmental innovation.

This article illustrates by means of a detailed case study based on *bremenports GmbH & Co. KG*, the company managing the port of Bremen, in Germany, how maritime sustainable development can be achieved through innovation. While the case study is specific, it is informative of the challenges associated with innovative thinking in the shipping and port sectors. The case also offers the opportunity to analyse some of the most likely disruptive developments that are likely to impact shipping and ports in the coming decades, such as the commercial exploitation of the arctic, the impact of increasingly stringent global environmental regulation, the China-led initiative *One-Belt-One-Road* (OBOR) and the fuel transition that will limit the use of fossil fuels in transport. Taking advantage of such developments requires an innovative approach to ports and shipping, enabled by innovation in the areas of green finance and alternative fuels, in particular hydrogen, and aligned with the new concepts of *blue economy* and *natural capitalism*.

3. The tension between public and private interests in ports

Notwithstanding the often very high technological complexity of shipping and port operations, the industry has been characterised by a rather conservative approach towards the implementation of new technologies to foster sustainability (Vanelslander *et al.*, 2016). It is expedient a this stage to clarify that while many developments impact both the port and shipping industry, these two complementary sectors operate in very different ways. It is not within the scope of this paper to give a comprehensive overview of the

shipping business beyond what is necessary to illustrate the changes affecting the port sector. It should be noted that international shipping, tends to be a global industry that is primarily characterised by high levels of competition and regulated through international conventions and through flag states, while ports tend to be often embedded within a country regulatory infrastructure and, in most cases around the world, are managed though some form of public and private cooperation.

While several ports globally enjoy some degree of geographical monopoly, in many cases this advantage has been eroded over time as the logistics infrastructure in the port hinterland improved providing shippers with the opportunity of moving their cargo though different ports (Wilmsmeier & Monios, 2013). Also on the maritime side the emergence of transhipment as a business has been accompanied by an increase in levels of competition, as hubs contend for larger shares of container traffics. Whether characterised by a geographical advantage or by competition for the same contestable hinterland, ports have witnessed an increase in the private sector participation in operations and often also in management activities (Peters, 2001). In the pursuit of efficiency, most ports have entrusted their commercial operations to private firms, and many port authorities globally have corporatized, i.e. they are managed as private enterprises (Chen & Everett, 2014; de Langen & van der Lugt, 2017).

Although this development has afforded the port sector unprecedented efficiency gains, it also resulted to some extent in a tension between the public interest and the pursuit of more traditional private companies goals, such as profit, market share or cost reduction. Governments around the world have resolved this tension in various ways. In some cases, municipal, state or other local or national authorities have retained ownership and control of the corporatized port authority as in the case of Rotterdam, Vancouver, Ningbo Zhoushan or Singapore. In other cases, such as Hamburg, or Genoa, or Los Angeles and Long Beach port authorities are public agencies managed either by the municipalities, the state/municipality or central governments. In other cases port management enterprises, often integrated with terminal operators, have become private companies, such as in the case of Felixstowe, Piraeus in Greece or Newcastle in Australia, that operate within specific national legal framework that in principle should safeguard public interests. In these cases some functions, such as maritime authority, are retained by the public sector.

The growing degree of deregulation and of global competition among ports has some potentially critical implications for sustainability. The fact that ports are increasingly managed as private enterprises implies that their pursuit of public interest is not necessarily enshrined in the port managers' practices. Ports, especially those managed by the public sector or whose majority shareholders are public entities, are subjected to public scrutiny that, at least in democratic societies, would keep the actions of management under check. For those ports that have been corporatized of course the degree of pursuit of public interest depends on the vision adopted by the port, its statutes and most likely by the composition of the shareholding body. While it could be expected that corporatized ports that are controlled by the public sector would be more sensitive to public demand, this is not guaranteed, especially as some port corporations provide substantial dividends.

The issue is complex as a broader definition of shareholder value can certainly encompass the wellbeing of civil society or the neighbouring communities around the

port. Besides, companies, including port-managing corporations, are subjected to the law and need to operate within the norms of the country and society on which they depend. There is an abundance of cases in which port managers are required to consider public interest and are forced to gauge market forces against local community demands. This implies that corporate social responsibility acquires increasing relevance for port managers (Acciaro, 2015), in what has often been referred to as the *licence to operate*, and that effective regulatory mechanisms need to be in place to remove or minimise negative external effects from port management. The licence to operate for a port manager entails a shift from its role as sole manager for the marine infrastructure to becoming an integrator of all relevant stakeholders of the port (Stemmler, 2015). Port managers become increasingly vulnerable to reputational risk and tension with local communities are likely to increase, when the negative external effects borne by local stakeholders are not sufficiently accounted for in port management decisions.

The global nature of competition among ports, however, places ports in a similar dilemma as multinational corporations. In the absence of effective global governance mechanisms many ports are subjected to global competitive pressure, but their potential negative external effects are regulated locally, at a national level or in some rare cases at a regional level as in the case of the European Union. This results potentially in tension between public interests and those of the shareholders.

As an example, consider the pledge that several port corporations globally have made to become carbon neutral. Such strategy could be in conflict with a profit maximisation goal or financial self-sufficiency, unless:

- the port is able to achieve such strategy without increasing its costs, for example through innovative technologies, or
- in presence of market power and an inelastic demand, so that an increase in port costs would not result in a decrease in revenue.

While it is possible to envisage situations where the implementation of a more sustainable strategy through a new technology allows for a reduction in operating costs, or even that some users could be willing to pay more for a more sustainable service, this is not necessarily the case.

There are several ways to overcome such tension. A possibility is that of creating transnational agreements among competing ports aimed at harmonising environmental (and social) regulation and developing common standards and metrics, so that competitive pressure would not result in a race towards less stringent regulation. There are several examples of these collaborative initiatives, such as the *Northwest Ports Clean Air Strategy*, between Vancouver, Seattle and Tacoma, *Green Marine*, the *World Port Climate Initiative* or the regulatory efforts at EU level. While these industry-led initiatives are an important driver towards sustainable port management and operations, there is not guarantee that they will ensure a sufficient response to the environmental and social concerns associated with port operations.

Another alternative is the pursuit of sustainable development strategies for globalised ports. Those more forward looking and innovative port management enterprises can in many cases outline investment and development strategies that fully embed sustainability considerations at the start of the strategic process.

This approach allows for port companies to explore innovative sustainable solutions without seeing environmental and social issues as a constraint, but more as an opportunity. While such approach can offer valuable insights for port managers, it does not guarantee that sustainability would deliver competitive advantage. In other words in the context of global competition, among the strategies available to a port corporation, there is no guarantee that a strategy that places the importance on environmental and social issues that would be optimal from the perspective of society, would necessary be superior to other strategies.

Good arguments could be made on the account of the specific characteristics of the port business, such as the accountability towards local communities, public involvement in port management, and the current developments in the world of shipping, that justify taking into account in port strategy processes society perspective on environmental and societal issues (Santos, Rodrigues & Branco, 2016). An important role for the regulator can be envisaged to ensure that sustainable strategies are at least as competitive as strategies that do not account for society perspective. There is finally, also a role for academic research to develop methods and provide a rigorous basis for developing sustainable strategies for ports.

4. Drivers for sustainability in ports

Before providing a set of suggestions on sustainable port management concepts it is useful to summarise the characteristics of the port sector that warrant the pursuit of sustainable business models, and provide an indication of some of the current industry developments that offer opportunity at the intersection between societal interests and profitability.

Among the characteristics of ports that can be considered conducive to the inclusion of sustainability consideration in port management are substantial external positive economic impacts deriving from port operations in terms of jobs, value added and connectivity. Ports are associated with large economic impacts and are responsible for substantial job creation (Acciaro, 2008). Inevitably this attaches a substantial political liability associated with port operational choices, as the debate on containerisation and the automation attests (Bechtsis *et al*. 2017; Acciaro & Serra, 2014).

Furthermore, the role that ports play in facilitating trade should not be underestimated. Efficient ports serve better their hinterland and the interest of the country or community in which they are based. This is the primary reason that has justified the transition from publicly operated ports to the private terminals, and the success of the landlord port governance model. However, the expansion of the port hinterland beyond the direct geographical proximity of the port often even beyond the borders of the hosting country, meant that large part of the economic benefits arising from port operations often materialise far away from the port (Musso, Ferrari & Benacchio, 2006). Unfortunately, many of negative external costs traceable back to port operations are instead localised, so that the party that bears the external costs of the economic activity is not the same one that benefits from it (Acciaro, 2008).

Over the years it has become evident that the external costs associated with port operations are diverse and substantial. They range from pollution, to noise, community and natural habitat disruptions, to congestion. Vandermeulen (1996) has discussed these effects in terms of resource utilisation conflicts. Littoral areas, for example, could be used for industrial activities, port loading and unloading operations, tourism, recreation, aquaculture or simply preserved to protect local fauna and flora or the landscape. And within these categories multiple alternative uses can be identified, e.g. within tourism, the development of a cruise terminal, a recreational craft marina, or a promenade. The choice among these alternatives is a complex exercise in (social) cost benefit analysis and, in absence of adequate metrics to valuate certain alternative uses, such as the preservation of a landscape or of artisanal fisheries, can result in conflict that can erupt later in the development of the project.

In addition, the long-lived nature of port infrastructure, the irreversibility of many port investments, the often long time requirement for construction and planning procedures, as well as the risks associated with large infrastructure project that can delay completion or substantially rise costs imply that there is plenty of time to identify (alleged or real) resource conflicts and act upon them by means of class action, lobbying, protests, strikes or civil disobedience. The emergence of these resistance phenomena can have enormous consequences also for the profitability of port investment, the relations between the port and the local communities and the competitiveness of the port. It should be stressed that not necessarily all forms of resistance are necessarily justifiable in view of the actual circumstances, and in fact there are examples of opposition to port projects that after a rigorous analysis was unjustified, cold be considered the result of deliberate or unintentional misinformation, or simply favoured the interests of smaller groups at the expenses of the wider society.

Whatever the case, the (perceived) urgency of such forms of resistances is often exacerbated by the proximity of ports with metropolitan areas, the ecological or historical vulnerability of port areas. Many modern industrial and commercial ports have evolved out of smaller harbours in the proximity of cities and villages and the existence of the port within the urban environment results in high negative valuation of some of the externalities associated with port operation, such as noise, pollution, congestion and visual intrusion. Furthermore, ports are often located in the proximity of river estuaries or in protected bays, which because of their nature are the habitat of autochthonous fauna and flora. Substantive arguments can be made in favour of the protection of the ecological diversity of such natural habitats and probably hardly any port projects have been concluded without facing the constraints imposed by nature conservation. In addition, the historical heritage of many port cities imposes additional constraints on port development and port management.

The nature of port projects, often characterised by large capital outlays, substantial economic, political and financial risks, and the public nature of certain port infrastructure, has often justified the involvement of public actors, either by the direct sponsoring or financing of the project, or through public private partnerships (Van Ham, & Koppenjan, 2001). The use of public moneys warrants the scrutiny of civil society and results in the expectation that the port manager would maintain full accountability of the port, independently of whether the port manager is involved in port operations. It is not unusual

for port management enterprises to be contacted in relation to economic activities they have no direct involvement with.

It is also the traditional role that has been played by the public sector in port management and the fact that many port managing companies are public agencies or retain regulatory and policy enforcement functions, as for example in the case of safety and security—hence the term authority—that justifies in the eyes of the public opinion the identification of the port managing company with the totality of port, although in practice a variety of contractual agreements might be in place that limit the ability of the port management company to interfere or condition the economic activities taking place in the port. In some cases, the port management company might even be seen accountable for effects caused by economic activities indirectly linked with the port, such as in the case of coal dust from rail-wagon leading to the Port of Vancouver, or the impact of ship-collision with cetaceans in the port of New York/New Jersey.

The expected accountability of port management, combined with the regulatory role that many port-managing companies still retain as port authorities is often formalised in the mandate of the port management company that might include the protection of the public interest. The rusting conflict, briefly outlined in the previous section, has been the subject of extensive port management literature, primarily in the context of European ports. Whatever the case, the characteristics of the governance models prevailing globally for port management and the historical tradition of large public sector involvement in the port business result in the likely exposure of port authorities to reputational risk. Such exposure is bound to increase as port activities are deregulated and in the wake of the corporatisation trends in the port business. In view of such considerations, it becomes even more important to envision port development strategies centred on sustainability.

5. Shifting global trends

In the previous section the sustainability drivers intrinsic to port management and operations have been discussed. But a complete discussion of port strategic processes cannot be carried out without the consideration of the opportunities offered by the changing port business context. The objective of this section is that of illustrating—admittedly not exhaustively—some of the global trends that will potentially impact the port industry and that could offer valuable opportunities to sustainable port development. This section provides also a more general context to some of the issues presented later in the case study.

The Arctic Silk Road

The Belt and Road initiative, also known as *One Belt One Road* (OBOR), and New Silk Road, has been launched by the Chinese government in 2013, and aimed at improving the quality of the transport infrastructure connecting China globally and primarily westwards. The initiative has clearly a substantial geopolitical role and represents the increasing role that China is to play at the global level (Fallon, 2015). The initiative is articulated through a number of loosely connected infrastructure projects, linking China

on land through the former USSR republics of central Asia to Europe, and to South-East Asia but also Bangladesh, India and Pakistan (Blanchard & Flint, 2017).

It also comprises a maritime new silk road and since this year, it also includes an arctic branch. Although China in not an arctic State, a recent paper issues by the State Council Information Office indicates that the country is interested in developing, jointly with others, shipping through the Northeast Passage, also known as the Northern Sea Route. The possibilities offered by arctic shipping have been investigated for over a decade now as a result of the possibility of sailing through the arctic for longer and longer periods every year. The Northeast Passage can afford sailings between Europe and Asia that are up to 20 days shorter and is associated with the exploitation of the rich arctic resources, from oil and gas, rare minerals an fisheries (Buixadé Farré *et al*., 2014). Among the Chinese interests in the region, is a stake in Russia's Yamal liquefied natural gas project, according to China Daily, a state-run news outlet. The project would supply China with four million tonnes of LNG a year and it is clearly of great strategic interest to China.

The extent of the exploitation of the Arctic Silk Road, however, is highly uncertain, and although China became an observer member in the Arctic Council in 2013, its ability to benefit from shipping through the Arctic is dependent on the agreements between artic States and the international community. Sailing through the arctic is still an expensive, risky and uncertain enterprise, heavily dependent on weather and the availability of icebreakers, primarily controlled by Russia (Liu & Kronbak, 2010). The depth constraints in the Sannikov and Laptev straits, as well as uncertainty of sailing conditions and the harsh climate are a deterrent of extensive exploitation. The vulnerability of the pristine arctic ecosystem (e.g. Miller & Ruiz, 2014) and the difficulty in carrying out search and rescue (SAR) operations have also been influencing the debate on the exploitation of Arctic resources (Buixadé Farré *et al*., 2014).

Notwithstanding opposition from many non-governmental agencies, shipping in the arctic is increasing, driven by expedition tourism, its natural resources and the prospect of shorter sailing times. This has led several locations in the high north to prepare for a potential increase in the Arctic economic exploitation. Finland and Latvia have been indicated as potential beneficiaries of the Arctic Silk Road investment strategy, while Norway, Greenland and Iceland have been developing plans to upgrade their port infrastructure to serve economic interests in the North.

Sustainable maritime tourism

An area that has increased in importance in the arctic is tourism. In the last decade an increasing number of cruise vessels have been sailing in the Arctic every summer increasing the urgency of developing adequate SAR responses and environmental regulation principles (Leet *et al*. 2017). The set of amendments to major International Conventions such as SOLAS and MARPOL, approved between 2014 and 2015 and specific norms known as the *Polar Code*, have been an important step in this direction. While the *Polar Code* has not specific provision on sustainable tourism, it lays the foundation for the environmental protection of the Arctic and safety of navigation.

Maritime tourism is an increasing source of income in many countries, and given the exponential growth experienced by the industry, tension between the economic interests and the environmental and social aspects of maritime tourisms are increasing. Resistance is starting to emerge in several locations around the Planet such as Venice or some Greek islands, and the overcrowding of certain areas is becoming a constraint in the development of the industry. The development of new concepts to take advantage of tourism in a sustainable fashion is critical for many areas (Lekakou, Stefanidaki & Theotokas, 2016).

Alternative fuels and forms of propulsion

Electrification has been a trend on land transportation, with electric or hybrid cars and busses becoming a common sight in many cities around the world. The opportunities of electrification have also been extended to maritime vessels with onshore power supply (OPS) becoming available in many ports globally and the testing of batteries on-board of vessels. Electric ships are also becoming available. The Icelandic whale watching company, North Sailing, for example, operates two fully electric ships out of Húsavík. Fuel cells have also being tested with rather successful applications in shipping, albeit always as hybrid technologies. The ship *Viking Lady*, is one of the first vessels to commercially deploy fuel cells, converting hydrogen to electricity. The ship, owned by the Norwegian company *Eidesvik* and chartered to Total, operates as an offshore support vessel in the North Sea.

Hydrogen has been identified as one of the potential game changers for transport. Although currently still more costly to produce than other fuels, it is likely to play an increasingly important role as a transportation fuel not only on ships. One of the main limitations of hydrogen as a fuel, beyond the costs of acquiring and operating fuel cells, is associated with the difficulty of producing it sustainably, as the majority of hydrogen is produced today using steam reforming from hydrocarbons. An alternative production, through electrolysis is much more sustainable, as long as renewable energy is available. Adequate considerations need also to be made for the movement and storage of hydrogen, that because of its molecular structure tends to be rather energy intensive. But substantial savings can be achieved by packaging hydrogen chemically through a synthetic hydrocarbon such as methanol or dimethylether (DME).

Alternative fuels are likely to be the next substantial disruptive innovation in shipping led by GHG and other emission reduction regulation, the increasingly affordable processes to produce them and societal awareness. Fuels such as LNG, methanol, biofuels among others, are likely to coexist together with common diesel based fuels, for the coming decade and their use will probably spread fist in some of he sectors of shipping without a single fuel becoming the only alternative. Their use is a necessity in light of the recent agreement reached in April this year within the International Maritime Organisation, that aims at reducing GHG emissions from shipping to 50% of the 2008 levels by 2050. Such reduction could potentially imply that ships built today would need to achieve efficiency levels improvements of 20%, and the shipping technology will have on average to achieve relative GHG emission reductions of over 80% per ton-mile.

This development implies that all technological options available, including alternative fuels, need to be deployed.

Renewable energy

Renewable energy offers another opportunity for shipping and ports. An increasing large number of ports have been developing renewable energy within their perimeters or have been benefitting from an increase in the traffics associated with the renewable business offshore. Ports are ideal locations for the development of wind, tidal, wave and solar installations. Several projects globally have been exploring the potential of energy generation at ports with the development of virtual power plants and the assistance of smart grids. It also been suggested (Acciaro *et al*., 2014) that ports could financially benefit from these initiatives and in general from energy management. In addition some ports have also benefitted from the increase in traffic associated with the development of offshore installations, primarily wind power plants.

Energy flows in port

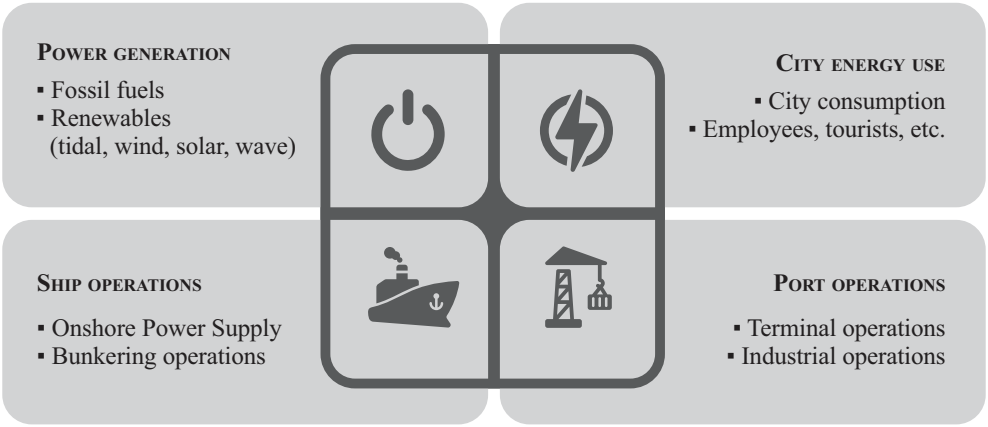


FIGURE 1 - SOURCE: SRM on Authors'analysis

Ships also use renewable energy and the use and origin of electricity is an important issue especially when onshore power supply is considered. Other energy carriers, such as hydrogen or ammonia or batteries can play an important role in the transition from traditional forms of power generation in port towards more renewable and sustainable models. The proximity of many ports to cities also suggests the potential availability of energy sinks that play an important role in determining the economic viability of renewable energy projects. A diagram summarising energy flows in ports is provided in Figure 1.

Green finance

While the financial viability of many renewable projects justifies their development, there is a wide array of situation that could prevent the development of environmentally sound projects on ground of lack of financing. The World Bank indicates, on the basis of estimates made by the International Energy Agency, that between 2030 and 2050, reducing GHG emissions to 50% by 2050 would require about 1.6 trillion US$ a year globally and that urgent action should be taken to bridge the gap between what is available and what is needed (Baietti, 2013). Estimates for the port sector are difficult to obtain, but it is likely that also in this sector, eco-friendly project are not necessarily financially more attractive than traditional ones.

Many green investments exhibit different cash-flow profiles and unique risks associated with regulatory changes or technology maturity. Greener projects tend to be more front-loaded and this is a substantial disincentive for private sponsors, as the project specific risk factors will tend to weight this upfront cost very heavily (Criscuolo & Menon, 2015). In addition, distortions exist in many countries that tend to favour non-renewable energy projects in form of fossil fuel subsidies (Coady *et al*., 2017). It is well documented (e.g. Berensmann *et al*., 2017) that the financing of Low Carbon Climate Resilient (LCCR) infrastructure cannot be entirely provided only by the public sector and private participation is necessary.

Port infrastructure investment has a tradition of public private partnerships (PPP) that can be applied also for LCCR investments. While there is no current specific study on green finance for LCCR in ports, and notwithstanding the opportunities associated with such constructions, several risks can also be identified. Koppenjan (2017) analyses six potential tensions between the application of PPP and LCCR (reported in Table 1 below), and provides a list of research and policy challenges.

Tensions between DBFMO contracts and LCCR requirements

Characteristics of PPP contracts	Requirements from LCCR perspective	Research and policy challenges
Infrastructure focused	Ensuring LCCR performance	• Development and selection of high potential, LCCR friendly alternatives • Ensuring LCCR performance during the life cycle of the project
Proven technology	Innovative technology	• Optimize life cycle approach • Steer on innovative competitive dialogs
Long term contracts	Application of new technologies and practices	• Real options • Provisions in contract for adaptations • Functional specification
Return on investment	Costs of sustainability	• Addressing affordability • Ensuring positive business cases • Value capturing and scope management
Economic regulation	Sustainability considerations	• Development and institutionalization of LCCR indicators • Greening of regulation and management
Government–business interface	Stakeholder involvement and ownership	• Stakeholder management and public–private–society partnerships

TABLE 1 - SOURCE: Koppenjan, 2017, pg. 34

Digitalisation and automation

Many of the current technology developments in the area of renewable and alternative fuels would not be possible with the support of advanced information and communication technologies. Beyond the facilitation in the uptake of renewable energy sources, through for example smart grids, digitalisation has offered substantial contributions in increasing efficiency and reliability of port operations. Automation is becoming common in many large container terminals, with automated guided vehicles that run on batteries and autonomously plan their maintenance and recharging schedules. More sophisticated sensors and the deployment of remote monitoring for ships or of port areas through drones have also dramatically increased the quantity and the quality of data collected.

Digitalisation has been affecting ports in primarily three areas: monitoring and reporting; documentation and compliance; and automation. Remote condition monitoring for ships and port equipment allows for the prevention of accidents and for a more efficient management of maintenance and downtime. This is one of the first steps towards the deployment of autonomous or robotic equipment. Substantial innovation has also taken place in the area of legal compliance and documentation management, with an increasingly large number of ports and agencies developing single window platforms for document submissions. The first examples of autonomous vessels are also being tested while autonomous terminal equipment is an already tested technology.

Are areas where digitalisation is impacting the shipping and port business is in terms of traceability, with promising applications made possible by blockchain technologies, artificial intelligence and the use of big data in planning and forecasting, that is a prerequisite for many advanced technology applications. The increasing availability of detailed data will impact shipping and port management, as it has been happening for example with the growing use of Automated Identification System (AIS) data. It should be stressed, however, that digitalisation also brings about potential economic threats in terms of job substitution and cyber security for example. It is therefore paramount that these technological developments are driven by real societal interests and framed within a factual discussion on the sustainability needs of the industry they are aimed to serve.

6. Sustainable port concepts

In the last decade multiple studies have investigated the extent and the drivers of ports' increasing interest in sustainability. Most studies, however, have been concerned primarily with describing how sustainability is currently implemented in ports. A report prepared for Atlantic Canada by Michelle Adams and others, for example, endeavoured to measure the benefits of corporate social responsibility action for ports (Adams *et al*., 2009) and tellingly concluded that: «In general, the conventional wisdom appears to be that ports and port authorities find little competitive advantage in their environmental performance and do a minimal job of advertising what they have accomplished».

Many ports appear to have embraced some form of commitment towards sustainability in their infrastructure development and management processes, often reluctantly and as a result of local pressure, and in some cases proactively, but generally always in those

cases where some degree of market power would afford their sustainability actions not to compromise their competitive position. With some exceptions, port managing companies have only marginally embedded sustainability in their operations and processes, generally more in the attempt to appease local stakeholders, increase their political agency, reduce reputation risk or gain and maintain their *social licence to operate*.

For ports to truly become sustainable, there is a necessity for a paradigm shift, which encompasses a global regulatory response so environmental and social external effects of shipping, a novel management approach and most likely the uptake of sustainable technologies in operations. Notwithstanding the increasing number of port studies dealing with sustainability issues, seldom, however, these contributions have argued for a radical change in the way ports operate. Such recommendations are often difficult to be supported by evidence, which by definition originates from the way the industry operates and is managed now. Sustainability has been therefore seen more as a change at the margin. But, as already outlined before, a meaningful inclusion of sustainability in port management needs a more fundamental change in perspective.

The green port concept can be seen as a first step towards the definition of a new sustainable model for ports. Acciaro (2015) provides a definition of green ports «as those ports engaging in the proactive development, implementation and monitoring of practices aiming at reducing the environmental impacts of the port at local, regional and global levels beyond regulatory compliance […] ». Such definition, however, entails a change in the way a port is managed and operated, but does not necessarily require a change in vision. In other words, a port can become greener by changing the way in which some of its operations are carried out, or by compensating some of the external costs associated with its activities, but in essence the fundamental strategic aim of the port remains unchanged.

So far there have been limited insights aimed at describing how a sustainable port might look like, but inspiration can come from concepts developed on other areas of economics. Some ideas could be borrowed from the areas of urban planning. The concept of the *regenerative city* (see for example Batty *et al*., 2012), can be extended to ports, and entails the establishment of a restorative relationship between ports and the natural systems they depend on, based on efficient and renewable energy and new economic structures that would favour such development. A zero impact port could be seen as a natural extension of the recently zero emission port concept. For cities, these concepts have already been advanced, such as the *ecopolis* concept developed by Herbie Girardet (2014).

Another interesting perspective is provided by the concept of *Blue Economy*, championed by Gunter Pauli (2015). The blue economy approach builds on local resources, where products are renewable, organic and biodegradable and advocates an economic model where everything has value. While it is not possible in the context of this paper to envisage what role ports could play in a Blue Economy scenario, ideas such as building with nature, sustainable tourism, zero emission ports and power generation through renewables in the port sector can probably all fit into the Blue Economy approach.

The ideas of the Blue Economy are linked to the concept of *natural capitalism*, that builds on three main principles (von Weizsäcker and Wijkman, 2018): use resources more productively; use approaches such as *biomimicry* (Benyus, 1997) and the *circular*

economy, to design how products, services and energy are delivered; and aim at building regenerating human and natural capital. It will take some effort to conceive sustainable management models for ports inspired by these ideas, but ports could offer ideal test cases for more radical sustainability concepts. The case study that follows is a good example of how a forward-looking and innovative port managing company has already profitably embraced the challenges of sustainable development.

7. The Finnafjord Port Project

This section illustrates a case of sustainable port development through the new Finnafjord Port Project, led by *bremenports*, the firm managing the ports of Bremen and Bremerhaven. The Finnafjord Port Project in Northeast Iceland is an interesting case as it is set to become a truly "green" port harnessing the abundant resources of Iceland´s affordable renewable energy. The facility is also a new landmark deep-sea port in the North Atlantic Ocean for transhipment sailing the Northern Sea Route capturing the Asia-Europe trades. Together with the local municipalities of Þórshöfn and Vopnafjörður, and EFLA, an Icelandic engineering consultancy, *bremenports* is responsible for developing the greenfield port project at Finnafjord. *bremenports*' scope of work is to attract investors under build-operate-and-transfer (BOT) concessions to exploit the favourable location of Finnafjord. *bremenports* has also been involved in developing the project structure, carrying out preliminary technical and environmental studies as well as drafting the concessions.

bremenports

bremenports GmbH & Co. KG is the company that manages the ports of Bremen and Bremerhaven in Germany. The company has been established as a private company in 2002 whose shares are controlled by the Free and Hanseatic City of Bremen. The ports of Bremen and Bremerhaven are the second largest ports in Germany in terms of throughput with 75 million tons of cargo handled in 2017. bremenports is responsible for the management of the port that is carried out in collaboration with the public port authority. bremenports has also as main activity integrated port infrastructure management, and is active in port development and construction, maintenance, environmental planning and reporting, port marketing, consultancy and the management of land leases.

Finnafjord - The project opportunity

The Finnafjord area is located in North-East Iceland. Leeward to the prevailing winds and waves, the Finnafjord Port can draw on the affordable and green geothermal and hydroelectric power of Iceland to process natural resources. Key uses can include:

- Production of hydrogen or other emission-free future fuels; using oxygen as by-product in land-based fish-farming (as opposed to in the water to prevent dilution of DNA of any native salmon population).
- Desalination of water.

- Consolidation and processing facility for raw material from mines in the Arctic region for export to North America or Europe.
- Application of energy-intensive bioeconomics, such as fertilizer, animal feed production (fish meal).

The Finnafjord Port aims to address the anticipated developments in the Arctic and might provide answers to the strategic opportunities and challenges in the North.Due to climate change we might see changing migration patterns of fish challenge Iceland´s fish industry; we might see an opening up of the Northern Sea Route that will shorten transit distances from North East Asia to Europe; with new sea routes there might be a wish to exploit the abundance of renewable energies on Iceland for export purposes. The unique topographic situation at Finnafjord with gently sloped embankments, which is unusual on Iceland, its ice-free bay opening up to leeward of prevailing winds, as well as with 1200 ha of development land and supportive stakeholders, *bremenports* aims at implementing the first real greenfield port project on Iceland. The project will provide for regional development combined with an industrial development opportunity for the Arctic to achieve an example of LCCR port.

Challenges

Among the challenges faced by the port has been the funding of initial planning and the implementation of internationally aligned contract structure to local conditions. Currently bremenports is compiling governmental support towards the port.

Finnafjord Port Governance

Being the first public-private partnership on Iceland, the project combines the implementation of a private greenfield port project on Iceland with public regional development activities. It combines industrial development opportunities for the Arctic with the ambition to become a CO_2-emissions-reduced port. It combines local economic activity with the opportunities of international cooperation.

The project will exploit a concession model whereby the municipalities will jointly award a concession to private bidders for a period of at least until 2040. The concession shall require the bidder to design, build, finance and operate port infrastructure and suprastructure at the Finnafjord site in accordance with their own requirements. For this to be achieved, both Municipalities will establish the Finnafjord Port Authority (FFPA), which they own by 100%. The FFPA will award concessions focusing on green business models (see Figure 1). The FFPA will also assume all statutory obligations of a port authority under the Icelandic Harbour Act (Act No. 61/2003) and manage the port as the Municipalities are doing today in Þórshöfn and Vopnafjörður. Private partners together with the FFPA will set up the Finnafjord Port Development Company (FFPD). FFPD will select, award, monitor and administer the concession on behalf of the Municipalities, which includes the management of the environmental issues arising from the concessioning. It will be a consulting and development partner and provide the FFPA with the required technical, engineering, environmental and business development and marketing support.

The award of one or more concessions to private investors requires the availability of development land. FFPA will enter into a long time lease agreement with local landowners. The responsibility for the provision of hinterland infrastructure is in the hand of the Icelandic state. The municipality is responsible for utility services. The provision of ancillary services such as tugging, longshoremen etc. will be licensed to private operators.

Governance structure of the Finnafjord project

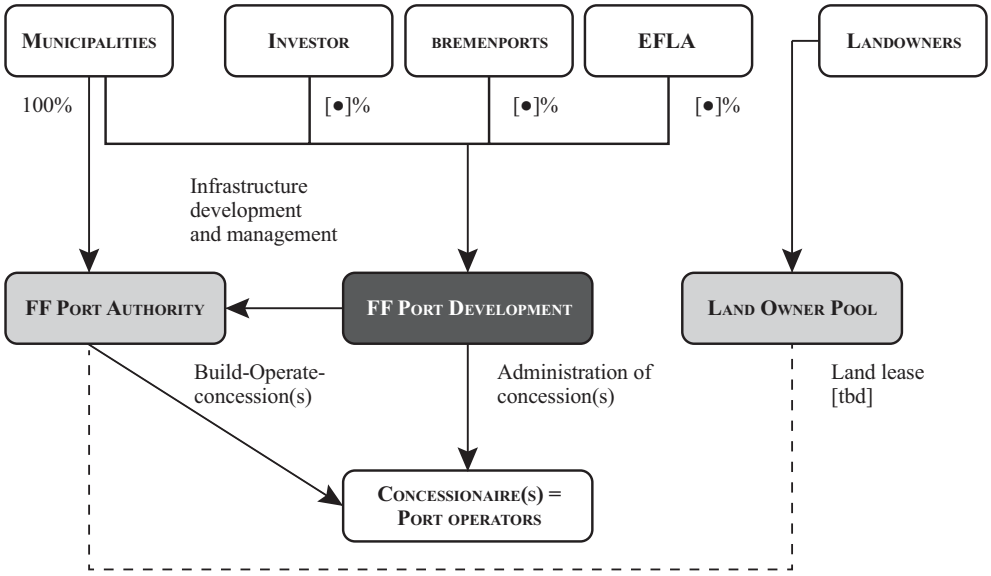


FIGURE 3 - SOURCE: SRM on bremenports

This three-pillar approach ensures not only national political support, but also the close involvement of all relevant local stakeholders.

Nevertheless, the project faces some challenges, such as

- Funding of initial planning.
- Implementation of internationally aligned contract structure to local conditions.
- Status-quo: compiling governmental support towards the Project.

8. CONCLUSIONS

This chapter has explored sustainable development concepts for ports describing how traditional port management models might be at variance with sustainable concepts. The chapter argues that for ports to really become truly sustainable new innovative concepts need to be developed. An example is provided by the Finnafjord Port project development led by bremenports. The project indicates that it is possible to build sustainable concepts for port that are profitable.

Chapter VI

The cruise sector: results of an analysis of flows and the impact on competitiveness in Naples' port system

1. Foreword

Throughout 2017 the number of cruise passengers in the port of Naples dramatically and unexpectedly dropped below the annual average. Nonetheless, it is commonly acknowledged that the southern Italian city is experiencing a new revitalization and its touristic attractiveness is being re-enhanced and valued again.

Tourism companies in Naples generate value thanks to both invaluable practical resources and non-physical assets, the latter primarily due to the millenary culture of the Neapolitan people.

The touristic attractiveness of Naples, therefore, is boosted by the wide range of possibilities and services which are seemingly wider and more varied than those of other Mediterranean destinations.

Offers are in fact divided chiefly into two types: on the one hand we find the enjoyment of natural resources whilst on the other, there are the services offered in the region ranging from museums to gastronomy.

The varied offer of services in a context of cultural liveliness creates a competitive advantage for Naples, despite the fact that some issues can still be found in the social fabric.

A competitive factor for this port lies in its central and strategic position within the context of the major tourist attractions of Campania as a region[1], a logistic advantage made even clearer by the easy accessibility for visitors to the historical centre of the city and to the major shopping areas such as Via Toledo and Via Scarlatti, which are comfortable and safe pedestrian walks. Also, the region's capital city has so far been immune to terror attacks which influence the perception of safety that tourists hold of a particular place.

Forecasts of economic growth linked to tourism are also strengthened thanks to the effective implementation of development programmes that can potentially stabilize visitor flows in the medium and long run[2].

Nonetheless, in this context it is necessary to highlight that cruise traffic clearly decreased by 378,693 passengers (pax) annually, reaching a figure of 927,458 in 2017, according to data from Port Network Authority Central Tyrrhenian Sea.

[1] i.e. Pompeii and Herculaneum ruins, the Vesuvius National Park, Caserta Royal Palace, Cuma and Campi Flegrei, the National Museum of Archaeology.

[2] i.e. World University Games 2019 and the agreement thanks to which a solution was found for the environmental recovery of the Bagnoli area in 2017.

It is also necessary to highlight that an overall reduction in the number of passengers was witnessed throughout the entire cruise sector in the Mediterranean but the comparison between the variation of tourist flows and that of cruise goers calling at Naples seems unusual because there is a negative spillover between the two phenomena which should, theoretically, be aligned.

Therefore, this paper aims to highlight possible empirical correlations that can provide a vision of significant aspects of passenger traffic in the cruise terminal of the Port of Naples.

The analysis method is based on demand and on passenger movements. However, another type of analysis was carried out thanks to a closer look at the programmed offer. This made it possible to create a database of approximately 300 observations extracted from websites or brochures of the major liners calling at the cruise terminal in Naples.

The research approach has taken two paths: a) a competitive analysis based on homogeneous variables of traffic handled in the main Italian cruise terminals and b) a transport macroeconomics approach aimed at gauging the impact of variations in the macroeconomic humus on the trends in transport phenomena.

Following this, several functional relations are produced although not being able to claim scientifically final in the definition of a market sector that is constantly evolving and subject to multiple factors[3].

Furthermore, the appeal of the cruise sector lies in the fact that it can connect people from different cultures and languages on a journey with multiple international destinations in a brief time span[4] allowing visitors to rediscover the deepest value of maritime connectivity.[5]

Besides figurative language, it is necessary to highlight that this paper exceeds the limits of the more managerial approach of cruise companies, which favours the technical study of management costs.

A greater interest will be shown amongst stakeholders of the cruise terminal, terminal operators, entrepreneurs of the hospitality and culture sector who offer specific services linked to cruise flows, co-modal transport companies, as well as public player[6].

Following this perspective, the paper hereby presented is organised in five paragraphs. The first comprises a brief overview of studies on the topic of cruise shipping, whereas in the second a methodology of statistical analysis is presented. The third paragraph refers to certain results of the tourist phenomenon in Naples, while in the fourth a descriptive analysis of the cruise flows is introduced. The fifth paragraph presents the matrix of offer and details explicative models of the movements of cruise passengers in the Neapolitan port. Finally, some findings are presented as a conclusion.

[3] This is even more true in a dynamic international context that appears to be influenced by the competition of other cross markets (i.e. hotel industry and other sectors of shipping).

[4] Even though duration may vary (7,14, 21 and even 120 days for the most fascinating itineraries around the world).

[5] It is fascinating to notice that this value is rooted in many cultural and religious traditions (i.e. the Ark of the Covenant, the mythical voyage of the Argonauts or the legendary Drakkar, the Viking ships sailing North Seas).

[6] People in charge of: a) transport flows calling at Naples, b) public offices for the management of maritime portuality and c) the city's museums.

2. An overview of studies in the cruise market

An interesting study on the key features of the Spanish cruise traffic conducted by researchers of the Department of applied economics of the University of Seville adheres to an approach that combines technical aspects of transport with territorial descriptive elements (Castillo Manzano, Fageda & Gonzalez Laxe, 2014).

Firstly, this research highlights the role of an international airport in the development of cruise traffic around a maritime destination, above all when this is located in an area with high population density and a great concentration of hospitality facilities.

The presence of Roll-on/Roll-off cabotage for passengers and goods increases the possibility for cruise traffic to develop, due to the possibility of the sharing of services for cruise vessels as well as for the availability of a deep seabed and appropriate quays.

On the other hand, one of the factors partially preventing the development of cruise activities is the presence of container traffic, a sector that represents a limit in Spain.

Finally, the researchers encourage Spanish public authorities to devise synergic and coordinated strategies on maritime portuality, so as to avoid counterproductive single initiatives by individual port authorities.

A contrasting point of view is instead proposed by the "Belgian school". In fact, in a comparison between the Mediterranean and the Caribbean market, it is highlighted that ship-owners have the ability to influence and guide the market, defining itineraries based on their managerial choices. The optimization of costs and revenues allows there to be a range of itineraries in which the choice of a port of call is made considering the cost for the use of ship spaces, in compliance with scheduled travel times and while also keeping in mind the need to offer specific cultural and territorial experiences.

Moreover, another factor of choice is seasonality, which explains the repositioning of ships in favour of itineraries consistent with the best enjoyment of each season's climate, in order to better exploit the profitability of naval assets.

From this point of view, the allure of ports of call is subordinated to managerial strategies (push ups). Territorial competitive advantages do not exist, let alone are they attributable to infrastructural facilities or socio-economic conditions.

Therefore, the Mediterranean segment is complementary to the Caribbean market, with interdependencies dependent on seasonality.

However, this does not rule out dynamic forecasts, in which the saturation of supply in opposition to the saturation of demand, will lead the cruise industry to such levels of maturity as to induce companies to plan itineraries with alternative ports of call, and the birth of a specific private portuality, as in the case of Ensenada in Mexico (Nottebom & Rodrigue, 2013).

A previous work by Petrick and Li (2006), on the other hand, aims to outline the impact of "perceived value" on the choices of the cruise consumer customer, classifying the passenger as first buyer or repeater ("re-buyer"), therefore allocating customers to three degrees of sensitivity to perceived value: low, medium and high.

A perspective of the Italian market was offered by Vianelli (2007). This research shows that passengers who repurchase cruise services are anchored to the experience of an organized holiday, while passengers who buy a cruise for the first time ("first timers"), are influenced by the option of organising their own holidays.

Another managerial study, aimed at probing the characteristics of market demand, was conducted by Petrik (and Hum, 2010), with the aim of defining a scale of limitations for a potential client interested in buying cruise services.

Still on the demand side, with the aim of identifying the economic significance of cruise flows calling at Greek ports, Papadopoulou and Sambracos (2014), conclude that the average minimum expenditure of each passenger calling in Greece is at least €104.2 in transit ports.

However, while European passengers spend up to €50, Americans are willing to spend about €200. This result is linked to the average annual income of American passengers which is higher than that of their European counterparts.

Finally, a study conducted by Croatian researchers highlighted the structural aspects of the cruise industry. In particular, in terms of demand, it is noted that on a global scale 26% of cruise passengers are aged between 40 and 49 years while more than 26% are over the age of 26. Additionally, most of them are citizens of North-American origin.

This study focuses on the Croatian cruise market in which seasonality is a critical factor for the development of the sector. It is also recommended that we monitor the risk of congestion during peak periods in order to guarantee sustainable tourism development. (Sciozzi *et al.*, 2015).

3. Statistical methods and sources

Statistical sources on the movements of cruise passengers account for both the number of vessels that call and the number of passengers (pax), the latter are classified by Eurostat according to three categories based on way of boarding: a) those who start a journey in the port considered are defined *inward*, b) those concluding a journey are called outward and c) those *in transit*. The last category is particularly significant in the port of Naples. These passengers are sometimes referred to as 'excursionists' due to their habit of calling at a specific port and of boarding/unboarding normally within the same or within a few days.

