http://dx.doi.org/10.21622/MARLOG.2022.11.086

Vol. 11, Iss. 1, August 2022

The Impact Of Globalization On Mediterranean Container Terminals

Gianfranco Fancello [1i], Daniel M. Vitiello [2] and Patrizia Serra [3]

[1,2,3] DICAAR – Department of Civil and Environmental Engineering and Architecture, University of Cagliari, Cagliari, Italy

E-Mail: fancello@unica.it, danielm.vitiello@unica.it, pserra@unica.it

1. *ABSTRACT:* The Mediterranean basin has always played an important role in the global maritime scenario due to its key positioning along the main East-West trading routes and its centrality with respect to the Atlantic and North European markets, on the one hand, and to those of Asia and Africa on the other. The growth of container traffic has led to the emergence of new routes and the construction of ever-larger ships and ports.

These factors have increased the competitiveness among the Mediterranean ports, which must improve their functionality and productivity to meet new needs and acquire ever-higher market rates. It is estimated that in 2020 Mediterranean ports handled almost 40% of worldwide containerized trade flows. The total throughput of Mediterranean ports has risen from 40,5 million TEUs in 2010 to about 59 million TEUs in 2020, with a 46% increase (UNCTAD).

The establishment of a limited number of multi-trade strategic alliances in container shipping is concentrating the demand on a few players. Currently, all major container carriers are involved in one of the three global alliances: 2M (Maersk, MSC; capacity 8,475,700 TEU, share 33.8%, 1,363 ships), Ocean Alliance (Cosco-OOCL, CMA CGM, Evergreen; capacity 7,541,341 TEU, share 30.1%, 1,248 ships), THE Alliance (Hapag-Lloyd, ONE, Yang Ming, HMM, capacity 4,799,815 TEU, share 19.2%, 633 ships).

These big players often enter terminal operations, mostly investing in pure transshipment hubs along main shipping services, in order to control multiple supply chain phases. Some companies have their own 'terminal operating holding' such as Maersk (APM Terminals) and COSCO Group (COSCO Shipping Ports).

The increase of naval gigantism and the reduction of vessel calls due to strategic choices of carriers could influence the competitiveness of smaller container ports that are cut out from the main market trades (e.g. Cagliari) or that have physical limits on their terminals. This paper focuses on the specific case of Mediterranean container ports, analyzing the evolution of the containerized traffic and how the strategies of the main carriers are affecting container terminal policies.

Keywords: ***Mediterranean container ports, gateway and transshipment container ports, global shipping companies, global container trades***

2. INTRODUCTION

In the global maritime scenario, the Mediterranean basin plays a strategic role linked to its key positioning along the major East-West trading routes (known as pendulum routes) and its centrality with respect to both the Atlantic and North European markets, and the Asian and African ones.

Its unique location, incorporated along the main trade routes, offers network advantages to ocean carriers due to the shortened transit times to major emerging markets, in particular to and from the Asian region. It is estimated that Mediterranean container ports as a whole currently handle almost 40% of worldwide-containerized trade flows. Between 2010 and 2020, the global TEU throughput increased by 42%. This trend also involved the Mediterranean ports which saw a 46% increase in their total container volumes (UNCTAD, 2021).

The growth of container traffic has led to the emergence of new routes and the construction of ever-larger ships and ports. In the last years, shipping companies often decide to use the Cape Route to bypass the Suez Canal, due to slow steaming practice and high fees of the Suez Canal. Furthermore, the consolidation of the Arctic Route and the Belt and Road Initiative could cut out Mediterranean ports from the main trading route, the Asia-North Europe-Asia lane. These factors have increased the competitiveness among the Mediterranean ports, which must improve their functionality and productivity to meet new needs and acquire ever-higher market rates (Fancello et al., 2014).

This study considers the 36 main container ports in the Mediterranean region in terms of TEUs handled in the last decade. The ports analyzed are geographically distributed as follows: 11 ports are in Italy, 4 in Egypt, 4 in Spain, 4 in Turkey, 2 in Greece, 2 in Israel, 1 in Croatia, 1 in Cyprus, 1 in France, 1 in Lebanon, 1 in Malta, 1 in Morocco, 1 in Slovenia, 1 in Tunisia, and 1 in Syria. As for the traffic volumes handled, seven ports handled more than 3M TEUs in 2019, 12 from 1M to 3M TEUs, and 16 less than 1M TEUs. In 2019, the 36 ports as a whole handled about 60 million TEUs. Figure 1 shows the map of the 35 ports analyzed.

Figure 1: Map of the 36 ports analysed

The proposed analysis offers an overview of Mediterranean container ports, thus providing some useful information on the state of the art. The framework is as follows: section 2 presents an overview of the main Mediterranean container ports, analyzing the growth in the last twenty years while section 3 describes the infrastructural elements that characterize the ports. Section 4 and 5 focus on container shipping alliances and the main global trades that include the Mediterranean region. Section 6 summarizes the shown data.

