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TRANSSHIPMENT HUBS: THE CASE OF MEDITERRANEAN PORTS AND THE PROSPECTS.

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Abstract

In this study, an attempt is first made to describe the activity of transshipment, while examining the development and operation of modern mega transshipment hubs, as well as all the elements that contributed to their emergence and development. Next, a review of contemporary scientific literature is followed to determine the position of these hubs today within the global supply chains and how they contribute to shaping their competitiveness. The following section examines the development of this economic activity in the Mediterranean Sea region and presents the criteria that have formed in the past and which continue to affect the development of transshipment in that region today. Finally, a comparative analysis of the largest hubs in the Piraeus follows, according to their movement data collected during the years 2007 to 2015, while identifying the factors that contributed to their emergence.

Keywords: transshipment, mega transshipment hubs, supply chains, Mediterranean Sea

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1 Introduction

1.1 Background of the Dissertation

From the time of the Phoenicians and to a greater extent from the time of the ancient Greeks to the present day, the contribution of shipping to the development of commerce and to the improvement of human economic and quality of life was of great importance (Pascali, 2017). The evolution of maritime transport has been smooth over the centuries, until 1961, when the phenomenon of containerization emerged and prevailed, with commerce and in particular maritime transport showing tremendous growth over the next fifty years (Munim & Schramm, 2018). The above events, together with the prevalence of globalization, have simultaneously favored the emergence and rapid development of transshipment activity (Slack & Gouvernal, 2016). They have evolved, and continue to evolve, mainly due to the introduction of large container ships, ports or port terminals that serve as transshipment hubs and which, as will be presented below, have contributed significantly to the development of trade and the world economy (Fugazza & Hoffmann, 2017). Indicatively, worldwide shipping had increased from 88 million TEUs in 1990 to approximately 623 million TEUs in 2012 (Lam, 2016). Approximately 28% of this traffic includes transshipment loads, which has tripled in the last 15 years to 175 million TEUs in 2012 compared to 2000, where the transshipment of container shipments around the globe amounted to only about 58 million TEUs (Lam, 2016).

1.2 Aim of the Dissertation

The rapid development of this particular trend mentioned above led to the decision to launch this study, where an attempt is made to analyze the transshipment process with the ultimate goal of identifying the position of modern mega transshipment hubs

within the supply chains. At the same time, the aim of this research is to determine the extent to which the operation of the above hubs determines the effectiveness of global logistics chains. Finally, this Diploma Thesis seeks to describe the specific activity in the Mediterranean basin in order to examine the elements that led to its development, and finally present an analysis of Piraeus port one of the most significant modern transshipment hubs in this maritime region.

1.3 Methodology of the Dissertation

In order to address the above questions, contemporary scientific literature has been studied and presented. Articles from reputable scientific journals, scientific journals, but also articles and several studies published online have been widely used as sources. At the same time, statistics and information published in various surveys, but mainly posted on the Port Authority websites of the various mega transshipment hubs, have been exploited and analyzed extensively.

1.4 Definition of the Concept of Port

It is necessary to note that the various attempts at formulations and definitions of ports described their different operating conditions at specific times. It is also clarified that the definitions set out below relate to Logistics procedures, excluding port passenger service (Geerlings, Kuipers & Zuidwik, 2017; Roso et al., 2009). Passenger transport (including a cruise) is a significant capital of the port and shipping market even though freight transport monopolizes international inquiries (Geerlings, Kuipers & Zuidwik, 2017; Song, 2003).

In 1990, Goss (as cited in Ducruet, 2016) defined the concept of Port as "a gateway from which cargo and passengers are transported by and to ships on or offshore." (p. 23)

This definition seems to be incomplete as it does not include the development of combined transport. The development of container handling operations has created the need to investigate the operation of ports and, consequently, combined transport. Thus, according to Agamez-Arias & Moyano-Fuentes (2017), ports are defined as interconnection spaces between different modes of transport, and therefore as centers of combined transport, which must be integrated within the logistics chains to effectively perform their functions. Such a definition aims to describe large and modern ports and not smaller ones that do not require or require more sophisticated production methods.

The European Commission (as cited in Monios, 2016) gave a complete definition, stating that ports are commercial enterprises located by the water, which is sufficiently deep to allow watercraft to move. In these areas, there are port companies operating the port infrastructure and superstructure, as well as conventional road and

rail infrastructure. The port market shall be regulated or regulated by an Authority (Jarzemskis & Vasiliauskas, 2007).

Marlow and Paixao also argue that 'ports are defined as areas with infrastructure and superstructures capable of receiving ships and other means of transport to handle their cargo to and from the coast and provide logistics services that will add value to the product ', such processes are the various stages of logistics such as warehousing, packaging and door-to-door transportation (as cited in Panayides, 2017).