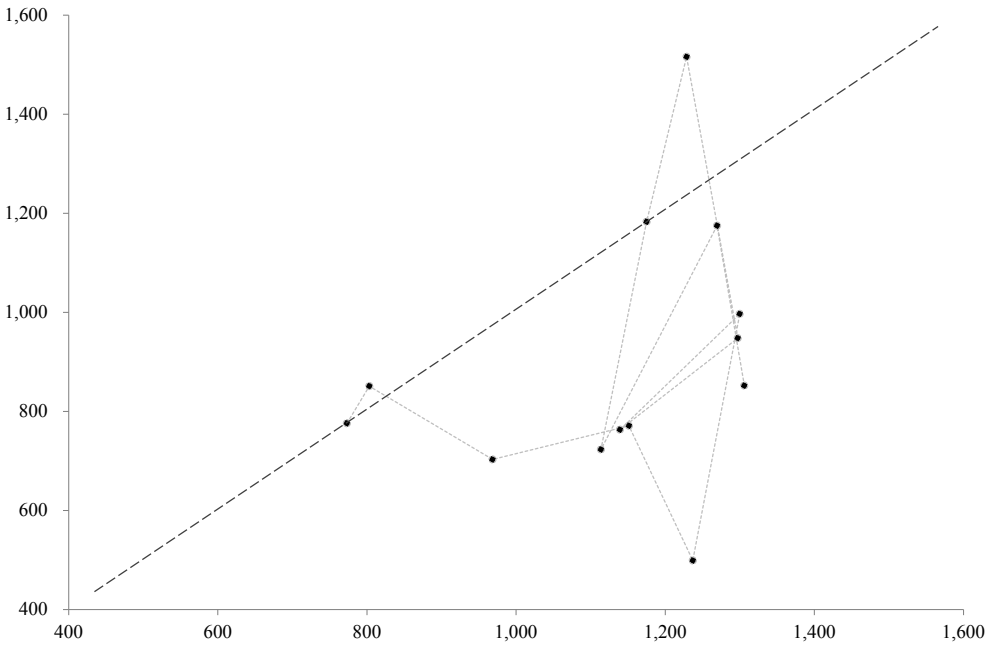
The data describing cruise passengers movements are comprehensive and derive from the summation of the three aforementioned categories.

Despite analogies in the classification between Port Authorities (whose data are collated in Assoporti's publications) and the Istat (National Institute of Statistics providing data to Eurostat), we often witness differences between the two statistical surveys.

The discrepancies lie in the different methods of data collection. In fact, Istat's surveys have a declarative origin, deriving from a drafting process which, although compliant with European legislation, presents the characteristics of an administrative procedure, monitored by statistical procedures. On the other hand, the surveys of the Port Authorities are conducted with the diligence of a public body with institutional functions, in terms of monitoring and management of the areas also with the aim of adapting them to the objectives of the General Transport Plan (Articles 1 and 6 L.84 / 1994 and subsequent amendments).

For the formulation of the explanatory models of the movements (pax), we chose the data released by Assoporti on their institutional website, in fact Eurostat surveys on cruises are fragmented and when performing annual observations they impose a downsizing of the sample size.

Distorsion in surveys: Annual movements of cruise passengers calling at Naples by number of pax: on y-axis Eurostat survey (2018) and on x-axis Assoporti (2018). Period 2004-2016 (dashed line x=y perfect theoretical correspondence)



GRAPH 1 - SOURCE: elaboration on Eurostat and Assoporti data, 2018

The distortion with respect to the case of perfect correspondence is highlighted in Graph 1, illustrating the annual movements of cruise passengers in the port of Naples.

The prevalence of points in the lower set below the line of perfect theoretical correspondence, highlights the tendency to underestimate passenger flows with the declarative methods used by Istat.

In order to increase the sample size, a number of publications from Answers & Tourism were monitored (Di Cesare, 2011, 2017), while some non-coherent data were estimated. Findings from publications by CLIA (Cruise Line International Association) and MedCruise were also taken into account in this study, as acknowledged in the bibliography[7].

As far as macroeconomic variables are concerned, the IMF database was consulted, while the description of touristic phenomena was based on Istat data (movement of guests in hospitality, 2018).

[7] See pg. 239.

In addition, De Winter's study (2013) was the base for the treatment of the aforementioned data and the use of statistical tests based on normal distribution of residuals (upon the occurrence of dependent variables).

To derive explanatory relations of the movements (pax) the methodological structure of the multiple linear regression model (MLR) was used. The models obtained are consistent by sample size with the study by Knofczynski and Mundfrom (2007)[8] on the relationship between the R^2 index, covariant number and sample size. The results highlighted in fact have an explanatory capacity of more than 90%, meaning that according to this study the explanatory capacity is 'excellent'.

4. Tourism movements in Naples

Naples has developed a solid tradition of tourist hospitality, whose origins can be traced to the past. A key moment of this process of development can be found when the viceroy Don Pedro De Toledo who, despite harsh political methods, is credited with carrying out crucial work in the field of urban expansion.[9] In that period, Naples also benefited from the growth of the Spanish Empire led by Charles V[10].

Another milestone in this overview can be found in Goethe's *Italian Journey* (1786) where the German writer states: «I was making this remarkable journey not to deceive myself but to become acquainted with myself» and, with reference to Naples he says: «We spent today in ecstasies over the most astonishing sights [...] Naples is a Paradise [...] everyone lives in a state of intoxicated self-forgetfulness, myself included. I seem to be a completely different person whom I hardly recognize»[11].

These feelings can still be applied to the present, in the collective imagination and in the wishes of tourists visiting Naples. The city, in fact, continues to offer unique cultural experiences in a natural setting of incomparable beauty, made even stronger by the artistic creativity of its inhabitants.

Nowadays, the consequences on cultural tourism are marked, more than anything else, by the increase in the number of visitors to the Pompeii ruins.

Between 2009 and 2016, the annual flow of visitors rose by about a million, a figure equivalent to 50% of the annual flow in 2009 (data from Ministry of Cultural Heritage and Activities and Tourism, 2018).

On the other hand, it has been estimated that in 2017 the Neapolitan cruise terminal lost 378,653 passengers, equivalent to 29% of the 2016 flow.

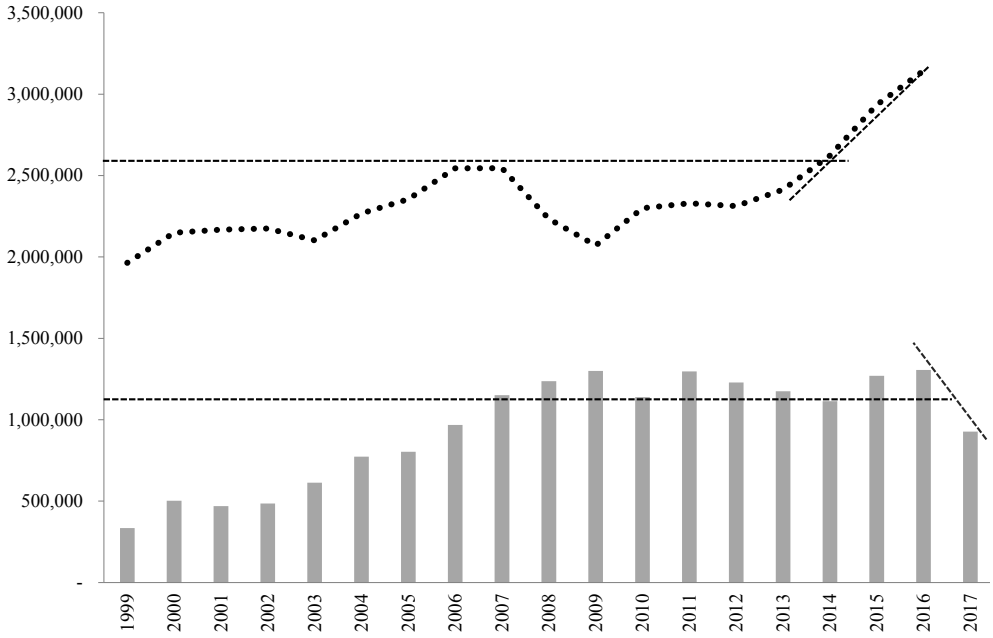
[8] This seems appropriate here since cruise demand is influenced by psychological factors (Petrik & Hum, 2010).

[9] Urbani I. (2014, 22 October). "Pedro De Toledo il Vicerè che volle la Napoli Capitale", *La Repubblica*.

[10] In the Kingdom of Naples, the impact of expansionist policies produced cultural boom and later, during the counter-reformation, it contributed to increasing the support for pilgrimages to Rome. Another important contribution to the promotion of Naples came from the eighteenth century landscape painters, i.e. Caspar Van Wittel, father of master architect Luigi Vanvitelli. The Neapolitan School of Painting in the nineteenth century also played a key role in this context.

[11] von Goethe J.W. (2016). *The Essential Goethe*. Princeton University Press, p. 775.

Comparison and divergence between
annual movements of cruise passengers calling at Naples, by number of pax (bars)
and number of visitors of Pompeii ruins (dotted line)
Years 1999-2017



GRAPH 2 - SOURCE: elaboration on AdSPMTC and MIBACT, 2018

In Graph 2 it is clear to see, following the dotted lines, that visitor flows have exceeded the maximum values of the last years, whereas cruise passenger numbers have decreased below the lows recorded over the last years of the investigation.

This seems to be a contradictory comparison due to the divergence in the trend, which inspires interest and encourages the research of possible causes.

A component of divergence is quite surely explained by the effects of ministerial decree 94/2014 by the Ministry of Cultural Heritage and Activities and Tourism, which allows free access to museums.

Government action, however, has generated a virtuous circle, with an impact that is reflected by the 35% increase in overall revenues of the archaeological area.

According to our estimates, moreover, about 30% of the cruise passengers of the Neapolitan terminal are potentially interested in a paid visit to the Pompeii ruins.

Therefore, with the current tariffs, of every 1,000 passengers that disembark, tax collection for the services of enjoyment of the archaeological heritage provided in Pompeii is on average €3,900. Hence, when annual traffic exceeds one million movements (pax), its impact can contribute 4 million euros per year to the protection of the Italian archaeological and museum heritage, due to the attractiveness of Pompeii.

As a consequence, the decline in port movements of cruise passengers is equal to a loss of tax revenues equivalent to €1.47 million.

Consequently, these considerations invite us to consider the impact on public finance and therefore the relevance of the cruise phenomenon to the government.

A further starting point for analysis showing a positive trend in tourism in Naples is offered by tourist movements (Istat database, www.istat.it). In fact, the number of guests in the hospitality sector has increased in recent years.

The waste crisis had negative consequences from 2010 to 2014, in particular on small-category hotels (see Table 1), but after the government commission a noticeable resumption of attractiveness was shown that culminated in 2016, with significantly high growth rates for accommodation types alternative to hotels (B&Bs, private rentals).

The significant increase in customers seeking alternative accommodation may have generated a substitution effect that has had a negative impact on traditional accommodation and cruises. It should also be noted that the weight of foreign customers on the total number of tourists has increased significantly (Table 1).

As will be seen in the following analysis and in the final explanatory reports, the importance of international tourism is particularly high also in cruise tourism with destination Naples.

Touristic movements in Naples:
Number of guests in hospitality businesses by type of business (biennial percentage variation), ratio between foreign and total guests (percentage points)
Years 2010-2016

Biennial percentage variation Number of clients by type of business											
	Total hospitality businesses	Hotels	Five and four star hotels	Three star hotels	Two and one star hotels	Non-hotel businesses	Campsites and resorts	Private rentals	Agriturismo	Bed & Breakfast	Other hospitality businesses
2010	2.6%	2.9%	7.6%	2.8%	-27.1%	-1.6%	13.3%	-1.0%	267.3%	n.a.	-32.4%
2011	20.5%	21.3%	27.3%	17.9%	-9.6%	7.1%	-3.2%	38.8%	554.0%	n.a.	-28.8%
2012	9.8%	9.8%	13.8%	3.5%	6.8%	8.8%	-14.4%	48.4%	0.1%	n.a.	9.4%
2013	-10.0%	-11.0%	-11.1%	-8.7%	-22.4%	8.5%	0.5%	0.0%	2.9%	26.9%	47.2%
2014	-5.0%	-5.6%	-6.4%	1.0%	-33.7%	5.9%	-0.1%	3.7%	-19.9%	49.8%	11.8%
2015	22.5%	20.6%	22.1%	18.6%	15.5%	52.2%	13.3%	74.3%	-2.5%	156.9%	93.1%
2016	29.2%	25.5%	28.1%	19.1%	41.2%	82.3%	35.2%	119.4%	122.5%	185.3%	94.1%
Percentage of foreign guests											
	Total hospitality businesses	Hotels	Five and four star hotels	Three star hotels	Two and one star hotels	Non-hotel businesses	Campsites and resorts	Private rentals	Agriturismo	Bed & Breakfast	Other hospitality businesses
2010	43%	42%	45%	39%	35%	52%	49%	54%	61%	n.a.	59%
2011	46%	45%	48%	42%	35%	57%	58%	56%	69%	43%	59%
2012	47%	46%	50%	41%	34%	56%	55%	55%	57%	46%	63%
2013	49%	48%	53%	42%	31%	58%	59%	56%	69%	53%	61%
2014	49%	48%	53%	41%	35%	61%	58%	64%	67%	55%	64%
2015	50%	49%	55%	41%	36%	64%	60%	64%	68%	61%	71%
2016	50%	49%	54%	40%	34%	61%	55%	62%	65%	61%	71%

TABLE 1 - SOURCE: elaboration on Istat data, 2018

5. A BRIEF OUTLINE OF CRUISE PASSENGER MOVEMENT IN THE MEDITERRANEAN

In 2016, Mediterranean ports showed an 11% increase in cruise passenger figures compared to 2012, exceeding the threshold of 27 million a year[12].

At the moment, a risk factor for the stability of the cruise market in this macroregion can be found in the rise of emerging Asian markets.

In 2017, the combined effect of the terrorist attacks in Nice and Barcelona (July 2016 and August 2017 respectively) caused a reduction in the capacity offered by cruise liners in the Mediterranean (see the sample of shipping companies of the CLIA-Cruise Lines International Association, 2017).

Therefore, as highlighted by 'Risposte Turismo' in their 'Speciale Crociere 2016-17' (special report on cruises), the capacity offered in 2017 was dramatically low, only reaching the same level as ten years before, settling at 15.4% of the world capacity.

This circumstance affected the projections of 2017 movements. On average the expected reduction (forecast) in Italian ports is 7.1%, (RT, 2017), but the decline is not evenly distributed among the national ports due to peculiarities differentiating each airport, as will be highlighted in the following analysis.

As far as the year 2016 is concerned, the analysis of ports by passenger movements on overall values highlights the leading position of Barcelona, which is also the first port where cruise goers begin and complete a journey in the Mediterranean (homeport, see Table 2).

Over the last five years, amongst the leading ports, Marseille and the Balearic Islands have shown higher growth rates in terms of overall movements[13] while Venice and Athens (Piraeus) have lost traffic (Table 2).

In 2015, the nationality of cruise goers was predominantly North American. However, the share of passengers coming from this location is decreasing. In fact, it has experienced a 5% fall on 2010, with the figure at 52.2%. Conversely, in the same period the share of European passengers in MedCruise ports increased and reached 6.6 million pax, a figure equivalent to 28.5% of the market.

The overall growth of the Mediterranean witnessed until 2016 was also due to passengers from Asia, one of the major potentials of development for the industry. The increase of this sector is partly dependent on the economic growth Asian countries have experienced over the past few years.

Similar shares to those elaborated by MedCruise are shown by the CLIA 2018 report illustrating a subdivision of passengers by nationality. Despite the CLIA data collection taking into account the major cruise liners on a global scale, its results are very similar to the MedCruise ones.

The distribution has been summarized in Table 3, in which the currency areas of passengers are highlighted showing a marked prevalence of demand for US dollars.

[12] In a sample of ports representing 78% of passenger movements of this sector and 80% of the ports of call, according to a report on cruise traffic in the Mediterranean elaborated by MedCruise (2017) in which also adjacent seas were taken into consideration.

[13] These ports take on a leading position on the overall movements, including the 'passengers in transit' sector.

Cruise movements in the Mediterranean, leading ports by type of passenger movement (pax and percentage variation)

Years 2016-2015-2012

		2016	2015	2016-15	2012	2016-12
			Passenger movements - in transit			
1	Civitavecchia	1,492,667	1,403,509	6.35%	1,472,958	1.34%
2	Balearic Is.	1,357,248	1,442,605	-5.92%	875,125	55.09%
3	*Naples*	*1,164,041*	*1,142,899*	*1.85%*	*1,137,014*	*2.38%*
4	Barcelona	1,127,775	1,176,548	-4.15%	970,251	16.24%
5	Marseille	1,110,249	947,734	17.15%	576,698	92.52%
			Passenger movements - in/out			
1	Barcelona	1,555,819	1,363,754	14.08%	1,438,383	8.16%
2	Venice	1,408,066	1,364,044	3.23%	1,444,100	-2.50%
3	Civitavecchia	847,009	868,143	-2.43%	920,612	-8.00%
4	Genoa	606,278	565,687	7.18%	530,872	14.20%
5	Balearic Is.	600,181	553,928	8.35%	466,385	28.69%
9	*Naples*	*142,137*	*126,672*	*12.21%*	*160,219*	*-11.29%*
			Passenger movements - total			
1	Barcelona	2,683,594	2,540,302	5.64%	2,408,634	11.42%
2	Civitavecchia	2,339,676	2,271,652	2.99%	2,393,570	-2.25%
3	Balearic Is.	1,957,429	1,996,533	-1.96%	1,341,510	45.91%
4	Venice	1,605,660	1,582,481	1.46%	1,775,944	-9.59%
5	Marseille	1,597,213	1,451,059	10.07%	890,020	79.46%
6	*Naples*	*1,306,151*	*1,269,571*	*2.88%*	*1,297,233*	*0.69%*

TABLE 2 - SOURCE: MedCruise, 2017

Distribution of passengers of major cruise liners in the world, by country of origin and currency area

Year 2016

United States	11.5	54.5%	Us Dollar	11.5	54.5%
China	2.1	10.0%	Yuan Chinese	2.1	10.0%
Germany	2	9.5%	Euro Area	3.9	18.5%
United Kingdom	1.9	9.0%	GBP	1.9	9.0%
Australia	0.3	1.4%	Australian Dollar	0.3	1.4%
Canada	0.8	3.8%	Canadian Dollar	0.8	3.8%
Italy	0.8	3.8%	Real Brazilian	0.6	2.8%
France	0.6	2.8%			
Brazil	0.6	2.8%			
Spain	0.5	2.4%			
Total	21.1		Total	21.1	

TABLE 3 - SOURCE: elaboration on CLIA data, 2017

6. Explanatory aspects of pax movements in the port of Naples

Researchers of cruise shipping have illustrated analyses with various methodologies and objectives which mainly fall into two categories: demand-driven and supply-driven[14].

In this study we will outline demand-driven functional relations with the aim of extracting explanatory aspects of cruise movements. Nonetheless, maritime connectivity was firstly analysed and the offers of the major maritime cruise liners calling at Naples were evaluated. This fed into an impressive data collection on itineraries. In this analysis, connectivity is not considered in the classical sense of direct link between ports but as the share of the same cruise itinerary.

Data collection is therefore aimed at building a supply-driven research tool, both as prospective description of connectivity and as control tool of the following demand-driven analyses.

Offers comprise cruises planned from February 2018 to December 2019 on the websites or brochures of some of the main cruise companies[15] that have chosen to call at Naples both as a port of transit and homeport.

Naples is a destination on cruise itineraries covering five continents and also on world tours stretching from South America to Australia.

On the Italian coast of the Tyrrhenian sea, Civitavecchia is the most linked port to Naples. In fact, about 50% of the passengers calling at Naples also stop at Civitavecchia. In the Western Mediterranean, Barcelona and Marseille are particularly relevant to Naples as they are, respectively, on 49% and 43% of itineraries travelling to Naples.

Dubrovnik is the destination with which Naples shares the highest number of cruises in the Adriatic Sea (25%), whereas in the Eastern Mediterranean it is Athens (Piraeus 18.3% - see Table 4).

The analysis of fares and travel times of planned offers allows an estimate to be made that a cruise ship calling at Naples will also call at ten other ports on average, over a period of about 13 days and with an average cost of €1,527.95 per passenger[16]. Therefore, a cruise to Naples costs approximately €120.63 per day and €149.86 per destination.

[14] The aim of this analysis is to highlight explanatory aspects of cruise traffic in the port of Naples through an analysis of pax movements. As the complexity and changeability of the market are acknowledged, there is no intention to establish new dogma or to adhere to any doctrines.

[15] 300 observations of offers categorised by the following operators: Arcadia Shipping Co Ltd, Carnival Cruise Line, Celebrity Cruises, Compagnie Du Ponant, Costa Crociere, Cunard Line, Holland America Line, Kristina Cruises, MSC Cruises, TUI.

[16] The services offered may vary.

Cruise Maritime connectivity of the port of Naples in the plan of a sample of companies calling at Naples (prospective analysis)

February 2018-December 2019 (Frequency and percentage of overall frequency)

Baleari Is.	179	8.2%	Catania	33	1.5%	Olbia	9	0.4%
Civitavecchia	152	7.0%	Valencia	32	1.5%	Mgarr, Muggiaro MLT	8	0.4%
Barcelona	147	6.8%	Monte Carlo	30	1.4%	Santa Cruz de Tenerife	8	0.4%
Marseille	129	5.9%	Crete	29	1.3%	Koper	7	0.3%
Valletta	116	5.3%	Spalato	28	1.3%	Port Evaerglades	7	0.3%
Messina	81	3.7%	Ajaccio	23	1.1%	Taormina	7	0.3%
Dubrovnik	75	3.5%	Malaga	22	1.0%	Alicante	6	0.3%
Palermo	70	3.2%	Rhodes	22	1.0%	Amber Cove	6	0.3%
Venice	70	3.2%	Bari	21	1.0%	Antigua	6	0.3%
Genoa	62	2.9%	Sarande	20	0.9%	Aqaba	6	0.3%
Athens	55	2.5%	La Spezia	19	0.9%	Haifa	6	0.3%
Katakolon	55	2.5%	Nauplion	19	0.9%	Lisbon	6	0.3%
Kotor	50	2.3%	Cartagena	18	0.8%	Nassau	6	0.3%
Savona	49	2.3%	Cadiz	16	0.7%	Zadar	6	0.3%
Cagliari	47	2.2%	Toulone	16	0.7%	Ancona	5	0.2%
Livorno	46	2.1%	Sarande	15	0.7%	Portoferraio, Elba	5	0.2%
Corfu	43	2.0%	Agrostoli/ Kefalonia	14	0.6%	Rijeka	5	0.2%
Mykonos	42	1.9%	Gibraltar	12	0.6%	Santa Margherita	5	0.2%
Santorini	42	1.9%	Villefranche/Nice	12	0.6%	Tarragona	5	0.2%

TABLE 4 - SOURCE: elaboration on CLIA data, 2017

With a retrospective methodology referring to the major Italian ports of call we attempted to identify competitive relations and synergies between the different ports.

The analysis of prospective connectivity illustrated above highlights the presence of ports that cooperate with positive externalities for the profitability of itineraries with Naples as a destination.

The retrospective analysis of flows (Table 5) shows the special dynamism of Italian cruise port networks. In this context, in fact, a port may at times take on the role of competitor or partner when affecting the attractiveness of flows to the port of Naples.

Therefore, the table above shows a dynamic matrix with correlation indexes of flows in 2000-2016, through the analysis of cruise passengers movements between Naples and other major Italian ports.

Theoretically, a port with correlation index +1 would be perfectly connected with Naples. This ideal port would therefore be on the same itineraries as Naples.

In contrast, a port with correlation index equivalent to -1 represents a destination where traffic increases as passenger movements in Naples decrease. Subsequently, it is in competition with Naples.

The trend of the correlation index is not stable and in fact if we increase the number of observations, i.e. widening the period of the analysis, significant variations occur.

Therefore, the criterion of higher average and lower variability was taken into consideration in order to define a partner or competitor port.

Cruise Maritime connectivity of the port of Naples, index of dynamic correlation with other Italian ports (retrospective analysis). Years 2000-2016

	Catania	Civitav.	Genoa	La Spez.	Livorno	Messina	Olbia	Palermo	Salerno	Savona	Trieste	Venice
2000	70.1%	93.3%	65.4%	42.3%	93.6%	82.0%	84.9%	73.6%	-1.9%	93.6%	56.8%	89.6%
2001	68.0%	92.5%	61.4%	42.3%	92.4%	78.7%	84.9%	70.5%	-1.9%	92.1%	56.8%	87.3%
2002	65.5%	91.5%	58.7%	42.3%	90.5%	72.5%	84.7%	66.6%	-1.9%	89.6%	56.8%	85.2%
2003	62.7%	90.0%	62.8%	39.5%	88.0%	62.8%	85.8%	61.6%	-1.9%	83.5%	55.1%	81.3%
2004	51.6%	86.4%	73.1%	36.0%	84.5%	60.7%	85.7%	52.8%	-1.9%	70.9%	51.8%	77.5%
2005	41.1%	78.7%	61.2%	29.9%	76.7%	51.1%	80.5%	36.0%	-1.9%	58.1%	45.0%	67.9%
2006	23.8%	62.3%	40.9%	21.1%	60.5%	33.8%	66.4%	14.5%	-1.9%	43.4%	34.2%	49.6%
2007	-0.5%	30.1%	6.2%	8.7%	45.5%	5.7%	38.5%	18.8%	-1.9%	-5.6%	33.6%	6.4%
2008	-8.8%	13.8%	-16.1%	1.6%	40.4%	-6.2%	22.5%	38.2%	-24.0%	-19.1%	33.4%	-28.4%
2009	-7.9%	17.8%	-18.2%	2.8%	40.2%	-5.6%	22.4%	50.7%	-26.3%	-19.0%	33.3%	-39.8%
2010	-13.2%	57.9%	6.6%	19.2%	45.6%	23.0%	17.5%	40.7%	1.6%	8.4%	60.2%	-19.2%
2011	-5.6%	40.5%	2.1%	-0.4%	52.1%	17.2%	10.5%	27.2%	-17.9%	-32.7%	48.8%	-52.9%
2012	-16.7%	20.9%	22.4%	25.0%	39.2%	-7.7%	55.6%	9.2%	1.9%	-40.8%	93.9%	-75.4%
2013	-28.3%	19.8%	31.0%	46.6%	78.4%	-10.8%	79.3%	23.7%	5.2%	-67.4%	98.9%	-77.7%
2014	24.3%	98.7%	73.1%	44.7%	89.4%	75.0%	84.4%	-27.7%	-7.5%	-85.8%	98.8%	-94.5%
2015	100.0%	100.0%	100.0%	100%	100.0%	100.0%	-100.0%	-100.0%	-100.0%	-100.0%	100.0%	100.0%
Average	21.7%	59.6%	35.4%	26.8%	67.8%	35.5%	60.2%	37.1%	-5.5%	18.0%	57.2%	10.4%
Variance	11.7%	10.0%	9.9%	2.7%	4.5%	11.6%	8.1%	7.0%	0.8%	35.4%	4.9%	44.8%

TABLE 5 - SOURCE: elaboration on Assoporti (2018), RT (2011), Port Network Authorities (2018), Becheri (2009)

These two categories allow an explanatory model of cruise passenger movements in the port of Naples (*Y*), bi-varied (*m=2*), fcomposed by a positive explanatory component of the synergies and by a negative component representing the negative impact of competition on the movements in the Neapolitan cruise terminal.

Thanks to the use of software[17] it is possible to obtain the most efficient estimate of the coefficients after an accurate selection of the variables, reaching the following functional form:

$$\boldsymbol{Y} = A + B\boldsymbol{X} + \boldsymbol{\varepsilon} \qquad (1)$$

$$y = a + b_1 x_1^c + b_2 \ln(x_2) + \varepsilon \qquad (2)$$

$X_1 = cruise\ passenger\ movements\ in\ the\ port\ of\ Venice$ (*driver competitor*)

$X_2 = \sum m\ movements\ selected\ partner\ ports$[19]

[17] MacromultiR in VBA, designed to elaborate Models of Linear Regression (MLRs) quickly with different functional forms and testing numerous variables.

[18] Cruise passenger movements in Civitavecchia, Livorno and Olbia.

Consequently, we reach an estimate of the coefficients[19], with the standard error of the regression equivalent to 4.49% of the port movements in Naples in 2016.

It seems important to highlight sign coherence[20] rwith respect to the explanatory contribution of the competitive and synergic movements, as well as the overall explanatory capacity of this model which can explain 96.7% of the movements of cruise passengers in the port of Naples (R^2).

The statistical results show, consistently with the analysis of connectivity, the existence of competitive and cooperative cruise circuits with the port of Naples, due to the different logistic positioning of the ports in relation to the specific location of tourist destinations.[21]

During the process of selection of explanatory variables, the most explanatory cruise flow of competitive forces with Naples was that of Venice, which reduces residuals consistently compared to other competitor ports (also combining flows in a set of ports).

Although the cruise movements of Salerno directly steal flows from the port of Naples, the small number of movements detectable in the period analysed is not intercepted by the bi-varied models due to the low number of observations detectable on this port[22] and the decrease (even more marked than for Naples) of traffic in 2017.

It is believed that the competitiveness of Venice is due to two structural factors, its homeport role (see paragraph 5), and its natural logistical positioning on the Adriatic and Eastern routes, alternative to the Tyrrhenian and Western ones in the Mediterranean.

Developing the model at average values, it is also noted that an annual increase of 1000 cruise passengers in Venice (pax) subtracts an average of 203 passengers in Naples. However, due to the increasing trend of movement variables, the impact of the competitive component expands to 9.81% in 2016.

On the other hand, the cooperative effect of partner ports tends to decrease, signalling an evolution towards independence. At average values, of every 1000 people that choose journeys with Civitavecchia, Livorno and Olbia as destinations, 293 pax call at the port of Naples, while in 2016 this value was 201 pax, resulting in a 31% decrease on average values[23].

According to this data, the decrease of the movements of the port of Naples in 2017 will be due to the greater competitiveness of the competitor ports, as well as to the lower synergy offered by the partner destinations.

[19] PI = (0.000000206; 0.026037972; 0.000000108); type II test passed with 99% and 95%; coefficient of systemic part A = -8,627,150.79. Number of obs. = 17 years (2000-2016). Test F: 0.000000000016085.

[20] *B = (-0.002741445;676257.9).*

[21] Therefore, the residuals show a measure of the sum of synergic and cooperative movements of the competitor ports.

[22] The attractiveness of Salerno is mainly due to the typical infrastructural phenomenon of demand created by the inauguration of the new maritime terminal

[23] Such a decrease is due to the logarithmic form of the cooperative variable.

If we update the data with the projections of 2017 for the competitor ports and the first statistical traffic bulletins of Naples and Venice, we obtain a residual of only 927 passengers (0.001%) on the movements of the Naples terminal in 2017.[24]

The functional relation previously noted offers an easy forecasting tool, when one intends to check the progress of the projections, however, this is bound to the statistics of other ports in order to predict the trend of movements in the Neapolitan port.

Therefore, we elaborated a first degree autoregressive bi-varied model ($m=2$), , with a forecast nature and with the same structure of the equation (1 and 2, and $c=1$), al fine di individuare elementi interpretativi dei movimenti passeggeri.

in order to identify interpretative elements of passenger movements.

With the aim of highlighting possible implications between macroeconomic results and passenger flows in the port of Naples (dependent variable=y), numerous descriptive variables of macroeconomic phenomena were then tested (independent variable=x).

Considering the distribution of passengers by currency area (paragraph 5), the following possible covariates were tested, relative to areas of origin of cruise passengers: population, per capita income in national currency at constant prices, exchange rate with euro, as well as other variables that combine the previous ones.

$$X_1 = \textit{passenger movements port of Naples (period } t - 1)$$

$$X^2 = \textit{explanatory variable of currency expectations}$$

This model does not reach more efficient results than the previous one, but it has a better forecasting structure, in fact it is based on delayed variables therefore, making it possible to obtain estimates of future trends in a simpler way.

In particular, it highlights that currency expectations affect the choice of cruises. This is particularly reflected in the cruise passengers of the port of Naples (compared to other national ports). The reduction in passengers in 2017 is therefore explained by the change in currency expectations of cruise customers[25].

[24] PI = (0.000000000091; 0.000054703210; 0.000000000032); type II test passed with 99% and 95%; coefficient of systemic part A = -8,652,732.35. B = (-0.002775756; 678,185.03). Number of obs. = 18 (2000-2017). Test F: 0.00000000000269.

[25] Since the end of June 2017, the euro has appreciated by 4.2% against the dollar, by 4.5% against the yen and by 1.6% against the pound. The strengthening of the euro explained a general change in the orientation of market operators, highlighted by the prevalence of positions that signal expectations of further appreciation of the single currency. The prospects for gradual monetary normalization in the United States and the review of the calibration of monetary instruments in the Euro Zone contributed to this. In nominal effective terms, the euro appreciated by 2.8% (Bank of Italy, 2017). The customer of a foreign nationality is faced with comparatively higher fares for cruise services which encourage the purchase of services on other markets. In addition, European consumers who expect a rise in cruise fares prefer either to buy on other markets in which to assert their greater purchasing power or to defer the purchase of services in European currency to a subsequent period of expected rebalancing.

7. Conclusions

Naples, considered as the centre of gravity for conjunctures that sometimes cross the boundaries of its territory, is experiencing a new surge in tourism, a phenomenon which is in fact also revealed by the positive variation of numerous movement indicators.

For example, the consequences on cultural tourism are clearly signalled by the exponential growth of visitors to the archaeological area of Pompeii. In fact, from 2009 to 2016 there was an increase in the annual flow of visitors of about one million people and over 35% of revenues.

In the city after the "waste crisis", on the other hand, there was a noticeable recovery of the tourist activity which culminated in 2016, with remarkably high growth rates for the businesses alternative to the traditional ones (B&B, private rentals) and an increase in the weight of foreign guests in comparison to the total number of tourists.

However, in 2017, the Neapolitan cruise terminal lost 378,653 passengers (about 29% of the flow compared to 2016).

Therefore, the comparison between transport and tourist results is contradictory because of the divergence of the trend and invites the search for explanatory aspects of cruise traffic in the port of Naples.

The decline in port movements of cruise passengers, according to our estimates, is equivalent to a tax revenue loss of €1.47 million, solely taking into account the impact of Naples bound cruises on visits to the Pompeii ruins.

The intensity of the reduction of the flow with Naples as a destination is considerably higher than that estimated for other destinations of the Italian market (-7%), in the context of an overall weakening of the cruise market in Southern Europe[26].

A brief analysis of the cruise market in the Mediterranean has been outlined (paragraph 5), finding the following aspects useful for the purpose of the research:

1. a risk factor for the market stability in the macro-region is the growth of emerging markets in Asia;
2. Venice is one of the major ports of boarding and call, while Naples is in ninth place in the ranking of this sector;
3. the distribution of cruise passengers by nationality is predominantly North American;
4. the capacity offered by cruise liners was downsized as a result of the terrorist phenomena that happened in the western Mediterranean (Nice and Barcelona).

Researchers of cruise shipping have proposed analyses that observe the phenomenon with different research methodologies and objectives and that are ascribable to two strands: demand-driven and supply-driven studies (see paragraph 2).

The analysis of cruise connectivity of the port of Naples, with a prospective and retrospective value, has made it possible to highlight descriptive aspects of the flow of pax movements with Naples as a destination.

Consequently, some descriptive prospective considerations have emerged (see paragraph 6).

[26] The expansion of the Salerno terminal, although naturally competitive for Naples, cannot explain the decrease because the decline in passenger numbers has hit Salerno even more markedly than Naples.

In fact, a cruise to Naples costs on average €120.63 per day and €149.86 per destination visited.

With the retrospective analysis of connectivity, Italian ports have been classified into partners and competitors, to derive an explanatory model (demand side) of the pax movements of the port of Naples.

In the model, the functional relation is formed by a positive explanatory component of the synergies and by a negative component that represents the negative impact of competitiveness on the movements of the Neapolitan cruise terminal (see paragraph 6).

Updating the data with the projections of 2017 for the partner ports, as well as the first statistical traffic bulletins for Naples and Venice, results in a residual of only 927 passengers (0.001%) on the movements of the Naples terminal in 2017.

Therefore, the combination of factors emerged in the 4 points highlighted in the analysis of the Mediterranean, determines the decline of the pax movement due to the unfolding of cooperative and competitive effects with a non-positive budget for the port of Naples. Venice has the most competitive cruise flow for Naples because of two structural factors: a) the role of homeport, and its natural logistic positioning on the Adriatic and eastern routes as an alternative to the Tyrrhenian and western counterparts in the Mediterranean.

Moreover, with a transport macroeconomics approach, it is noted that the expectations of a currency nature affect the choice of cruises. This is particularly true for cruise passengers of the port of Naples (compared to other national ports).

The fall in passenger numbers in 2017 is therefore also due to changes in the currency expectations of cruise customers.

What we observed leads us to point out the need for a coordinated public plan aimed at recovering a prominent role for the Neapolitan port through:

1. The full exploitation of waterfront resources, (i.e. the San Vincenzo Pier).
2. A specific plan to promote Naples as a destination to cruise carriers, possibly coordinated with the Capodichino airport.
3. An independent local observatory, specific to the sector, with publicity in support of the aforementioned promotional plan.

Part Two

Focus Far East:
the Silk Road, port models, shipping and new container routes

Chapter VII

Status and trend of the global shipping finance focusing on Europe, China, and South Korea

1. Foreword: the importance of shipping finance in shipping industry

The shipping industry is a representative capital-intensive industry. While the price of a ship, which is the main asset of a shipping company, is very high, that of highly advanced maritime equipment and offshore plant is estimated to cost billions of dollars. Therefore, shipping companies rarely purchase a vessel outright with owner's capital. They rather access the banking sector or capital market for capital financing.

Since a huge downturn of the global shipping market, European financial companies and US private equity funds that used to drive the market have switched to become passive and reduced the investment in the shipping industry. This has increased the share of Chinese capital, rebalancing the shipping finance market from Europe to Asia. As the shipping crisis has particularly dwindled the lending source in which commercial banks used to play a central role, leasing companies have started to fill up the funding gap between the supply and demand of shipping finance.

After Financial crisis of 2008, the financing of shipping industry for acquisition of new vessels and conversion of old vessels to high efficiency vessels has become very important for the survivor of shipping companies. Shipping industry faced with overcapacity, bearish market and the shrink of the traditional shipping finance fund has to find another way to get financial source and improve financial management. In this moment, it is very useful for shipping industry to understand a status and trend of the global shipping finance and get implications from best practices of major shipping countries and region implemented.

As European countries, China and South Korea are key players in global shipping industry[1], their shipping finance and related shipping policies have a huge impact on global shipping market. Therefore, this chapter aims to analyse the status and trend of global shipping finance, especially focusing on Europe, China, and South Korea.

2. Introduction to global shipping finance

2.1 Types of shipping finance

Shipping finance that is known as ship finance, shipbuilding finance and maritime finance provides sources of funds for the building of new vessels and major conversions. Many stakeholders participate in shipping finance for different reasons and aim.

[1] Greece, Japan, China, Germany and South Korea were ranked top 5 by country of controls as of January 1st, 2016 (Institute of Shipping Economics and Logistics, 2017).

Shipping company seeks finance from bank or capital market to cover insufficient fund except for its equity, meanwhile investors and financial institution seek investment opportunity in shipping to get revenue. Theses stakeholders may choose different type of shipping finance depending on many factors, such as interest rate, demand and supply of vessels, global economy growth, status of shipping industry and many other conditions.

Shipping finance is classified into bank financing, capital markets, government grants and others based on source of fund, and there are mixtures of these three types of fund sources as below. Of course, there are various classification on shipping finance depending on source of provider, consumer, objective of financing and so on.

Types of shipping finance based on source

Bank financing	Capital markets	Government grant	Others
Mortgage-backed loans	High yield bonds	Government loans	Seller's credit
Newbuilding financing	Convertible notes	Subsidizing interest rate	Finance lease
Unsecured/corporate loans	IPOs	Cash grant to owner/shipbuilder	Operating lease
Mezzanine	Follow-on offerings	Cash or credit to allied industry	Private equity
	At-the-market offerings	Operating subsidies tied to shipbuilding agreement	Securitization
	MLPs	Favorable taxation incentives	Export credit agency's finance
	SPACs	Guarantee of private loans	

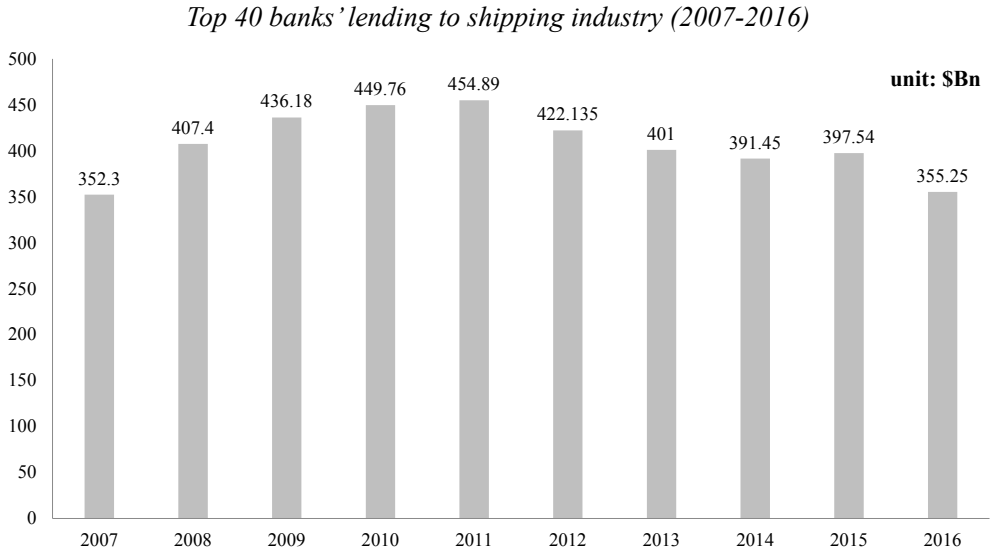
TABLE 1 - SOURCE: The International Handbook of Shipping Finance, 2016

Bank financing, especially bank debt financing, is the most important source of fund for shipping industry historically. Bank debt financing is the cheapest form of external capital compared to another financial sources. Based on report written by Petrofin Bank Research, the top 40 banks lending to shipping industry was about $355 billion in 2016, and even over $454 billion was provided to shipping industry in 2011 by these banks.

The main types of bank financing are mortgage-backed loans, newbuilding financing, unsecured loans and corporate loans.

As shipping companies expand their fleet, the demand for shipping finance increased and more stakeholders started to seek funds from capital markets. The growth of global trade and the anticipation of high returns increased the visibility of the shipping industry to a variety of participants beyond ship-owners and commercial banks. These days, whether institutional or individual, any investor can participate in shipping finance through debt or equity products such as corporate bonds, convertible notes, common equity, private equity and so on.

In the shipping financial market, government is also an important player to offer a variety of financing assistance to activate local shipping industry and strengthen their competitiveness. The government grants include government loans, subsidizing interest rate, cash grants, taxation incentives, vessel-scrapping subsidies. Some countries having state-owned or operating shipping and shipbuilding companies provide these grants and aids with favourable conditions.



Graph 1 - Source: Petrofin Bank Research, 2017

2.2 The history of shipping finance: from commercial bank loan to structured finance

Whether the global economy is prosperous or not, there are the demand of financing in shipping industry all the time. When the global economy is prosperous, volume of global trade and the demand of shipping increase, so shipping companies are willing to expand their fleet and require a lot of capital for acquire vessels. On the contrary to this, when the global economy is in depression or financial crisis develops, the trade volume decreases and financial institutions reduce their exposures to secure soundness and profit, and shipping companies face with scarce of funding source and liquidity. Historically, the global economy was full of ebbs and flows, as a result, the landscape and trend of shipping finance has changed depending on macro and micro economy conditions.