2. MEDITERRANEAN PORTS THROUGHPUT

Mediterranean ports throughput, as a whole, has grown annually at a rate of 5.4% from 2002 to 2020, with an overall increase of about 160%. During this period, only three times the growth has undergone a trend reversal: in 2009 (-5.8%) due to the global economic crisis, in 2015 (-2.4%) and in 2020 (-0.2%). Figure 2 shows the total TEU throughput of all the container ports that make up the sample.

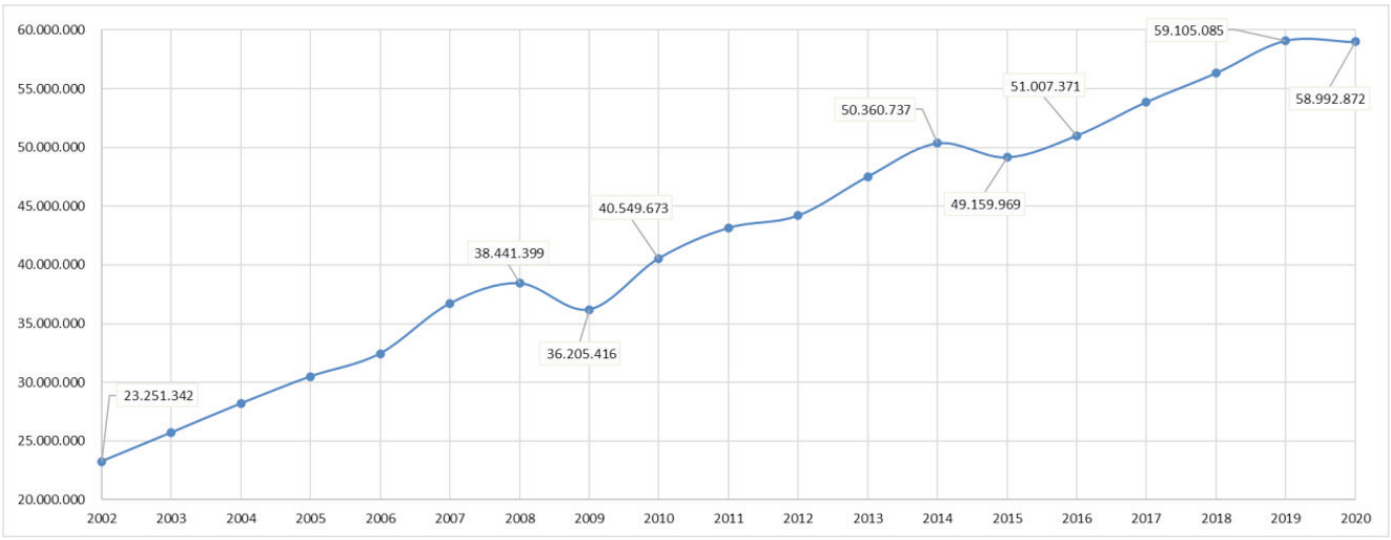

Figure 2: Mediterranean container throughput (TEU)

Container ports can be classified according to their main service: gateway or transshipment. Gateway ports, mainly positioned along the Mediterranean Northern Range and the Eastern Mediterranean Range, have the role of doorways towards local markets. On the other hand, transshipment ports, located along the Suez - Gibraltar route (Port Said, Piraeus, Marsaxlokk, Tanger and Algeciras), mainly transfer containers between ships, allowing them to continue their journey to other continents or, by means of feeder ships, to reach the minor ports of the Mediterranean area (Notteboom et al., 2019). Of the 36 ports considered, 13 are transshipment ports while the remaining 23 gateway ones (see Table 1). Despite this, transshipment ports annually handle, on average, 56% of the total TEU throughput. In Figure 3, the total container throughput trend is split up for gateway and transshipment ports. It is easy to notice that the overall throughput reduction of 5.8% recorded in 2009 (see Figure 2) is entirely to blame to gateway ports that saw a drastic reduction of their total movements in that year (-13%). In 2020, Mediterranean container ports handled approximately 112,000 TEUs less than the previous year (-0.2%).

Table 1. Mediterranean container ports: 2010, 2019 and 2020 throughput (TEU)