1.5 Ports and the Port Product

The Port product is considered a critical link in the maritime trading chain (Hesse & McDonough, 2018; Roso, 2007)). In the port market, the term product does not describe any material but the provision of services. The primary function of a port is described as "cargo management center," i.e., it is the management of cargo between maritime and inland transport. This primary function is categorized into four sub-functions (Hesse & McDonough, 2018).

1. Ship service
2. Cargo handling at the dock
3. Freight receipt and distribution
4. Logistics functions

Correspondingly in the passenger transport market, including cruise, port operations focus on passenger embarkation and disembarkation (Wang et al., 2016). In this case, too, it is divided into four functions.

In addition to the essential functions mentioned above, namely cargo management and embarkation, passenger attachments are also attached to them and some additional

benefits, which in economic theory function as supplementary goods (Cullinane & Wilmsmeier, 2011).

Such goods are (Wang et al., 2016).:

1. Towing
2. Navigation
3. Ship Feeding
4. Inland Traffic.

Such benefits complete the port network and can be defined as economic activities involving public and private entities directly related to the arrival - departure of ships, cargo, and passengers at the port. The port industry has multiple roles, and its primary purpose is to meet different objectives from different and often disparate groups of "consumer-users" (Satta, 2017; Roso & Lumsden, 2009).

According to the definitions above, this specific work accepts the definition of the port as' the area where passenger-cargo services and ship management - service are carried out, together with the additional services incorporated in this product but also with the other services provided (Esmer et al., 2016).

Ports with modern facilities and infrastructure belong to a global logistics chain. There may be the coexistence of different companies handling cargo from different logistics chains that compete with each other (DeMartino & Morvillo, 2008).

Similar is the case of cruise ships in passenger ports whose attachment to the combined transport network is a critical factor in their competitiveness (Nyugen et al., 2016).

1.6 Maritime Transport

When there is a volume of maritime trade between two or more geographical sites, which justifies the provision of maritime transport services between these sites, a liner service is usually developed (Monios & Wilmsmeier, 2012). The provision of services regularly refers to the existence of several ships, which are under the same ownership or management company, which offer specific services at regular intervals between specific ports (Ducruet, 2016).

Line ships carry freight at regular intervals with constant frequency and regularity of routes between fixed ports, thereby enabling importers and exporters to plan their buying and selling strategy (Gziakis, Papadopoulos, & Plomaritou, 2010).

The main types of ships in this market are container vessels, multipurpose vessels, and RO-RO (LO on / Roll-off) or LO-LO (Lift on / Lift off), which are usually modern and fast (Ducruet, 2016). Line market vessels can also be distinguished from deep-sea liner services, e.g., Europe-Far East, and ships operating between smaller commercial ports within a specific geographic area (feeder services), e.g., in the Mediterranean Sea and the Black Sea (Andrews, 2015).

There are many types of cargo shipping, but the most common is the container. It is a box designed mainly from iron and sometimes in combination with aluminum, which can carry goods (Esmemr et al., 2010). This mode provides ease, protection, and security of freight loading and unloading. Containers have the advantage that they can be stacked on top of each other and can be towed or transported by various means of transport (Levinson, 2016).

Containers have evolved a lot since they first appeared, and today, their main features are (Mangan & Lalwani, 2016):

— Suitable openings for loading and unloading of cargo

— Their size is suitable for loading and unloading on board

— allows to carry not only general cargo but also dangerous and liquid cargo

— Their shelf life is from 5 to 10 years depending on the material they are made and how to use them

— can be quickly loaded and downloaded in different media.

The evolution of containers has contributed significantly to the development of combined transport and has led to an increase in the volume of transport and the speed with which movements are made. This, in turn, created needs that had to be adapted to ships, ports, storage facilities, and port technology (Till, 2018).

1.6.1 **Characteristics of Maritime Transport**

Its main feature is the use of containers, which gives homogeneity to the load. In recent years, line shipping has been in constant demand, which has also led to an increasing trend in fares and capacity (Mansouri et al., 2009). An essential role in this has been played by globalization on the one hand and the increase in the standard of living and consequently over-consumption in developing countries (Pantuso et al., 2014). It is well-known that ships operating in liner shipping carry mainly processing products and industrial products. In terms of the nature of demand, shipping is distinguished by the existence of a large number of loaders, while the quantity of cargo being transported constitutes a small part of the total capacity of vessels operating in that market (Bejan, Gunes & Sahin, 2019).

As a consequence, the weight/volume ratio of the cargo being transported is meager as opposed to the value of the cargo being high. Also, line shipping serves the transportation needs of mainly industrial products (deMoura & Botter, 2017).