In the period of 2001-2008, the world economy rapidly grew and the trade volume increased with China's entry into World Trade Economy and the rise of new markets such as Brazil, Russia, India and other emerging countries, and this growth of world economy and trade volume caused increase of demand for shipping services. To provide more and better shipping services, shipping companies started to expand their fleet and converted their vessels. In this period, the freight market was also strong so, shipping companies could easily utilize bank loan with their own equity for purchase of vessels. Especially, European commercial banks were a main player of shipping finance that provided readily available, attractive priced loan for shipping companies until 2008.

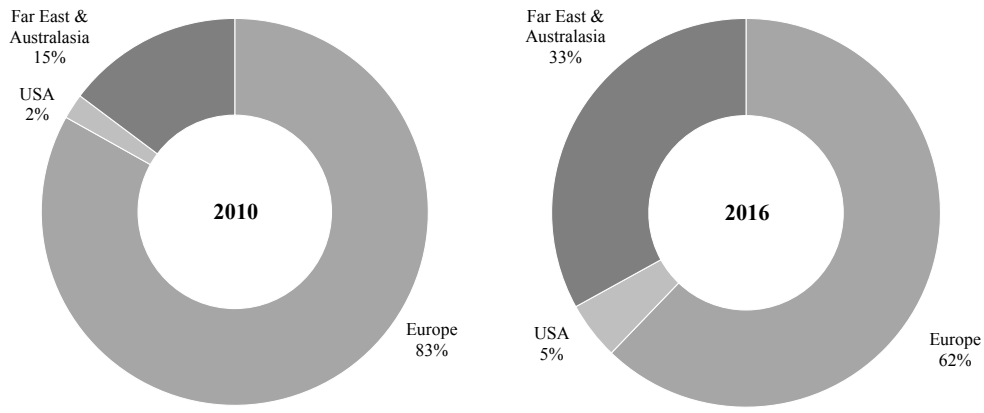
After a time of unexampled prosperity, the global financial crisis caused by the Subprime mortgage crisis of USA and European sovereign debt crisis made economy and trade shrink. Moreover, this crisis has influenced on credit financial business of commercial banks and global interbank market. Many European commercial banks have decreased their exposures to shipping industry to secure financial soundness and performance.

With this result, the demand of financing in shipping industry excessed the supply and it has remained the demand-supply gap of shipping finance.

After 2008, new types of shipping finance covered the demand-supply gap, and the East Asia countries have become main players utilizing Export Credit Agency (ECA) finance and leasing finance. In particular, the ECAs of China and South Korea, representative countries having a competitiveness in shipbuilding industry, has provided lots of capital to the international ship-owners and shipping companies to support the export of ships that are built in their local shipyards. The leasing finance has also increased its impact on shipping industry as well as ECAs finance during the last 9 years. Because leasing companies can offer up to 100% of asset value and support predefined working capital, leasing finance is very useful and flexible to capital-intensive projects such as new building and offshore projects.

The shares of Far Eastern region in the global shipping finance increased from 15% in 2010 to 33% by 2016. On the contrary, the shares of European banks decreased from 83% in 2010 to 62% by 2016. Although the shares of European banks in shipping finance have decreased, Europe is still important region in shipping industry and has many commercial banks that committed to shipping finance.

Global shipping finance portfolios according to geographical area



GRAPH 2 - SOURCE: Petrofin Bank Research, 2017

3. STATUS AND TRENDS OF THE SHIPPING FINANCE IN MAJOR SHIPPING COUNTRIES

3.1 Europe

The shipping industry policy of the EU

Because Europe has established and implemented policy for shipping industry through the European Union (EU), this Chapter will introduce EU policy for shipping industry instead of looking through that of each European country.

The EU adopted a ministerial declaration on maritime transport in March 2017 that outlines priorities for the EU's maritime transport policy, focusing on competitiveness, digitalization and decarbonisation. With the adoption of the so-called Valletta Declaration, EU states will focus on these three priorities by 2020, reinforcing the effort to strengthen the leading role of the shipping industry.

Specifically, EU states have decided to apply standards for safety, security, environment and labour conditions more rigorous than the international level to increase its competitiveness. In addition, EU states will establish an internal network of multimodal transport, nurture human resources to maintain excellent maritime clusters and develop a stable taxation guidelines etc. As part of an effort of digitization, the EU will promote a full and swift implementation of the Blue Belt, a harmonized electronic cargo manifest, as well as electronic authentication system for vessels and sailors.

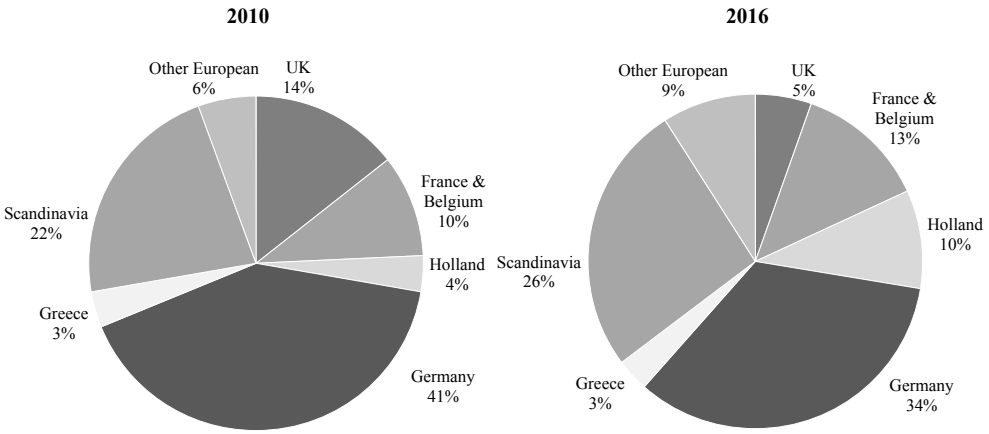
With regard to decarbonisation, EU states will actively apply IMO policy for reducing greenhouse gases, promoting the use of alternative energies and fuels for shipping, notably harmonized standards for LNG bunkering connectors and procedures for LNG bunkering in European ports. In addition, EU states will particularly encourage the implementation of the Green Shipping Guarantee program. The Green Shipping Guarantee program provides financial support to the cost for new orders of eco-friendly ships or the cost of upgrading existing vessels to eco-friendly ones.

European commercial bank loan

European commercial bank is traditionally the main source of shipping finance, and it has a long history in shipping finance since 1850s with the expansion of steamship fleet.

The result of the European bank global ship finance portfolios in 2010 and 2016 by main regional groups shows that the share of Germany falling sharply, but this country is still the biggest lender with share of 34% in Europe. The UK and Ireland banks has lost their share drastically as Bank of Ireland has withdrawn from shipping sector.

European banks' global shipping finance development



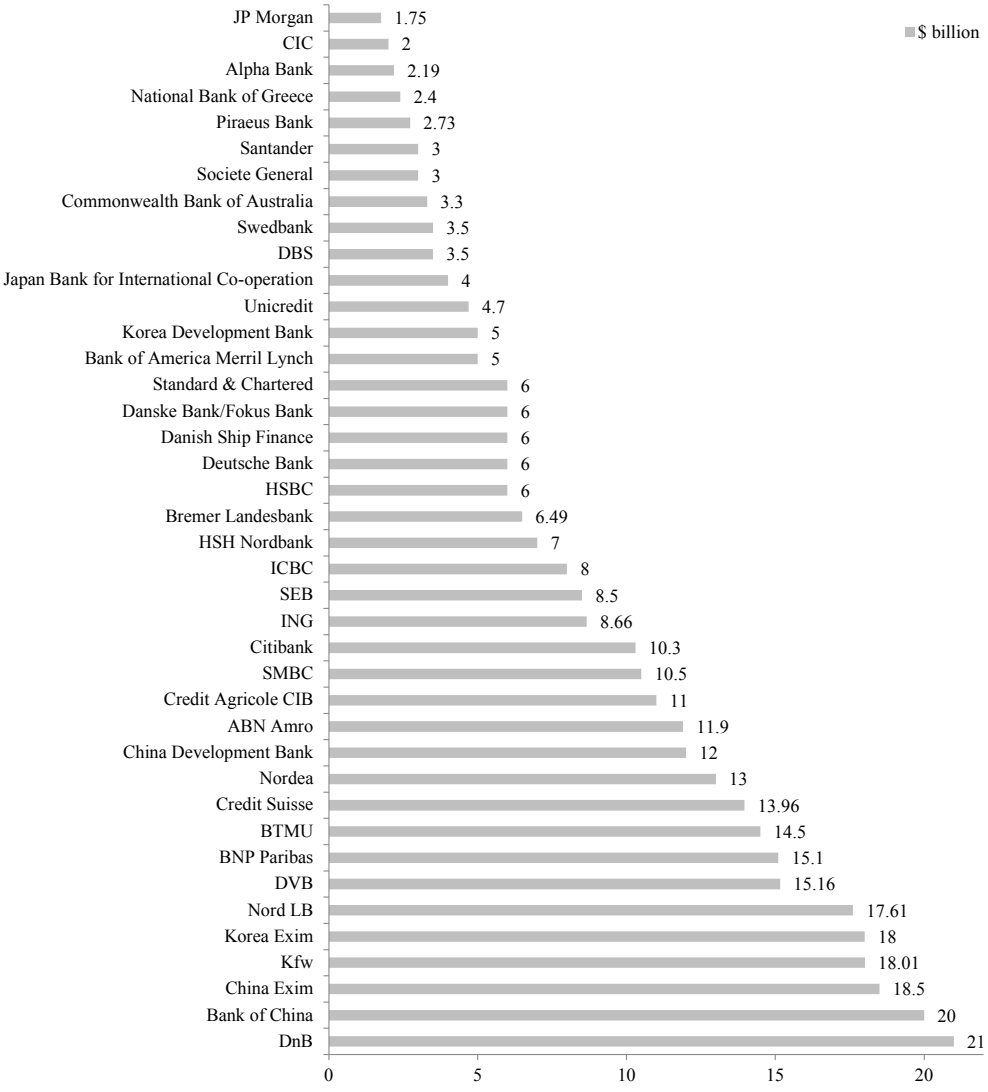
GRAPH 3 - SOURCE: Petrofin Bank Research, 2017

On the contrary, Dutch bank shows a rapid growth from 4% in 2010 to 10% by 2016, and Scandinavian, French and Belgian banks showed a slight growth as the French bank CIC has up in top 40 banks in 2016. In addition, other European banks show stability and slight growth.

Greece, financing primarily the Greek fleet, has managed to control their declining portfolios and have carefully continued to lend small amounts to their Greek clients.

The top 40 global banks have an exposure of $355.25 billion to shipping sector as of December 2016. Many banks who have committed to shipping finance are European banks, and even 27 banks out of top 40 global banks are European banks.

Bank lending to shipping as of end 2016



GRAPH 4 - SOURCE: Petrofin Bank Research, 2017

DNB, Norway's largest financial services group, has the largest portfolio stood at $21 billion by the end of December 2016. Following DNB, the KfW, German government-owned development bank based in Frankfurt, is listed on the top 40 banks with exposure of $18.01 billion. Except for KfW, Germany has several global banks committed to shipping finance such as Nord LB, one of the largest banks in Germany, and DVB Bank, a subsidiary of the DZ BANK Group and a specialist in international transportation finance, Deutsche Bank and HSH Nordbank, Bremer Landesbank, merged with NORD LB as of September 1 2017.

Many French banks are also listed their names on the top 40 banks such as BNP Paribas, a French's largest international banking group, Credit Agricole CIB, Societe Generale and CIC.

UK, traditionally having a strong competitiveness in maritime finance and industry, has famous shipping finance institution such as HSBC, Standard Chartered and Santander that are British multinational banking and financial services companies. Greece, the representative ship-owners' county, has provided loan for its ship-owners through Piraeus Bankis, National Bank of Greece and Alpha Bank. Italy, the neighbouring country, also has a bank, Unicredit, listed on top 40.

Besides DNB, a number of banks located at Northern Europe such as Nordea, Credit Suisse, SEB, Swedbank, Danish Ship Finance and Danske Bank have participated in shipping finance actively. These Northern European banks have expanded their exposure over the years as well as the Dutch banks including ABN AMRO Bank and ING. On the other hand, HSH Bank and Commerzbank have reduced their exposure gradually in shipping.

EU's green shipping guarantee program

As one of EU Shipping strategy, EU has implemented Green Shipping Guarantee Program that is intended to finance Shipbuilding projects including new vessels, conversion and retrofitting of vessels, and this program is designed to promote commercial investment in technologies which both improve energy efficiency and reduce harmful emissions in the European shipping sector. This program is composed of Green Shipping Loan Program which is supported by European Fund for Strategic Investments (EFSI) and Green Shipping platform which is supported by Connected Europe Facility (CEF).[2]

As a €50 million-loan program, Green Shipping Loan Program was approved by EFSI investment committee and European Investment Bank (EIB) in June 2016. The eligible investment projects are related with EIB transport lending policy with significant European interest such as flag, ownership, incorporation, and routes or green investments and sustainable shipping such as fuel alteration, installation of hull treatment and ballast water treatment system. This program will support up to 50% of investment costs, so the total expected support amount is around €500 million of investments, and this program provides direct senior secured loans to European corporates. In pilot phase, this program focuses on Mediterranean and Atlantic based EU ship owners who contract new build vessels with eligible projects.

[2] European Investment Bank (2016, 11 May). *Environmental and social data sheet*. Luxembourg.

Green Shipping platform is aimed to design a sustainable, scalable and commercial financial instrument that provides a solution to accelerate investments in greener shipping and can be replicated to finance compliance with future regulations on ballast water. This platform intends to reduce risk of environmentally focused shipping investments such as general fleet renewal.

This platform will support small and medium enterprises of which the annual sales are below €50 million. For efficient operation and implementation, EIB will have a partnership with commercial banks which play a front office role based on framework agreements. To achieve the main objectives of the platform, the optimal financing structure is a guarantee or funded risk participation rather than direct lending. Furthermore, this platform supports the issuance of guarantees for senior and subordinated obligations as well as taking of funded risk. EIB will support green components of retrofitting operations up to 100% and debt financing of new vessels up to 50%. Nevertheless, in all cases, there will be insufficiency of financing between 20% and 50%, EIB needs co-financing with commercial banks.

The pilot program of this platform is to be launched with France, the Netherlands and Nordic countries' financial institutions with the amount of €750 million. To put it more concretely, the CEF and EFSI will support €250 million and €500 million each. The eligible investment projects are similar to those of Green Shipping Loan Program[3].

3.2 China

Shipping industry policy of China

China recognized the importance of marine and shipping industry after 2012 through China's 12th Five Year Plan (2011-2015), and established China's first objectives in shipping industry such as development of marine economy and establishment of marine power at national level. In 2014, China upgraded development of shipping industry as a national strategy after announcement of *The Several Opinions on Promoting the Healthy Development of the Shipping Industry*. The opinions clarified shipping industry as a key industry for economic and social development which contributes to protection of sea rights and interests, enlargement of foreign trade, structure reform of industry.

In 2007, China emphasized reinforcing the reform of systems from the supply side, innovation and strengthening the protection of ecosystem during the National People's Congress, China's biggest political event and Chinese People's Political Consultative Conference. Following the policy direction at the government level, China's shipping industry has experienced significant changes. As part of the reform from the supply side, China's shipping and shipbuilding companies have carried out a large-scale restructuring. Meanwhile, China has strengthened the management of pollutants emitted from ships and controlled its emissions. In addition, it continues demolition and replacement of aging vessels. As part of such movement, the Chinese government has recently extended the period for ship scrapping subsidy program.

[3] Gaudet F. (2016, 28 September). "EIB's Green Shipping Programmes" (presentation material), *Motorway of the Sea Workshop*. Brussels.

Furthermore, China's shipping and logistics companies will continue investing and making inroads into countries along the One Belt and One Road Initiative.

Therefore, the Mediterranean region occupies an important strategic position in the B&R, and is both a transit point and a destination. With the further development of B&R, the Mediterranean region as the key node of B&R will be more and more significant.

For example, the Mediterranean is one of the Chinese people's favorite travel destination. Goods such as wine, olive oil, textiles and leather products are very popular in China. In addition, the Mediterranean region is rich in resources, and the B&R partner countries' industries are highly complementary. These will provide the relevant countries a broad market for trade and production capacity cooperation. China has built a number of landmark projects with countries in the Mediterranean region so far.

Increase of ECF and leasing finance

As of June 2017, The Export-Import Bank of China (China Exim), one of ECAs, provided more than $115.1 billion (730 billion Chinese Yuan) for construction of 8,399 vessels and offshore platforms as the direct loan and grant of credit.[4] In 2016, China Exim and China Development Bank (CDB) decided to provide $47.3 billion (300 billion Chinese Yuan) to the shipping and shipbuilding industry for acquisition of vessels and investment into foreign assets through strategic cooperation agreement. Both public financial institutions respectively signed development of financial cooperation agreement with China COSCO Shipping Group on August 2016 and January 2017. China Exim will provide the loan of $18.9 billion (120 billion Chinese Yuan) for construction and acquisition of China COSCO Shipping Group's 50 vessels, and CDB will provide the loan of $28.4 billion (180 billion Chinese Yuan) until 2021.[5]

Recently, China Banking Regulatory Commission encourages leasing companies and trust companies enlarge their participation in shipping industry, and plans to allow financial leasing companies to establish and operate a subsidiary specializing in shipping finance not only in mainland China, but also in Hong Kong and Taiwan. As the quarter of 2017, China leasing companies had 989 vessels and the total value of lease assets was $18 billion (114 billion Chinese Yuan) which increased by 58% compared with the end of March 2016.[6]

As of November 2017, China boasts 20 leasing institutions involved in ship leasing, with the asset value related to shipping finance surpassing 200 billion Yuan. In particular, major domestic leasing companies with size of assets over 100 billion, including ICBC Leasing, Minsheng Leasing, CMB Leasing, and CDB Leasing are participating in the shipping finance market. While most of ship leasing takes the form of financial leasing in the beginning, nowadays witness an increasing share of operating lease, exceeding 30% of the total.

[4] See Eastmoney.com, 2 June 2017 [http://finance.eastmoney.com/news/1355,20170602743267851.html].

[5] See Xinhua News Agency, 5 August 2016 [http://www.xinhuanet.com/2016-08/05/c_1119345198.htm].

[6] See Yicai.com, 17 May 2017 [http://www.yicai.com/news/5286422.html].

ICBC Leasing, a leading leasing firm in China, has provided the loan of 15 billion Yuan for exporting 70 vessels constructed in Chinese shipyards.[7]

China's ship scrapping subsidy program

For acquiring high efficient and eco-friendly ship assets, China government has implemented ship scrapping subsidy program since 2013. Based on Ship Scrapping Subsidy program, China shipping company, who early scrapped their China flagships of 1,000 DWT or more at domestic ship breaking yard where China government approved, can get special subsidy from the government. Originally, this program was set to expire at the end of 2015, but the Chinese government extended this program until 2017, because of shipping companies' request for extension of term and a positive response from the shipping industry. Considering all ships that can meet the requirements apply for this subsidy after demolition, total $1.13 billion (7.06 billion Chinese Yuan) would be provided to China shipping companies. In 2014, COSCO Holdings received $275 million (1.74 billion Chinese Yuan) as a subsidy from China government, and $217 million (1.38 billion Chinese Yuan) out of $275 million was subsidy for ship scrapping. COSCO Holdings, a shipping company the most received ship scrapping subsidy, scrapped total 56 vessels of 3.14 million DWT including container ship and bulk carrier 1n 2014. In the same year, China Shipping Container Lines received $18.9 million (120million Chinese Yuan) as a ship-scrapping subsidy.[8]

3.3 South Korea

Shipping industry policy of South Korea

The Korean government has set the establishment of maritime power through mutual growth of shipping and shipbuilding as one of 100 national tasks. This year, the Korean government will strengthen the support for one-stop service by establishing the Korea Ocean Business Corporation. In addition, it promotes the cooperation of shipping industry and shipbuilding industry by offering shipbreaking subsidy for eco-ships. Furthermore, the cooperation between ship owners and shippers will be enhanced, while logistics networks will be further expanded by establishing a cluster for maritime industry.

Korea also has established a long-term goal by 2022 based on eco-friendly ships, cooperation between shipping industry and shipbuilding industry and active support to shipping companies. Compared with policies of China and EU, however, Korea's effort is lagging behind in terms of securing a new source growth engine for the shipping industry. Korea's shipping industry requires sources for a long-term new growth engine by responding to digitization, technological innovation and the fourth industrial revolution. For this purpose, it is necessary to come up with effective and practical policy that can keep up with that of other major shipping countries.

[7] See Eworldship.com, 17 November 2017 [http://www.eworldship.com/html/2017/ship_finance_1117/133762.html].

[8] See Eastmoney.com, 26 June 2015 [http://finance.eastmoney.com/news/1355,20150626520720724.html].

Dominance of Development Finance Institution (DFI) in shipping finance

Korean government has promoted shipping finance through establishment of Development Finance Institution (DFI) such as Marine Finance Center, Korea Maritime Guarantee Insurance Co., Korea Shipping and Maritime Transportation Co., Ltd (KSmart). As Hanjin Shipping filed for receivership and business performance of Korean shipping companies deteriorated with liquidity crisis, Korea government announced a government plan to strengthen the competitiveness of the shipping industry. As part of the government plan, the size of financial support increased to $2.4 billon to invest in purchase of new vessels of Korea shipping companies for acquisition of high efficient and high eco-friendly ships, and KSmart was established on January 2017.

Marine Finance Center (MFC) was established to support financing of domestic shipbuilding, offshore plant, shipping industry through consolidation of shipping finance segment and human resource from The Export-Import Bank of Korea (Korea Exim bank), Korea Trade Insurance Corporation (K-sure), Korea Development Bank (KDB). The first project of MFC was to provide ship fund of KRW 340 million for Greece Oceanbulk Container that made a contract with Hyundai Heavy Industries Co., Ltd for construction of 8 container ships.

On December 2014, Korea Maritime Guarantee Insurance Co. (KMGIC) was established with initial capital KRW 60 billion which jointly financed by KDB and Korea Exim bank. KMGIC aims to promote the growth of relevant industries by providing debt guarantees for businesses in shipbuilding and vessel purchasing, and in other economically sensitive industries. Main business scope of KMGIC is to provide guarantee insurance for the purchase of vessels by shipping companies and other projects.

At the end of 2015, KMGIC provided subordinated debt performance guarantee insurance of KRW 30billion to HSLine and Dong-A Tanker for the building of new vessels. HS Line and Dong-A Tanker planned to acquire bulk carrier of 115,000 DWT and 2 containerships of 1,800 TEU. The total price of 3 vessels is about KRW 100 billion, KMGIC provided guarantee of KRW 10 billion for each vessel.

Ship investment company and ship fund

The Korean government decided to develop ship investment company and ship fund to prevent decrease of Korean shipping companies and support the domestic shipping industry after the Asian financial crisis (1997) and global financial crisis (2008). As a result, KAMCO Ship Investment Management Company (KAMCO SIMC) was established as a subsidiary of Korea Asset Management Corporation (KAMCO) in March 2015 to professionally manage ship funds. After this establishment, Korea Shipping and Maritime Transportation Co., Ltd (KSmart), as a tonnage bank, was established with initial capital KRW 1 trillion, which jointly financed by KDB (50%), Korea Eximbank (40%) and KAMCO (10%)

The main businesses of KAMCO SIMC are the purchase and charter of ships, financing from domestic and foeign financial institutions, issuance of bonds and equities, management and disposal of purchased ships on behalf of ship investment company.

As of March 2018, KAMCO SIMC has been operating 45 ship funds of Korea tonnage ship investment company and already cleared 33 ship funds of KAMCO global ship investment company.

Types of shipping finance based on source

The name of ship fund	The name of Ship	Date of Establishement	Status
KAMCO global ship investment company No.1-17	Hyundai Atlas, Hanjin Tacoma, Hanjin New Orleans, Hanjin Bombay, Hanjin Shanghai, Hanjin San Francisco, Hanjin Los Angeles, Hanjin Wilmington, Hanjin Valencia, Hanjin Nagoya, Hanjin London, Hanjin Washington, Hanjin Beijing, Hanjin Berlin, Hanjin Paris, Hanjin Rome, Hanjin Oslo	2009.07.03	
KAMCO global ship investment company No.18	Universal Crown	2009.11.18	
KAMCO global ship investment company No.19-23	Heung-A Tokyo, No.2 Green Pioneer, No.3 Green Pioneer, Hanjin Richard Bay, FEG Success	2010.03.19	
KAMCO global ship investment company No.24	Global Brave	2010.06.18	Completion
KAMCO global ship investment company No.25	Global Frontier	2010.08.03	
KAMCO global ship investment company No.26-27	Global Genesis, Global Hope	2010.08.18	
KAMCO global ship investment company No.28-33	Daebo IBT, Dong-A Peneus, Dong-A Tyche, Dong-A Ether, Silver Bridge, Hyundai Glory	2011.11.13	
Korea tonnage ship investment company No.1-2	Sea Honesty, Sea Future	2015.04.09	
Korea tonnage ship investment company No.3, 4, 6, 7	Ultra Omega, SM Aurora, Wooyang Banders, Ricsea	2015.10.19	
Korea tonnage ship investment company No.5	GNS Harmony	2015.10.21	
Korea tonnage ship investment company No.8-13	T Symphony, T Prime, Sunny Young, Wise Young, Wooyang Friend, Youngheung	2016.06.15	Proceeding
Korea tonnage ship investment company No.14-18	F Sun, Golden Denise, DK Ione, DK Itonia, Hyundai Tacoma	2016.11.09	
Korea tonnage ship investment company No.19-36	SM Mumbai, SM Tokyo, MSC Kwangyang, MSC Spain, MSC Portugal, SM Jakarta, SM Vancouver, SM Tacoma, SM New York, SM Norfolk, SM Savannah, SM Newcastle, SM Gladstone, SM Samarinda, SM Challenger, Star Clipper, Star Skipper	2017.04.24	
Korea tonnage ship investment company No.42-45	KG Asia, SM Charleston, SM Tianjin, SM Qingdao	2017.11.14	

TABLE 2 - SOURCE: KAMCO Ship Investment Management Company website (www.kamcosimc.com)

KSmart, as a tonnage bank, purchases vessels from shipping companies at market value and charters with low charterage to shipping companies to improve the financial structure of shipping companies KSmart also invests in paid-in capital increase and permanent convertible bonds and supports shipbuilding companies by purchasing.

As of March 2018, KSmart invested in paid-in capital increase of KRW 104.3 billion and permanent convertible bonds of KRW 600 billion of Hyundai Merchant Marine Company Limited to secure captial expansion for the loss on disposition taking place during the Sales&Lease Back.

Investment status of KSmart

Investment Type	Product		Beneficiary
Ship fund (Holiding ships)	Korea Ship Global No.1	Hyundai Forward, Hyundai Unity, Hyundai Grace, Hyundai Dynasty, Hyundai Voyager, Hyundai Supreme	Hyundai Merchant Marine Company Limited
	Korea Ship Global No.2	Hyundai Brave, Hyundai Courage, Hyundai Faith, Hyundai Force	Hyundai Merchant Marine Company Limited
Ship fund (Sale and Lease Back)	Korea Ship Global No.3	Dong-A EOS	Dong-A Tanker
	Korea Ship Global No.4	Golden Pioneer	Heung-A Shipping Co.,Ltd.
	Korea Ship Global No.5	Dongyang Chemi	SUNWOO TANKER
Paid-in capital increase	Capital increase by issuing new stocks	KRW 104.3 billion	Hyundai Merchant Marine Company Limited
Permanent convertible bond	Permanent convertible bond (issue a single account)	KRW 600 billion	Hyundai Merchant Marine Company Limited

TABLE 3 - SOURCE: Korea Shipping and Maritime Transportation Co., Ltd website (www.ko-smart.co.kr)

Construction plan of investment business

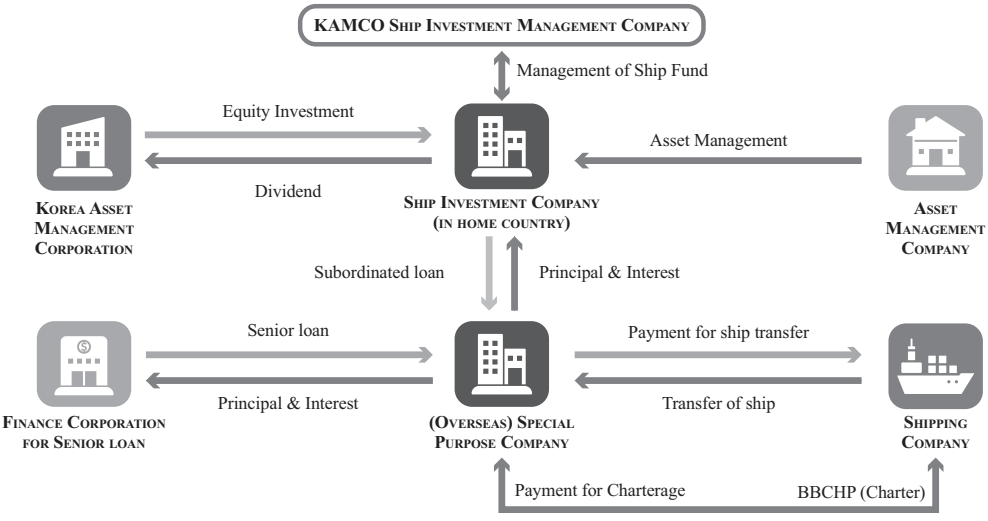


FIGURE 2 (A) - SOURCE: SRM on Kamcosimc website (www.kamcosimc.com)

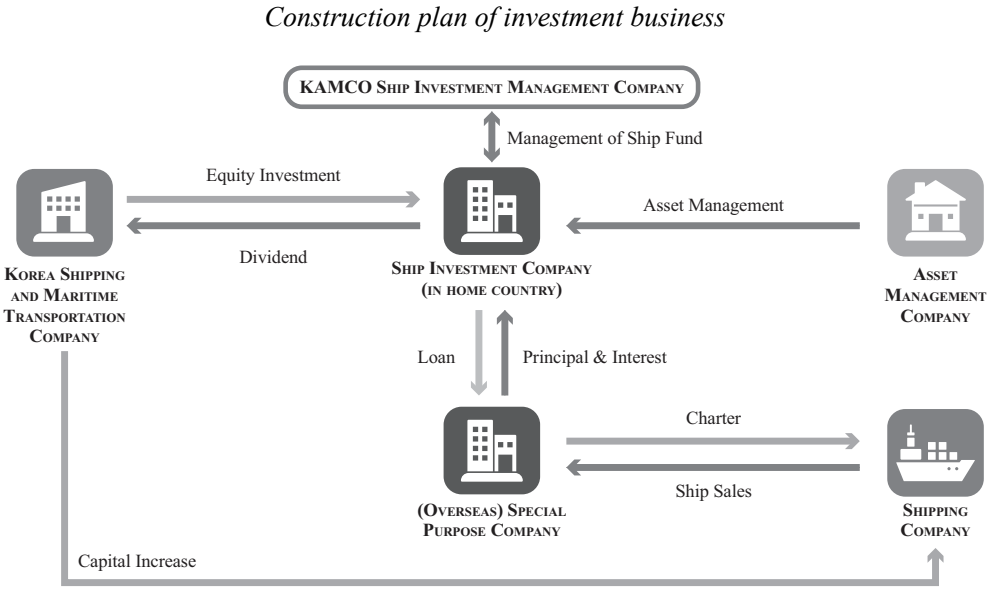


Figure 2 (b) - Source: SRM on Kamcosimc website (www.kamcosimc.com)

4. Conclusions

This chapter examined the status and trends of global shipping finance by period and types. In addition, the case studies on shipping finance of European countries, China and South Korea implied that financing is a key for the revitalization and development of the shipping industry. The sources and forms of shipping finance have become more diverse, ranging from European driven commercial banking to East Asian dominant ECF and leasing finance. Trend of shipping finance is continually changing, and the size of shipping finance has fluctuated over the past few years. As shipping finance plays a major role in the survival and development of shipping companies, further studies and analyses in this area are required. However, it is difficult to access to and collect financial data from financial institutions and shipping companies because these are very credential and sensitive as private data. For this reason, this study was mostly dependent on literature data from books, newspaper, articles, financial institutions and government websites, and there remains the constraint to obtain accurate figures and data on shipping finance.

Accordingly, shipping research institutes of each country should cooperate to share the data on shipping finance to develop more precise analysis and best practices and offer suggestions for the shipping industry.

APPENDIX

The list of export credits agencies

Region	Country	Name of the agency
Europe	Austria	Oesterreichische Kontrollbank AG (OeKB)
	Belgium	Credendo
	Czech Republic	Export Guarantee and Insurance Corporation (EGAP), Czech Export Bank
	Denmark	Eksport Kredit Fonden (EKF)
	Estonia	KredEx
	Finland	Finnvera, Finnish Export Credit Ltd (FEC)
	France	Bpifrance Assurance Export
	Germany	Euler Hermes Aktiengesellschaft
	Greece	Export Credit Insurance Organisation (ECIO)
	Hungary	Hungarian Export Credit Insurance Ltd and Hungarian Export-Import Bank plc
	Italy	Servizi Assicurativi del Commercio Estero (SACE)
	Latvia	Latvian Guarantee Agency (LVA)
	Luxembourg	Office du Ducroire (ODL)
	Netherlands	Atradius
	Norway	Export Credit Norway, Garantiinstituttet for eksportkreditt (GIEK)
	Poland	Korporacja Ubezpieczén Kredytów Eksportowych (KUKE)
	Portugal	Companhia de Seguro de Créditos
	Slovak Republic	Export-Import Bank of the Slovak Republic (Eximbanka SR)
	Slovenia	Slovenska izvozna in razvojna banka, d.d. (SID)
	Spain	Compañía Española de Seguros de Crédito a la Exportación (CESCE)
	Sweden	Exportkreditnämnden (EKN), AB Svensk Exportkredit (SEK)
	Switzerland	Swiss Export Risk Insurance (SERV)
	Turkey	Export Credit Bank of Turkey (Türk Eximbank)
	United Kingdom	UK Export Finance
Middle East	Israel	The Israel Export Insurance Corp. Ltd. (ASHRA)
America	Canada	Export Development Canada (EDC)
	Mexico	Banco National de Comercio Exterior
	United States	Export-Import Bank of the United States (Ex-Im Bank)
Asia	China	China Export&Credit Insurance Corporation, Export-import Bank of China
	Japan	Nippon Export and Investment Insurance , Japan Bank for International Cooperation
	Korea	Korea Trade Insurance Corporation , The Export-Import Bank of Korea
Oceania	Australia	Export Finance and Insurance Corporation (EFIC)
	New Zealand	Export Credit Office (ECO)

TABLE I - SOURCE: OECD (http://www.oecd.org/tad/xcred/eca.htm), ECA Watch (www.eca-watch.org)

Chapter VIII

Big Data-based analysis report on world's top container shipping routes and ship types

1. Overview of top container shipping routes in the world

1.1 Distribution of container ship types

There are approximately 5,700 container ships sailing on international routes worldwide. According to the analysis results of the Shipping & Port Big Data Laboratory (SPBD-Lab), Shanghai International Shipping Institute (SISI), container ships of below 4,000 TEUs mainly operate on near-sea shipping routes and Europe-North America ocean routes; the sailing paths of those between 4,000-10,000 TEUs are on trans-ocean routes; while those above 10,000 TEUs primarily concentrate on China-Europe routes with some sailing to the west coast of the America.

Figure 1 is a bubble chart based on the numbers/times of ship calls at ports. It can be seen that the bubbles representing ports in south China are significantly larger than those of other ports, indicating a larger number of ships calling at these China-based ports. Meanwhile, the ports of Malacca and Nordic Europe are also popular ports of calls.

Bubble chart of ports
("number" represents the numbers/times of ship calls at ports)

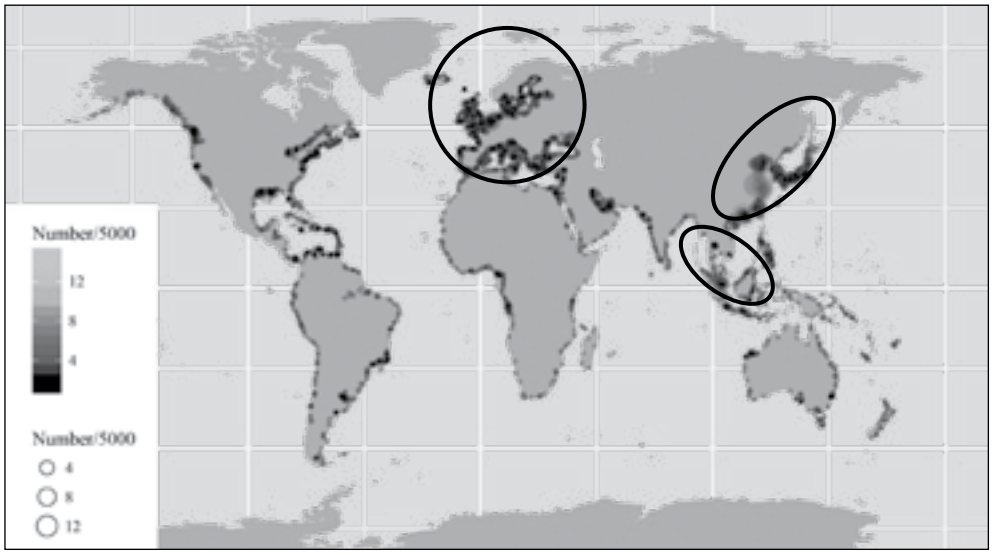
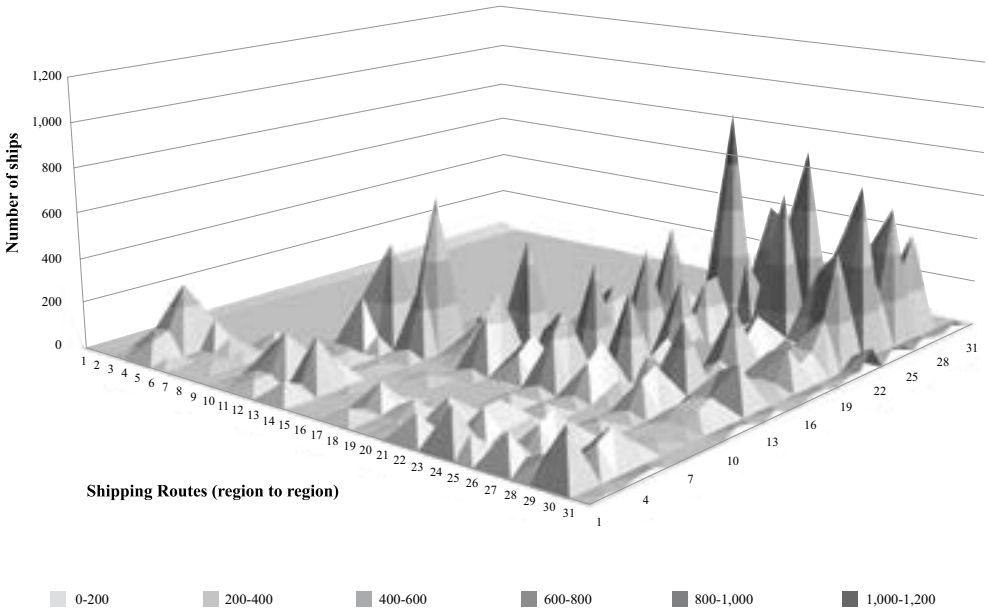


Figure 1 - Source: SPBD-Lab, SISI

1.2 Top container shipping routes in the world

In this report, the SPBD-Lab first divides the world into 31 regions, and then analyzes and studies the shipping routes defined by different combinations of ships connecting these regions, excluding those without any shipping capacity. The analysis finally identifies a total of 334 shipping routes in actual use and Graph 1 shows the number of container ships on the 334 shipping routes.

Numbers of ships on global shipping routes (334 in total) in Q3 2017

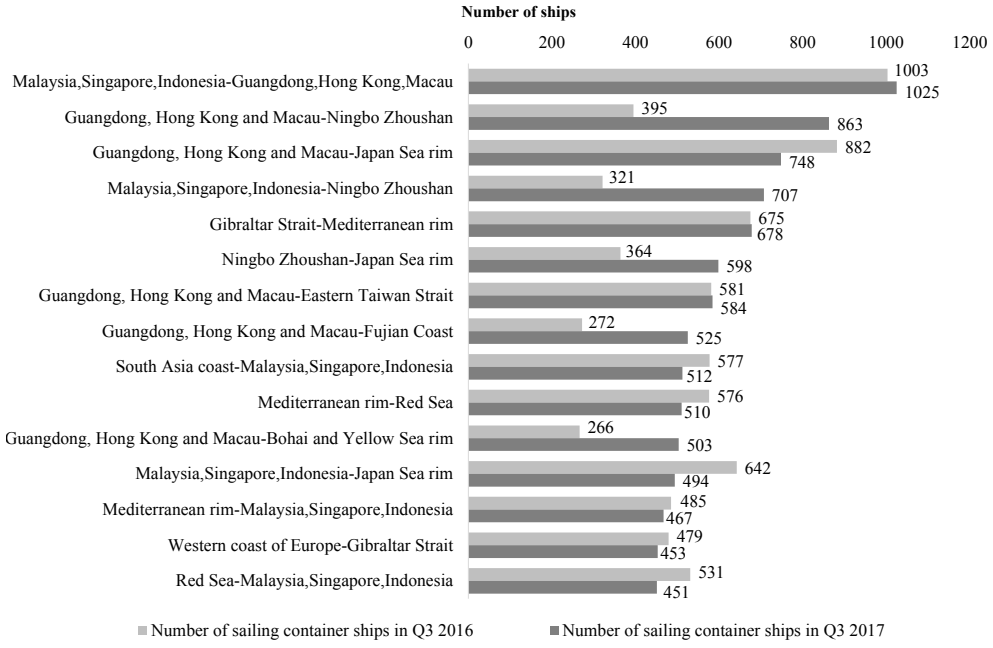


GRAPH 1 - SOURCE: SPBD-Lab, SISI

In 2017, the global shipping routes with relatively high numbers of container ships were primarily near-sea ones in the Far East and Europe (see Graph 2). Regions with relatively high numbers of container ships include the Guangdong-Hong Kong-Macao region, its neighboring regions such as the Singapore-Malaysia-Indonesia region and Ningbo-Zhoushan, plus the Japan Sea area, eastern region of the Taiwan Strait, the Pearl River Delta, and the rim of the Yellow Sea and the Bohai Sea.

Comparing the capacity variation on global container shipping routes (334 in total), as shown in Graph 3, we can see that most shipping routes with wide increments in shipping capacity start from China's coastal regions. In particular, shipping routes starting from Ningbo-Zhoushan, the Guangdong-Hong Kong-Macao region, the Bohai Sea rim, and the Fujian coast witness significant growth in shipping capacity. The intra-Asia market and the Far East—Europe market also grow rapidly.