Port	*Main*	*Throughput (TEU)*			*Var%*	*Var%*
	service	*2010*	*2019*	*2020*	*2010-2019*	*2019-2020*
Alexandria-El Dekheila	transshipment	832,494	1,814,950	1,693,252	118,0%	**-6,7%**
Algeciras	transshipment	2,810,242	5,119,500	5,107,873	82,4%	**-0,3%**
Alicante	gateway	147,308	170,739	113,000	15,9%	**-33,8%**
Ambarli	gateway	2,540,000	3,104,882	2,887,800	22,2%	**-7,0%**
Ashdod	gateway	1,017,000	1,400,000	1,584,000	37,7%	**13,1%**
Barcelona	gateway	1,948,422	3,324,651	2,958,040	70,6%	**-11,0%**
Beirut	gateway	949,155	1,229,081	772.873	29,5%	**-37,1%**
Cagliari	transshipment	629,127	151,405	68,406	-75,9%	**-54,8%**
Damietta	transshipment	1,214,910	1,068,002	1,051,869	-12,1%	**-1,5%**
Genoa	gateway	1,758,858	2,635,000	2,352,769	48,7%	**-10,0%**
Gioia Tauro	transshipment	2,852,264	2,522,874	3,193,364	-11,5%	**26,6%**
Haifa	gateway	1,263,000	1,400,000	1,470,000	10,8%	**5,0%**
Izmir	gateway	727,675	605,727	436,386	-16,8%	**-28,0%**
Izmit	gateway	416,000	1,715,193	1,800,642	312,3%	**5,0%**
Koper	gateway	476,731	959,000	945,000	101,2%	**-1,5%**
La Spezia	gateway	1,285,000	1,490,537	1,173,660	16,0%	**-21,3%**
Latakia	gateway	586,283	325,097	243,348	-44,5%	**-25,1%**
Limassol	transshipment	348,358	389,900	360,408	11,9%	**-7,6%**
Livorno	gateway	628,489	789,833	716,233	25,7%	**-9,3%**
Marsaxlokk	transshipment	2,370,729	2,720,000	2,441,589	14,9%	**-10,3%**
Marseille	gateway	953,000	1,454,621	1,717,028	52,6%	**18,0%**
Mersin	gateway	1,024,171	1,939,000	1,948,700	81,1%	**5,1%**
Naples	gateway	532,432	681,929	643,540	28,1%	**-5,6%**
Piraeus	transshipment	878,083	5,650,000	5,437,477	543,2%	**-3,7%**
Port Said East	transshipment	2,793,416	3,200,000	3,510,140	7,5%	**16,9%**
Port Said West	transshipment	834,397	660,000	499,532	-21,6%	**-23,7%**
Ravenna	gateway	183,041	218,138	194,868	19,2%	**-10,7%**
Rijeka	gateway	137,048	305,049	344,091	122,6%	**12,8%**
Tanger	transshipment	2,058,430	4,801,713	5,771,200	133,3%	**20,2%**
Taranto	transshipment	581,936	0	5,512	-100,0%	-
Thessaloniki	gateway	273,282	448,766	460,724	64,2%	**2,7%**
Trieste	gateway	281,629	789,640	776,022	180,4%	**-1,7%**
Tunis-Radès	gateway	420,089	285,262	256,078	-32,1%	**-10,2%**
Vado Ligure	gateway	196,434	54,542	146,081	-72,2%	**167,8%**
Valencia	transshipment	4,206,327	5,439,800	5,382,303	28,1%	**-0,1%**
Venice	**gateway**	**393,913**	**593,070**	**529,064**	**50,6%**	**-10,8%**

This reduction is to be ascribed to gateway ports that recorded a -5.2% of their throughput. At the same time, transshipment ports saw their total movements increase by 3.7% compared to 2019. Since 2002, the only trend reversal related to the transshipment ports traffic occurred in 2015, with a reduction of 4.4% compared to 2014.