The high-value goods transported by liner shipping create the need for speed and regularity in the transport services provided, in order to minimize the financial burden on the loader, due to the inability to capitalize (Berle et al., 2011). This need for regularity and high-speed inline shipping results in the employment of high technology ships operating by the requirements of demand operators (Kang & Woo, 2017).

1.6.2 **Maritime Transport Cargo**

The general consignment consists of individual consignments of less than 2000-3000 tones, which do not supplement the capacity of a ship or hold and are subsequently transported together with other consignments (Wang & Cullinane, 2016). They are usually ready for the end consumer and are small batches of high value. The most important categories of general cargo are (Felicio, Caldeirinha & Dionisio, 2015):

- non-bulk cargo breakers: boxes, machine parts, etc., which are stacked and unloaded individually in lots.
- Containerized cargo: any cargo transported in containers measuring 8 feet wide, 8.5 feet high and 20,30 or 40 feet long (20dv, 40dv, 40hc)
- Palletized cargo: each palletized and unloaded pallet cargo for easy stacking and quick handling
- Liquid cargo: small batches of liquid cargo transported in tanks, containers, or barrels (drums)

— Refrigerated cargo: susceptible products, such as fruit or food, transported frozen or frozen in suitable vessels - refrigerators or reefer containers

— Heavy cargo: heavy, bulky and cumbersome products, challenging to load loading and stacking (Pantuso & Fagerholt, 2015).

1.7 Transshipment

In the case that the volume of maritime traffic between two or more geographical points supports it, a regular liner for the completion of the maritime transport, characterized by regularity, shall be developed between these points in order to optimize the efficiency of the shipping process (Coelho et al., 2012). Relates to its itineraries, from transport operations between specific ports and pre-arranged tariffs (Wang & Cullinane, 2016).

1.8 Transport Shipping

1.8.1 **Transshipment process**

Transshipment means the process of unloading cargoes in one port and reloading them in another in the same or different geographical area or even country (Zhao & Atkins, 2009). In particular, the concept of transshipment of containers describes their unloading from a ship at a port or port terminal and, after their temporary stowage, their reloading to another or other ships in order to reach their final destination. The precise definition of transshipment, of course, can vary between ports, mainly depending on the integration of inland waterways (canals operating on canals and rivers inland) (Nishimura et al., 2009). If shipper handling procedures are involved, we are not talking about transshipment, even if there is a change of ship at various points (Wang & Meng, 2012).

The first transshipment ports began to develop in the Far East in the 1970s and were aimed at connecting those countries and areas not directly served by the main trade routes (Zhen et al., 2009). During the 1990s the ports of Salalah (in Oman), Tanjung Pelepas (in Malaysia), Gioia Tauro (in Italy), Algeciras (in Spain), Damietta (in Egypt) have developed mainly in the field of transshipment), the port of Malta (in the

Mediterranean Sea) and many more, while the pioneers in this field are Singapore, Hong Kong and Tanjung Pelepas (Zhao & Atknis, 2009).

Transshipment usually takes place at transport hubs worldwide, with most of it taking place in the customs areas concerned, thus avoiding the need for customs controls or duties, which are a significant obstacle to the efficient and efficient transport of goods (Huang & Sosic, 2010).

Transshipment processes are usually perfectly legal and occur daily in much of world trade. However, it can often be a method used to cover up illegal cargoes, such as smuggling, drug trafficking, etc. (Petering & Murty, 2009) Specifically, the example of the Gioia Tauro harbor is often cited by several how it is involved in the illicit trafficking of weapons and drugs. According to a 2006 report, Italian researchers concluded that the port was considered the main entry point for illicit substances into the European continent with approximately 80% of cocaine in Europe coming from Colombia mainly through the port (Bae et al., 2013). Although as previously mentioned, the term refers to unloading containers from one ship and then loading them to another; in fact, it has a significant legal meaning (Boysen & Fliedner, 2010). For example, transshipment between different modes of transport not specified in the bill of lading may result in banks failing to pay if the load is lost, especially in cases of bills that do not allow or do not provide for transshipment (Shao & Krishnan, 2011).

1.8.2 **Types of Transshipment**

The development of the operation of transshipment over the last forty years has led to the creation and development of hubs or port terminals specializing in the service of container ships seeking transshipment services (Paterson et al., 2011). Due to the

nature of this type of trade, the location and operation of these hubs do not depend on their geographical proximity to their hinterland or the existence of useful links to it (Nishimura et al., 2009). Most of these centers operate either as Hub and Spoke Systems or as a direct connection of one port to another (He et al., 2014). As explained in the following pages, there are three significant forms of transshipment in modern economic and commercial reality that one can encounter in modern commercial reality. The Hub and Spoke system, the Interline system, and the system of relayed transshipment hubs (Mirzapour Al-e-hashem & Rekik, 2014).