Top 15 shipping routes in terms of the number of container ships



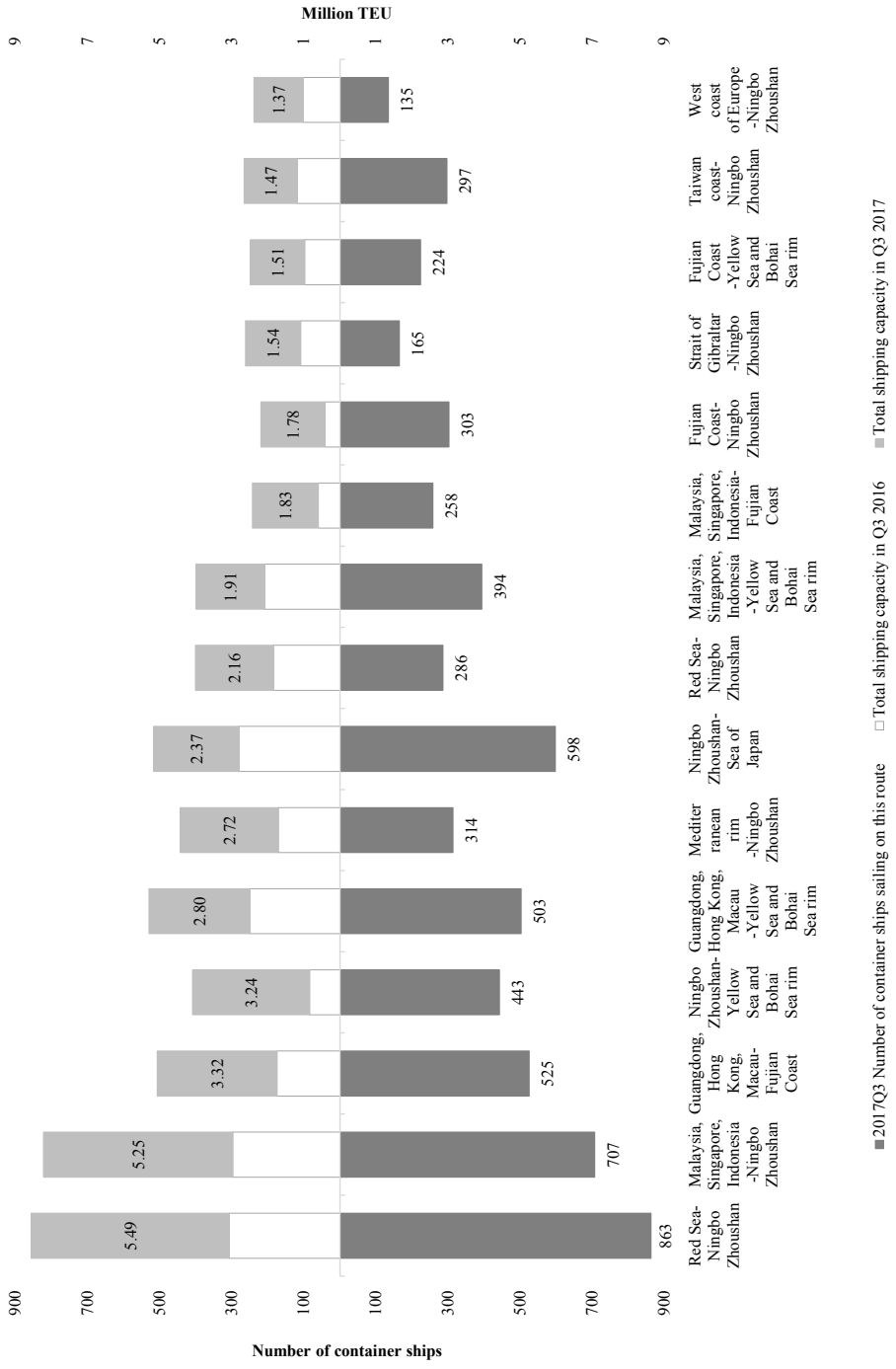
GRAPH 2 - SOURCE: SPBD-Lab, SISI

Graph 4 shows that shipping routes with higher growth in shipping capacity are primarily near-sea ones connecting the Far East and Africa, the Far East and the Americas as well as those within the Fast East and Europe. Specifically, shipping routes with small numbers of ships are emerging routes, while those with large numbers of ships are popular routes with rapid development.

As shown in Graph 5, among the 334 container shipping routes in the world, the shipping capacity of out-going shipping routes in the Red Sea region and the Japan Sea rim declines significantly. With the help of preceding analysis, we can find that the out-going shipping capacity of the Strait of Gibraltar is shifting from the Mediterranean Sea, the Red Sea, the Japan Sea rim and South Asia to China.

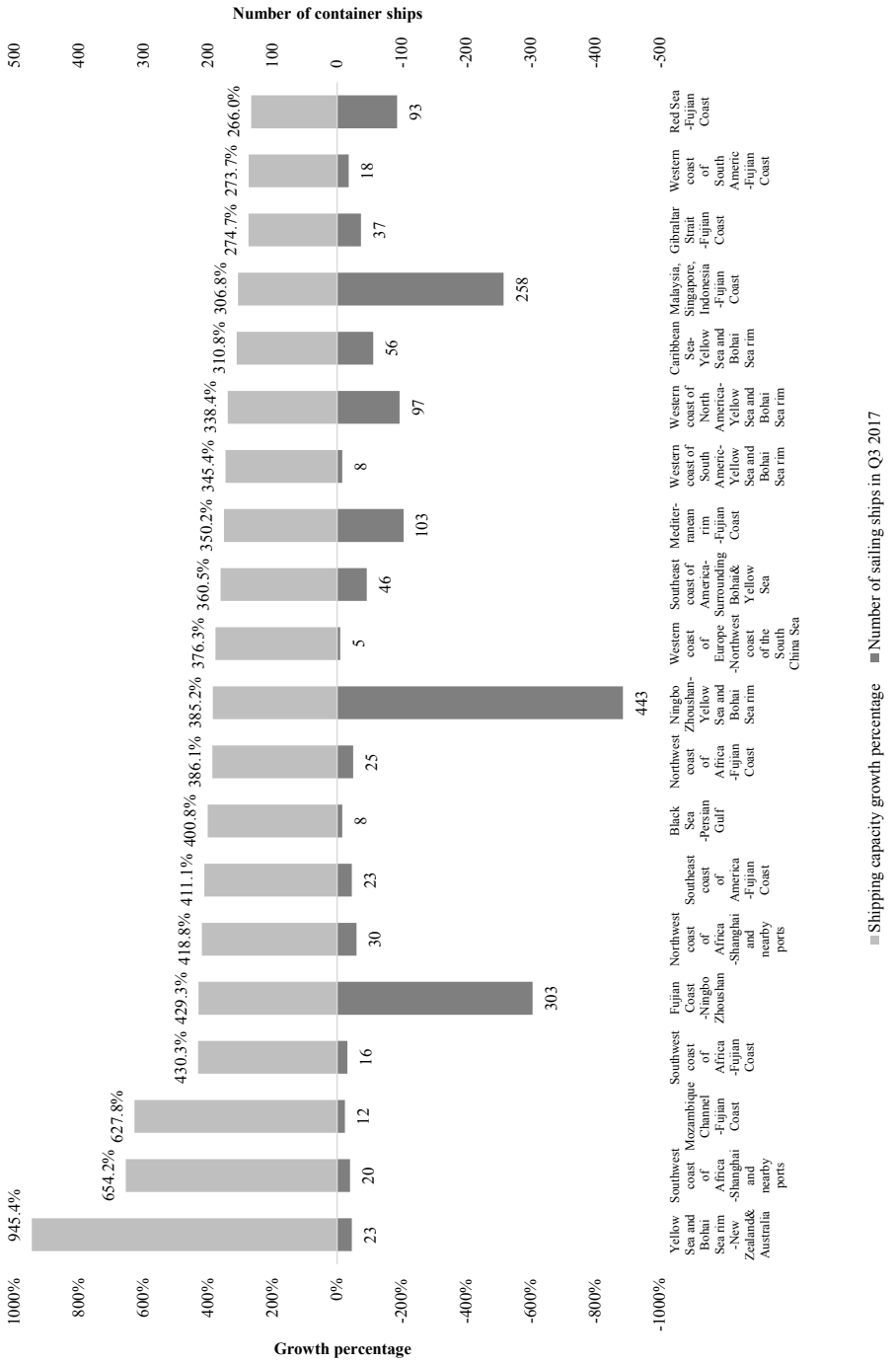
In Graph 6, we can see that shipping routes with the most significant shipping capacity decline are those connecting the southwestern coast of Africa and the Persian Gulf region, as well as those from the western coast of South America to the Far East. In addition, only a small number of ships are still operating on the routes that suffer a wide decline in shipping capacity. Only the route connecting the Arabian Sea and the Bay of Bengal-Sea with the Japan Sea rim retains a higher number of ships. Q3 2017 analysis found that the number of ships on this route has declined by 60, indicating the withering container shipping capacity on the route.

World's top 15 shipping routes in terms of shipping capacity increment (ranked by increment)



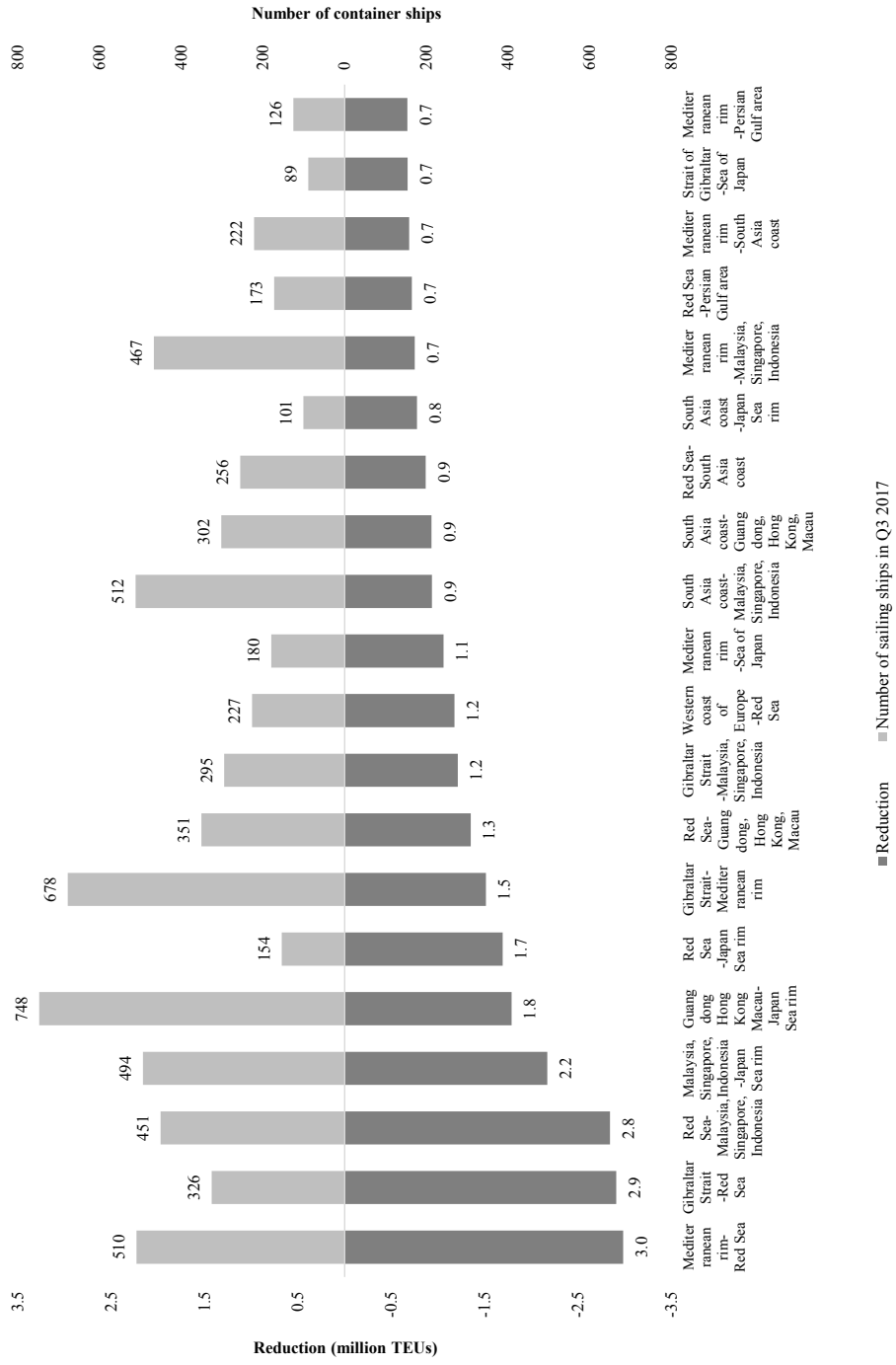
GRAPH 3 - SOURCE: SPBD-Lab, SISI

World's top 20 shipping routes in terms of shipping capacity growth (ranked by growth percentage)



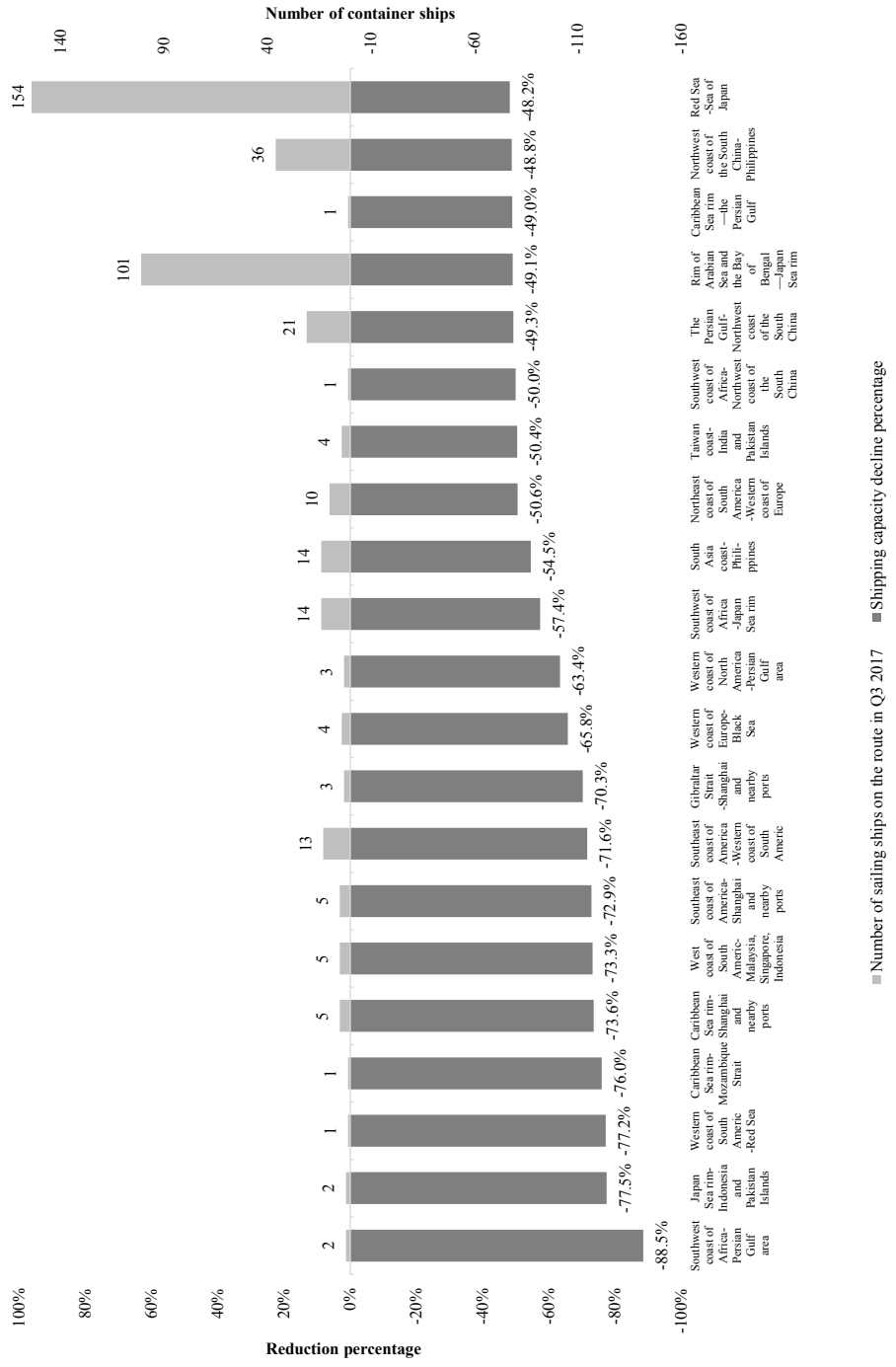
GRAPH 4 - SOURCE: SPBD-Lab, SISI

World's Top 15 shipping routes in terms of shipping capacity reduction (ranked by amount of reduction)



GRAPH 5 - SOURCE: SPBD-Lab, SISI

World's top 20 shipping routes in terms of shipping capacity decline (ranked by decline percentage)

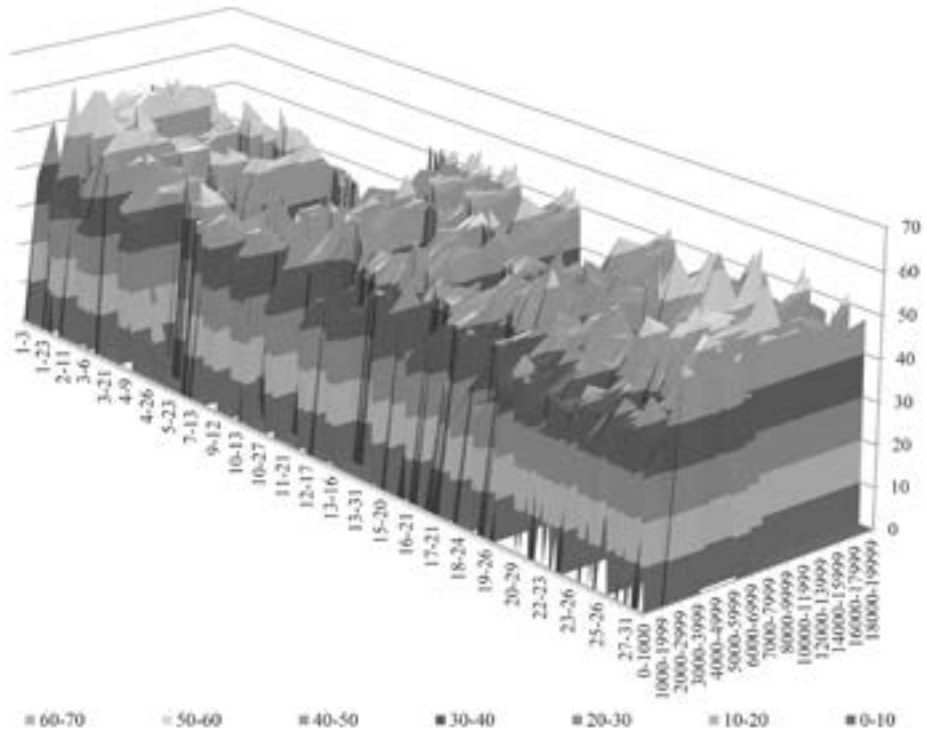


GRAPH 6 - SOURCE: SPBD-Lab, SISI

2. Performance of ship types on shipping routes in the world

In this report, the SPBD-Lab figures out a corresponding performance indicator through comprehensive calculation of various data of each ship type sailing on the shipping routes. The indicator takes into account a slew of factors, such as ship busyness, proportion of newly commissioned ships, speed and shipping capacity to measure whether a ship type is popular on a shipping line, which can serve as a reference for shipping companies when they put ships into service.

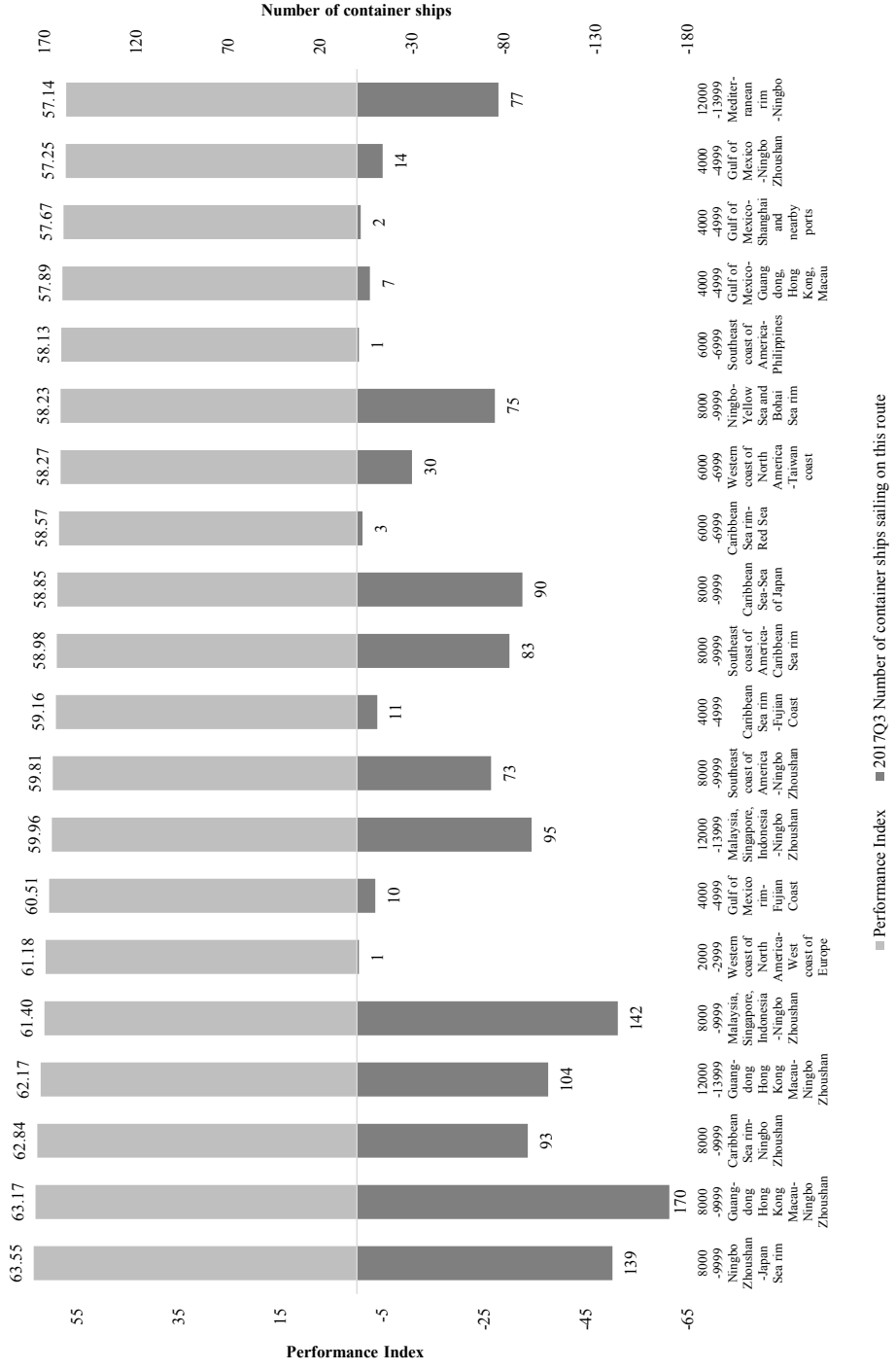
Performance indicators of container ships on all shipping routes



Graph 7 - Source: SPBD-Lab, SISI

By analyzing the performance of different ship types on the 334 shipping routes, we can see from the Top 20 shipping routes in terms of performance indicator that popular ship types are 8,000-9,999 TEU and 12,000-13,999 TEU vessels sailing from the Ningbo-Zhoushan Port to the Japan Sea rim, the Guangdong-Hong Kong-Macao region, the Caribbean Sea rim, the Singapore-Malaysia-Indonesia region, and the Mediterranean rim among others. In addition, performance indicators of 6,000-6,999 TEU and 8,000-9,999 TEU vessels sailing from Caribbean Sea to the southeast coast of the United States, the Japan Sea rim, and the Red Sea region are also high. The performance of smaller sized ships between 4,000-4,999 TEUs is relatively high for ships sailing from south China to the Gulf of Mexico and the Caribbean Sea rim. Ship owners are suggested to arrange appropriate ship types on high-performance shipping routes.

World's top 20 shipping routes in terms of performance indicator



GRAPH 8 - SOURCE: SPBD-Lab, SISI

2.1 Popular ship types on busy shipping routes

From the shipping route analysis in the previous section, we can find that several fast-developing busy shipping routes starting from China, such as those from the Fujian coast to Ningbo-Zhoushan Port, and from Ningbo-Zhoushan Port to the rim of the Yellow Sea and Bohai Sea, witness fast growth in shipping capacity. As for near-sea shipping routes leading to the Far East, Europe and Americas, those connecting the Singapore-Malaysia-Indonesia region and the Indian-Pakistan islands, those connecting the Caribbean Sea rim and Mediterranean rim, and those from the Gibraltar Strait to the northwestern coast of Africa enjoy fast growth.

Analysis results on popular ship types on busy shipping routes above and the performance indicators of these ship types are shown in Graphs 9 and 10. It can be seen that the performance of shipping routes with a relatively high shipping capacity, such as the Ningbo-Zhoushan—the rim of the Yellow Sea and the Bohai Sea, and Ningbo-Zhoushan—the Fujian Coast shipping routes, was basically proportional to the shipping capacity of ships. In other words, ship types with high performance enjoy a higher presence on the shipping routes in respective market, indicating that the market has entered relatively stable development.

Ships of over 10,000 TEUs deliver obviously higher performance on the other two shipping routes, such as the shipping line from the Singapore-Malaysia-Indonesia region to the Fujian coast shown in Graph 11. However, the number of ships with such a shipping capacity is not big, so ship owners are suggested to put such ships on the shipping routes.

Graph 12 shows the distribution of ship types on the Caribbean—Mediterranean rim shipping line. 8,000-9,999 TEU ships boast the highest performance and the largest shipping capacity in operation. On the contrary, 6,000-6,999 TEU and 5,000-5,999 TEU ships with high performance only register a small quantity in operation. This is another niche that ship owners are suggested to focus on.

Performance indicators of container ships on all shipping routes

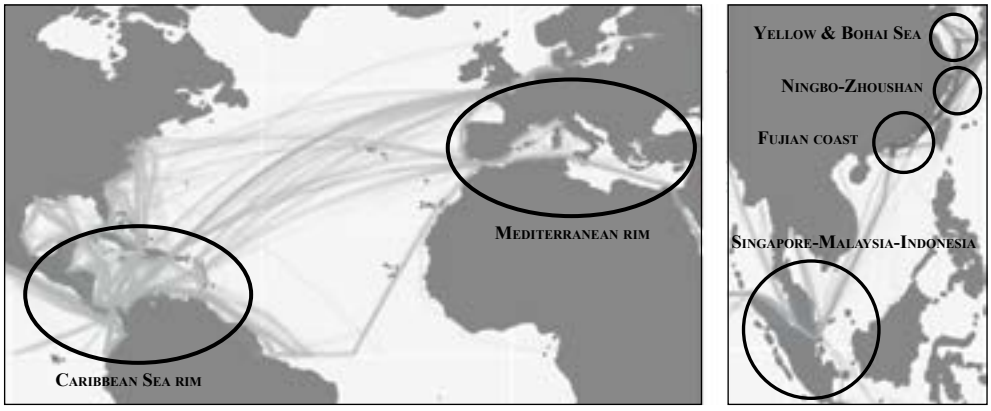
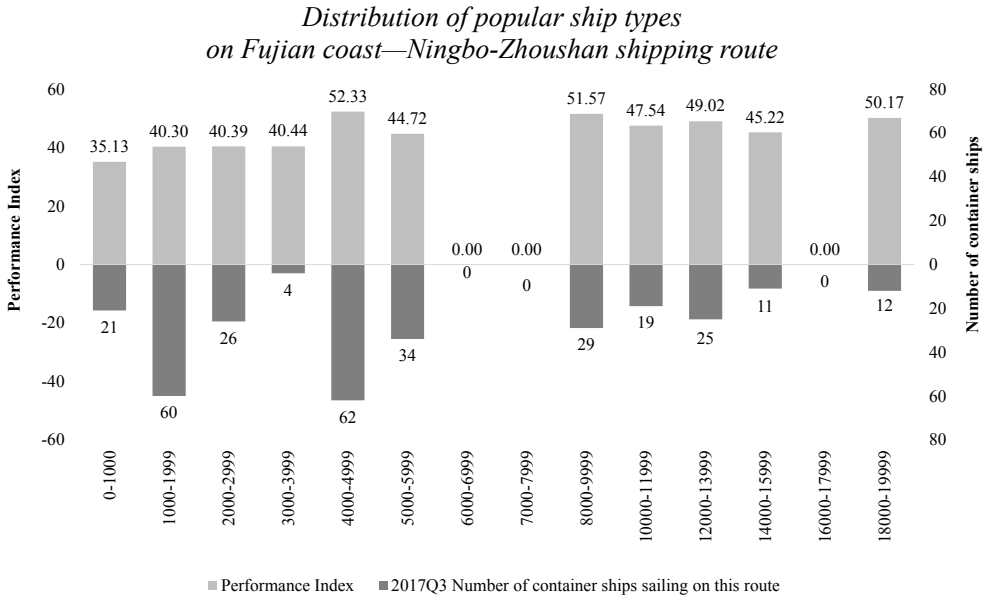
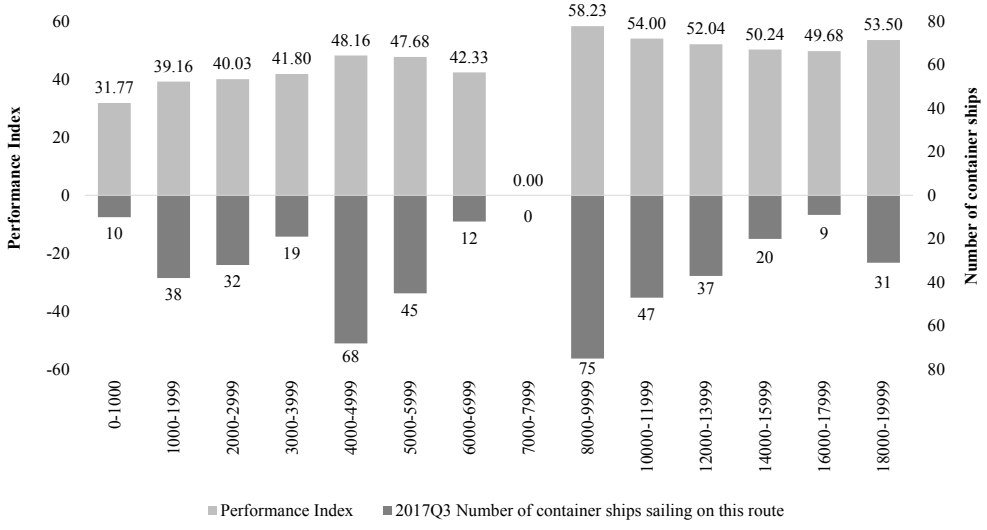


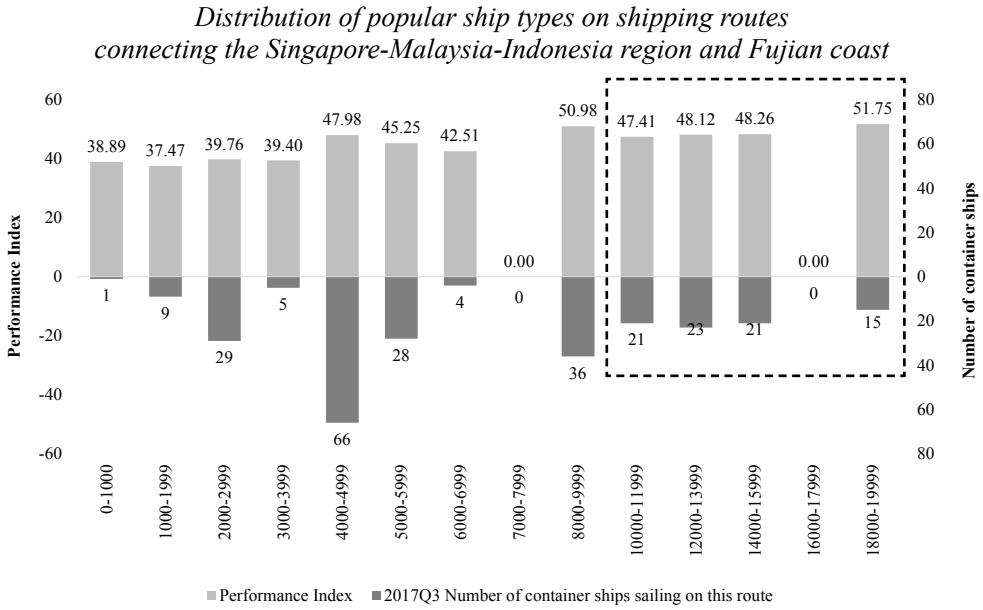
FIGURE 2 - SOURCE: SPBD-Lab, SISI



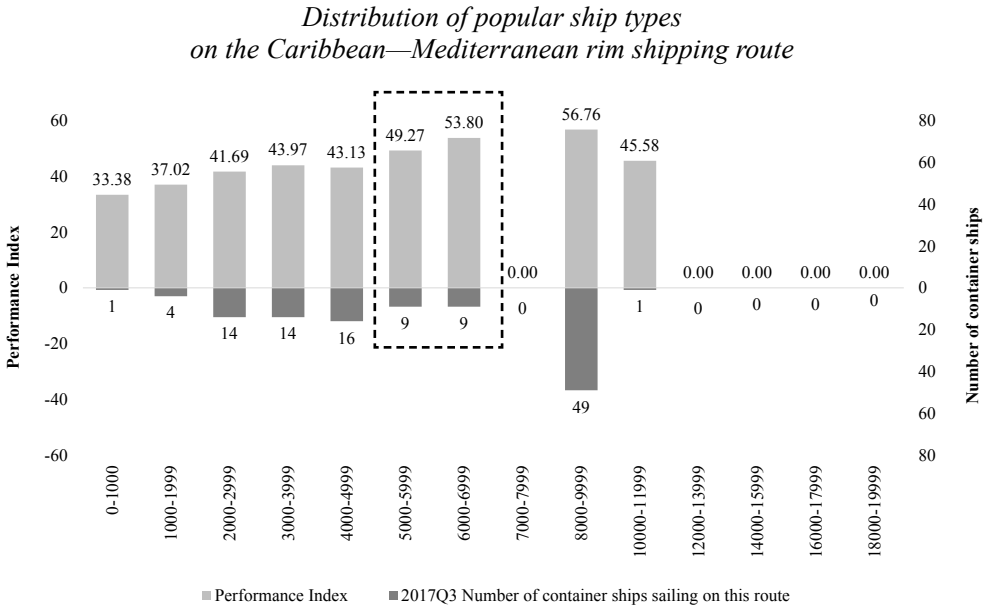
GRAPH 9 - SOURCE: Shipping & Port Big Data Laboratory



GRAPH 10 - SOURCE: SPBD-Lab, SISI



GRAPH 11 - SOURCE: SPBD-Lab, SISI



GRAPH 12 - SOURCE: SPBD-Lab, SISI

2.2 Popular ship types ranked by performance indicator

As shown in the performance indicator ranking of container ships, 2,000-2,999 TEU, 4,000-4,999 TEU, 6,000-6,999 TEU, 8,000-9,999 TEU, and 12,000-13,999 TEU ships deliver high performance. The following is the analysis on the three medium-sized ship types respectively – 4,000-4,999 TEU, 8,000-9,999 TEU and 12,000-13,999 TEU.

(1) 4,000-4,999 TEU container ships

Among 4,000-4,999 TEU container ships, those with remarkable performance are on the shipping routes from the Mexico Sea rim to some regions in China, including the coastal areas of Fujian, the Guangdong-Hong Kong-Macao region, Shanghai neighboring regions and Ningbo-Zhoushan Port. These shipping routes have limited numbers of container ships in operation, thus they are the "New Continent" yet to be explored. By comparison, shipping routes from the Guangdong-Hong Kong-Macao region to Ningbo-Zhoushan and the Fujian coast have sufficient shipping capacity in operation while maintaining high performance, ensuring a stable demand for 4,000-4,999 TEU container ships (Graph 13).

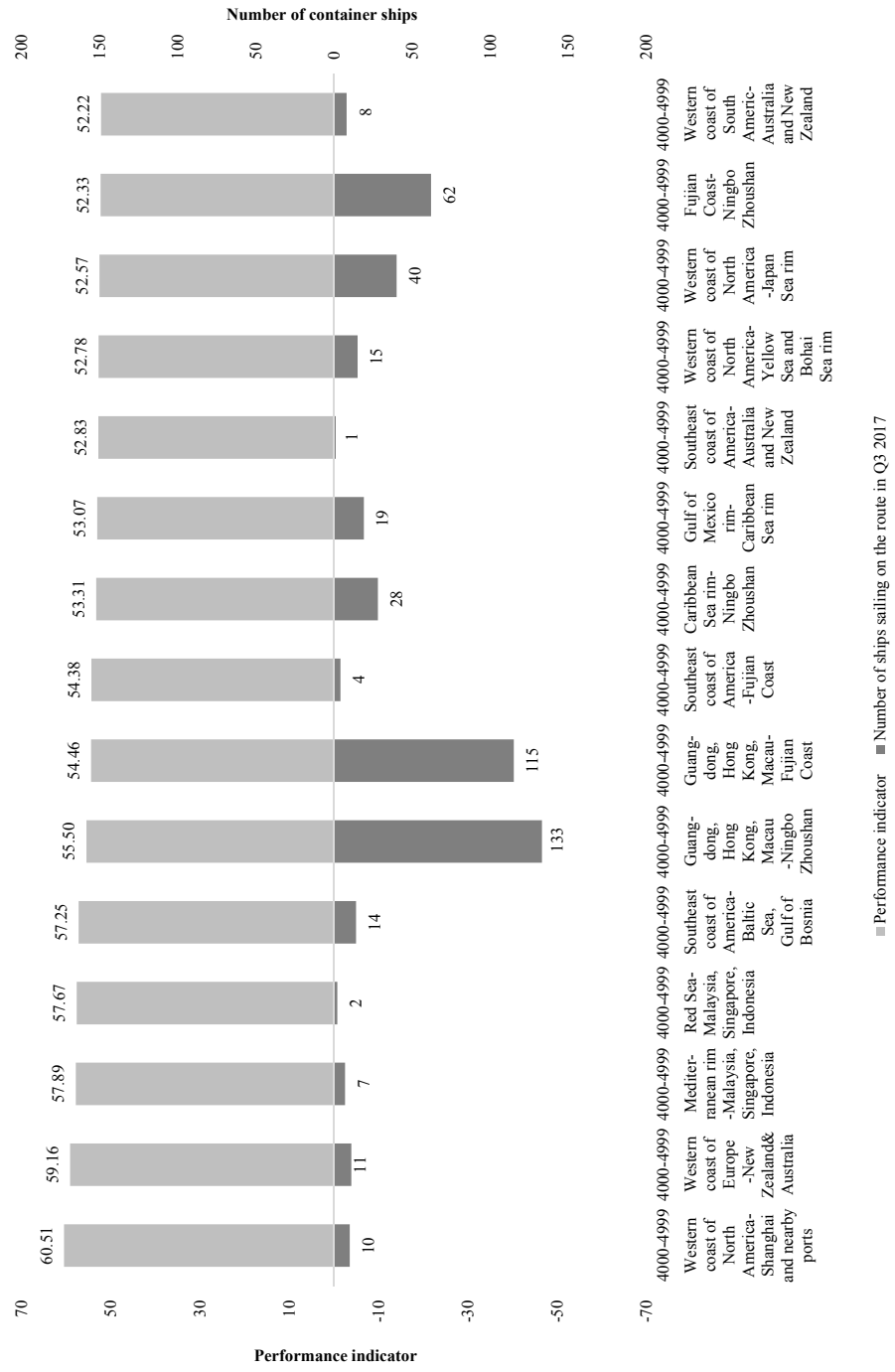
(2) 8,000-9,999 TEU container ships

8,000-9,999 TEU container ships record outstanding performance in the ship type performance ranking on all the shipping routes. In particular, the performance of the route originating from Ningbo Zhoushan area is leading, liner companies can give priority to placing such vessels on these routes. At the same time, shipping routes from the west coast of North America to the southeast coast of the US and the northwest coast of the South China Sea, and from the Caribbean Sea rim to the rim of the Yellow Sea and the Bohai Sea demonstrate high performance, but they have limited in-service shipping capacity. For this reason, 8,000-9,999 TEU container ships can be put into operation on these shipping routes (Graph 14).

(3) 12,000-13,999 TEU container ships

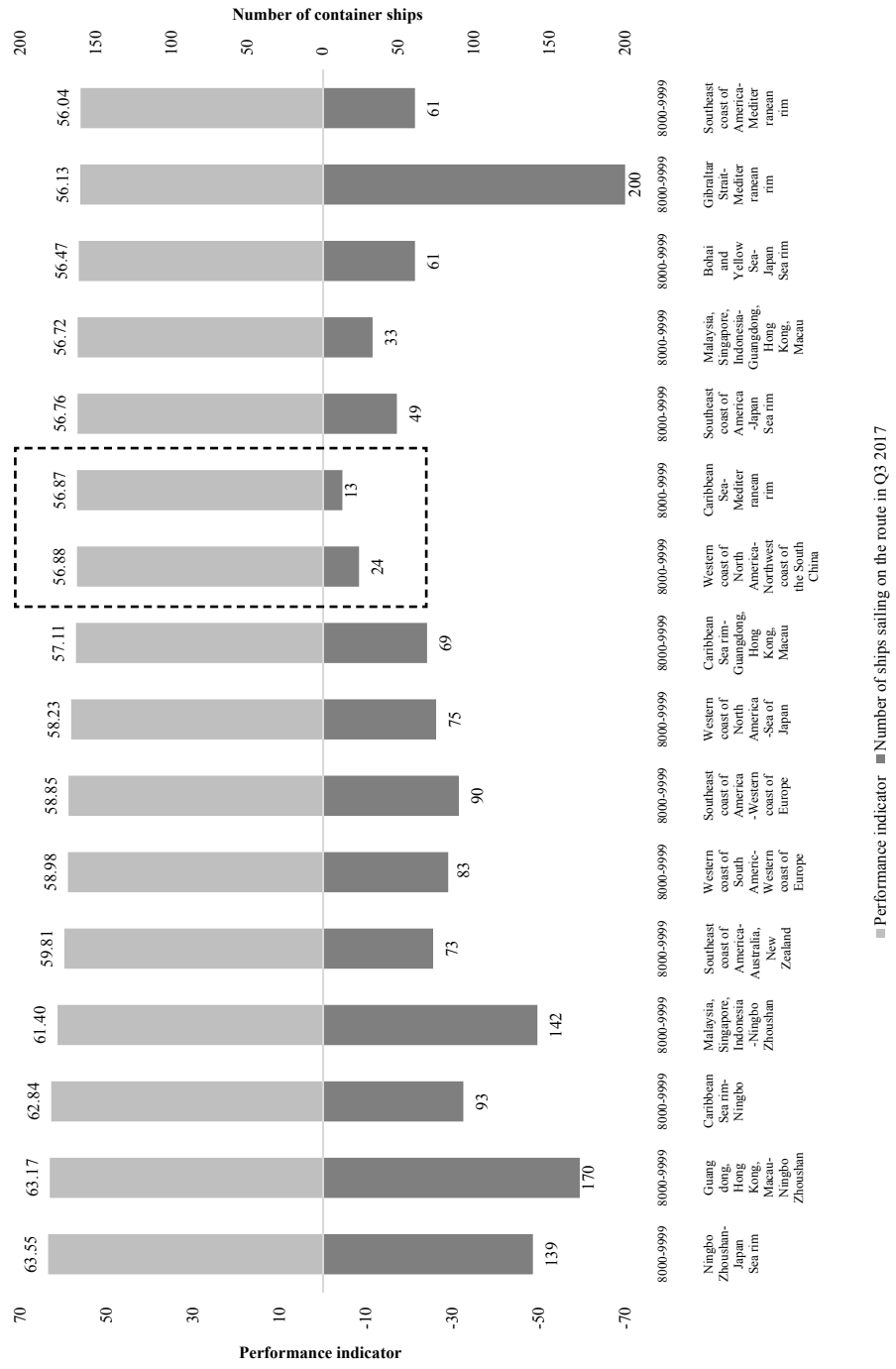
The navigation path map of global container shipping routes shows that ships of over 10,000 TEUs primarily sail on China-Europe routes, among which the shipping routes from Ningbo-Zhoushan to the Guangdong-Hong Kong-Macao region, the Singapore-Malaysia-Indonesia region, the Mediterranean rim and the Red Sea region are the highest performing ones. Specifically, ship owners are suggested to pay attention to shipping routes of Caribbean Sea rim—the Singapore-Malaysia-Indonesia region and the west coast of North America—the west coast of Europe, because this ship type is able to deliver high performance on shipping routes but with limited capacity in operation, a niche worth investment (Graph 15).