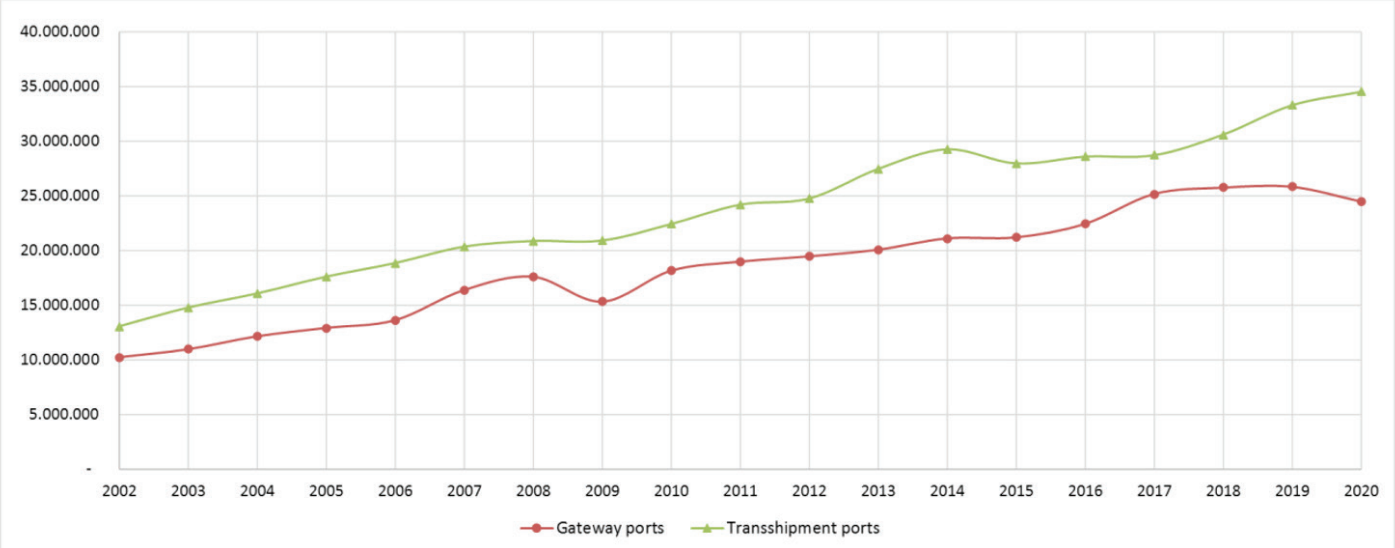

Figure 3: Mediterranean container throughput: gateway and transshipment ports (TEU)

Between 2010 and 2019[c] the overall Mediterranean throughput grew by 15.8%. During this period, not all ports behaved in the same way. Table 1 provides the throughput of each port for the years 2010, 2019 and 2020. The column "Var% 2010-2019" shows the variation between 2010 and 2019. Most ports (27 out of 35) are characterized by an increase of their throughput, with the ports of Alexandria-El Dekheila, Izmit, Koper, Piraeus, Rijeka, Tanger and Trieste that have at least doubled it. Among the ports that register a negative variation, the ports of Cagliari and Taranto have been facing, in the last years, a period of great difficulty (Fancello et al., 2021).

Although the effects of the sars-cov-19 pandemic on the global economy are not yet concluded, we can make some initial assessments on the response given by Mediterranean ports with respect to the number of TEUs handled in 2020. The column "Var% 2019-2020" of Table 1 presents the variation, for each port, of the 2020 throughput compared to 2019. 24 ports have suffered a reduction in their traffic, with 13 ports that have exceeded by -10%. Among the remaining 12 ports, Vado Ligure stands out because of its recent new terminal opening.

The authors grouped the Mediterranean ports into six groups, represented in Figure 4. Tanger (fourth Mediterranean port in 2018 and first in 2020), Algeciras (fourth in 2020) and Valencia (third in 2020) are included in group 1: its throughput represents 33% of the handled TEUs in the Mediterranean area. Group 2 consists of the Italian ports located in the North Mediterranean Range and the French port of Marseille. Only the port of Genoa is ranked in the top 10 (tenth position in 2020). The ports located in the North Adriatic Range make up group 3, handling less TEUs than the others. Group 4 encloses ports located in the central Mediterranean area.

The most important ports are marsaxlokk (which went from the sixth position in 2018 to the ninth in 2020) and the Italian port of Gioia Tauro (ranked tenth in 2018 and sixth in 2020). The ports overlooking the Aegean Sea and the Marmara Sea are those that form group 5. More than 75% of the total movements are carried out by the ports of Piraeus and Ambarli. Group 6 is the most numerous one in terms of number of ports but not in terms of total throughput. In this group, only Port Said (both East and West terminals) is ranked in the top 10.

[c] this period is chosen because of its position after the 2009 global crisis and before the sars-cov-19 one