World's top 15 shipping routes in terms of performance indicator for 4,000-4999 TEU container ships



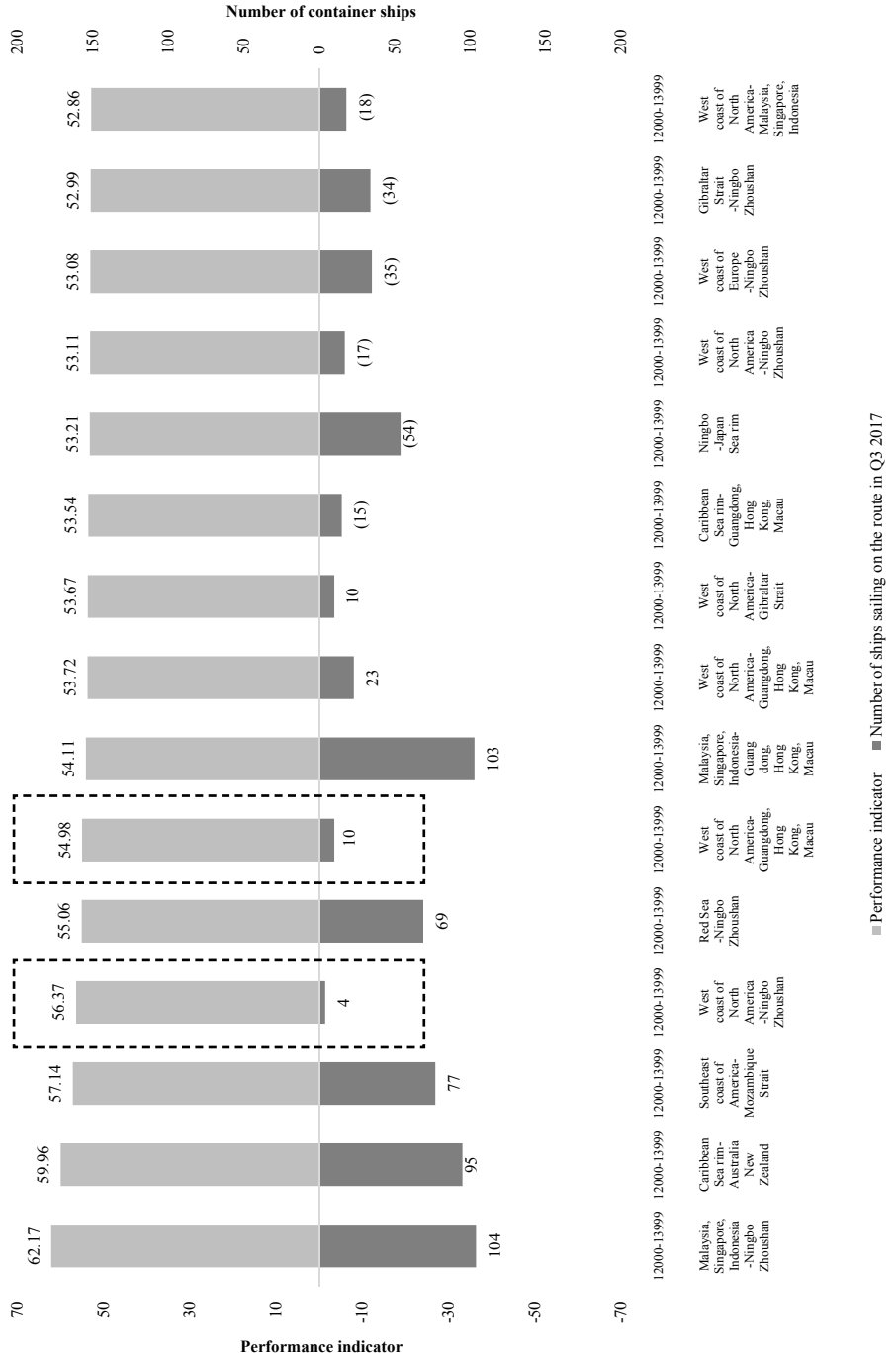
GRAPH 13 - SOURCE: SPBD-Lab, SISI

World's top 15 shipping routes in terms of performance indicator for 8,000-9,999 TEU container ships



GRAPH 14 - SOURCE: SPBD-Lab, SISI

World's top 15 shipping routes in terms of performance for 12,000-13,999 TEU container ships



GRAPH 15 - SOURCE: SPBD-Lab, SISI

2.3 Popular ship types on China's international shipping routes

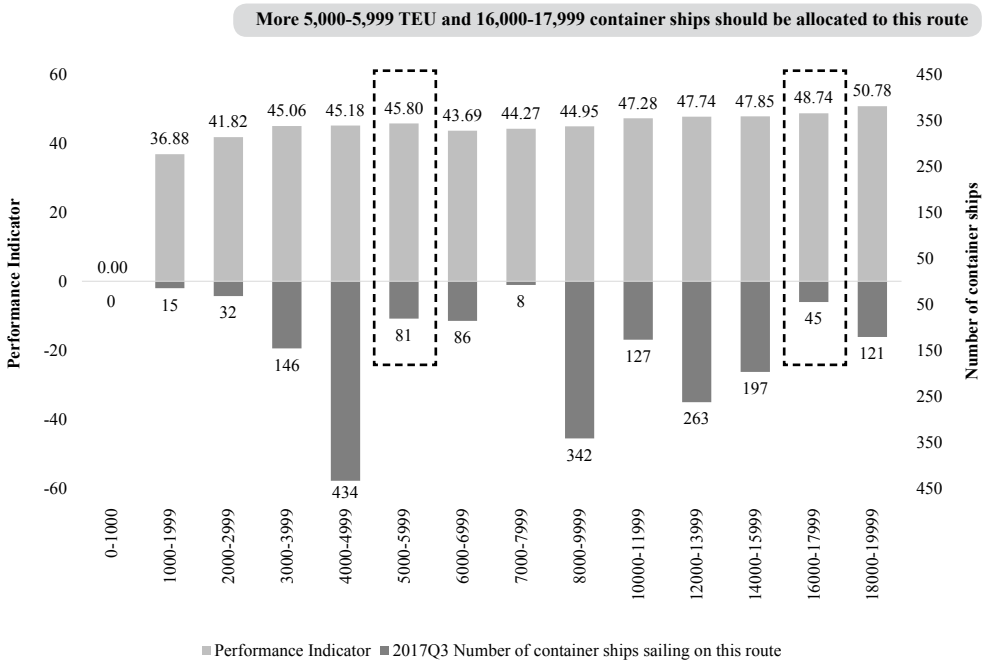
Comparing the margins of growth of shipping capacity on China-related shipping routes (Graph 4), we can see that shipping routes from the Fujian coast to Ningbo-Zhoushan Port, the Mediterranean Sea rim to Ningbo-Zhoushan Port, and Fujian coast to the rim of the Yellow Sea and the Bohai Sea demonstrate evident potential for growth. Among China's out-going shipping routes, container shipping routes to Australia, New Zealand and Africa witness the fastest growth in shipping capacity, a proof of the achievements of the 21st Century Maritime Silk Road.

China's top 26 international shipping routes in terms of shipping capacity growth

GRAPH 16 - SOURCE: SPBD-Lab, SISI

Analysis on popular ship types on China-Africa shipping routes shows that larger tonnage ships on this shipping line deliver higher performance. However, despite the high performance of 5,000-5,999 TEU and 16,000-17,999 TEU container ships, their capacity is limited. It is suggested that more such ships can be allocated to China-Africa routes.

Popular ship types on China-Africa shipping routes

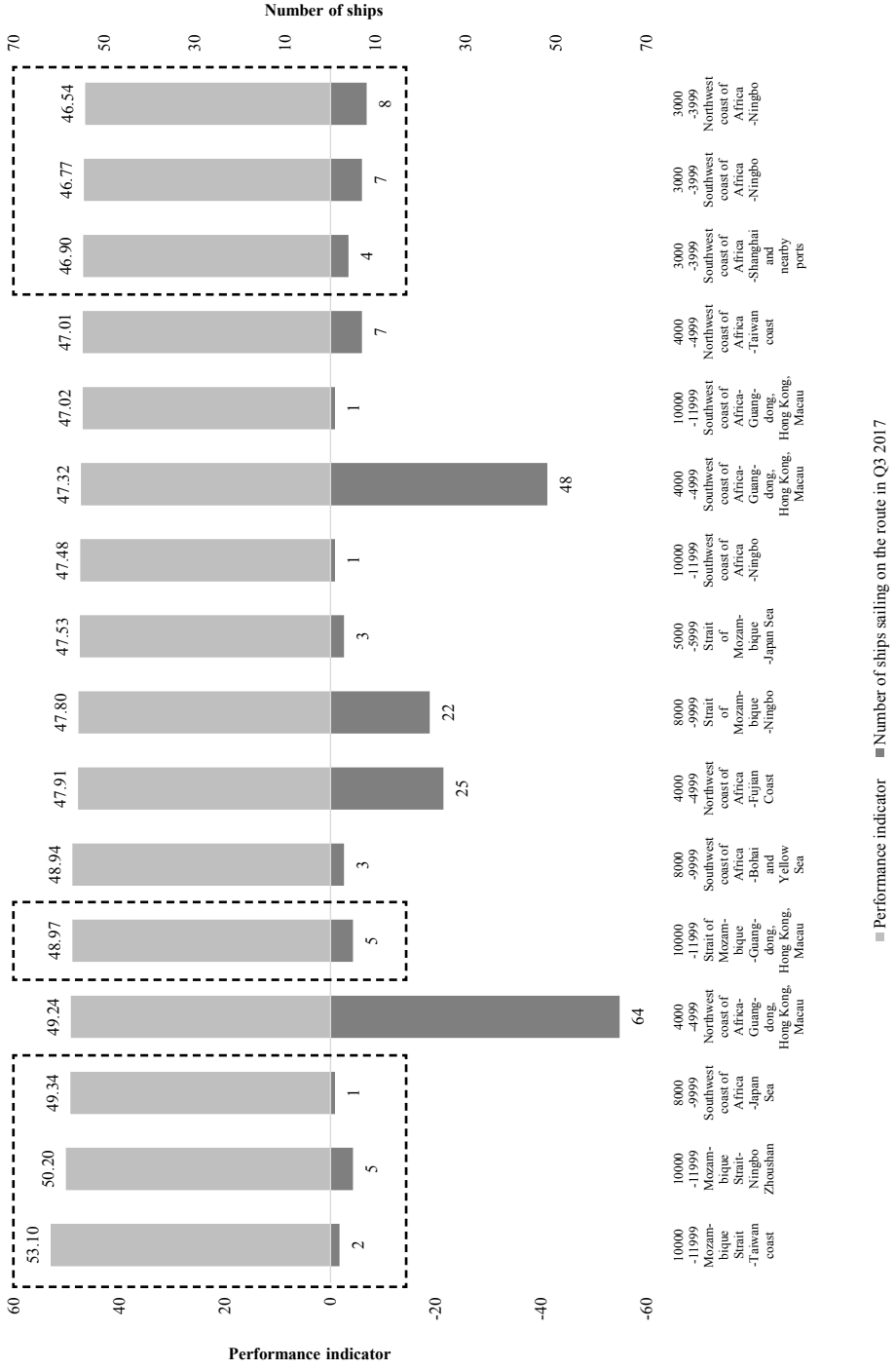


GRAPH 17 - SOURCE: SPBD-Lab, SISI

Shipping line-specific, we can find that the performance of ships on some shipping routes is not proportional to the available number of such ships. This points a direction worth ship owners' attention. More 18,000-19,999 TEU and 5,000-5,999 TEU ships can be allocated to shipping routes from Strait of Mozambique on the southeast coast of Africa and the Southwest coast of Africa to South China Ports, like Ningbo Zhoushan, Fujian Coastal Ports.

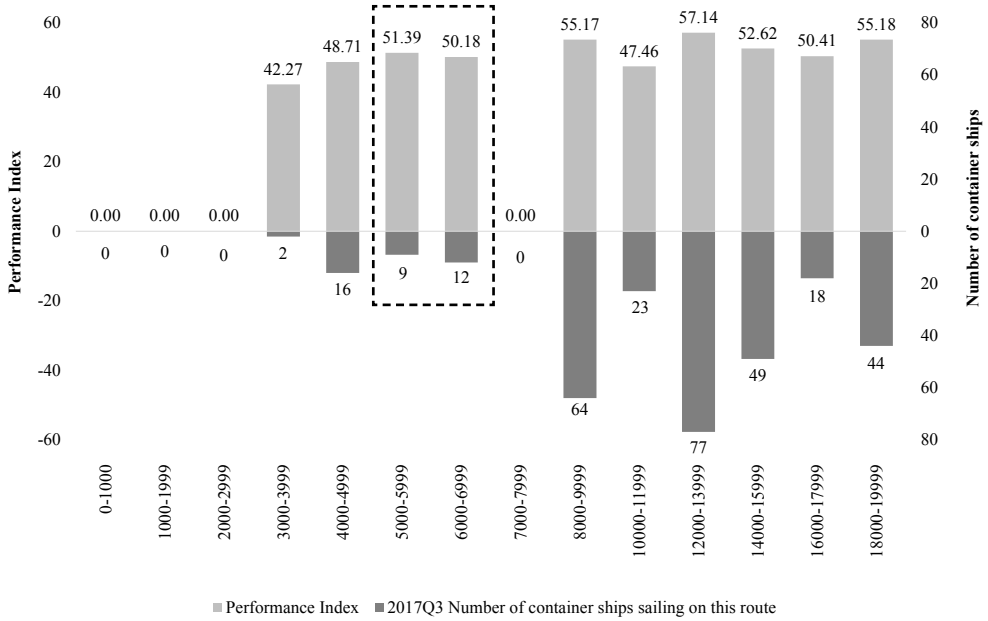
Graph 16 shows that the shipping capacity on the Ningbo-Zhoushan—Mediterranean Sea rim and Malaysia, Singapore, Indonesia shipping routes grew rapidly in recent years. The Malacca Strait is a must-access route from China to the Mediterranean Sea route, It can be considered that Ningbo-Zhoushan—Mediterranean Sea rim contributes a large part of shipping capacity of Ningbo Zhoushan- Malaysia, Singapore, Indonesia shipping routes. From the distribution of ship types on this route, we can see that 5,000-5,999 TEU and 6,000-6,999 TEU ships, though in small numbers, deliver sound performance, and hence ship owners are suggested to allocate more such ships to the shipping routes.

Performance indicators of different ship types on busy China-Africa shipping routes



GRAPH 18 - SOURCE: SPBD-Lab, SISI

Performance indicators of different ship types on busy shipping routes of Mediterranean Sea rim—Ningbo-Zhoushan rim



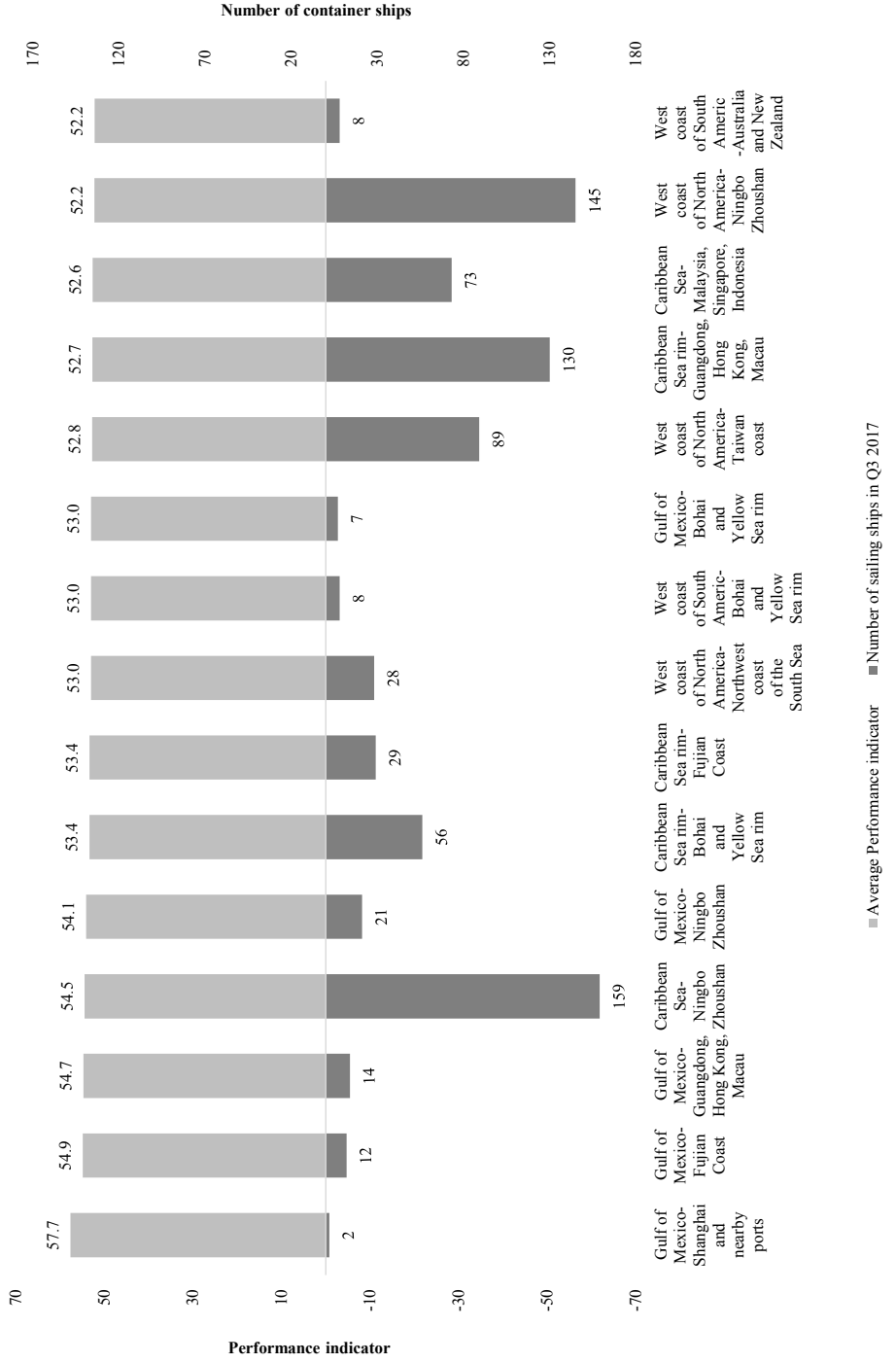
GRAPH 19 - SOURCE: SPBD-Lab, SISI

2.4 Popular ship types on pan-Pacific shipping routes

Graph 20 shows the performance of popular container ship types on pan-Pacific shipping routes. Among the Top 15 shipping routes, performance indicators of those from ports around the Gulf of Mexico to China-based ports (especially ports in south China) are generally high, followed by shipping routes from ports around the Caribbean Sea to ports in the Far East. The indicators of shipping routes from the west coast of North America and the west coast of South America to ports in the Far East come after the two. Meanwhile, we can also find that in the pan-Pacific market, shipping routes from Australia and New Zealand, the Singapore-Malaysia-Indonesia region, and Taiwan to the Americas are also booming, in addition to those from the Far East to the Americas.

In terms of the number of vessels, the in-service ships on shipping routes from ports around the Caribbean Sea to ports in the Far East are far more than those on shipping routes to/from the Gulf of Mexico. The pivotal status of the Panama Canal determines that most ships from the Far East to the Americas have to berth and load/unload cargoes at Caribbean ports. Therefore, the indicators of shipping routes from the Caribbean Sea rim and the Gulf of Mexico rim to the Far East are a key target of study for pan-Pacific shipping routes.

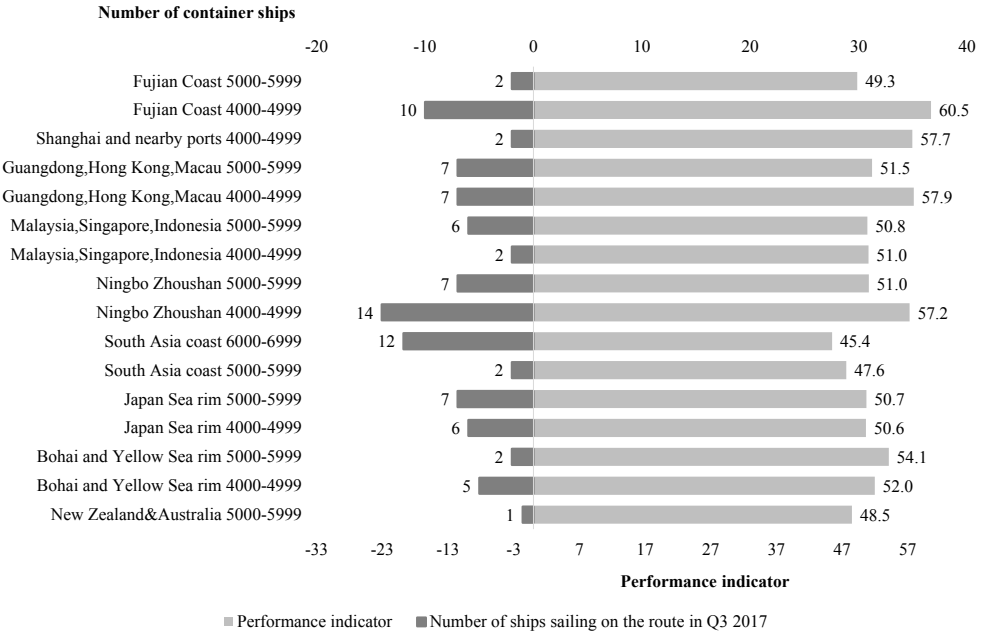
Top 15 Pan-Pacific shipping routes in terms of comprehensive performance indicator



GRAPH 20 - SOURCE: SPBD-Lab, SISI

Graph 21 illustrates the indicators of various ship types and shipping routes and the numbers of sailing ships on routes from the Gulf of Mexico rim to Asia. We can see that only 4,000 to 5,999 TEU ships sail on this route. On the shipping routes from the Gulf of Mexico rim to ports in north China (the Bohai Sea rim), the indicator for 5,000-5,999 TEU ships is higher than that of 4,000-4,999 TEU ships. On shipping routes from the Gulf of Mexico rim to ports in south China (the Pearl River Delta, the Guangdong-Hong Kong-Macao region, and the Singapore-Malaysia-Indonesia region), the indicator of 5,000-5,999 TEU ships also outperforms that of 4,000-4,999 TEU ships.

Indicators of various ship types and shipping routes and numbers of sailing ships on routes from the Gulf of Mexico rim to Asia

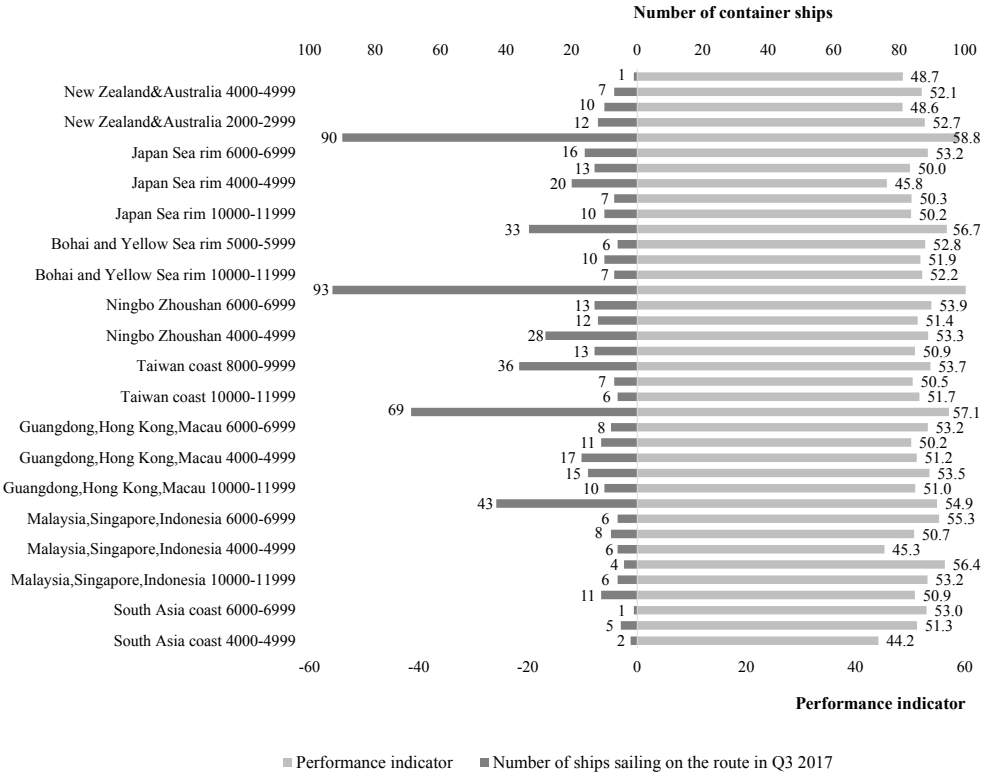


GRAPH 21 - SOURCE: SPBD-Lab, SISI

However, as shown in Graph 22, the numbers of ships on shipping routes from the Caribbean Sea rim to Asian ports are larger, with more ship types in operation. We can see that there are more 8,000-9,999 TEU ships which also deliver higher performance indicators.

Shipping routes from the Caribbean Sea rim to Australia and New Zealand employ limited numbers of container ships and all of the container ships are below 6,000 TEUs with a wide gap in performance. Shipping routes from the Caribbean Sea rim to the Japan Sea employ quite a few 4,000-4,999 TEU container ships, but they deliver low performance indicators. In fact, 4,000-4,999 TEU container ships sailing to ports in the Far East all suffer lower performance than other ship types.

Indicators, numbers of ships and shipping capacity of shipping routes from the Caribbean Sea rim to the Far East



GRAPH 22 - SOURCE: SPBD-Lab, SISI

NOTE

Shipping & Port Big Data Laboratory (SPBD-Lab) was co-founded by Shanghai Municipal Transportation Commission, Shanghai Municipal Education Commission, and Shanghai International Shipping Institute (SISI), and is affiliated to SISI. It has set up an experimental environment suitable for storage and analysis of big data in shipping & port area, and has studied and mastered the world-class key technologies and application schemes for shipping & port big data analysis. It provides value-added data services such as consulting, training, strategic planning, technical solutions, technology research and development, data analysis, and data visualization for the shipping & port industry.

Chapter IX

The Silk Road: current state of affairs, investments in infrastructure and opportunities of a great development project

1. From OBOR to BRI: the main features of the project

Many economists and researchers of geo-economics define the *One Belt One Road Initiative* (OBOR), recently renamed *Belt and Road Initiative* (BRI), as one of the most important investment projects in modern history. Before analysing its figures in detail, it is necessary to outline some features of the initiative. The BRI was launched in 2013 by President Xi Jinping during his visits to Asian countries. In Italy it is often known as 'the new Silk Road' and it entails a project of infrastructural development and integration via road and sea. According to the joint public announcement of the Chinese Ministry of Foreign Affairs and Ministry of Commerce named *Vision and Actions on Jointly Building Silk Road Economic Belt and 21st Century Maritime Silk Road* (28th March 2015): a) the land economic belt of the Silk Road aims at encompassing China, Central Asia, Russia and Europe (Baltic sea) by linking China with the Mediterranean Sea through Central and Western Asia and by connecting China with South Eastern and Southern Asia, as well as with the Indian Ocean; b) the maritime Silk Road was planned to connect the Chinese coastline with Europe through the South China Sea and the Indian Ocean and also to provide links between the Chinese coastline and the Southern Pacific through the South China Sea.

Therefore, the initiative entails two types of investment: the construction of land infrastructure (railways, roads, pipelines, gas pipelines) and maritime infrastructures to be improved and developed (ports and dry-port services).

Research conducted by the World Bank in 2015 estimated that $819 billion a year is necessary for infrastructure in developing countries, with the axis Europe-Asia covering more than 60% of such figure. This investment cannot possibly be made by multilateral development banks alone and requires the intervention of private investors which often come from other countries.

The BRI is a project promoted by China but it also directly involves 65 countries located in most of Asia, Europe and in some parts of Africa. In reality, the countries involved (both as investors and receivers of investments) are many more. The BRI is, broadly speaking, the project which aims to increase access routes of China to the rest of the world, and not only along the Silk Road (investments will be made also in Australia, Colombia, Sri Lanka, Zimbabwe, etc.).

According to the Belt and Road Portal, over the last 4 years more than 100 countries and international organisations have supported and participated in the BRI and the initiative has evolved from plan to reality – as of September 2017 China had already signed cooperation agreements with 74 countries and international organisations).

Many sources acknowledge that China already invested $60 billion (between 2013 and 2016) and that it is planning to invest a further $800 billion in the next five years. Some estimates forecast an overall investment amounting to $1,800 billion in ten years with the AIIB (Asian Infrastructure and Investment Bank[1]) as the main catalyst but the figures should be extended beyond the simple investments and comprise the possibility of stable growth offered to some economies of the BRI.

This chapter, after an analysis of the main economic data, focuses on the investments (expanding the analysis to those not comprised in the 65 countries identified) and then moves on to take into consideration foreign trade of these countries and their bilateral trade with Italy.

2. The economy of BRI countries

Before starting the economic analysis of the countries directly involved in the initiative, we report their subdivision according to geographic area as stated by the World Bank (Table 1).

The fact that the GDP of these countries (totalling about $25 trillion) represents almost 1/3 (31.1%) of the world GDP gives us an idea of the size of the project we are discussing in this chapter. It is estimated that all the regions comprised in the BRI will record high economic growth between 2018 and 2020. On the whole, they will grow by 5.3% over the next three years (compared with +3.7% of global growth). South Asia (which includes countries like India, Pakistan and Bangladesh) and East Asia (China and Mongolia) will grow by 7.5% and 6.3% respectively. South-East Asia (+5%), Central Asia (+4.1%), MENA (+3.1%) and Europe (2.6%) follow. Although the 65 countries represent a good part of the world economy, the respective populations still have a medium-low level of wealth: only the European and MENA countries are on par with the world average level (about $11,000 per capita per year).

If we move from economy to demography, the data are even more significant. The BRI involves 4.4 billion people (62.4% of the world's population) and is mainly concentrated in South Asia (India, Pakistan, Bangladesh, etc.), with almost 1.8 billion people; the East Asian region follows with 1.4 billion people. In addition, the population is growing at a high rate: in the last ten years there has been an overall increase of 13.1% for the 65 countries; in the MENA countries, in South Asia and in South-East Asia the highest growth percentages reach or exceed 20%.

[1] Cfr. SRM (2017). *Italian Maritime Economy. The Mediterranean as new key crossroads: outlooks, geomaps and Italy's role on the Silk Road. 4th Annual Report*. Naples: Giannini Editore.

The 65 countries directly involved in the Belt and Road Initiative

East Asia	South East Asia	Central Asia	MENA	South Asia	Europe
China	Brunei D.	Kazakhstan	Bahrain	Afghanistan	Albania
Mongolia	Cambodia	Kyrgyz Republic	Egypt	Bangladesh	Armenia
	Indonesia	Tajikistan	Iran	Bhutan	Azerbaijan
	Laos	Turkmenistan	Iraq	India	Belarus
	Malaysia	Uzbekistan	Israel	Maldives	Bosnia and H.
	Myanmar		Jordan	Nepal	Bulgaria
	Philippines		Kuwait	Pakistan	Croatia
	Singapore		Lebanon	Sri Lanka	Czech Republic
	Thailand		Oman		Estonia
	Timor-Leste		Qatar		Georgia
	Vietnam		Saudi Arabia		Hungary
			Palestine		Latvia
			Syria		Lithuania
			UAE		FYR Macedonia
			Yemen		Moldova
					Montenegro
					Poland
					Romania
					Russia
					Serbia
					Slovak Republic
					Slovenia
					Turkey
					Ukraine

TABLE 1 - SOURCE: SRM on China International Trade Institute, 2015

Some economic and demographic data of the Belt and Road Initiative (2017)

	BRI	East Asia	South East Asia	Central Asia	MENA	South Asia	Europe	World
GDP								
$ Bn	24,663	11,948	2,705	280	2,867	2,825	4,038	79,281
% of global GDP	31.1	15.1	3.4	0.4	3.6	3.6	5.1	100.0
% growth	5.4	6.8	5.0	4.5	1.7	6.7	3.2	3.6
% growth 2018-2020	5.3	6.3	5.0	4.1	3.1	7.5	2.6	3.7
$ per capita	5,361	8,572	4,233	3,968	9,042	1,599	9,731	10,752
Population								
million	4,602	1,394	639	70	318	1,766	415	7,374
% of global population	62.4	18.9	8.7	1.0	4.3	23.9	5.6	100.0
% growth (2005-2017)	13.1	6.4	16.7	20.7	22.9	19.1	0.8	15.1

TABLE 2 - SOURCE: SRM on IMF data

It is clear which of the 65 countries analysed have a greater economic dimension (higher GDP) and the best growth forecasts for the next three years (2018-2020). If we exclude China, India and Russia, which together account for 64.2% of the GDP of the 65 BRI countries, the remaining 8,800 billion of GDP (more than 10% of world GDP) are evenly distributed. Among the countries that have a high share of GDP and characterized by high growth estimates in the three-year period 2018-2020 (high performing country) we find Indonesia, Egypt, the Philippines, Malaysia, Bangladesh and Vietnam, all with annual growth rates of over 4%. If we stretch the point slightly we can include in this category Turkey, Poland, Thailand, Iran, UAE, Israel, Singapore, and Romania, with growth rates ranging between 2.5% and 4%. Then there are countries that have very high growth estimates, but still low shares of GDP ('question marks'). Bhutan and Yemen fall into this category, with percentages respectively higher and close to 10% per year in the three-year period; finally, Myanmar (+7.5%), Cambodia (+6.7%), Brunei (+6.1%) and Uzbekistan (+6%) also deserve a mention. Some countries are in a middle ground: they have a slightly higher economic dimension and growth rates close to 4% (Slovakia, Kuwait and Ukraine). Countries with the lowest levels of growth and GDP are Belarus, Bahrain, Slovenia, Lebanon, Azerbaijan.

GDP and economic growth in some BRI countries

	GDP ($bn)	% growth (2018-2020)		GDP ($bn)	% growth (2018-2020)
Question marks			High performing countries		
Bhutan	2.3	11.1	Bangladesh	250.0	7.0
Yemen	25.7	9.8	Philippines	321.2	6.8
Myanmar	67.0	7.5	Vietnam	216.0	6.2
Cambodia	22.3	6.7	Indonesia	1010.9	5.4
Brunei Darussalam	12.0	6.1	Egypt	332.0	5.2
Uzbekistan	67.5	6.0	Malaysia	309.9	4.8
Low-Medium performing countries			Medium-high performing countries		
Kuwait	118.3	3.8	Islamic Republic of Iran	427.7	3.9
Slovak Republic	95.0	3.7	Romania	204.9	3.8
Ukraine	104.1	3.5	Turkey	841.2	3.5
			Thailand	437.8	3.3
Low performing countries			United Arab Emirates	378.7	3.2
Lebanon	52.7	2.3	Israel	348.0	3.1
Azerbaijan	39.2	2.3	Poland	510.0	3.1
Slovenia	48.1	2.1			
Bahrain	33.9	1.9			
Belarus	52.8	1.0			

TABLE 3 - SOURCE: SRM on IMF data

Many of the BRI countries have populations that exceed 50 million and per capita incomes below the global average. These are therefore countries with great potential for development.

There are few BRI countries that can be classified in the *big population / big income* category: only Saudi Arabia with per capita income of over 20 thousand dollars and a population of 32 million. Poland and Turkey follow, with per capita income levels slightly higher than normal, and populations of 38 and 81 million respectively. Then, there is a list of countries characterized by successful per capita income but a low population level. In this case we find some countries belonging to the Gulf Cooperation Council (GCC) such as Kuwait, Bahrain and Oman, some Eastern and Northern European countries such as Slovenia and Estonia, and finally the Sultanate of Brunei. The characteristic "high population-low per capita income" (below the threshold of 10,000 dollars a year) can be found in Iran (81 million) and Thailand (69 million), with GDP per capita of respectively $5,200 and $6,300 a year, but also in Egypt (92 million), the Philippines (106 million), Bangladesh (163 million), Ukraine (42 million), Pakistan (197 million), Myanmar (53 million). Finally, some countries such as Belarus, Tajikistan, Kyrgyz and Timor-Leste present very low per capita income and population.

Population and GDP per capita in some BRI countries (2017)

	Population (m)	GDP per capita ($)		Population (m)	GDP per capita ($)
Small population / High income			Big population / High income		
Brunei Darussalam	0.4	27,893	Poland	38.0	13,429
Kuwait	4.3	27,237	Turkey	80.6	10,434
Bahrain	1.3	25,170			
Slovenia	2.1	23,277			
Estonia	1.3	19,618			
Oman	4.1	17,406			
Small population / Low income			Big population / Low income		
Belarus	9.5	5,585	Thailand	69.1	6,336
Timor-Leste	1.2	2,190	Islamic Republic of Iran	81.4	5,252
Kyrgyz Republic	6.2	1,140	Egypt	92.3	3,685
Tajikistan	8.8	819	Philippines	106.3	3,022
			Ukraine	42.3	2,459
			Bangladesh	163.2	1,532
			Pakistan	197.3	1,441
			Myanmar	52.6	1,272

TABLE 4 - SOURCE: SRM on IMF data

3. FDIs IN BRI COUNTRIES: THE FIGURES

When discussing the topic of investments, Foreign Direct Investments (FDIs) are one of the main variables playing a key role and providing a clear idea of a country's attractiveness to foreign investors. Over the last few years FDIs have grown in many countries of the BRI. In particular, in some countries these investments continue to grow despite the fact that the FDI stock has already reached high levels (High performing

country). For instance, in Vietnam, Philippines, UAE and Israel FDI stocks exceeded $110 billion in 2016, showing an average annual increase of more than 10% in the period 2010-2016. It is also possible to consider Kazakhstan as a member of this category. In some other countries FDIs grew significantly (by more than 20% annually between 2010 and 2016) but the FDI stock is still low. Therefore, in terms of attractiveness, the following countries represent a sort of question mark: Cambodia and Bhutan (with average annual increases of about 35%), Nepal, Mongolia, Azerbaijan, Turkmenistan, Maldives and Kyrgyzstan (with growth percentages between 20% and 30%). Bangladesh can also be considered part of this group (+15.9%). Egypt and Thailand, despite significant FDI stocks (approximately $190 billion for Thailand), show growth rates in the last few years that are not very marked. On the other hand, Poland, Turkey, Hungary and Romania have medium-high FDI stocks but their annual growth in the period 2010-2016 was nil or negative. Finally, there are some countries where the FDI stock is low and has not increased over the last few years: Croatia, Lithuania, Bosnia and Herzegovina, Macedonia and Syria.

FDI stock and percentage growth in some BRI countries (2016)

	$bn	% growth average (2010-2016)		$bn	% growth average (2010-2016)
Question marks			High performing countries		
Bhutan	0.2	36.2	Vietnam	115.4	13.0
Cambodia	16.7	35.2	Philippines	64.2	12.4
Nepal	0.7	31.0	United Arab Emirates	117.9	11.5
Mongolia	13.0	30.1	Israel	112.7	10.5
Azerbaijan	26.7	21.0	Kazakhstan	129.8	9.4
Turkmenistan	36.2	20.7			
Kyrgyzstan	5.1	20.5			
Maldives	3.2	20.3			
Bangladesh	14.5	15.9			
Low performing countries			Medium-high performing countries		
Syrian Arab Republic	10.7	3.6	Thailand	188.7	8.9
TFYR of Macedonia	5.0	1.8	Egypt	102.3	6.4
Lithuania	13.8	0.9	Low-Medium performing countries		
Bosnia and H.	6.8	0.1	Poland	185.9	2.3
Croatia	27.6	-2.3	Turkey	132.9	1.8
			Romania	71.8	0.6
			Hungary	77.7	-2.8

TABLE 5 - SOURCE: SRM on Unctad data

In general, high per capita FDIs are an indicator of high attractiveness of a certain country, therefore considered as a ‘hub’ for investments. When evaluating the quality of per capita FDIs, it is also necessary to take into consideration the dynamic in order to check whether the country is able to maintain its high level of activity.

In contrast, a stagnant low level of per capita FDI also indicates low attractiveness, while a growing one represents an index of potential attractiveness. Amongst the countries with the highest levels of per capita FDIs and with a higher dynamic of increase we find Bahrain, Israel and UAE, with FDIs higher than $10,000 per capita (more than 50% increase in the period 2009-2016). Levels of slightly lower but significantly growing per capita FDIs are found in Maldives and Turkmenistan. Amongst the countries with a high potential of attractiveness we find Kyrgyzstan, Nepal, Cambodia, Mongolia and Philippines, all showing an increase of more than 100% between 2009 and 2016 but with levels of per capita FDIs still lower than $5,000. Some other countries have high levels of per capita FDIs but show stagnancy in their attractiveness: Estonia, Qatar, Lebanon show figures higher than $10,000 per capita but low or negative growth rates. In Brunei, growth rates are within the average range. Countries characterized by low attractiveness are Yemen, Turkey, Oman, Kuwait and Bosnia and Herzegovina (low per capita FDIs and low growth rates).

Stock of per capita FDIs and percentage growth of some BRI countries

	$	% growth (2009-2016)		$	% growth (2009-2016)
Countries with high potential in attractiveness			Countries with high potential in attractiveness		
Mongolia	4,318	308.6	Turkmenistan	6,664	238.2
Nepal	23	293.9	Maldives	8,695	216.5
Kyrgyzstan	846	218.4	United Arab Emirates	12,727	78.1
Cambodia	1,052	208.8	Israel	13,757	77.6
Philippines	628	151.1	Bahrain	20,480	63.4
Countries with low attractiveness			Countries with stagnant attractiveness		
Kuwait	3,559	0.2	Brunei Darussalam	13,382	47.5
Bosnia and Herzegovina	1,801	-0.4	Estonia	14,661	23.7
Turkey	1,669	-17.6	Lebanon	10,190	5.0
Oman	3,985	-19.9	Qatar	14,813	-9.0
Yemen	104	-48.7			

TABLE 6 - SOURCE: SRM on Unctad data

4. FOREIGN TRADE

The Belt and Road Initiative countries already represent an important part of world trade and, with the implementation of new infrastructure projects, they are destined to further increase their role. Currently, with almost $11 trillion, they account for about a third of international trade. A significant part belongs to East Asia (and therefore mainly to China) which reaches $3.7 trillion of foreign trade; also important are the shares of foreign trade represented of European countries ($2.5 trillion), South East Asia ($2.2 trillion) and MENA area ($1.5 trillion). By comparing the value of foreign trade to the size of the corresponding economies (trade/GDP ratio), we observe an international openness (43.9%) in line with the world average (40%), but particularly developed in

Southeast Asian countries, in European countries and in those belonging to the MENA area. Over the last few years (period 2010-2016), the commercial exchange of BRI countries increased by 40.1%, a higher value than the one recorded globally (26.9%). Growth rates are very high in East Asia (+67%), in South Asia (+45.7%) and South East Asia (+43.5%). Overall, BRI countries have a trade balance surplus (exports exceed imports in value), thanks mainly to the contribution of East Asia (and therefore China) which has a high trade surplus.

Some figures on foreign trade in the Belt and Road Initiative

	BRI	East Asia	South East Asia	Central Asia	MENA	South Asia	Europe	World
Total Trade								
$bn	10,820	3,694	2,208	112	1,511	814	2,482	31,963
% of GDP	43.9	30.9	81.6	40.0	52.7	28.8	61.5	40.3
% of global Trade	33.9	11.6	6.9	0.4	4.7	2.5	7.8	100.0
% growth (2010-2016)	40.1	67.0	43.5	0.5	16.6	45.7	23.6	26.9
Import-Export								
Import ($bn)	5,133	1,591	1,072	52	710	486	1,222	16,023
Export ($bn)	5,687	2,103	1,136	60	801	328	1,260	15,940
Trade Balance ($bn)	554	511	64	8	92	-159	37	-82

TABLE 7 - SOURCE: SRM on Unctad data

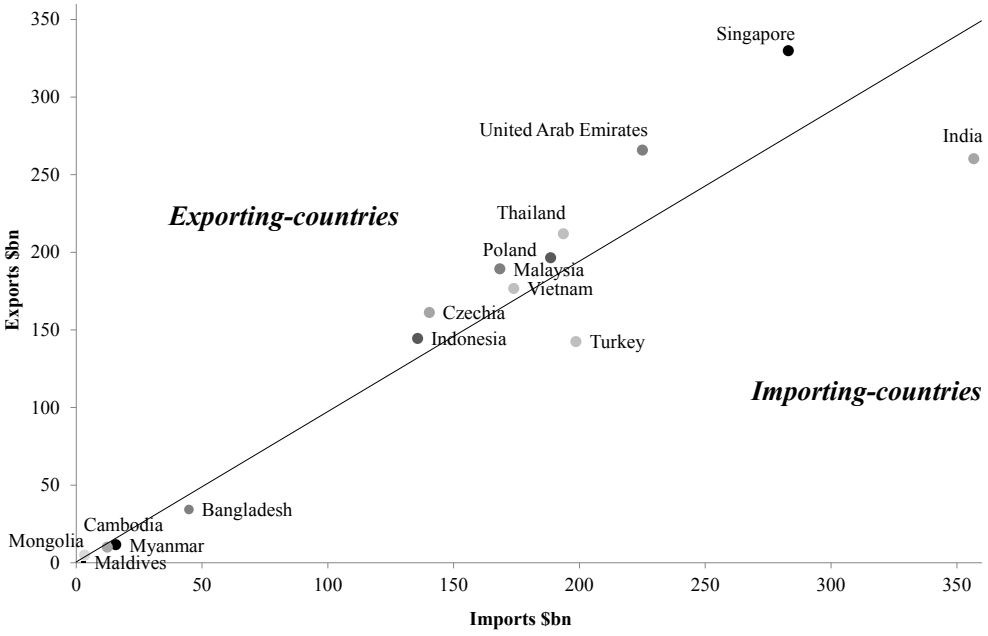
Within the BRI, excluding China, some countries stand out because of their high share of foreign trade and high growth rates (high performing countries): Vietnam, India, UAE, Thailand, Poland, Malaysia, Turkey, Czech Republic and Indonesia, all have exchange values higher than $250 billion and growth rates higher than 20% (2009-2016). Singapore can also be considered part of this group thanks to its 19% growth rate. Myanmar, Cambodia, Bangladesh, Maldives and Mongolia are considered 'question marks' (significant growth of foreign trade but still low values), since their foreign trade grew by more than 100% between 2009 and 2016 but is still lower than $80 billion per year. Saudi Arabia is the only country that shows high levels of import-export (mainly thanks to exports of energy products) but low growth rates. Many countries show low levels of exchange within average growth rates (lower than 50% on 2009) while others show very low or negative growth rates and low values of foreign trade (Yemen, Brunei, Azerbaijan, Kazakhstan, Bahrein, Montenegro). If we focus only on the 15 countries hereby indicated as 'High performing countries' and 'question marks', it is interesting to notice whether they are more inclined to export or import goods. Therefore, amongst exporter countries we find Singapore and the UAE with trade surpluses higher than $40 billion, but also Thailand, Turkey, Malaysia, Czech Republic and Indonesia with a surplus lower than $25 billion. Finally, amongst importer countries we find only one of the 'question marks': Mongolia. The main importer countries with remarkable trade deficits are India ($100 billion), Turkey ($56 billion), Bangladesh, Myanmar, Cambodia, Maldives (less than $11 billion).

Trade exchange in some BRI countries

	$bn	% growth (2009-2016)		$bn	% growth (2009-2016)
Question marks			High performing countries		
Myanmar	27.4	148.1	Viet Nam	350.6	175.9
Cambodia	22.4	123.8	United Arab Emirates	490.9	44.8
Maldives	2.4	110.0	Thailand	405.5	41.7
Mongolia	8.3	104.7	Turkey	341.1	40.3
Bangladesh	79.1	103.9	India	617.0	39.2
			Czechia	301.6	38.5
			Poland	385.0	34.5
			Indonesia	280.1	31.3
			Malaysia	357.8	27.4
			Singapore	612.9	18.9
Low performing countries			High trade / low growth		
Bahrain	21.6	-1.7	Saudi Arabia	307.9	8.3
Montenegro	2.6	-3.1			
Kazakhstan	62.0	-13.5			
Brunei Darussalam	7.9	-18.2			
Azerbaijan	21.7	-20.3			
Yemen	7.8	-49.7			

TABLE 8 - SOURCE: SRM on Unctad data

Exporter and importer country: an analysis of some countries of the BRI (2016)



GRAPH 1 - SOURCE: SRM on Unctad data

5. The role of Italy: bilateral trade with BRI countries

Italy has good commercial relations with the BRI countries, especially with its European counterparts. In total, almost 40% of Italian foreign trade is carried out with these countries, in particular 22.3% with the European area, 6.8% with East Asia and 4.8% with countries of the MENA area. In total, in 2017 we estimate that the commercial exchange of Italy with the BRI countries will reach almost $280 billion (more than half with European countries). At aggregate level, Italy is in a trade deficit (imports exceed exports by about $20 billion), in particular, there is a deficit with all areas except the MENA area. If, on the other hand, we change the point of view and analyse the role that Italy has in the foreign trade of the BRI countries, we observe that Italy manages to cover 2.6% of their commercial exchange, a percentage higher than 2.2% covered by Italy in the global foreign trade.

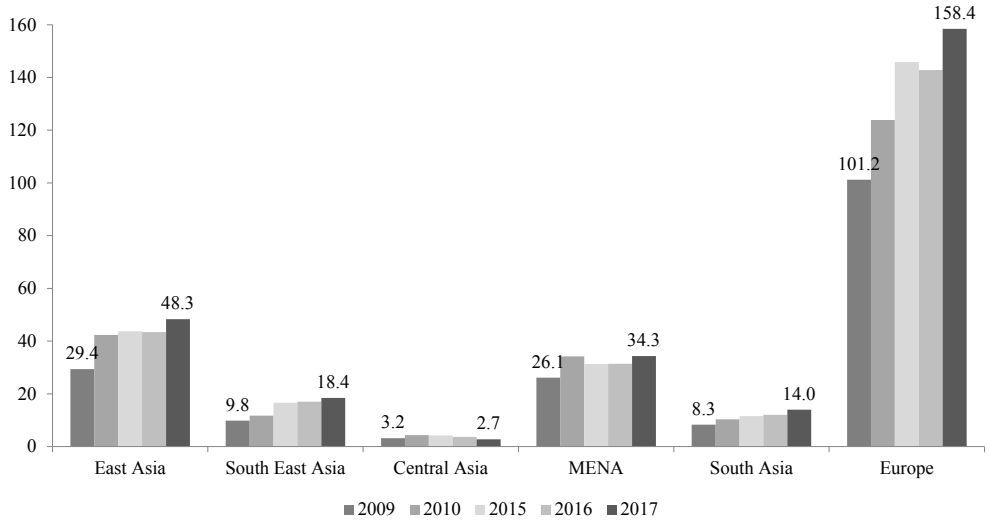
Trade exchange between Italy and all the BRI countries

	BRI	East Asia	South East Asia	Central Asia	MENA	South Asia	Europe	World
Values and shares								
Imports from	148.1	33.4	9.6	1.7	13.5	8.5	81.3	337.1
Export to	128.1	14.9	8.8	1.0	20.8	5.5	77.1	373.6
Trade with	276.3	48.3	18.4	2.7	34.3	14.0	158.4	710.7
% of Italy's trade with BRI	100.0	17.5	6.7	1.0	12.4	5.1	57.4	
% of Italy's total	38.9	6.8	2.6	0.4	4.8	2.0	22.3	100.0
% of partner area's total	2.6	1.3	0.8	2.5	2.3	1.7	6.4	2.2
Balance Trade	-20.0	-18.5	-0.8	-0.7	7.3	-3.1	-4.2	36.6
% growth								
Trade growth (2009-2017)	55.2	64.7	87.6	-13.4	31.2	68.3	56.6	6.7
Exports growth (2009-2017)	53.4	99.0	82.2	-34.9	23.7	35.6	58.0	13.4

Table 9 - Source: SRM on Istat data

Even more interesting is the dynamics of foreign trade and Italian exports in the period from the crisis of 2009 to 2017. Foreign trade increased by 55.2% (+6.7% recorded in the total Italian foreign trade) and exports rose by 53.4% (+13.4% in total Italian exports). With the exception of Central Asia, foreign trade and Italian exports have grown in all BRI areas, with more marked increases in absolute terms for trade with European and East Asian countries (China).

Trade exchange between Italy and the BRI countries: dynamic 2009-2017 (billion $ [*])



[*] Exchange rate 2017.

GRAPH 2 - SOURCE: SRM on Istat data

A closer look at 2017 estimates reveals that the countries with which Italy has solid commercial bases and growing relations are Turkey, Romania, Czech Republic, Bulgaria, Hungary, Slovakia, Serbia and Vietnam: trade exchange exceeds $3.5 billion and growth in the period 2009-2017 was higher than 70% (average exchange Italy-BRI). Obviously, Italy has the most significant bilateral exchange values with China ($42.7 billion in 2017, +64.5% on 2009), Poland ($22.3 billion, +53%) and Russia ($20.4 billion, +9.8%). Remarkable increases were recorded in the Italian foreign trade with Bangladesh and Kuwait (in both cases, values higher than $2 billion in 2017, more than tripled compared to 2009). Interesting figures also emerge with regards to Lebanon, Lithuania and Albania, with trade exchange higher than $1 billion and growth rates 2009-2017 higher than 70%. Mongolia, Kirghizstan, Bhutan, Latvia, Philippines and Estonia show uncertain trends as they all have growth rates 2009-2017 higher than 100% (trade with these countries has more than doubled) but they still have values lower than $1 billion. Amongst the countries with which Italy already has solid trade bases (more than $3.5 billion in 2017), growth rates are all positive and higher than 10% even though in some cases these do not reach the average 70% (i.e. Slovenia, UAE, Egypt, Azerbaijan, Croatia, Iran). Finally, there is a group of countries with which exchanges are low and have further decreased or remained stable in the period 2009-2017: Montenegro, Belarus, Kazakhstan, Yemen, Afghanistan and Syria.

Trade exchange between Italy and some BRI countries

Growing partners (Italy-country trade > $3.5bn)	$bn	% growth (2009-2017)	Growing partners (Italy-country trade < $1.0bn)	$m	% growth (2009-2017)
Vietnam	4	238.9	Mongolia	85	213.2
Serbia	3.5	120.3	Kirghizistan	24	207.6
Repubblica Ceca	12.4	96.4	Bhutan	5	160.2
Bulgaria	4.6	94.5	Lettonia	587	114.9
Slovacchia	7.2	90.2	Filippine	927	111.4
Turchia	18.1	80	Estonia	564	100.6
Ungheria	9.9	79.7			
Romania	13.6	71			
Cina	42.7	64.5			
Polonia	22.3	53			
Slovenia	7	51.5			
Emirati Arabi Uniti	6.2	50			
Azerbaigian	4.8	38.1			
Croazia	4.6	27.4			
Egitto	5	23.1			
Iran	4.6	15.8			
Russia	20.4	9.8			
Other best growing partners (Italy-country trade < $3.5bn)	**$bn**	**% growth (2009-2017)**	**Declining partners**	**$m**	**% growth (2009-2017)**
Bangladesh	2.1	244	Montenegro	170	2.5
Kuwait	2.4	241	Bielorussia	430	-2.8
Libano	1.6	100.4	Kazakhstan	1.922	-22.8
Lituania	1.3	98.8	Yemen	71	-40.9
Albania	2.3	82.5	Afghanistan	18	-49.3
			Siria	95	-91.6

TABLE 10 - SOURCE: SRM on Istat data

6. FOCUS: INFRASTRUCTURE INVESTMENTS ALONG THE BRI IN THE WORLD

The Belt and Road Initiative (BRI) is based on five pillars: political harmonization, infrastructure connectivity, trade and investments, financial integration and cultural exchanges.

This section will mainly address the third pillar, in particular the infrastructure investments on which Beijing and its partners have bet in order to increase trade flows. These are ports, airports, long-distance and high-speed rail lines, motorways, but also investments in finance, banking, energy, real estate, businesses and companies. If we break down the BRI by geographical area, a great absentee stands out: the Americas. The Trump presidency in the United States, anticipated by a strongly anti-Chinese electoral campaign, saw Washington introduce neo-isolationist positions, such as withdrawing from the Trans-Pacific Partnership (TPP) launched by Obama to boost trade in the Pacific.

Geographical distances do not help either. China has therefore decided to focus on countries that are close or easily accessible by land and sea.

6.1 China

It is impossible to analyse BRI infrastructure without beginning with China. Xi Jinping's presidency has been the creator and first sponsor of the New Silk Road and if in the past it was said that all roads lead to Rome we can state that within the BRI all roads (railways and sea routes) lead to Beijing or to the great industrial centres of the nation.

In December 2016 the Chinese government invested CN¥ 3.5 trillion in the railway sector in projects to be completed by 2020 aiming to connect 80% of the nation's cities with more than 200,000 people. This expansion would take the total distance of the national network to 150,000 kilometres. Pricewaterhouse Coopers has estimated an increase in infrastructure investments in that year amounting to 14.5%[2]. From China there are five major railway routes that many investments have concentrated on: 1) the Sino-Pakistani corridor, to reach the port of Gwadar; 2) the China-Burma-Bangladesh-India corridor, to connect Southeast Asia to the subcontinent; 3) the China-Indochinese peninsula corridor, which connects the hinterland with Singapore; 4) the new Eurasian land bridge, which starts from western China, crosses Kazakhstan and ends in Russia, where it joins with the rails arriving to Europe; 5) the China - Central Asia - Western Asia corridor, which reaches Turkey, and finally the China-Mongolia-Russia corridor, which crosses the steppes to reach the eastern part of the largest nation in the world.

Beijing strongly focuses on railways and wants to improve its internal network. For 2018 the government has announced that it wants to invest a total of CN¥ 732 billion, in order to build 4,000 km of new networks, the majority of which (3,500 km) will operate at high speed. The estimated passenger increase is 3.25 billion, with an annual volume of goods moved of 3.02 billion tons[3].

The BRI comprises not only rail stations but also ports, which is even more important if we consider that the greatest volumes of good still travel via sea. We have witnessed significant investments also in this sector, with record breaking figures. The port of Shanghai, with 40 million tons of traffic in 2017, was the busiest in the world, taking the lead over Hong Kong which held the second position. Shenzhen, thanks to its technology district and to the proximity with the estuary of river Zhujiang and the city of Hong Kong, handled almost 24 million TEUs in 2016. Guangzhou and Qingdao follow, with about 17.5 million TEUs each[4].

These figures and the rapid rise in the ranking of the busiest ports, show that China is imposing itself as the ruler of the seas, also thanks to the dense network of interests in several other ports around the world, as we will see later.

[2] PwC, B&RWatch (2017, February). *China and Belt & Road Infrastructure, 2016 review and outlook* [https://www.pwccn.com/en/consulting/br-watch-infrastructure.pdf].

[3] China Daily (2018, 3 January). *China to invest $113b in railway in 2018* [http://www.chinadaily.com.cn/a/201801/03/WS5a4c90c4a31008cf16da4e93.html].

[4] iContainers (2018, 16 January). *Top 10 ports in China* [https://www.icontainers.com/us/2018/01/16/top-10-ports-in-china/].

Some of the main investments in specific projects of the BRI

Country/City	Plan	Sector
China	CN¥ 3.5 trillion by 2020.	Railway
Beijing	CN¥ 732 billion.	Railway
Thailand	873 km high speed rail to link Thai ports to the Chinese borders.	Railway
Laos	418 km high speed rail. $6 billion financed by the Bank of China.	Railway
Cambodia	New motorway to connect the port of Sihanoukville to the capital. Modernisation of the local airport.	Ports and Airports
Khorgos	$250 million for the construction of an dry port to be completed by 2020.	Dry port
Kazakhstan	Railway Zhezkazgan-Beyneu, worth $1.2 billion. 1200 km long and inaugurated in 2014.	Railway
Turkmenistan	Kuryk ($280 million) and Aktau ($121 million).	Ports
Pakistan	$1.6 billion invested by China in the port of Gwadar and in infrastructure connected to this.	Ports
Iran	China Export-Import Bank contributed $1.5 billion to finance the electrification of the railway lines in Teheran. A further $9 billion will be invested in Energy-infrastructure.	Railway and Energy
Turkey	838 km railway line reaching the city of Kars, financed by the State Oil Fund of Azerbaijan. Rail tunnel of Marmaray and Tavuz Sultan Selim Bridge.	Railway
Turkey	COSCO Pacific, China Merchants Holdings International e CIC Capital acquired a majority share (65%, $940 million) of the strategic port of Kumport.	Ports
UAE	Five Chinese companies have agreed to spend a total of $300 million in a deal with Abu Dhabi Ports.	Ports
Nairobi and Mombasa	471 km railway with freight and high speed passenger trains.	Railway
Egypt	Expansion of the Port of Alexandria by a Chinese company, 70 km extension of the railway network surrounding Cairo by China Railway Construction Corporation.	Ports and Railway
Djibouti	The port of Doraleh, built in two years by China Merchants Holdings International.	Ports
Ethiopia	750 km railway line connecting the new port with Addis Abeba, financed by Chinese EximBank and built by China Railway Group and CCECC.	Railway
Zambia	Renovation of TanZam, railway between Zambia and Tanzania, which will comprise a new line, built by CCECC with destination Mozambique via Malawi.	Railway
Russia	Russian Railways RZD and China Railway Corporation announced the railway line 'Eurasia', a $118 billion project to be completed by 2026.	Railway
Belarus	Smolevichsky industrial park, on the outskirts of Minsk. The project, which will take 30 years to complete, costs between $2 and $5.5 billion, offered by the Chinese State Bank, Belarus and by Singapore and Russian investors.	Industry
Greece	During the economic crisis Chinese companies bought a majority share of the Piraeus port.	Ports
Serbia	Alibaba would like to build a logistic hub.	Logistics

TABLE 11 - SOURCE: SRM on various sources

Beijing is proving that its previous infrastructural deficiencies are not a hindrance and is doing everything possible to increase the quality and the capillarity of its transport network. China is pursuing several objectives through this initiative: the internationalization of its companies, an increase in exports, the strengthening of the renminbi (the local currency), the strengthening of its geopolitical role, the reduction of overproduction through export and a modernization of its own business culture.

6.2 South East Asia

Amongst the areas that will benefit the most from BRI-related investments, one of them is undoubtedly South-East Asia. The nations south of China are rapidly shifting from developing economies into competitive economies, as highlighted by the extremely encouraging growth estimates of the giants of the region according to the World Bank's Global Economic Prospects.

Indonesia shows an expected growth of 5.3% of its GDP in 2018, while neighbouring Thailand records 3.6%. The entire region, excluding China, shows growth estimates of +5.3% for the new year, thanks above all to a 5.8% increase in investments.[5]

An 873 km high-speed rail project aims to connect the Thai ports to the Chinese border, turning the Yunnan province into the crossroads between the Far East and the rest of the continent.[6]

One of the countries with the highest growth rate is Laos, which recorded a +7% growth in 2016. Here Beijing has planned a 418 km long rapid railway reaching the capital Vientiane, which will be completed in the next five years and will be the longest and fastest in the country. The $6 billion project is funded by the Bank of China. It is impossible for Laos to invest such a sum of money, which represents almost half of its GDP[7]. Many multinational companies operate in this country, attracted mainly by the low cost of labour.

Many of the BRI's efforts are concentrated in the region. South of Laos, on the coasts of Cambodia, Beijing has invested heavily on the port of Sihanoukville, whose strategic position is fundamental for trade in the region. Sihanoukville will be connected to the capital Phnom Penh by a new four-lane motorway and some Chinese funds have decided to contribute 15 million dollars to the modernization of the local airport. The area has the potential to become a hive of activity enriched by a "Special Economic Zone" 12 km from the port, where a hundred Chinese companies are already operating.[8]

The SEZs are infrastructures that China is frequently using around the world in planning the new Silk Road. In Malaysia, an industrial park is being built in the city of Kuantan where steel and aluminium will be produced and palm oil will be treated. These types of industrial areas are particularly successful because they are welcomed by local governments, which are often included in a partnership. They allow to reduce the tax burden on companies – given the export tax exemption for products manufactured in these areas – they involve local companies and create jobs for urban dwellers. In the

[5] World Bank (2018, January). *Global Economic Prospects. Broad-Based Upturn but for How Long?* [http://www.worldbank.org/en/publication/global-economic-prospects].

[6] The Straits Times (2017, 14 May). *The trains and sea ports of One Belt, One Road, China's new Silk Road* [http://www.straitstimes.com/asia/the-trains-and-sea-ports-of-one-belt-one-road-chinas-new-silk-road].

[7] Saigal K. (2017, 26 September). "Belt and Road: China fast-tracks southeast Asian infrastructure" in *Euromoney* [https://www.euromoney.com/article/b14szy6vmn6bg1/belt-and-road-china-fast-tracks-southeast-asian-infrastructure].

[8] de Freitas G. (2017, 7 February). "China-Backed Cambodian Deep-Water Port Emerges as BRI Focal Point" in *HKTDC Research* [http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/China-Backed-Cambodian-Deep-Water-Port-Emerges-as-BRI-Focal-Point/imn/en/1/1X3CGF8J/1X0ACZHM.htm].

specific case of Kuantan, but also in others, the creation of SEZs is accompanied by the strengthening of pre-existing infrastructures. The local port is in an easily accessible area, just a day of navigation from Singapore.[9]

ASEAN, the political organization that brings together the countries of Southeast Asia, is China's third largest trading partner and some claim that these countries will overtake the EU in the future[10]. According to estimates, the volume of business between China and ASEAN is expected to hit the trillion dollar mark by 2020.

6.3 Central Asia

Another strategic area for the future of the BRI, thanks to its geographical position as a crossroads of Chinese business, is Central Asia. The steppes offer Beijing huge political and geographical spaces to improve economic relations with Russia and Europe. Local governments, although often in Moscow's orbit, are open to foreign investment and China is a stakeholder with a lot to offer. One of the most interesting projects in this sense is the dry port of Khorgos. It might look like a cathedral in the desert, but the centre, which cost nearly $250 million and to be completed by 2020, is already showing competitive traffic data. Khorgos is located in Kazakhstan close to the border with China, under the Tianshan mountains and is a key transit point, since there is a break of gauge between China and former Soviet countries, which makes it necessary to transship goods. This centre opened in 2011 and receives 65 trains per month, amounting to 6,200 TEUs per month. The numbers are destined to grow.

Since Kazakhstan does not have ocean ports, most of the BRI-related investments in this country are in the railways. The most ambitious project in this sense is the Zhezkazgan-Beyneu railway, costing $1.2 billion. 1,200 km long and inaugurated in 2014, this line connects the geographical heart of the country to the Caspian Sea. On this Central Asian water surface, other investments are concentrated, particularly in the ports of Kuryk ($280 million) and Aktau ($121 million), cities near the border with Turkmenistan and Russia on the opposite bank.

China's growing influence in the region is partially outshining the historical importance of Russia in Central Asia. In 2016, Beijing's direct investments amounted to $961 million in Kazakhstan and $301 million in Kyrgyzstan. The share of goods traded with China is between 15% and 30% in all countries of the area.

With the progress of the BRI one can only think that these numbers will grow rapidly. Beijing has flooded the steppes, where domestic regulations often hinder foreign investment, with strategic funding to improve its infrastructure. An expensive but crucial toll charge on the journey of Chinese goods to Russia and Europe.

[9] HKTDC Research (2017, 16 May). *Prospects for the Malaysia-China Kuantan Industrial Park and Kuantan Port* [http://hkmb.hktdc.com/en/1X0AA0CO/hktdc-research/Prospects-for-the-Malaysia-China-Kuantan-Industrial-Park-and-Kuantan-Port].

[10] Li X., Yongke L. (2017, 28 November). "The Belt and Road Initiative and China's Southeast Asia Diplomacy" in *The Diplomat* [https://thediplomat.com/2017/11/the-belt-and-road-initiative-and-chinas-southeast-asia-diplomacy/].

6.4 Middle East and Africa

One of the most important crossroads of the Belt and Road Initiative is the port of Gwadar, Pakistan. Located in a very unsafe region due to the presence of terrorist groups, this is one of China's riskiest bets, as the investment made in this port and its infrastructures amounts to $1.6 billion[11]. The main aim of this operation is to make the port a deep dredging one so as to make it suitable to receive bigger ships travelling along the route to the strait of Aden and the Suez Canal. The investment in Gwadar falls within the scope of the China-Pakistan economic corridor, a project worth $70 billion and which terminates in the city of Kashgar, in the Chinese region of Xinjang.

The involvement of Pakistan in the operation is one of the reasons why India is wary of the Belt and Road Initiative. Also, New Delhi does not welcome the initiative because it would rather pursue expansionist ambitions of its own economic influence.

Close to Pakistan there is another country that is becoming increasingly more important to the BRI: Iran. A staging post to the Silk Road, the nation descending from Ancient Persia has maintained excellent relations with Beijing during the period of the international sanctions and now that these have been lifted almost completely Teheran has re-opened its doors to international trade. In February 2017 the first freight train from China arrived in Iran and a few months later China Export-Import Bank provided $1.5 billion to electrify the 926 km long Teheran-Mashhad railway[12]. The aim is to invest a further $9 billion in other projects encompassing infrastructures and energy.

If we take a closer look at countries adjacent to Europe, we find that Turkey has received significant funds to improve its infrastructures.

As far as railways are concerned, the city of Kars, close to the border with Armenia, is the train terminal of a railway track that starts from Baku (capital of Azerbaijan) and shortens the usual route between China and Europe by 7,000 km. This 838 km long line crosses Georgia and was mainly funded by the State Oil Fund of Azerbaijan. It features an extension linking Kars and Edirne and cost $30 billion. Near the Bosphorus Strait there are other big infrastructure projects linked to the BRI: the rail tunnel of Marmaray and the third bridge over the strait – the Tavuz Sultan Selim Bridge[13]. The Turkish coastline is a staging post also to the Maritime Silk Road.

A consortium of three Chinese companies (COSCO Pacific, China Merchants Holdings International and CIC Capital) has acquired a majority share (65% for $940 million) of the strategic port of Kumport, on the European bank of Istanbul[14].

[11] Chang L. (2015, 12 November). "Chinese firm to develop SEZ in Gwadar" in *China Daily USA* [http://usa.chinadaily.com.cn/epaper/2015-11/12/content_22441296.htm].

[12] Shepard W. (2017, 31 October). "Iran: The Place Where The World's Rail Industry Goes To Feast" in *Forbes* [https://www.forbes.com/sites/wadeshepard/2017/10/31/iran-the-place-where-the-worlds-rail-industry-goes-to-feast/#300d2c111ebf].

[13] Parlar Dal E. (2017, 15 November). "'Belt and Road' project: China's new vision and Turkey" in *Anadolu Agency* [http://aa.com.tr/en/analysis-news/analysis-belt-and-road-project-chinas-new-vision-and-turkey/965994].

[14] Invest in Turkey (2015, 28 September). *News from Turkey: Chinese consortium buys into Turkish port with USD 940 million investment* [http://www.invest.gov.tr/en-US/infocenter/news/Pages/280915-cosco-pacific-buys-turkish-kumport.aspx].

The Arabian Peninsula is also affected by the BRI. Five Chinese companies have joined forces to finance the ports of Abu Dhabi with $300 million. The agreement includes a 2.2 square km Free Zone close to the port of Khalifa, in the UAE[15].

China's interest is also glaringly obvious in Africa. Beijing is filling the void left by the former European colonialist powers without interfering with local politics too much but still obtaining important concessions in terms of exploitation of natural resources. These agreements are usually accompanied by investments in infrastructures which should not be seen as a favour but rather as operations crucial to the economic success of the initiatives. On the African coast of the Indian Ocean, China financed a 471 km long railway between Nairobi and Mombasa with high speed freight and passenger trains. Another crucial area to the Chinese interests in Africa is Egypt and in particular the Suez Canal. A Chinese company has signed an agreement for the enlargement of the port of Alexandria, while China Railway Construction Corporation has been entrusted with carrying out a 70 km extension of the railways surrounding Cairo[16]. Other projects of investors in the region, often in partnership with local players, are the port of Doraleh, in Djibouti, built in two years by China Merchants Holdings International, and the railway line that connects the new port with Addis Ababa, in Ethiopia. The new 750 km long railway is financed by the Chinese EximBank and built by China Railway Group and CCECC. For the future, one of the countries to watch out for is Zambia, where the TanZam, the railway linking the country to Tanzania, is due to be renewed, and a new line, built again by CCECC, is planned with destination Mozambique via Malawi.

6.5 Russia and Europe

Russia, despite its commercial relations with Europe not being excellent, is one of the staging posts in the long journey of many goods travelling from East to West, and vice versa. Although Moscow often wants to be a major player in foreign policy, it has willingly joined the Belt and Road Initiative. Last August the Russian railways RZD and China Railway Corporation announced the "Eurasia" railway line, costing $118 billion and to be completed by 2026. The line would connect Berlin to Urumqi, in Xinjiang, going through Russia for most of its length.

Part of the project might include the Moscow-Kazan line to connect the capital to the city on the banks of the Volga. This has to be considered just a possibility because there are doubts about the $30 billion cost of the line, whose project is currently blocked.

The China Development Bank is alleged to have offered $7 billion to finance the railway, adding 900 million for the Moscow-Nizhny Novgorod and one billion for Nizhny

[15] Crabtree J. (2017, 31 July). "China's $300 million investment in Abu Dhabi Ports is a 'milestone'" in *CNBC* [https://www.cnbc.com/2017/07/31/china-300-million-investment-in-abu-dhabi-ports-is-a-milestone.html].

[16] Breuer J. (2017, July). "Two belts, One Road? The role of Africa in chinas's Belt & Road initiative" in *Blickwechsel*. Colonia: Stiftung Asienhaus [https://www.asienhaus.de/uploads/tx_news/Blickwechsel_OBOR-Afrika_01.pdf].

Novgorod-Kazan, but the interest rate demanded by the Chinese financial institution is deemed too high by RZD[17].

Contrastingly, a success was recorded with the construction of the Smolevichsky industrial park, on the outskirts of Minsk, in Belarus. The project, which should be completed over the next 30 years, costs between $2 and $5.5 billion, funds that will be provided by the Chinese State Bank, by Belarus and also by Singapore and Russian investors. The industrial park, which should employ around 120,000 people, will be a hub for electronics, biology, chemistry and engineering, with the aim of exporting manufactured products to Europe.

The old continent, in the race to the Belt and Road Initiative, is not standing by and watching. Chinese companies during the economic crisis have won a majority stake in the Athenian port of Piraeus and have planned investments in all the Balkans. Although the proposal for a modernization of the railway line between Belgrade and Budapest has collapsed, due to a lack of EU interest, e-commerce giant Alibaba has set its eyes on the Serbian capital, where a logistic centre could be built. Also in Serbia, the Chinese steel giant Hesteel took over the Smederevo mine, inaugurated personally by Xi Jinping.

Western Europe, as a destination of Chinese exports and hopefully an origin for imports to China, also benefits from the BRI. Italian ports and railway lines, which require profound modernization, can be crucial for connecting incoming goods from the Mediterranean to the north of the continent. The French President Macron, while visiting this year the city of Xian, has given encouraging signs of openness towards the initiative, while Germany is already a top destination for trains bound for Europe. Even London, which inaugurated the first freight train bound for China, is looking for new shores following Brexit and Beijing could be among the first signatories of a possible new free trade agreement.

6.6 The role of Hong Kong

Geography, growth and internationalization

Within the BRI scenario, Hong Kong plays a major role for investors, intermediaries and project owners. The geographical proximity with mainland China and the excellent connections with all the main cities of the mainland make the former British colony an ideal gateway for the development of projects both in the territory of the Asian giant and in the whole area involved in the BRI project.

The Hong Kong Special Administrative Region today represents the sixth commercial economy in the world: with a trade amounting to $974 billion[18] in 2016, it recorded a

[17] Trickett N. (2017, 20 October). "The Gordian Rail Tie: Russia's Mythic Belt and Road Cooperation" in *The Diplomat* [https://thediplomat.com/2017/10/the-gordian-rail-tie-russias-mythic-belt-and-road-cooperation/].

[18] Fuochi R. (2017). "Hong Kong: partner ideale per cogliere le opportunità offerte dall'iniziativa Belt and Road", speech at the *Genoa Shipping Week*, Genoa 30th June 2017 [http://www.gsweek.it/wp-content/uploads/05_FUOCHI.pdf].

3.9% GDP growth[19] in the period January-September 2017. Also, 62% of the flow of foreign Chinese investment passes through here and the city has been increasingly chosen as a headquarter by multinational corporations, international chambers of commerce, consulting firms, media and services.

Finance and tax system for the BRI

A member of the Asian Infrastructure Investment Bank (AIIB), Hong Kong, in addition to being one of the world's main financial centres, is Asia's second largest private equity centre.[20]

Thanks to significant experience in assisting Chinese continental and international companies, credit institutes and private funds, numerous public-private partnership projects relating to ports, motorways and power stations can be structured and financed in the whole area covered by the BRI. Over 150 international and local banks present on site, of which 70 among the top 100 in the world, are all active in loans to companies, syndicated loans and in the financing of projects in the region.

The Stock Exchange, the world's eighth capitalization stock market and one of the world's top three IPO markets, is an optimal resource-gathering channel for new or ongoing development projects.

Finally, the Special Administrative Region is characterized by simple and moderate taxation and by free trade. Also, the local currency, the Hong Kong dollar, is increasingly being traded in the world.

State-of-the-art infrastructures

In terms of infrastructure, Hong Kong presents services of absolute excellence. The Region is 1st in the "2016-2017 Infrastructure Competitiveness" ranking of the World Economic Forum.[21]

In 2016, the freight airport ranked first for air cargo with 4.52 million tons and is connected by 100 airlines serving 190 destinations. The commercial port is one of the busiest and most efficient in the world with 24 million TEUs handled and 340 container shipping lines a week reaching 470 destinations (2016). The motorway network is first class and saw the completion in 2017 of the Hong Kong-Zhuhai-Macao Bridge, one of the largest infrastructure projects in the world.[22]

The widespread railway network will soon boast the West Kowloon Railway Terminal, which will be the largest underground railway station in the world[23] thanks to its 38,000 square metres and fifteen high-speed lines connecting Hong Kong with Beijing.

[19] InfoMercatiEsteri (2018, 12 March). *Quadro macroeconomico (Hong Kong)* [http://www.infomercatiesteri.it/quadro_macroeconomico.php?id_paesi=127].

[20] https://beltandroad.hktdc.com/en/hong-kong-advantage

[21] Fuochi R. (2017). *Op. cit.*

[22] Borgatti C. (2017, 30 November). "Il ponte Hong Kong-Zhuhai-Macao è completato" in *Strade & Autostrade* [http://www.stradeeautostrade.it/ponti-e-viadotti/il-ponte-hong-kong-zhuhai-macao-e-completato/].

[23] https://www.thingsiliketoday.com/west-kowloon-station-hong-kong/

Services to companies and legal assistance

Accountancy firms, insurances, due diligence companies, tax and management services operating in Hong Kong have considerable experience in collaborating with global investors, banks and public entities who need to evaluate their market entry strategies. These Honk Kong based firms are also experts of corporate finance, financial operations, corporate governance, fiscal consultancy, compliance, auditing, risk assessment and allocation.

The Region hosts approximately 850 local and over 70 international legal firms. Legal consultants are familiar with the regulatory and legal framework of various countries around the world and can play a key role in the development of the BRI.

In addition, Hong Kong has a reliable common law system and an independent judiciary system and has always been a highly respected centre for the settlement of litigations. It is no coincidence that the Hong Kong International Arbitration Centre is the favourite arbitration tribunal outside Europe.[24]

Institutional support to the BRI

The Hong Kong Trade Development Council provides information and facilitates opportunities linked to the BRI through its global network of 46 offices and thanks to its experience in the organization of some of the main global fairs and events for the promotion of services. Also, through the Infrastructure Financing Facilitation Office, the Hong Kong Monetary Authority plays a key role in the promotion of collaborations between the private and public sector. These activities are mainly aimed at exchanging information and sharing experiences in order to pave the way for more efficient and sustainable investment flows in the BRI countries.[25]

In 2017 Hong Kong hosted the Belt and Road Summit which gathered over 3,000 high officials from international institutions, company leaders and experts from the countries involved in the BRI. The event, where 70 projects were analysed, focused on multilateral cooperation and on the possibility to explore new investment opportunities.[26]

6.7 Public Investors

It is extremely difficult to make a clear distinction between public and private investment in such a majestic work as the Belt and Road Initiative. Even more so if we consider that in China and in many other nations involved, the division between public and private sectors is blurred, with different shades and players that often overlap.

One of the biggest bidders on this project is certainly the AIIB, the Asian Infrastructure Investment Bank, created in 2015 precisely with the aim of participating in infrastructure investments. Launched by China, today it has 57 members, including many European, Asian and Oceania countries.

[24] School of International Arbitration, Queen Mary University of London (2015, October). *International Arbitration Survey: The Evolution of International Arbitration*.

[25] https://beltandroad.hktdc.com/en/hong-kong-advantage

[26] http://www.beltandroadsummit.hk/en/information_centre/about_bars.html

Amongst the Asian funds involved and to which governments contribute, we find the Asian Development Bank, created in the 1960s to finance infrastructure projects on the continent and the Pacific. Amongst the para-state organizations concerned there is also the New Development Bank, the so-called "BRICS bank" based in Brazil and in which the funds of emerging markets converge.

The Silk Road Fund, launched by Xi Jinping and owned by the Export-Import Bank of China, the State Administration for Foreign Trade, the China Investment Corporation and the China Development Bank, has been created ad hoc. The fund is directly supervised by the Bank of China and is the prime sponsor of many infrastructure projects, from the Mombasa-Nairobi railway to the dams built in Pakistan, as collateral works of the Economic Corridor.

Many projects in China are financed by the China Development Bank, the semi-government arm that funds infrastructure works in the country. The Export-Import Bank of China has a similar status, but it focuses more on financial services related to international trade. On the other hand, export and credit insurance services are guaranteed by Sinosure, linked to the Export-Import Bank of China.

Other public investment banks in Central Asian countries and elsewhere have financed some of the works related to the Belt and Road Initiative.

6.8 Private Investors

It has been estimated that nearly 90% of investments in the new Silk Road come from state or public players. Hence, it is challenging to find private investments. This is mainly due to the fact that the initiative entails many highly expensive infrastructures with long-term and uncertain economic return. Also, the cost of these projects is so exorbitant that few private players possess the necessary liquidity or can afford to take the risk.

Nonetheless, some private players have bid on the BRI and, needless to say, most of them are Chinese benefiting from the advantages of an economy that is far from the free market model. Many tech companies have enthusiastically joined the initiative and are thinking of moving their production to countries with a lower cost of labour in order to increase profits. Also, the local real estate sector has grasped potential benefits, although construction, logistics and contractor companies play a significantly major role.

Amongst the aforementioned, China Merchants Holdings International (CMHI), the biggest port operator in the country, controlling majority shares in 29 foreign ports. Alongside this, although with interests covering also land trade, there is COSTO which, together with CMHI, owns Piraeus (Greece), Kumport (Turkey) and has a majority share of the dry port of Khorgos (Kazakhstan). This information give us a clear idea of the importance and power of this company.

The Chinese railway companies are China Railway Group (CREC) and China Railway Construction Corporation (CRCC). CRCC is involved in 111 projects in over 37 countries with a value of $15 billion, while CREC is the second company in the world for number of contracts (CRCC is third).

Amongst the foreign companies that have invested in the new Silk Road there is DP World, the fifth port operator in the world, which controls over 77 maritime and land terminals. Many of these are crucial to the initiative, from the Khorgos dry port to Aktau

in Kazakhstan to the Baku port in Azerbaijan. The creators of the free zone of Jebel Ali in Dubai want to export this model all over the world and believe that the BRI offers an opportunity for the creation of low-tax productive and commercial areas.

Among the Western companies involved, it is surprising to find HP, the IT giant, who has been one of the promoters of direct trains from China to Europe. The need to import technology products from Asia led to the first direct line between Chongqing and Duisburg.

Conversely, the great interest of DHL, global logistics leader, should not be a surprise. The German company has been one of the great sponsors and first customers of the Belt and Road since the launch of the initiative. A major supporter of intermodal transport, DHL has been a pioneer in using many of the routes offered by the BRI to connect Asia and Europe.

6.9 Conclusions

It is difficult to find historical comparisons that are able to highlight the immensity of funding needed to complete a monumental project like the Belt and Road Initiative. Fundraising, and in particular partnerships with the private sector, is the biggest challenge for this enormous project. The Chinese government is using all its soft power and its geopolitical influence to find funds to devote to the initiative, however, currently it remains the first investor in the BRI, also through various ramifications.

Nevertheless, if the costs are high, so are the benefits. Many areas of the developing world or with limited connections to the outside are finding new life and resources in the infrastructural plans linked to the new Silk Road. Africa can find new momentum in the construction of new railways, Central Asia is becoming the heart of intermodal transport and South East Asia will be supported in its growth by the expansion of its ports and high-speed railways. Europe cannot stand by and be a passive consumer of goods coming from China, but must do its part and stop looking at Beijing with suspicion. In an increasingly global world, it has become inevitable to confront the Chinese economic power. Although many may be afraid, especially for the social costs involved in the competition with a cheaper labour force, it is necessary for the West to play its part, aiming for reciprocity in trade with the East. The benefits will soon result in new cross-over investments, in the opening of new businesses and Special Economic Zones, in modern infrastructures that will drastically cut the travel time of people and goods and the possibility of exporting European goods over the Great Wall. The challenge is not the simplest and requires planning, political caution and team-building skills, but ignoring or even trying to hinder a project like the Belt and Road Initiative is a luxury that the old continent can no longer afford.