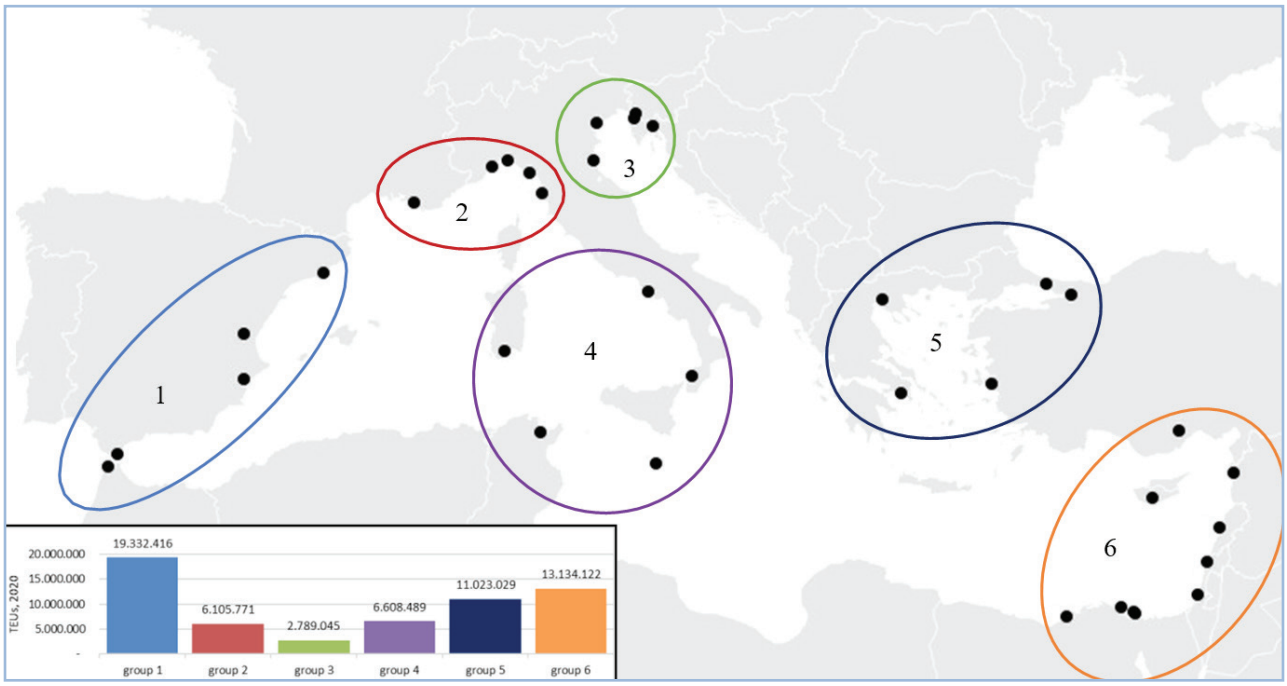

Figure 4: Mediterranean container ports grouped by location

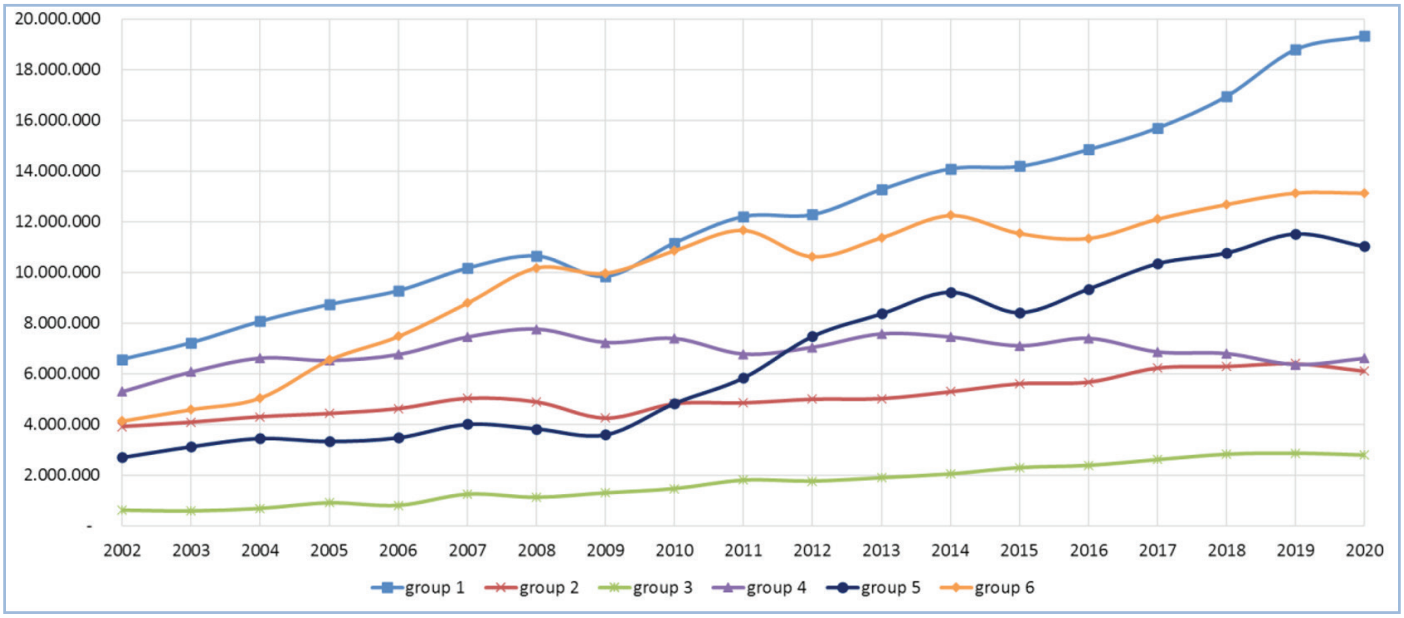

Figure 5: Mediterranean container throughput (TEUs) for the six identified port groups

Figure 5 illustrates the trend from 2002 to 2020 of the six groups. Group 1 is characterized by the exponential growth of the ports of Valencia, Algeciras and Tanger. Until 2009, year in which the privatization of Piraeus container berths took place, group 5 had a constant throughput. As for group 6, the opening in 2004 of the Suez Canal Container Terminal (located in Port Said East) influenced the trend growth.