APPENDIX

GDP and growth estimates in BRI countries

Country	GDP ($bn, 2017)	% growth (2018-2020)
East Asia		
China	11,937.6	6.3
Mongolia	10.9	4.7
South East Asia		
Brunei Darussalam	12.0	6.1
Cambodia	22.3	6.7
Indonesia	1,010.9	5.4
Malaysia	309.9	4.8
Myanmar	67.0	7.5
Philippines	321.2	6.8
Singapore	305.8	2.6
Thailand	437.8	3.3
Timor-Leste	2.7	5.8
Vietnam	216.0	6.2
Central Asia		
Kazakhstan	156.2	2.9
Kyrgyz Republic	7.1	4.7
Tajikistan	7.2	4.0
Turkmenistan	41.7	5.5
Uzbekistan	67.5	6.0
MENA		
Bahrain	33.9	1.9
Egypt*	332.3	5.2
Islamic Republic of Iran	427.7	3.9
Iraq	192.7	2.2
Israel	348.0	3.1
Jordan	40.5	2.7
Kuwait	118.3	3.8
Lebanon	52.7	2.3
Oman	71.9	2.9
Qatar	166.3	2.9
Saudi Arabia	678.5	1.5
Syria	n/a	
United Arab Emirates	378.7	3.2
Yemen	25.7	9.8
South Asia		
Afghanistan	21.1	3.5
Bangladesh	250.0	7.0
Bhutan	2.3	11.1
India	2,439.0	7.7
Maldives	4.5	4.8
Nepal	24.1	4.2
Pakistan	278.9	n/a
Sri Lanka	83.6	4.9
Europe		
Albania	13.0	3.8
Armenia	11.0	3.0
Azerbaijan	39.2	2.3
Belarus	52.8	2.7
Bosnia and Herzegovina	17.5	1.0
Bulgaria	56.0	2.9
Croatia	53.5	2.5
Czech Republic	209.7	2.4
Estonia	25.7	3.2
Georgia	15.2	4.5
Hungary	132.0	2.9
Latvia	30.2	3.5
Lithuania	46.7	3.4
FYR Macedonia	11.4	3.4
Moldova	7.9	3.8
Montenegro	4.4	2.6
Poland	510.0	3.1
Romania	204.9	3.8
Russia	1,469.3	1.5
Serbia	39.4	3.7
Slovak Republic	95.0	3.7
Slovenia	48.1	2.1
Turkey	841.2	3.5
Ukraine	104.1	3.5

TABLE I - SOURCE: SRM on IMF data

FDIs and average growth of FDIs in BRI countries

Country	FDI ($m, 2016)	% growth (average 2010-2016)
East Asia		
China	1,354,404	16.3
Mongolia	12,980	30.1
South East Asia		
Brunei Darussalam	5,739	7.7
Cambodia	16,656	35.2
Indonesia	234,961	12.6
Malaysia	121,621	7.1
Myanmar	22,666	18.9
Philippines	64,249	16.1
Singapore	1,096,320	11.9
Thailand	188,651	8.9
Timor-Leste	346	16.1
Vietnam	115,391	13.0
Central Asia		
Kazakhstan	129,773	9.4
Kyrgyzstan	5,102	20.5
Tajikistan	2,399	12.4
Turkmenistan	36,241	20.7
Uzbekistan	8,957	14.3
MENA		
Bahrain	28,606	10.7
Egypt	102,324	6.4
Iran (Islamic Republic of)	48,469	9.8
Iraq	9,498	10.3
Israel	112,701	10.5
Jordan	32,148	6.5
Kuwait	14,260	5.8
Lebanon	61,019	6.0
Oman	18,548	4.7
Qatar	33,943	4.1
Saudi Arabia	231,502	6.7
Syrian Arab Republic	10,743	3.6
United Arab Emirates	117,944	11.5
Yemen	2,865	-6.5

	FDI ($m, 2016)	% growth (average 2010-2016)
South Asia		
Afghanistan	1,361	6.6
Bangladesh	14,539	15.9
Bhutan	171	36.2
India	318,502	9.5
Maldives	3,216	20.3
Nepal	653	31.0
Pakistan	39,017	12.4
Sri Lanka	9,745	8.3
Europe		
Albania	4,987	7.1
Armenia	4,633	4.0
Azerbaijan	26,683	21.0
Belarus	18,970	12.4
Bosnia and Herzegovina	6,848	0.1
Bulgaria	42,165	-2.0
Croatia	27,645	-2.3
Czechoslovakia	na	na
Estonia	19,193	3.2
Georgia	14,109	9.6
Hungary	77,721	-2.8
Latvia	14,253	3.3
Lithuania	13,773	0.9
Montenegro	4,663	1.9
Poland	185,903	2.3
Republic of Moldova	3,581	3.8
Romania	71,804	0.6
Russian Federation	379,035	3.7
Serbia	30,345	5.8
Slovakia	41,615	-3.0
Slovenia	12,731	1.8
TFYR of Macedonia	5,016	1.8
Turkey	132,882	1.8
Ukraine	48,385	1.8

TABLE II - SOURCE: SRM on Unctad data

Chapter X

The Belt & Road Initiative and the role that Mediterranean region should play

1. Foreward: the Belt & Road Initiative and its major achievements

In 2013, Chinese President Xi Jinping proposed the Belt and Road Initiative (B&R). In the past 5 years, "The Belt and Road" is becoming a revolution which is reshaping the world economy gradually, and is playing a more and more important role to redefine the global economy in twenty-first Century.

According to the date provided by The B&R Trade Cooperation Big Data Report (2017), B&R covers 64 countries, and in 2016, the 64 countries' total GDP is about $12 trillion, accounting for 16% of the world GDP; the total population is 3.21 billion, accounting for 43.4% of the world's population.

In addition, the B&R has also attracted a large number of developed countries to participate, the scope of B&R is expanding from Eurasia to Western Europe, Africa, Australia and South America, including Britain, France, Germany, South Africa, Australia and other countries and regions.

Now the B&R has received a positive response from more than 140 countries and regions, the economic and trade cooperation along the Silk Road Economic Belt and a 21st Century Maritime Silk Road has achieved fruitful results.

First, the scale of trade is expanding. In 2017, Trade between China and countries along the B&R totaled $1.1 trillion, 14.8% higher than 2016, and it is also higher than the overall growth rate China's foreign trade by of 3.4 percentage. At the same time, the level of trade facilitation in the relevant countries and regions has been continuously improved.

Second, the range of investment is broadening. China' direct investment in the B&R related countries and regions has accumulated more than 60 billion dollars, involving many fields, such as agriculture, manufacturing, infrastructure, and so on.

Third, solid progress is being made in many major projects. A large number of railway, highway, port and other infrastructure projects have been completed, and a large number of energy and resources cooperation projects have made progresses smoothly, and a large number of manufacturing projects have been completed and put into operation. China has set up 75 overseas economic and trade cooperation zone in the B&R related countries, the amount of investment totaled about $27 billion.

2. The B&R has great potential to promote investment and trade growth

2.1 The B&R has been written into the Party Constitution of CCP

The first meeting of nineteenth National Congress of the Communist Party China which was held in the November 2017 decided to write «Build a Community of Shared Future for Mankind» and «Build the Silk Road Economic Belt and the 21st Century Maritime Silk Road» into the party constitution. The first meeting of the thirteenth National People's Congress which was held in March 2018 decided that «Build a Community of Shared Future for Mankind" should be written to China's Constitution, and in order to put "Build a Community of Shared Future for Mankind» into action, an important practical path is the B&R Initiative proposed by President Xi. This reflects the importance of B&R Initiative to CCP, and the determination and confidence of CCP to promote the B&R international cooperation firmly. Therefore, building the B&R will be a long and lasting plan which is sustainable, and will continue to receive support and input from the governments along the B&R, including the Chinese government.

2.2 The consumption upgrading in China

China is undergoing consumption transformation and consumption upgrading. In 2011 and 2015, China's GDP per capita reached $5,000 and $8,000. In 2017, China's total retail sales of consumer goods reached 36626.2 billion yuan, an increase of 10.2% over the previous year, demand for high-quality goods has also increased significantly. Through China's tourism shopping, one can see the momentum of China's import demand.

In 2017, the number of Chinese citizens traveling abroad reached 13.05 billion, up 7.0% from 2016. In terms of tourism expenditure, China's international tourism expenditure amounted to $115.29 billion in 2017, a 5% increase from the $109.8 billion in 2016. China has maintained the status of the world's largest outbound tourist country.

Another report released by Tmall Global and CNBData showed that China's import consumption shows four trends, such as:

- *Normalization*. More and more consumer in China used to shopping internationally.
- *Refinement.* Imports of nutrition and cosmetics increased rapidly.
- *Quality.* The unit price of consumption increased year by year.
- *Content.* Consumers are increasingly concerned about the lifestyle behind the product.

In addition, in December 2017, China launched its fourth consumer goods tariff reduction since 2015. The average tax rate fell to 7.7% from 17.3 percent.

In the future, the factors above will all help to accelerate the development of China's cross-border trade, accelerate the consumer goods and retail market transition, especially will promote B&R's partner countries' exports to China and trade balance.

2.3 Cooperation on production capacity along the B&R

The two ends of the B&R is the two most active engine of world economic growth: China and EU. More importantly, the countries along the B&R are in different economic

development stage and level of industrialization, they can be divided into three major categories.

The first category is the post industrialized countries with technology intensive and high added value industries, such as Singapore, Israel and other developed countries, the two countries' industrial index is 100

The second category is the mid-term industrialized countries with capital intensive industries. They are large and fast-growing emerging economies, such as China and India.

The third category is countries in early industrialization stage with labor-intensive industry. They are the least developed countries in the world, such as Yemen, Bangladesh and Nepal, of which Nepal's industrialization index is 0.

This difference between the countries will bring great complementarity, so cooperation will replace competition, and become the mainstream of building the B&R. Therefore, the cooperation on production capacity has huge potential and this will also bring about the full circulation of the products at all levels and create new trade demand.

2.4 Investment on infrastructure construction

The B&R has great potential for cooperation in infrastructure development and this is also an important support target of development assistance.

According to a report released by the Asian Development Bank in February 2017, after seasonally adjustment, Asian needs $1.7 trillion per year for new infrastructure projects, back to 2009, the estimation is $750 billion, and the funding gap is very huge.

According to the World Bank's data, currently, the annual investment on infrastructure construction in developing countries is about $1 trillion, but in order to maintain the current economic growth and meet the future demand, it is estimated that at least another 1 trillion dollars per year will be needed 2020. By 2030, the world is expected to need $57 trillion in infrastructure investment.

To support the infrastructure construction, China will scale up financing support for the B&R Initiative by contributing an additional RMB 100 billion to the Silk Road Fund, and will encourage financial institutions to conduct overseas RMB fund business with an estimated amount of about RMB 300 billion. The China Development Bank and the Export-Import Bank of China will set up special lending schemes respectively worth RMB 250 billion equivalent and RMB 130 billion equivalent to support B&R cooperation on infrastructure, industrial capacity and financing. China will also work with the AIIB, the BRICS New Development Bank, the World Bank and other multilateral development institutions to support Belt and Road related projects.

In 2017, Chinese enterprises invested $14.4 billion in the countries along the B&R, and the new project contracts in the countries along the B&R were $144 billion, up 14.5% over the same period.

According to the consultancy McKinsey, by 2050, the B&R countries will contribute around 80% of global GDP growth, become the engine of economic growth around the world. For the Mediterranean region, the B&R Initiative brings important cooperation and development opportunities.

3. The role of Mediterranean region in the B&R Initiative

3.1 Improvement of the economic environment

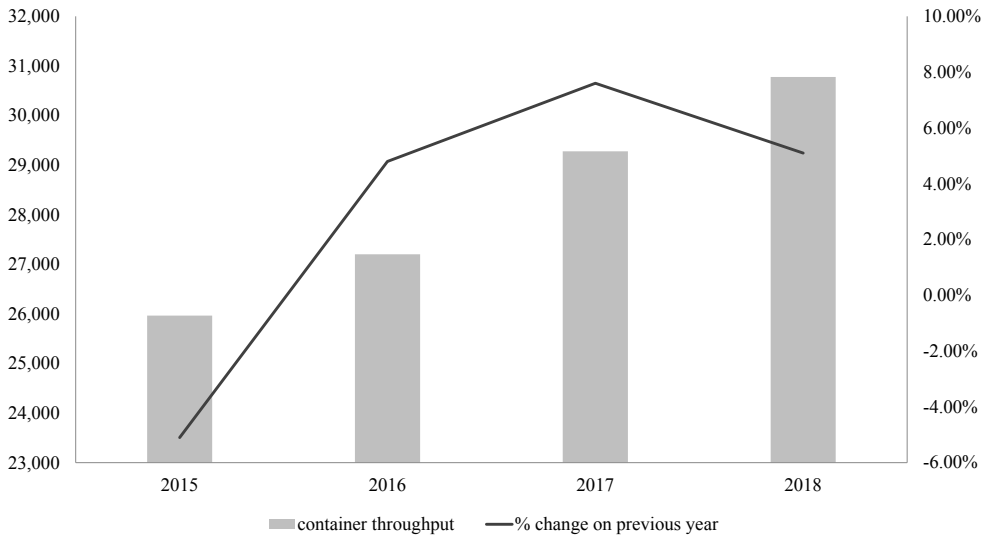
According to the IMF's World Economic Outlook published in January 2018, global economic activity continues to firm up, and the pickup in growth has been broad based, with notable upside surprises in Europe and Asia. The stronger momentum experienced in 2017 is expected to carry into 2018 and 2019, with global growth revised up to 3.9% for both years.

For the Mediterranean countries:

- Spain's GDP growth forecast for 2018 and 2019 is 2.4% and 2.1%, the impressive turnaround in Spain's economy is losing none of its momentum.
- Italy's GDP growth rate will be 1.4% and 1.1% for 2018 and 2019, as the third economy in the Eurozone, the sentiment about growth is better, and as the unemployment rate was around 11% in recent month, the labor market has improved considerably.
- Other Mediterranean countries outside the Eurozone, such as Egypt, Turkey and Syria are also in the process of recovery supported by consumer spneding, but in 2018, the recovery will face some uncertainty.

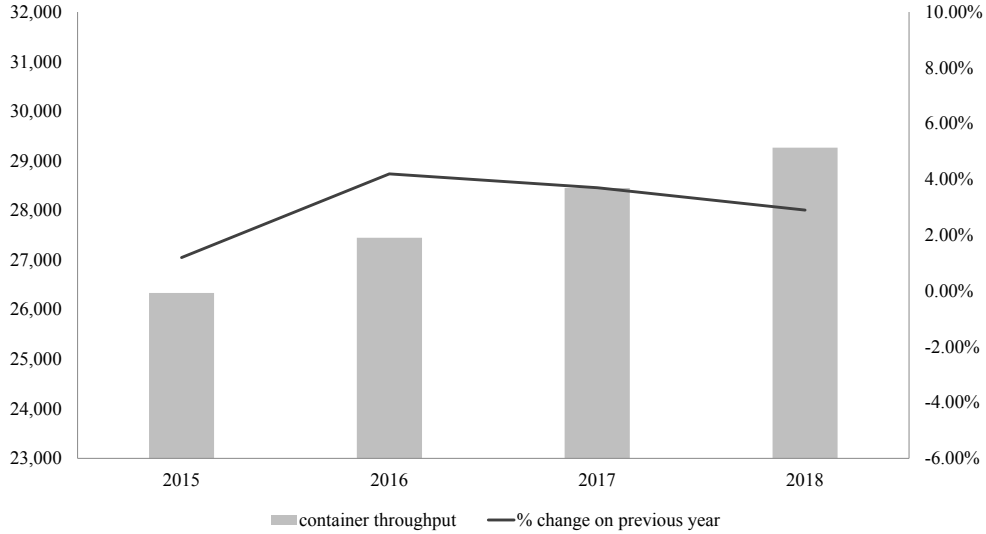
Thanks to the economic recovery, in 2017 and 2018, ports in both West Mediterranean region and East Mediterranean & Black Sea region will see moderate, even robust container throughput growth.

Container throughput in the East Mediterranean & Black Sea ports (2015-2018)



Graph 1 - Source: Drewry

Container throughput in the West Mediterranean Ports (2015-2018)



GRAPH 2 - SOURCE: Drewry

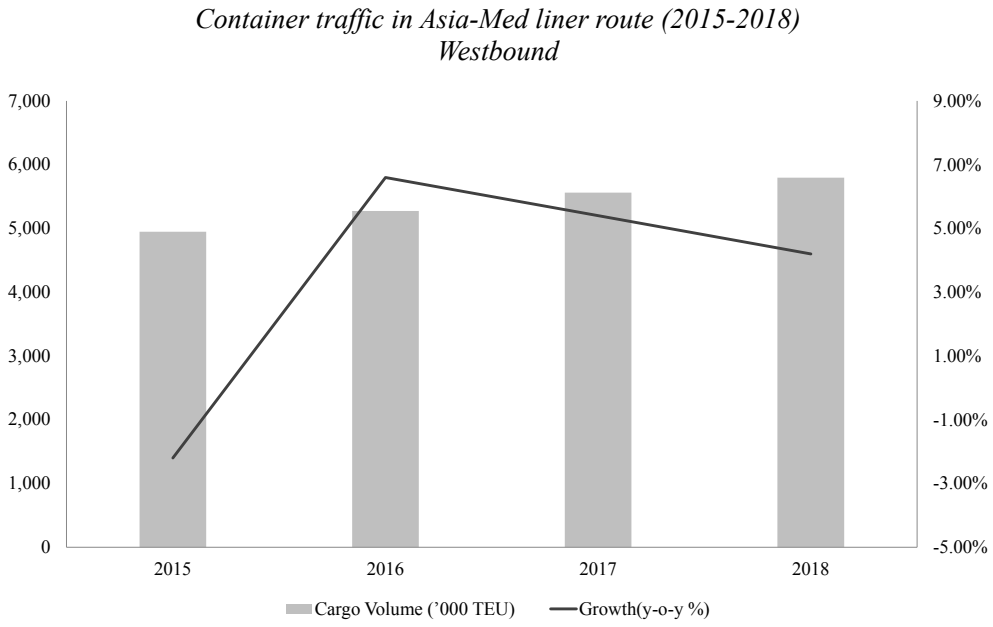
3.2 Container shipping trade between Mediterranean and Far East

The container trade route between Far East and Mediterranean is one of the important main East-West routes. In past 10 years – since before the global financial crisis – the Asia-Med headhaul market has swollen by 30%, compared with only 10% in the adjacent North European trade.

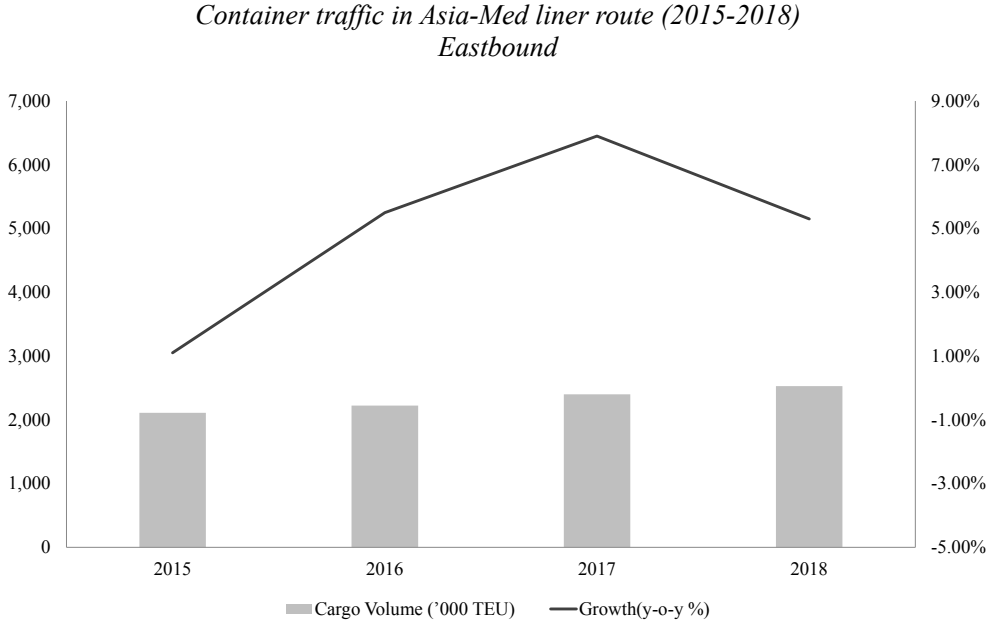
In August 2016, with Hanjin Shipping going bankrupt as the watershed, the container shipping industry reached the low point of this cycle and began to recover gradually.

In 2016 and 2017, container cargo volume in both direction on the Far East-Mediterranean route has maintained a healthy growth rate. In 2018, the demand growth rate is expected to lower, but still at a relatively healthy level.

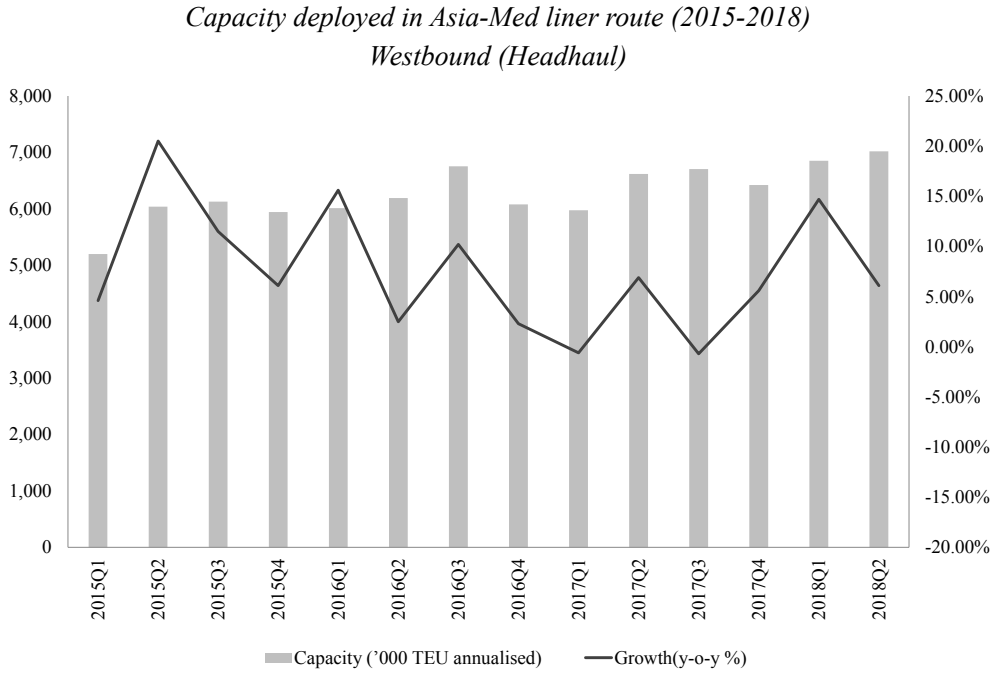
With the response of demand growth and the B&R Initiative, liner companies began to increase the capacity deployed on the route between Far East and Mediterranean. At the beginning of the second quarter 2018, the capacity deployed on the route of Far East-Mediterranean westbound will increase by 6.1% year on year.



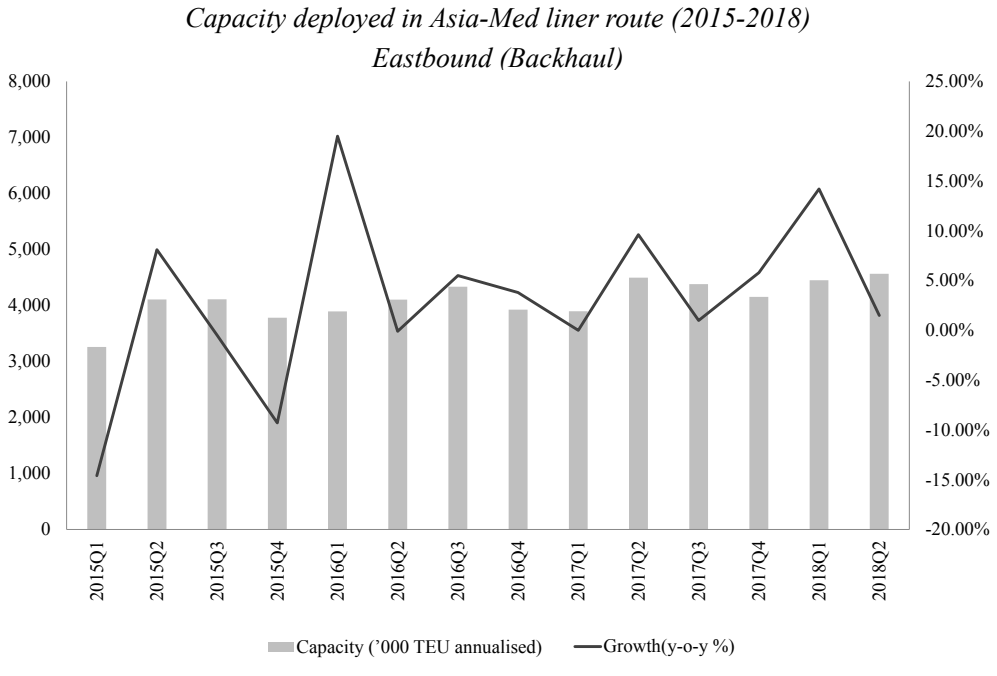
GRAPH 3 - SOURCE: Drewry



GRAPH 4 - SOURCE: Drewry



GRAPH 5 - SOURCE: Drewry



GRAPH 6 - SOURCE: Drewry

3.3 The economic potential of Mediterranean region in the B&R

The Mediterranean region is connected to the three continents of Europe, Asia and Africa. It is the intersection of the Silk Road Economic Belt and the 21st Century Maritime Silk Road.

In November 16, 2017, China National Development and Reform Commission and the State Oceanic Administration jointly published "Vision for Maritime Cooperation under the Belt and Road Initiative", the framework part of this file said, in line with the priorities of the 21st Century Maritime Silk Road, China will deepen ocean cooperation by fostering closer ties with countries along the Road, supported by the coastal economic belt in China. Ocean cooperation will focus on building the China-Indian Ocean-Africa-Mediterranean Sea Blue Economic Passage, by linking the China-Indochina Peninsula Economic Corridor, running westward from the South China Sea to the Indian Ocean, and connecting the China-Pakistan Economic Corridor (CPEC) and the Bangladesh-China-India-Myanmar Economic Corridor (BCIM-EC). Efforts will also be made to jointly build the blue economic passage of China-Oceania-South Pacific, travelling southward from the South China Sea into the Pacific Ocean. Another blue economic passage is also envisioned leading up to Europe via the Arctic Ocean.

Therefore, the Mediterranean region occupies an important strategic position in the B&R, and is both a transit point and a destination. With the further development of B&R, the Mediterranean region as the key node of B&R will be more and more significant.

For example, the Mediterranean is one of the Chinese people's favorite travel destination. Goods such as wine, olive oil, textiles and leather products are very popular in China. In addition, the Mediterranean region is rich in resources, and the B&R partner countries' industries are highly complementary. These will provide the relevant countries a broad market for trade and production capacity cooperation. China has built a number of landmark projects with countries in the Mediterranean region so far.

4. Hinterland of the Mediterranean: Central and Eastern European countries

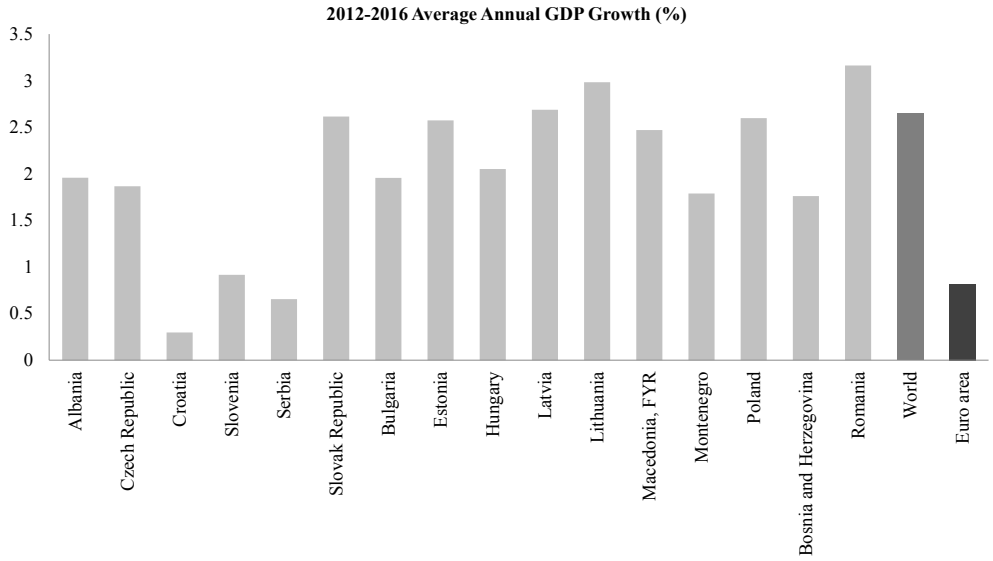
4.1 Central and Eastern European countries are European emerging market

To give full play to the potential of the Mediterranean region in the B&R, we need to focus on the hinterland of the Mediterranean region, which is the market of the 16 Central and Eastern European (CEE) countries. They are: Albania, Czech Republic, Croatia, Slovenia, Serbia, Slovak Republic, Bulgaria, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Bosnia and Herzegovina, and Romania.

According to World Bank's data, in 2016, the total GDP of the 16 CEE countries was $1.39 trillion, accounting for 1.8% of the world total. The total population these 16 countries was 119 million, accounting for 1.7% of the world total. The total value of export goods and services was $873 billion, or 4.2% of the world total. The total value of import goods and services was $826 billion, or 4% of the world total.

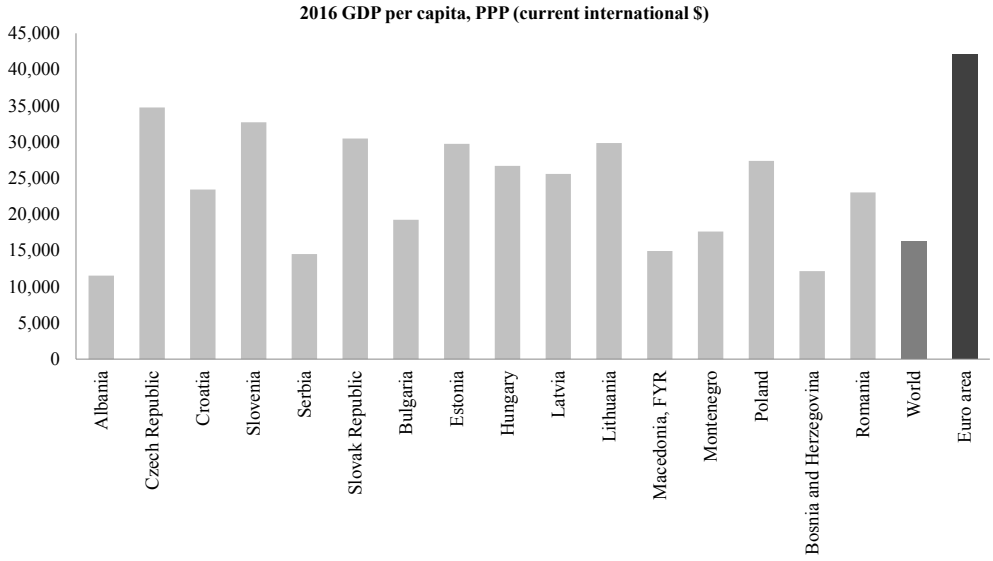
The 16 CEE countries are European emerging market countries, from 2012 to 2016, the GDP growth of these countries are significantly better than the overall level in the euro area, but from the point of view of GDP per capita, the overall level was significantly lower than the Eurozone.

GDP growth of the 16 CEE countries (2012-2016)



GRAPH 7 - SOURCE: World Bank

GDP per capita of the 16 CEE countries (2016)



GRAPH 8 - SOURCE: World Bank

In addition, the 16 countries in central and eastern Europe only 5.02 million TEU container port throughput, accounted for 0.7% of the global total, this shows that the state of container trade growth has great potential, on the other hand, explains their dependence on the Mediterranean ports.

4.2 Cooperation between China and 16 the CEE countries are increasing

As an important region in Europe and in the B&R Initiative, the 16 CEE countries plays a significant role in promoting the building the B&R. In 2012, China and the 16 CEE countries have established a cooperation mechanism dubbed 16+1.

Since then, trade between China and the 16 CEE countries has been grown fast, in 2017, it grew by more than 15% year-on-year, according to Chinese customs' statistics.

From 2012 to 2016, Chinese investment in CEEC is now over $9 billion while CEEC invested $1.4 billion in China. China's imports of agricultural products from these countries grew by average of 13.7% annually.

According to Tmall Global and CNBData's data, in 2017, among the top five kinds of goods with the fastest import growth, goods from the Mediterranean and the 16 CEE countries accounted for 4 seats, they were skin care products and cosmetics from Greece, Poland and Spain, and chocolate from Hungary.

Including trade and investment, now the 16+1 cooperation has expanded to such fields as infrastructure construction, agriculture and forestry, logistics, science and technology, finance, energy and health.

In the financial sector, China established the 10-billion-dollar China-CEEC Investment Cooperation Fund last year and it has already invested in 12 projects in five CEE countries. Hungary, Lithuania and Poland have participated in China's bond market. China and the 16 CEE countries have also established the China-CEEC Inter-Bank Association and the second phase of China-Central and Eastern Europe Investment Cooperation Fund. The China Development Bank (CDB) will provide an equivalent amount of €2 billion euros ($2.4 billion) as development-oriented financial cooperation loans for the inter-bank association.

Definitely, The 16+1 cooperation and B&R Initiative will make CEEC a very promising market.

5. Piraeus Port: gate of the 16 CEE countries

5.1 Piraeus Port: ideal logistics hub between Asia and Central & Eastern Europe

As the first European port after the Suez Canal, Piraeus Port is the largest port in Greece and one of the largest ports in the Mediterranean. The country's geographical position makes it an ideal logistics hub on Asia - Africa - Europe's crossroads and it is also the closest EU's basic port to the Suez-Gibraltar axis.

Thanks to the favorable climatic conditions (e.g. no tide) and the depth of the sea—19m, Piraeus from 2017 became the only Mediterranean port that is able to simultaneously serve 5 mega container ships over 18,000 TEUs.

Piraeus is also a favorable port of transshipment for vessels and has a large network of feeder services to all nearby ports in the Mediterranean, Black Sea and the Adriatic.

According to Alphaliner's latest data, in 2017, container throughput of the Piraeus Port reached 4.15 million TEU in 2017, up 10.9% from 3.74 million TEU in 2016. Its rank in the top 110 container ports rose from 38th to 36th, and now is the third container port in Mediterranean and no. 1 in eastern Mediterranean.

The location of Piraeus Port

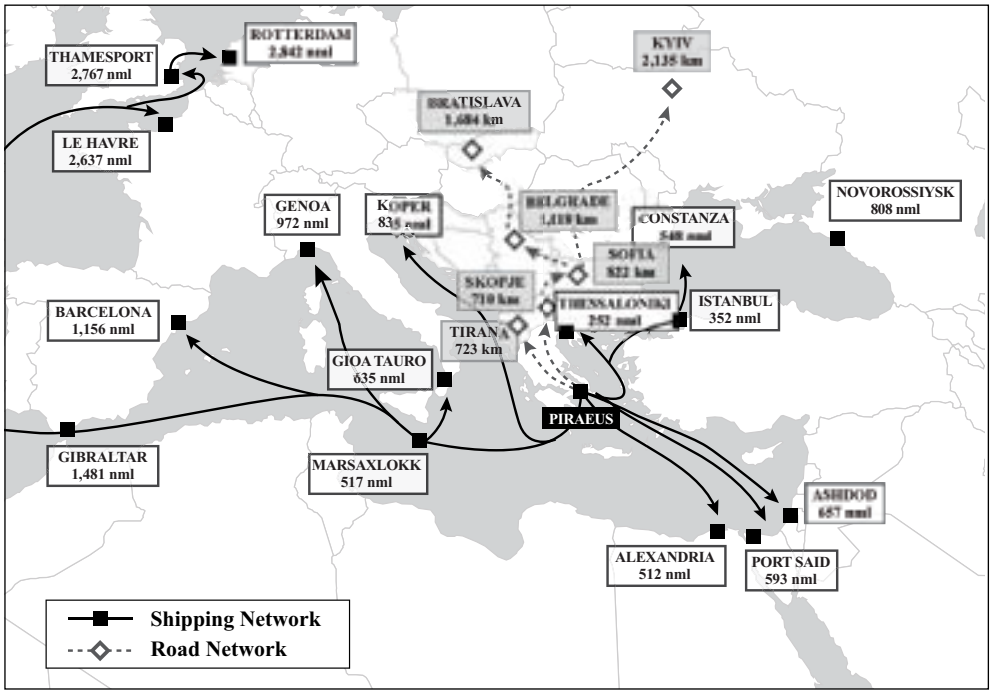


FIGURE 1 - SOURCE: SRM on Piraeus Port Authority S.A.

5.2 Piraeus Port and COSCO Shipping Group

On February 18, 2016, COSCO and China Shipping merged into COSCO SHIPPING, the world's largest integrated shipping group.

In June 2008, the former COSCO won the international bid for a 35-year concession for the No. 2 and No. 3 piers at the port of Piraeus. Piraeus Container Terminal S.A. (PCT), a subsidiary corporation of COSCO SHIPPING, has been formed and started to operate the No. 2 and No. 3 piers. On August 10, 2016, COSCO SHIPPING acquired 67% of the shares of the Piraeus Port Authority (PPA), officially taking over the port's business.

COSCO Shipping Lines, affiliated with COSCO SHIPPING, at the end of 2017 has a total of 361 container vessels, with a total capacity of 1.84 million TEUs, 2.68M TEU containers, ranking the 4th place in the world, and the 1st place in the Asia.

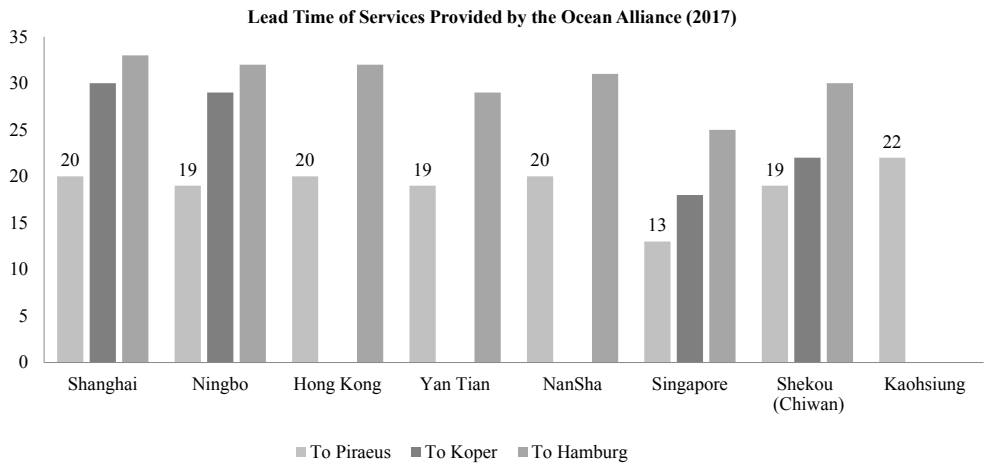
In recent years, COSCO Shipping Lines has placed a relatively complete network in Piraeus and been able to not only connect the main Eurasian trunk services with the feeder networks of North West Europe, Mediterranean, Black Sea, West Africa, North Africa and Adriatic Sea fast, but also go through Piraeus to the hinterland emerging markets of Central Eastern Europe and Balkans by direct railway.

To fully support the development of the port and make it the southern gateway of Europe—especially the 16 CEE countries, COSCO Shipping Lines and the Ocean Alliance (COSCO Shipping Lines, CMA CGM, OOCL and Evergreen) have increased the number of liner services called at Piraeus Port, and optimized the lead time. Now the services called the port are cover almost all the base ports in Far East.

In 2017, COSCO SHIPPING Lines' throughput in Piraeus exceeded 1 million TEU for the first time, up to 1.09 million TEU, 37% more than the same period of last year.

At present, COSCO SHIPPING is consolidating the logistics resources and working with all parties to strive to build Piraeus into the most important container transshipment port in the Mediterranean, land and sea intermodal transportation hub and international logistics distribution center.

Lead time advantage of services called at Piraeus



GRAPH 9 - SOURCE: China COSCO SHIPPING Corporation Ltd.

5.3 Piraeus Port to the 16 CEE countries: China Europe Land-Sea Express

In order to give full play to the advantages of Piraeus Port as the southern gateway of CEE countries, former COSCO launched the China-Europe Land-Sea Express service in 2014. This service connected Piraeus Port and major cities in the CEE countries by rail. In 4 to 6 days, the goods from Piraeus Port can reach CEE landlocked countries such as Czech, Austria, Slovakia and Hungary.

Central Europe Land-Sea Express radiation zone

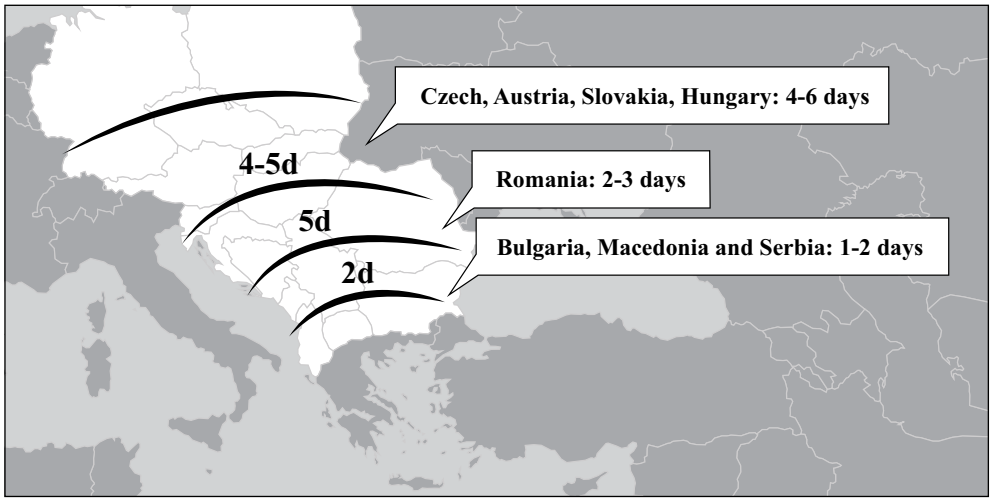


FIGURE 2 - SOURCE: SRM on China COSCO SHIPPING Corporation Ltd.

While the 21st Century Maritime Silk Road has opened a channel for trade between China and Europe, the China-Europe Land-Sea Express Line connecting Piraeus through COSCO SHIPPING has extended the Maritime Silk Road into the hinterland of Europe.

With more than 32 million people directly involved, the Express Line stretches from the port of Piraeus in the south to Budapest, Hungary in the north, and goes through Skopje of Macedonia and Belgrade in Serbia.

It has realized combined sea and land transportation, which means that after arriving at Piraeus, containers can be immediately transferred to railway before reaching Austria, the Czech Republic, Poland and other Central and Eastern European countries via the Express Line.

At present, some world-renowned manufacturers, such as Sony and the HP, have become loyal customers on the Express Line.

In response to the increasing demand, China-Europe Land-Sea Express Line made a breakthrough and became a 'regular' and 'daily' service in 2017, so the freight volume of sea rail multimodal transport increased exponentially.

At present, 4 main lines have been linked to 5 main inland CY of Czech, Austria, Slovakia, Hungary and Serbia, and are radiating about 1500 inland points, which basically cover the main towns of the 5 countries and provide customers with destination clearing and "CY – gate" service. In 2017, a total of 700 block trains carried about 40 thousand TEU cargos through this service, or increased by 134% year-on-year. In average, there were about 12 trains per week, and the number of customers also increased from single digits to more than 600.

In terms of time, the China-Europe Land-Sea Express which uses the Piraeus Port as the transshipment hub has obvious advantages compared to other multimodal transport services through other European ports (such as Hamburg and Koper). The lead time can be reduced by 3 to 10 days according to the different loading port of the Far East.