3. MEDITERRANEAN PORT INFRASTRUCTURES

In the maritime world scenario, various challenges are affecting Mediterranean container ports, which are trying to keep high their efficiency and their competitiveness through infrastructural and managerial improvements (Serra et al., 2016). The plot in Figure 6 provides an overview of the Mediterranean ports, showing two of the main infrastructural characteristics

of container terminals, namely the number of QC (quay cranes) and quay length. The x-axis shows the quay length, the y-axis the number of QC while the diameter of the circles the throughput of each port (red circles for those with less than one million TEUs, blue for those between one million and three million, and green for those with more than three million TEUs).

Figure 6: Mediterranean container ports: quay length, QC and TEU throughput

In Figure 6, the cartesian plane has been subdivided into four dials. All ports with less than one million TEU throughput are collocated in the third dial, that is, with less than 20 QC and a total quay length not superior to 2,500 meters. In terms of handled TEUs, the most important ports are located in the first dial except for Port Said East that is the only one located in the second dial. Lastly, intermediate ports require a careful analysis since their distribution follows different rules for each port. Genoa, for instance, has the highest quay length and is the forth port for number of QC, but its

throughput is lower than the one of Valencia and Ambarli (the closest ports in the plot). Compared to the ports of their group, Marseille and Gioia Tauro have a surplus of quay length.

4. CONTAINER SHIPPING COMPANIES AND ALLIANCES

Container shipping transportation has become the dominant mode for transporting cargo globally. As a result, the container shipping sailing network continues to expand and become more refined, further increasing the connectivity between most ports worldwide (Chao et al., 2018). In order to consolidate their position in the market, global container shipping companies aim to increase the capacity of their fleet. For this reason, the market is dominated by only a few container shipping companies. Table 2 summarizes the first 12 container shipping operators in terms of fleet capacity while Figure 7 shows the evolution in last three years.

Table 2. Top 12 shipping container operators (Source: Alphaliner TOP 100 / 10 Jan 2022)

Rank	*Operator*	*TEU*	*Ships*	*TEU Share*
1.	MSC (Mediterranean Shg Co.)	4.284.728	645	**17,0%**
2.	Maersk Line	4.277.274	736	**17,0%**
3.	CMA CGM Group	3.186.432	568	**12,6%**
4.	COSCO Group	2.932.779	479	**11,6%**
5.	Hapag-Lloyd	1.745.032	251	**6,9%**
6.	ONE (Ocean Network Express)	1.540.540	210	**6,1%**
7.	Evergreen Line	1.477.644	204	**5,9%**
8.	HMM Co Ltd	819.790	75	**3,2%**
9.	Yang Ming Marine Transport Co.	662.047	90	**2,6%**
10.	Zim	419.064	111	**1,7%**
11.	Wan Hai Lines	414.542	145	**1,6%**
12.	**PIL (Pacific Int. Line)**	**266.667**	**83**	**1,1%**

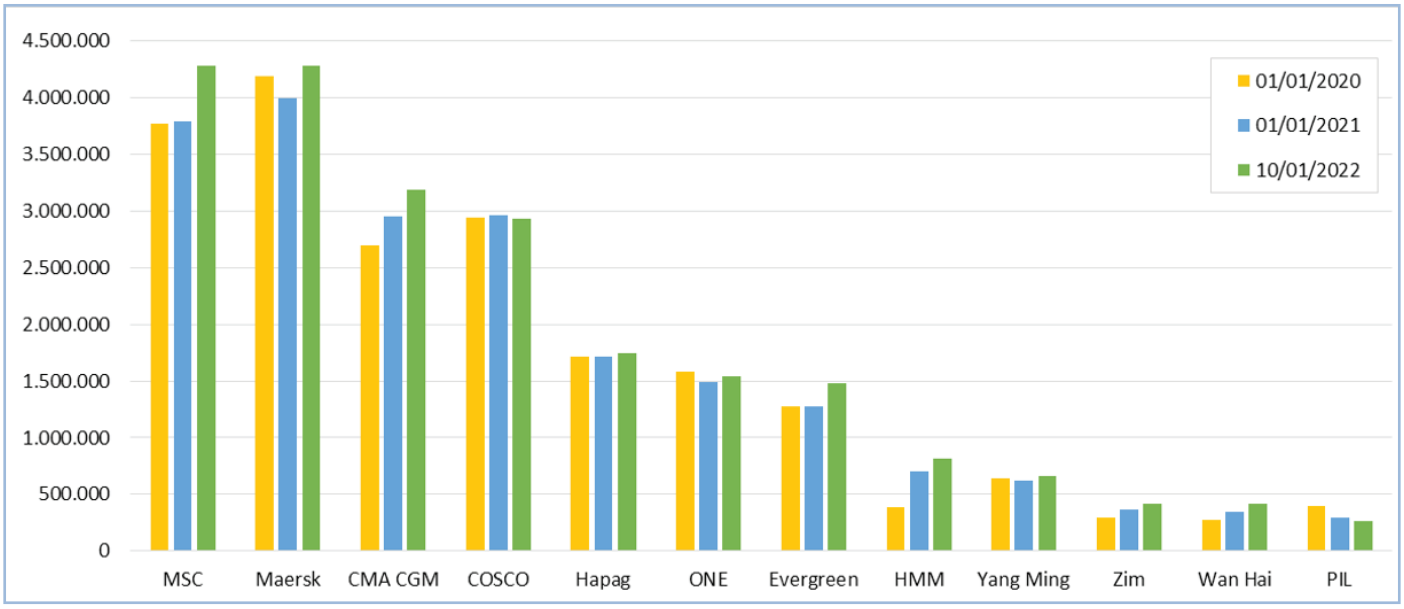

Figure 7: Top 12 shipping container operators: TEU capacity (Source: Alphaliner TOP 100)

These big players have changed their strategic approach towards terminal activities, often creating their own 'terminal operating holding' such as Maersk Line (APM Terminals), COSCO Group (COSCO Shipping Ports), MSC (TiL-Terminal Investment Limited) and CMA-CGM (Terminal Link). In the Mediterranean Sea, carriers mostly invest in pure transshipment hubs along main shipping services, in order to control multiple supply chain phases (van der Putten, 2016).

Main global carriers control Mediterranean container terminals through shareholding with other parties or through a total control on the terminal operations (Kaliszewski, 2020). Maersk Line, for instance, is based in Algeciras, Barcelona, Izmir, Marseille, Port Said East, Tanger, Vado Ligure and Valencia. MSC operates in, Ambarli, Genoa, Gioia Tauro, La Spezia, Livorno, Marseille, Naples, Trieste, Valencia and Venice. COSCO Shipping Ports owns the port of Piraeus and market

shares of Ambarli, Marseille, Port Said East, Vado Ligure and Valencia. CMA-CGM operates in Algeciras, Latakia, Marseille as well as Malta Freeport. Furthermore HMM owns shares of Algeciras terminal, Hapag-Lloyd entered in the new Tanger terminal at the beginning of 2021 while Evergreen used to operate in the Italian port of Taranto, now operated by Yilport Holding.

Table 3. The three global alliances in container shipping (Source: Alphaliner TOP 100 / 10 Jan 2022)

Alliance	*Operators*	*TEU*	*Ships*	*TEU Share*
2M Alliance	2M Alliance: MSC, Maersk Line	8.562.002	1.381	**34,0%**
Ocean Alliance	Ocean Alliance: CMA CGM, COSCO, Evergreen	7.596.855	1.251	**30,1%**
THE Alliance	**THE Alliance: ONE, Yang Ming, HMM, Hapag-Lloyd**	**4.767.409**	**626**	**18,8%**

Alliances have become a dominant feature of container shipping. Since global alliances in container shipping emerged around two decades ago, the market shares covered by carriers in global alliances have increased steadily, particularly during the last few years.

Between 2001 and 2011, there were three alliances (CYKH, Grand Alliance and New World Alliance) and their combined market share was around 35%. From 2012 onwards, with the creation of the MSC/CMA CGM alliance (both companies had not participated in any alliance before then), the global market shares of alliances gradually increased year by year. In 2015, MSC and Maersk created the 2M Alliance, with an initial share of about 30%. In the same year, Evergreen joined CYKH.

Currently, all major container carriers are involved in one of the three global alliances: 2M (Maersk, MSC) Ocean Alliance (Cosco-OOCL, CMA CGM, Evergreen), THE Alliance (Hapag- Lloyd, ONE, Yang Ming, HMM). Table 3 shows their capacity share. Together they hold 83% share of the global container fleet capacity (Merk et al., 2018). The establishment of a limited number of multi-trade strategic alliances in container shipping is concentrating the demand on a few players. Global alliances mainly operate on East-West trade lanes, where the combined market share of the three alliances is around 95% (Notteboom et al., 2017).

5. MAIN GLOBAL TRADES

The Mediterranean container ports play an important role in the global maritime scenario due to their key positioning along the main East-West trading routes and their centrality with respect to the

Atlantic and North European markets, on the one hand, and to those of Asia and Africa on the other. Among the East-West trades, the Asia-Europe trade is the major one in terms of container traffic, estimated at 26.3 million TEUs in 2021 (UNCTAD, 2021).

Figure 8 shows the trend from 2009 to today of container traffic along the East-West trades, which involve also Mediterranean ports. The first histogram column is relative to the Asia-Europe trade while the second to the Europe-North America one (Europe as Northern Europe and Mediterranean region). Notice that, in both cases, the Westbound trade traffic (Asia to Europe and Europe to North America) is higher than the Eastbound one. Between 2009 and 2021 the Asia-Europe trade grew by 55% while the Europe-North America by 51%.