Lead time advantage of China Europe Sea-Land Express

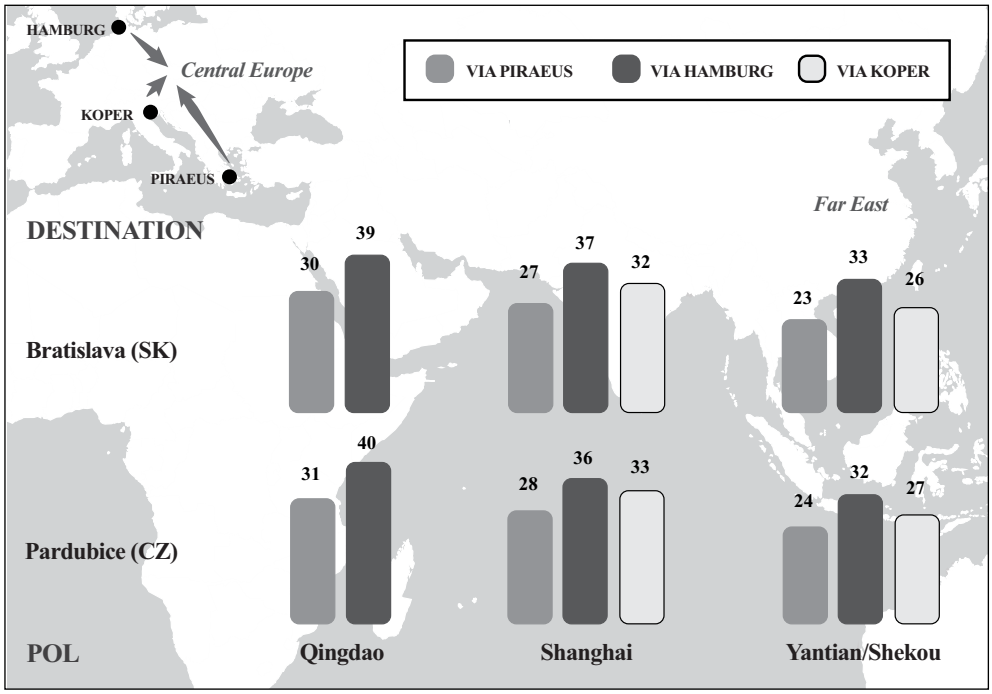


FIGURE 3 - SOURCE: SRM on China COSCO SHIPPING Corporation Ltd.

In the future, with the completion and operation of the Hungary-Serbia Railway, the service provided by the China-Europe Land-Sea Express will be further improved.

On the one hand, the service will drive the development of industry in the countries it covers, stimulate growth of the regional economy, so that China's equipment and technology can take advantage of this opportunity to cultivate CEE and even the whole European market. On the other hand, it will support the development of the 21st Century Maritime Silk Road and provide convenient and low-cost channels for more Chinese exports to the hinterland of CEE and vice versa.

HUNGARY-SERBIA RAILWAY

The 350-kilometer flagship railway will link Hungarian capital Budapest with Serbian capital Belgrade, with 184 km in Serbia and the rest in Hungary. A group of Chinese enterprises, led by China Railway Co, will build the line that will shorten the travel time from eight hours to three hours.

In Belgrade, construction of the Serbian section of Hungary-Serbia Railway began on November 28th 2017, but the construction of the Hungarian section will begin in 2020.

6. Conclusion: the Mediterranean is both a destination and a transit hub for the B&R Initiative

The Belt and Road Initiative (BRI) is based on five pillars: political harmonization, infrastructure connectivity, trade and investments, financial integration and cultural exchanges.

This section will mainly address the third pillar, in particular the infrastructure investments on which Beijing and its partners have bet in order to increase trade flows. These are ports, airports, long-distance and high-speed rail lines, motorways, but also investments in finance, banking, energy, real estate, businesses and companies. If we break down the BRI by geographical area, a great absentee stands out: the Americas. The Trump presidency in the United States, anticipated by a strongly anti-Chinese electoral campaign, saw Washington introduce neo-isolationist positions, such as withdrawing from the Trans-Pacific Partnership (TPP) launched by Obama to boost trade in the Pacific.

Geographical distances do not help either. China has therefore decided to focus on countries that are close or easily accessible by land and sea.

Chapter XI

Singapore Maritime Cluster

1. Foreword

This chapter provides an overview of the port of Singapore focusing on the governance structure of cluster within which it operates. An analysis is undertaken of the main sources of cargoes that pass through the port, especially as port of transhipment.

The overall performance of the port is assessed against a range of criteria and different types of operation that take place within the port are explained. In considering the governance structure within which all this takes place, particular attention is paid to the pivotal role of terminal Operator PSA and the Maritime and Port Authority (MPA) of Singapore as the statutory regulatory authority and to the ownership structure of the container-handling sector and the potential for privatisation within it.

The chapter presents, also, an exposition of the next investments in 'Tuas' seen as a possible driving force for further growth.

2. An overview on main data of Singapore

The sovereign city-state of Singapore is a strategic financial, trade and maritime business centre thanks to its geographic location in the South East of Asia.

Strategically placed along the Belt and Road Initiative (BRI), it can play a critical role in the project as a global financial, trade and maritime hub.

Singapore is located 152 km north of the equator, strategically placed on the tip of the Strait of Malacca. The archipelago (over 60 islands of which the biggest is named Singapore where the capital is located) is separated from Malaysia in the north by the Johor Straits and from Indonesia in the south by the Singapore Straits.

Singapore is located at the center of the main trade routes, thus, it is as a maritime gateway to the key Asian markets and a strategic center for maritime business. It can be considered as a hub that connects Asia to the World.

As a matter of fact, 400 routes pass through Singapore connecting 600 ports and 120 countries worldwide. 130,000 vessels enter the port yearly. At any one time there are about 1,000 vessels in the port and a ship arrives or leaves Singapore every 2-3 minutes.

The maritime industry contributes approximately 7% to its gross domestic product and most of this revenue is gained through bunkering and shipping services. Moreover, the industry – with the port at its heart, is responsible for 10% of the service sector, a sector that makes up 75% of the economy.

Singapore is already home to more than 5,000 maritime establishments and businesses and over 130 of the world's top shipping groups, with 170,000 people employed in the sector.

Maritime Sector: Key figures 2017

Competitiveness	1st Leading capital Maritime in the World (Menon Economics, 2017)
	Liner Shipping Connectivity Index (LSCI) 2017: 2nd in the World
	Logistics Performance Index (LPI) 2016:5th in the World
Shipping	1st transhipment hub in the world: 85% transhipment volumes account for 28.4 million TEUs (1/7 of total World)
	One of the busiest ports in transhipment: more than 145,000 vessel-calls annually
	2nd world container port: 33.35 million TEUs in 2017
	3rd Terminal operator in the world (PSA): 74.2 million TEUs
	One of the top refrigerator ports: 1.8 million TEUs of reefers
	5th world cargo handled: 626.2 million tonnes in 2017
Energy, Oil & Gas	1st bunkering (ship refuelling) port in the world: 50.6 million tonnes of bunkers annually
	1/5 of total vessels berth in the port are bunkering vessels.
	4th Refined Oil Exporting Country in the world
Maritime Technology	2nd of the world for Maritime Technology (Menon Economics, 2017)
Merchant Fleet	5th in the world in terms of shipowners
Fleet by Flag of registration	5th world flag registries
Bank & Insurance	4th world financial hub

TABLE 1 - SOURCE: SRM on various

According to the UNCTAD's Liner Shipping Connectivity Index (LSCI) Singapore ranks second in the World after China for competitiveness in the maritime industry.[1]

Singapore's strategic position makes the country a crucial logistic hub for global trade. According to the World Bank's Logistics Performance Index (LPI)[2], Singapore ranks fifth among all economies.

[1] The Liner Shipping Connectivity Index (LSCI) summarizes five elements of competitiveness in the maritime industry: number of ships; their container-carrying capacity in TEUs; maximum vessel size; number of services; and number of companies that deploy container ships in a country's ports.

[2] The Logistics Performance Index is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI 2016 allows for comparisons across 160 countries.

The Logistics and Performance Index summarizes the results of the countries on 6 complementary areas of evaluation.

- Efficiency of the clearance process.
- Quality of trade and transport related infrastructure.
- Ease of arranging competitively priced shipments.
- Competence and quality of logistics services.
- Ability to track and trace consignments.
- Timeliness of shipments in reaching destinations within the scheduled or expected delivery time.

In particular, the LPI provides a multidimensional assessment of logistics performance of a country by placing it on a scale ranging from 1 (worst score) to 5 (best score). The evaluation is the result of the survey carried out online on more than 5,000 individual country assessments provided by about 1,000 international shippers and express carriers in order to compare the logistics profiles of 160 countries. The selected sample of operators is based on the assumption that their opinions count as they decide the traffic routes to follow and influence companies in matters of choice of location, selection of suppliers and identification of the target market.

Both the indicators synthesize Singapore's undoubted capacity to combine maritime competitiveness together with logistics capacity.

Furthermore, Singapore achieved impressive results in maritime technology[3]. According to the last Menon Report 2017[4] – that examines four maritime sectors: shipping, finance and law, technology and ports and logistics, together with an overall assessment of the cities' attractiveness and competitiveness – Singapore is the leading Maritime Capital of the World.

Considering the maritime industry's pivotal role in Singapore's economy, and the fierce competition between global ports, Singapore's government is determined to ensure the country remains a leading maritime trading hub. The strategic blueprint aims to create over 5,000 new jobs in the maritime sector and increase its "value-add" by US$3.50bn by 2025, by developing technological innovation, workforce talent, and connectivity between maritime industry actors.

3. Maritime traffic and port sector of Singapore

The position of Singapore as a port hub is highlighted by its position in the new global ranking of container ports. In 2017 Singapore is the second container port in the World after Shanghai with 33.7 million TEUs handled last year; an increase of 8.9 per cent on 2016.

In Singapore transhipment volumes account for around 85% of all containers handled equal to one-seventh of the world's transhipment containers and 5% of global container throughput. Thus, Singapore is considered the first transhipment hub in the World.

The Port of Singapore is also one of the world's largest refrigerated container (reefer) ports. It has more than 9,000 reefer points and handled almost 1.8 million TEUs of reefers[5].

Cargo tonnage handled by Singapore reached a record 626.2 million tonnes in 2017 up 5.5 per cent on the previous year. Singapore is one of the five busiest port in terms of shipping tonnage.

Moreover, Singapore retained its crown as the world's top bunkering port surpassing the 50 million tonnes mark for the first time with 50.6 million tonnes of bunkers sold in the port in 2017 up 4.2 per cent on the previous year. 1/5 of total vessels berth in the port are bunkering vessels. Singapore is often listed as the leading oil trading hub in Asia (third in the world after New York and London) and 4th Refined Oil Exporting Country[6]. It has a refining capacity of nearly double its rate of petroleum products consumption[7].

[3] Menon Economics (2017). *The Leading Maritime Capitals of the World 2017*. Menon Publication No. 28/2017.

[4] *Ibid.*

[5] Logistics Insight Asia (2016). Automating Cranes PSA Singapore [www.logasiamag.com].

[6] Workman D. (2018). *Refined Oil Exports by Country, Site: World's Top Exports* [www.worldstopexports.com].

[7] Source: The U.S. Department of Commerce's Office of Trade Agreements Negotiations and Compliance.

Performance of the Port of Singapore

	2012	2013	2014	2015	2016	2017
Total container throughput (mln TEUs)	31.6	32.6	33.9	30.9	30.9	33.7
Total cargo (mln tonnes)	538.0	559.6	581.3	575.8	593.3	627.7
Bunker sales (mln tonnes)	42.7	42.7	42.4	45.2	48.6	50.6

TABLE 2 - SOURCE: SRM on MPA Singapore Statistics

Unlike the other ports that SRM has visited and analysed over time, it must be said that Singapore is a small-sized state that serves a bigger area. The port of Singapore will continue to grow not only because its internal demand increases but, mostly, because the demand of the surrounding countries will also increase.

Overseas volumes grow faster than Singapore. Experts estimate[8] a growth of traffic in the Strait of Malacca because in South East Asia there are at least 2-3 developing countries in excess of 100 million with low container volumes that are due to increase. Thus, South-East Asia and, more in general, Asia, are growing and Singapore is in the right position on the Strait of Malacca to intercept this traffic. Moreover, Singapore can play a critical role in the Belt and Road Initiative[9]; the Chinese initiative aimed at strengthening commercial traffic between Africa and Eur-Asia. This refers to the fact that 33% of all outward investments linked to the BRI flows through Singapore, while 85% of all inbound investment for the initiative makes its way into China through Singapore on the Strait of Malacca[10].

Thus, the Strait of Malacca could be considered as important a global transit point as Suez and Panama. The Strait of Malacca will be an important transit point between East and West and Singapore, with its new investments further discussed throughout the following section (The next investment: the mega-port of Tuas), would like to play a pivotal role providing the best transhipment to every customer.

4. MAIN STRATEGIES OF SINGAPORE TO REMAIN A GLOBAL MARITIME HUB: A STRATEGIC POSITION, TRANSHIPMENT, AN ADVANCED TECHNOLOGY SYSTEM, MEGASHIPS ACCOMMODATION AND BUNKERING

Thanks to its strategic geographic position, it plays a significant role in serving the global markets with over 400 routes and 62 weekly containership services connecting the port of to more than 140 ports worldwide. With its unrivalled connectivity, many small feeder vessels bring containers to Singapore. At the Port of Singapore, these containers get loaded onto large vessels which will then carry the shipment to their final destination. The value of transhipment lies in that it is more cost efficient and time saving than the vessels making a single direct voyage.

Shipping lines use PSA for these modes of transhipment:

[8] PSA Interview in Singapore.

[9] See Chapter X.

[10] Mr. Chan Chun Sing, Minister in the Prime Minister's Office of Singapore and Secretary-General of the National Trades Union Congress (NTUC) at the WEForum 2018 in Davos (Switzerland), 24th January 2018.

- Hub & Spoke (Main Line Operator to Feeder).
- Cross Strings (Main Line Operator to Main Line Operator).

Singapore is equipped to satisfy the shipping needs on a local and international level. It has a technologically advanced structure; cranes are fully automated and no longer require an operator each, 18 to 25 workers in the control centre handle 186 cranes at a time (1 worker controls from 7 to 10 cranes simultaneously). The Port of Singapore is open to ships 24 hours a day, 365 days a year. The port has very deep depths for the accommodation of megaships.

This predisposition in accommodating megaships allows it to better intercept this type of traffic from around the World, allowing Singapore to remain one of the world's major hubs.

This reception capacity becomes even more relevant when analysing the orderbooks up to 2020, which show an increase, by 2018, of the container fleet equal to about 2.4%, with the number rising to 24.7% when considering the class of the megaships of 18,000-23,000 TEU and to 7.5% for the 13,000-18,000 TEU fleet. So, it is expected that the already significant traffic of the area will intensify even further.

The possibility of bunkering ships at a competitive price allows Singapore to be a hub leader; a benchmark for others hub too. It should be emphasized that Singapore is a world leader in the bunkering sector. Singapore's bunker fuel sales in 2017 rose over 4% year on year to a record 50.6 million metric tonnes. This is the equivalent to 18.2 billion US in terms of sales. And looking at data from January to February, sources expect Singapore bunker sales to hit 8.7 million mt. In contrast, volumes done at Fujairah, the world's second largest bunkering port, were estimated to be at least 12 million mt in 2017.

While bunker sales in Singapore are expected to rise steadily, the number of players has been shrinking. This is in line with expectations of market participants, due to increased competition and the enforcement of mass flow meters (MFM)[11] undertaken recently. MFMs have increased transparency by curbing industry malpractices. MFM is an important step towards ensuring the bunker industry is more ethic than in the recent past.

In conclusion, we have to underline that Singapore, one of the 3 largest importers of Suez southbound oil flows, with China and India accounting for more than 58% of the total. In particular, Singapore accounts for 31% of Suez Canal southbound oil flows.

5. Singapore Maritime cluster: the key role of Terminal Operator PSA International

Singapore was traditionally a "re-export economy" by virtue of its historical role as an entrance door for Southeast Asia. Today, Singapore remains the first re-export point of the globe[12] and the shipping and logistics cluster of Singapore is considered number one in the world.

[11] Mass flow meter: a device that measures mass flow rate of fluid travelling through a tube.

[12] The United Arab Emirates National Media Council (2013, November). *United Arab Emirates Yearbook 2013*. Dubai, United Arab Emirates: Elite Media.

- The maritime cluster employs more than 170,000 people and contributes some 7% to Singapore's Gross Domestic Product.
- Singapore continues to attract a diverse range of maritime businesses and is now home to over 130 international shipping groups and more than 5,000 companies.

The gradual creation of the cluster dates back to 1996 when the Maritime and Port Authority of Singapore was established with the old name of PSA that was formerly the Port of Singapore Authority, a statutory board regulating, developing, operating and promoting the port of Singapore's terminals.

In 1996, PSA's regulatory functions were handed over to the Maritime and Port Authority of Singapore. PSA Corporation Limited was subsequently corporatised[13] in 1997 as the successor to the Port Authority to manage and operate its terminals and related businesses. Since 1997 PSA has been focusing specifically on port operations and common shore operations.

In this way, the MPA has been assigned the task of providing the addresses in the maritime and logistic field while PSA International has focused on operations.

In December 2003, PSA International became the investment holding company for PSA's businesses in Singapore and worldwide. PSA International is fully-owned by Temasek Holdings[14] the sovereign wealth fund of Singapore.

Nowadays, there are two big actors that have different but synergistic roles:

The MPA has the role of developing and promoting Singapore as a premier global hub port and an international maritime centre, and to advance and safeguard Singapore's strategic maritime interests.

PSA International's mission is instead "to be the port operator of choice in the world's gateway hubs, renowned for best-in-class services and successful partnerships"[15]. Thus, PSA has been working to create a big network overseas and investing worldwide.

In 2016 Singapore introduced a Master plan called "Industry Transformation Map. The programme integrated different restructuring efforts, taking a targeted and industry-focused approach to address issues and deepen partnerships between the Government, firms, industries, trade associations and chambers.

Under the programme, there are Industry Transformation Maps (ITMs) developed for 23 industries under 6 clusters[16].

[13] Corporatization involves the transformation of government enterprises into separate corporate entities with clear objectives, the establishment of a board whose members are appointed on the basis of their expertise, and managers who are given commercial objectives and the powers to raise funds on private capital markets. In other words, a public enterprise faces exactly the same market conditions as competing organisations in the private sector.

[14] Temasek was incorporated under the Singapore Companies Act in 1974 to own and commercially manage investments and assets previously held by the Singapore Government. This allowed the Ministry of Finance to focus on its core role of policymaking and regulations, while Temasek would own and manage these investments on a commercial basis. In accordance with the well-established Singapore Financial Reporting Standards, the Group Financials for Temasek are a consolidation of financial information of Temasek and its operating subsidiaries, such as PSA, Singapore Airlines, Singtel, ST Engineering, etc.

[15] Source: PSA Website.

[16] The 6 clusters are Manufacturing, Built Environment, trade and Connectivity, Essential domestic services, modern services and lifestyle.

The value added of this plan is given also by the synergy among the ITMs; they dialogue together. There are 23 of them, and the overall of these 23 is administered at government level, by the Prime Minister's office. But every division of ITM will have one government agency.

One of these is the Sea Transport Industry Transformation Map. This was launched in 2018. Lead Agency for the ITM is Maritime Port Authority.

The aim of the Sea Transport ITM is to grow the sector's value-add by S$4.5 billion and create more than 5,000 good jobs by 2025. It represents the policy of the government on the how transport is transforming Singapore: developed by the Maritime and Port Authority of Singapore (MPA) in partnership with the industry, unions and other government agencies, the Sea Transport ITM builds on MPA's strategic long term plans to develop Singapore's next-generation port.

To sustain Singapore's competitive advantage and strengthen port connectivity, MPA is also working with the industry to develop the port eco-system in adjacent sectors, such as logistics and e-commerce.

The port of Singapore and its governance structure

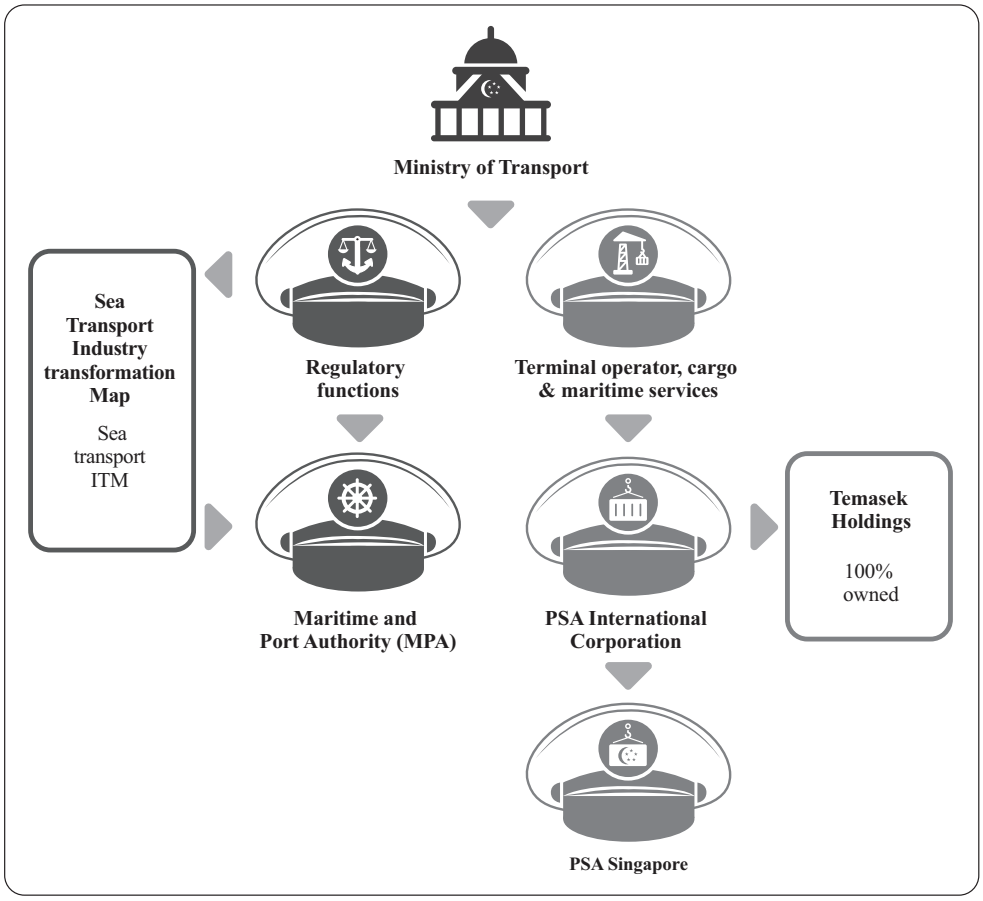


FIGURE 1 - SOURCE: SRM on PSA

PSA International is ranked 3rd in the world in terms of Terminal operators and covers 10% of the global market of container flows[17].

Ranking Global container Terminal operator

Company	Throughput (mln TEUs) 2017	Var. 2016-2017	Global Container Market
CMPort (China Merchant Port Holdings)	102.9	7.5%	14%
Cosco Shipping	87.3	12.6%	12%
PSA International	74.2	9.8%	10%
DP World	70.1	10.1%	9%
APM Terminals	39.7	6.5%	5%
Hutchinson Port Holding Trust (HPH Trust)	24.3	7.9%	3%
Eurogate	14.4	-1.4%	2%
International Container Terminal Services, Inc. (ICTSI)	9.1	5.3%	1%
Hamburger Hagen und Logistik AG (HHLA)	7.2	8.1%	1%
YILPORT Holding	4.3	9.40%	1%
Top 10	433.5	9.8%	58%
Global container Throughput 2017	743.5	6%	

TABLE 3 - SOURCE: SRM on Terminal Operator sites

PSA International, in fact, is one of the main international companies specialised in handling port operations with 40 maritime terminals in 16 countries across Asia, Europe and the Americas with flagship operations in Singapore and Antwerp (the locations include Genoa Voltri and Venice in Italy too) and a cargo traffic in the last year equal to more than 74 million TEU (+9.8%).

More than half of the traffic of PSA International (40.89 million TEUs) was handled outside Singapore, confirming the international projection of PSA and the amazing capacity of handling a large amount of traffic. This has been possible thanks to high management capacity and advanced technology which have enabled this group to achieve the highest level of traffic in 2017 (starting from 2011).

Global container terminals of PSA International

The Americas	Middle East South Asia
Argentina	India
Exolgan Container Terminal	Tuticorin Container Terminal
	Chennai International Terminals
Panama	Bharat Mumbai Container Terminals
PSA Panama International Terminal	Bharat Kolkata Container Terminals
	Kakinada Container Terminal
Colombia	
Sociedad Puerto Industrial	Saudi Arabia
Aguadulce	Saudi Global Ports

►

[17] Source: various sources and sites of the top 10 Terminal Operators.

Europe & Mediterranean	Northeast Asia
Belgium	China
PSA Antwerp	Dalian Terminals
PSA Zeebrugge	Fuzhou Container Terminals
	Guangzhou Container Terminal
Italy	Tianjin Terminals
PSA Voltri Prà	PSA Dongguan Container Terminal
PSA Venice	LYG-PSA Container Terminal
	Beibu Gulf-PSA International
Portugal	Container Terminal
PSA Sines	South Korea
	Incheon Container Terminal
Turkey	Busan Terminals
Mersin International Port	Japan
	Hibiki Container Terminal
	Southeast Asia
	Singapore
	PSA Singapore
	Thailand
	Eastern Sea Laem Chabang Terminal
	Vietnam
	SP-PSA International Port
	Indonesia
	New Priok Container Terminal One

TABLE 4 - SOURCE: SRM on Terminal Operator sites

6. PORT, INFRASTRUCTURES AND SERVICES: THE ROLE OF PSA SINGAPORE

PSA Singapore is the terminal operator of Singapore port. PSA Singapore is the flagship terminal of PSA International.

In 2017, PSA Singapore handled 33.35 million TEUs of containers. The Port of Singapore is:

- *The World's Busiest Transhipment Hub* – accounting for almost one-seventh of the world's total container transhipment throughput and 5% of global container throughput.
- *One of the World's Largest Refrigerated Container (Reefer) Ports* – more than 9,000 reefer points; it handled almost 1.8 million TEUs of reefers in 2016.
- *Excellent Connectivity* – connected to 600 ports, with daily sailings to every major port in the world. Singapore port has daily connections to Asia, Europe and USA.

Daily Containership Sailing from Singapore to the World

Daily Sailing to:	
Southeast Asia	34
China, Hong Kong & Taiwan	12
South Asia	8
Europe	3
Japan	3
US	2
Total	62

TABLE 5 - SOURCE: PSA Singapore Terminal

In Singapore PSA Singapore operates a total of 60 berths at its container terminals of Tanjong Pagar, Keppel, Brani, and Pasir Panjang. The particularity is that they operate as one seamless and integrated facility.

The terminals at Pasir Panjang are PSA's most advanced. The berths at Pasir Panjang 3 and 4 are up to 18 metres deep and equipped with quay cranes able to reach across 24 rows of containers to serve the world's largest container ships. They also feature the latest port innovations – such as a zero-emission, fully-automated electric yard crane system – which raises the port's productivity.

There are also two multi-purpose terminals: Pasir Panjang Automobile Terminal and Sembawang Wharves.

Pasir Panjang Automobile Terminal started operations in January 2009. It is PSA's vehicle transhipment hub and Singapore's first dedicated car terminal. PPAT has three dedicated berths and is supported by an open car yard and a multi-storey car storage yard, which together provide some 20,000 car park lots. As for containers, the Ro-Ro terminal does not only serve Singapore's internal consumption demand. It was created because of the interesting way South-East Asia is distributed.

South East Asia is very dispersed; a region of peninsulas and islands. Thus, it was necessary to have a central point where to collect all the car manufacturing coming, for example, from Indonesia, Australia or Thailand. So, Singapore has become a hub for South-East Asia's Ro-Ro shipping lines.

The Multi-Purpose Terminal Sembawang Wharves handles break-bulk and specialised cargo which includes heavy equipment, steelworks, and cables.

There are also joint ventures with major international groups. Companies like CMA-CGM, COSCO and the merged Ocean Network Express (ONE), have increased their corporate presence in Singapore.

These joint ventures give a priority to the groups with whom the joint venture is subscribed. CMA CGM and PSA have joined forces to form a joint venture company named CMA CGM-PSA Lion Terminal Pte. Ltd. (CPLT). The new company will operate and use four mega container berths at Pasir Panjang Terminal (PPT) Phases 3 and 4. CMA-CGM has also established its Asia regional office, its global Navigation and Port Operations Centre and, most recently, its Asian digital activity hub in Singapore.

COSCO-PSA Terminal Pte Ltd, is a joint venture company formed by COSCO Shipping Ports and PSA(CPT) at Pasir Panjang Terminal (PPT) Phases 3 and 4.

There is another joint-venture with MSC: MSC-PSA Asia Terminal (MPAT). The MPAT berths at Pasir Panjang Terminal are capable of handling mega vessels with capacity exceeding 14,000 TEUs.

In addition, Pacific International Lines (PIL) entered into a joint venture with PSA Singapore (PSA), forming PIL-PSA Singapore Terminal Pte Ltd (PPST) at Keppel Terminal.

There is also a joint-venture in the automobile sector of PSA, Nippon Yusen Kabushiki Kaisha (NYK) and Kawasaki Kisen Kaisha Ltd (K Line). Located at Pasir Panjang Terminal, this joint-venture (Asia Automobile Terminal Singapore- AATS) operates two dedicated berths and is a vehicle transhipment hub for the region.

In addition, ONE has chosen Singapore as its global liner headquarters. These activities in turn have drawn in other maritime services providers such as insurance, broking, financial services, classification societies, P&I Clubs, legal and arbitration.

7. The next investment: the mega-port of Tuas

The port is growing and to meet new demands Singapore is building a new mega-port located in 'Tuas' which will be built in the west part of the city, to free up prime land in Pasir Panjang and Taniong Pagar for future residential and mixed-use development. The project will create one consolidated port, to replace the current container terminals, namely Pasir Panjang Terminals, Brani, Keppel and Tanjong Pagar.

The Tuas terminal's consolidation will be conducted in a phased manner. It will open in four phases from 2021 to around 2040. Thus, this transition is part of an overall long-term plan to consolidate container port facilities at Tuas.

Port relocation in Singapore: Tuas Mega Port

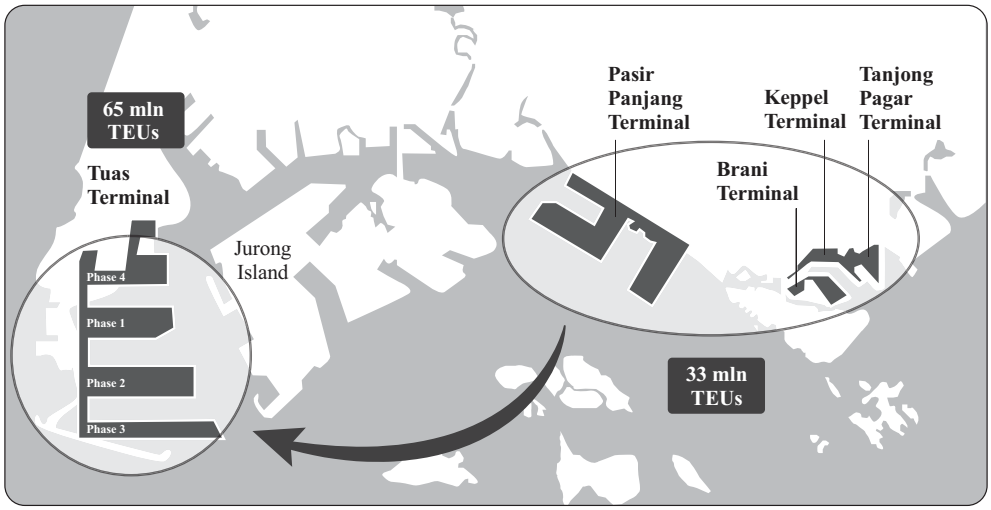


Figure 2 - Source: SRM on Straits Times Graphics

The port movement of the city terminals of Tanjong Pagar, Brani and Keppel are due to happen by 2027. Pasir Panjang's operations will run out in 2040. The new Tuas Mega port will be opened progressively from 2021 and the big move to Tuas is will take place by 2040.

When fully operational, the new mega port will handle 65 million containers a year, an increase of more than 85% capacity and it will occupy up to 1400 hectares of land. In addition, the new port will be more efficient than the current port system.

Currently, containers that arrive in Singapore and need to be transhipped are often required to be transported between terminals on trucks. This dramatically increases the time and cost of the operation, not to mention the road congestion caused. By consolidating all the terminals in one place, this will bolster efficiency, economies of scale, eliminate inter-terminal transfers and result in cost savings and increased productivity. Additionally, the industry is changing rapidly. Ships are getting larger and more complex – and will continue to do so, and there is a rise in the use of alternative fuels, such as LNG. A modern port needs to be able to cater for all of these new demands.

By creating a port that is as future-proof as possible, and also one that can be run as efficiently as possible, Singapore is demonstrating that it will continue to be a major player in both the region, and the world when it comes to the shipping and container industry.

The Tuas mega port will be outfitted with new technologies such as automated container port systems, to improve the efficiency of terminal operations. At Tuas, the number of automated yard cranes will rise to almost 1,000.

Tuas, when fully developed, is going to be the single largest fully-automated terminal in the world. The Maritime and Port Authority of Singapore (MPA) and the Dredging International Asia Pacific-Daelim Joint Venture (DDJV) have linked a contract for the USD 1.83 billion Tuas Terminal Phase 1.

The Tuas Terminal Phase 1 project is large in scope, and entails the construction of a new port terminal with 20 deep-water berths having a total capacity of 20 million twenty-foot equivalent units (TEUs) per annum.

The Joint Venture will be responsible for the erection of an 8.6-kilometre quay wall and its foundation, the dredging of the fairway and basins, as well as the reclamation of 294 hectares of new land.

The Tuas terminal, for example, will deploy advanced port technologies and will have numerous automated systems. In the progress are Automated Guided Vehicles (AGVs), automated yard and quay cranes and an Automated Storage and Retrieval System for containers to increase the yard storage capacity and create a mega intelligent container terminal.

The terminal will have also Green Technologies such as Electrified port handling equipment to reduce carbon emissions and usage of renewable energy such as solar power.

A contract for a value of SGD 1.46 billion (USD 1.11 billion) for the port development project Tuas Terminal Phase II in Singapore, also referred to as Tuas Terminal Finger Pier 3, has been signed between the consortium formed by Royal Boskalis Westminster N.V. (The Netherlands), Penta Ocean Construction Company (Japan), Hyundai Engineering & Construction Company (Korea) and the Maritime and Port Authority of Singapore (MPA).

The Tuas Terminal Phase II development is a part of the Tuas Port project and includes the design and construction of 387 hectares of land reclamation works bounded by 9.1 kilometres of caisson walls. The nearly 30-meter-high caissons designed for this project will be amongst the largest ever used in the world.

The activities will take place over a 9-year time frame and are expected to be completed in 2027.

To forge ahead, Singapore is investing in new port capabilities that will capitalise on emerging technologies arising from Industry 4.0. Tuas Port will be an efficient and intelligent port that harnesses data analytics to optimise operations, such as just-in-time vessel arrival.

The growth of investments may lead to an increase in traffic and international relations not only with Asia but also with Europe and Italy.

8. Relations between Italy and Singapore

Singapore and Italy share strong relations in several areas. Over than 4,000 Italian citizens live in Singapore. The Italian community is one of our largest in Asia, having almost doubled in the last five years.

The number of Italian companies in Singapore has increased reaching about 200. These companies operate in Shipping & Logistics, Banking & Insurance, Shipbuilding, Oil & Gas, Food &Beverage, Textiles and clothing.

In addition, Singapore is our first destination for exports in South-east Asia[18] equal to 27% of total (2.2 billion euro in 2017). In 2017, 54% of this traffic was seaborne.

In 2017, the most exported products were Machinery (41%), Chemistry and Plastic (14%), Oil &Gas (17%), Textiles & clothing (9%), Automotive & Aerospace (5%), Food & Beverage (4%). One of the most important Italian companies, leader in the bunkering sector, is Fratelli Cosulich. They are also physical suppliers able to move about 250,000 Tons of bunker per month.

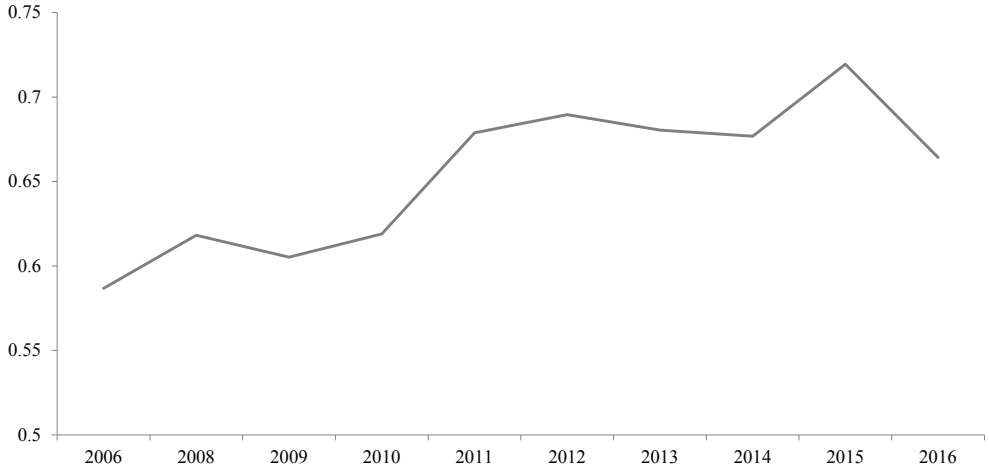
Italy was Singapore's seventh-biggest trading partner in the European Union last year and the 39th-biggest trading partner globally.

Referring to the maritime sector, the bilateral relationship – measured through Unctad's LSBCI (Liner Shipping Bilateral Connectivity Index)[19] – has been growing in recent years. This index reached a peak in 2015 when it was 0.72 (Maximum value=1), while it had a slight stop in 2016, which brought it to 0.66. It testifies that the bilateral trade made between Italy and Singapore is high and is increasing too.

[18] Brunei, Cambodia, Indonesia, Laos, Malaysia, Burma, Philippines, Singapore, Thailand, Timor Leste, Vietnam.

[19] LSBCI includes 5 components. For any pair of countries, A and B, represented in our sample, the LSBCI is based on: 1) the number of transhipments required to get from country A to country B; 2) the number of direct connections common to both country A and B; 3) the geometric mean of the number of direct connections of country A and of country B; 4) the level of competition on services that connect country A to country B; 5) the size of the largest ships on the weakest route connecting country A to country B. All the components are normalized. For further information, see UNCTAD's LSBCI.

Liner Shipping Bilateral Connectivity Index Italy-Singapore



GRAPH 1 - SOURCE: SRM on Unctad

Not only is Italy increasing its presence in Singapore but the opposite is also happening.

Through PSA International Singapore has made investments in Italy that are rapidly increasing; in particular, in Genoa and Venice. As a result, PSA International now has sites on both the Adriatic and Tyrrhenian seas.

7.1 The investments of PSA International in Italy

PSA Voltri-Pra, VTE, is the Port of Genoa's leading container terminal and ranks as the premier terminal in the North Tyrrhenian Sea. In 2017 it registered 1.6 million TEUs (+16.5% on the previous year) equal to 61.5% of total TEUs of the Port of Genoa.

PSA Voltri-Pra began operations in 1994. Located in the northwest of Italy, VTE is the gateway port for shipping lines serving the vast hinterlands of southern continental Europe. Far East services coming through the Suez Canal could consider Genoa Voltri as a natural access to Europe, using its intermodal connections to distribute their cargo directly to major central European destinations, instead of sailing an extra six days to Northern European ports.

Since 2015 a global expansion plan has been up and running, allowing PSA Voltri-Pra to develop a safer, more modern and efficient terminal. For these reasons in 2015 the company decided to invest more in the renewal of its equipment, purchasing new and modern ship-to-shore container cranes during 2016. The new cranes are part of a big investment plan worth 250 million euros.

One of the major characteristics that makes PSA Voltri-Pra a competitive Italian and European port is its geographically strategic position. The terminal is directly connected to the rail and road transportation system of Italy, which extends to all of Europe.

On the equipment front, VTE offers modern, efficient and specialised facilities which include 12 cranes including 8 super post panama quay cranes. This terminal has a designed capacity of 2.0 million TEUs.

Genoa's PSA Voltri Prà (VTE) Facilities

Container berths	4
Quay length (m)	1,433
Area (ha)	116
Max depth (m)	15
Quay cranes	12
Designed capacity (000 TEUs)	2,000

TABLE 6 - SOURCE: PSA International

PSA Venice administered by Vecon Spa (PSA International subsidiary) also known as Venice Container Terminal) is the main facility of the Port of Venice. Located in the north of the Adriatic Sea, it could be considered the gateway between Northeast Italy and the Mena Area.

PSA Venice - Vecon

Container berths	5
Quay length (m)	852
Area (ha)	28.3
Max depth (m)	11.5
Quay cranes	5
Designed capacity (000 TEUs)	430

TABLE 7 - SOURCE: PSA International

9. CONCLUSIONS

The chapter highlighted how the Singapore hub managed to become a world leader, notwithstanding its reduced domestic demand capacity. The strong point of the port was undoubtedly its geographical positioning but also its capacity for governance able to plan and implement long-term infrastructure plans (the investment in Tuas for instance). Singapore owes its leadership to the fact that it has become a centre for petroleum storage and handling.

In addition, the development of financial activities (such as banking) also has contributed to the inflow of shipping activities to the Singapore port.

It is undeniable that the concerted efforts of the Singapore government, MPA and PSA added a much-renewed focus of the direction the port of Singapore has taken. In keeping with growing competition, PSA has gradually added value to its activities not only in regional perspective but also internationally. As such, its modern day success is attributable to its far fetching aims and the continuous thirst to develop technologically as well as to compete internationally.

Patterns of port calls have changed, leading to the emergence of the Singapore port being a 'hub' and the further growth of bunkering and refuelling services.

Its presence along the Maritime Silk Road will increase the further development of the port thanks also to the growth and development of the surrounding economic areas.

In Singapore, Italian companies could create and use their synergies to address the challenges we have previously highlighted.

For all these reasons, Singapore as a maritime hub in Asia-Pacific seems to be the right place to be the site for the Italian maritime companies operating in the region. All the subsectors belonging to the global maritime industry are present in Singapore: Shipping & Logistics, Banking & insurance, Shipbuilding, Oil & Gas. The ultimate goal is to improve the position and the quantity of Italian companies in the region.

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This fifth issue of the Report on the Maritime Economy is based on four mainstays.
The first aims to provide a glimpse of the main data of the sector from a national and international point of view, including analyses of port traffic and transits through the major canals, the fleet and trends, as well as forecasts about the global maritime economy.
The second continues in the wake of an argument that SRM follows with great care, represented by the port and logistical investments of China in the Mediterranean, in the Middle East and in Northern Europe. A complex phenomenon with several implications that will probably continue for a long time, given the huge infrastructure investment plan that the Chinese Dragon is implementing to achieve the objectives of the Belt & Road Initiative.
The third mainstay is represented by energy corridors, one of the new topics proposed this year. The ports of our country represent a platform for energy supply at the service of the continent and the entire Mediterranean; liquid bulk traffic of Italian ports amounts to nearly 200 million tons and southern ports account for 47.4% of the country for this type of traffic. Additionally, we must mention the new, overbearing, advent of new fuels for ships such as LNG.
The fourth mainstay is represented by experiences on the field that SRM's researchers continuously transfer to the Report. Since the end of 2017 the research team have carried out scientific missions in countries that stand out for important port and maritime investments and which are characterized by innovative port models in place. This has been done in order to have a more detailed perception of the operations that will have implications on the global economy.
How is the Mediterranean changing in maritime and logistic terms? This is the question that the Report attempts to address, with original analyses and the support of thematic geomaps aimed at identifying routes and strategic directions of ships.

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