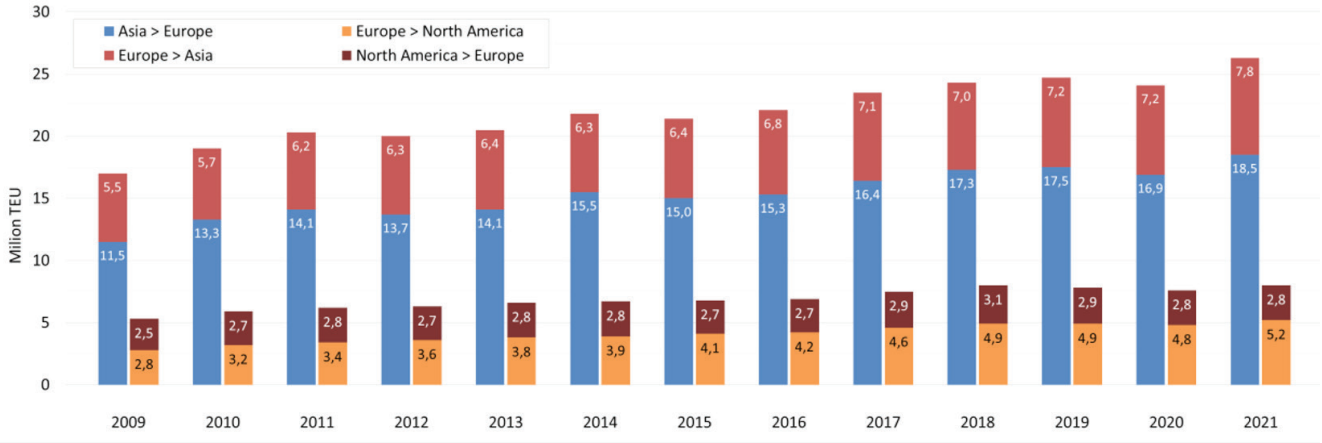

Figure 8: Containerized trade on major East-West trade routes, 2009-2021 (Source: UNCTAD)

6. CONCLUSIONS

This work presents a large data collection related to the main Mediterranean container ports. Through this study, the authors want to emphasize the strategic importance of the Mediterranean basin compared to the other global markets. Its key positioning along the major trading routes has influenced the total throughput growth of the Mediterranean container ports, favoring the main transshipment hubs, such as Piraeus, Tanger, Algeciras and Valencia.

Currently, Mediterranean container ports face a double task: on one hand an increase in competitiveness with the much larger and more structured ports of the Northern range and on the other an internal match against their competitors in the Mediterranean area.
The collected data show how the Mediterranean container port system has experienced a strong growth in the last twenty years, consistently with the main global container ports. The Mediterranean basin remains an important trading area, taking advantage of its central position with respect to European and North African markets.

The proposed analysis offers an overview of Mediterranean container ports, thus providing some useful information on the state of the art. The main objective of this work is to present a report with the last updated traffic data related to Mediterranean container ports (for many ports, 2021 data are not yet made public). The authors have decided to study the principal ports that overlook both sides of

the Mediterranean basin, thus going to include in the same system ports that belong to different geographical regions but share the same sea.

7. REFERENCES

1. UNCTAD, 2021. Review of Maritime Transport 2021 (United Nations publication. Sales No. E.21.II.D.21. New York and Geneva).

2. Fancello, G., Pani, C., Serra, P. and Fadda, P., "Port cooperation policies in the Mediterranean Basin: An experimental approach using cluster analysis," Transportation Research Procedia, 3, 2014, pp.700-709.

3. Notteboom, T. E., Parola, F., and Satta, G., "The relationship between transhipment incidence and throughput volatility in North European and Mediterranean container ports," Journal of transport geography 74, 2019: 371-381.

4. Fancello, G., Serra, P., Aramu, V., and Vitiello, D. M., "Evaluating the efficiency of Mediterranean container ports using data envelopment analysis," Competition and Regulation in Network Industries, 22(3- 4), 2021, 163-188.

5. Serra, P., Fadda, P., & Fancello, G., "Evaluation of alternative scenarios of labour flexibility for dockworkers in maritime container terminals," Maritime Policy & Management, 43(3), 2016, 371-385.

6. Chao, S., Ming-Miin Y., and Wei-Fan H., "Evaluating the efficiency of major container shipping companies: A framework of dynamic network DEA with shared inputs," Transportation Research Part A: Policy and Practice 117, 2018: 44-57.

7. van der Putten, F. P., "Infrastructure and geopolitics: China's emerging presence in the eastern Mediterranean," Journal of Balkan and Near Eastern Studies, 18(4), 2016, 337-351.

8. Kaliszewski, A., Kozłowski, A., Dąbrowski, J., and Klimek, H., "Key factors of container port competitiveness: A global shipping lines perspective," Marine Policy, 2020, 117, 103896.

9. Merk, O., Kirstein, L., and Salamitov, F., "The impact of alliances in container shipping," 2018.

10. Notteboom, T. E., Parola, F., Satta, G., and Pallis, A. A., "The relationship between port choice and terminal involvement of alliance members in container shipping," Journal of Transport Geography 64 (2017): 158-173.