1.9 Characteristics of Transshipment Routes

Liner shipping is characterized by steady precision in its itineraries, with the departure and arrival times of ships from the ports of loading to the ports of a receipt being strictly observed (Kjeldsen, 2011).

Also, due to the high value of the goods and goods being transported, high demands arise from the beneficiaries of the goods transported for quality services, with the result that the transport companies adopt actions such as pre-arranging the routes and announcing them even months before their realization in order to increase the credibility of their companies (Lorenc & Wiecek, 2013). In a fully globalized environment, maritime transport companies can gain a comparative advantage by only increasing efficiency and optimizing processes at all levels of operation, while at the same time focusing on enhancing their reliability and quality services Miao et al., 2012).

1.10 Types of Vessels Used for Transshipment

In the liner market, the most common types of ships, depending on their use are (Schwarzmann, 2013): 1. Container ships, 2. RO-RO ships (Roll on - Roll off), 3. LO - LO (Lift on - Lift off) ships and 4. Multipurpose vessels.

Maritime vessels can also be distinguished by the types of services they operate, on vessels used for seagoing services on the major global trade routes with Europe's leading ship - the mother vessels, and on vessels operating more inland restricted geographical areas and between smaller ports of feeder vessels, such as for example cruises in the Mediterranean (Wang & Meng, 2012).

1.11 Transshipment, Costs and Capital Increase

As stated earlier, line shipping is characterized by stable timing and regularity in its itineraries, with the result that de facto shipping vessels are 'forced' to depart at the level of occupancy existing at the time of scheduled departure, yet and if this is not satisfactory (Tracht et al., 2011).

Also, cruise ships move between the loading and receiving ports at high speeds due to the requirement of customers to carry out the shipping process as quickly as possible, thereby increasing fuel costs (Khurana & Arora, 2011).

Entering Land Processes, a liner shipping company that can cope with competition and comply with precision and regularity requirements, is characterized by high operating costs associated with the increased organization required for product handling and shipping processes, as well as the maintenance of the required network of routes and agencies worldwide (Notteboom & Vernimmen, 2009). These costs make it imperative to create economies of scale and use the latest technology at all operational levels (Dong et al., 2010).

Closing this passage, it should be shown that line shipping is a capital-intensive market because of the state-of-the-art and high-cost vessels it uses for its shipping operations, but also because of the specialized terminals it adopts, for which the use of machinery high precision for the handling and handling of goods is a non-negotiable requirement (Kordnejad, 2014). The continuous development and upgrading of terminals are the most critical component of efficiency in land-based shipping operations (Archibald et al., 2009).

1.12 Determinant Factors of the Transshipment Services

The demand for services offered by line shipping depends on the following vital factors (Archibald et al., 2009):

- Sea freight: Sea freight is the freight charge from the port of shipment to the port of landing. It should be noted that in most transport operations the sea freight also incurs additional costs related mainly to freight unloading costs at the terminals (Cheng & Tsai, 2009).
- Frequency of departures: Frequent departures today are the main action to adopt line shipping services in order to optimally serve their customers (and most of all immediate orders) but also to reduce their levels of storage space. Their. The key to success in this regard is the excellent organization of land-based procedures to maximize ship fullness (Yang & Chen, 2016).
- Travel time: This parameter plays an important role mainly in the case of long journeys where high-value goods are being transported, since in this case there is a non-negotiable need for precise compliance with

delivery dates, thereby reducing the flexibility of companies and service mainly to prospective customers (Moini et al., 2012).

— Accurate compliance with the program: As already stated, the most reliable indicator of the reliability of a company operating in the shipping market is the sturdy precision concerning pre-defined transport routes. The importance of strict adherence to the program is further enhanced by the fact that shipping services are the only link between customer and carrier, especially for high-value freight trips (Park & Min, 2011).

— Reliability and formality of companies: The ability of companies to provide in a timely and timely manner all the necessary documents for transport, as well as consistency in bidding procedures, etc., are essential factors in determining demand in the shipping market, with the demand to increase as the above procedures are more reliably carried out (De Oliveira, 2014).

— Space Availability: The ability to provide transport services even if the request takes place at the last hour is an essential factor in selecting a service for the stakeholders, with the demand for a company's services increasing as this capability increases (Li & Oh, 2010).

1.13 Determinant Factors of the Transshipment Services Offer

Every shipping company in the field of shipping can offer services based on the following factors (Sohn & Jung, 2009):

— Available fleet: An increasing number of modes of transport make it possible for shipping companies to serve a larger volume of transport,

provided that the available transport resources are optimized (Ferrari et al., 2015).

— Industry Reliability: Increased industry credibility increases demand for the services provided and, with the increased know-how of companies operating in the market for direct services, increases the volume of market transport (Rodrigue & Ashar, 2016).

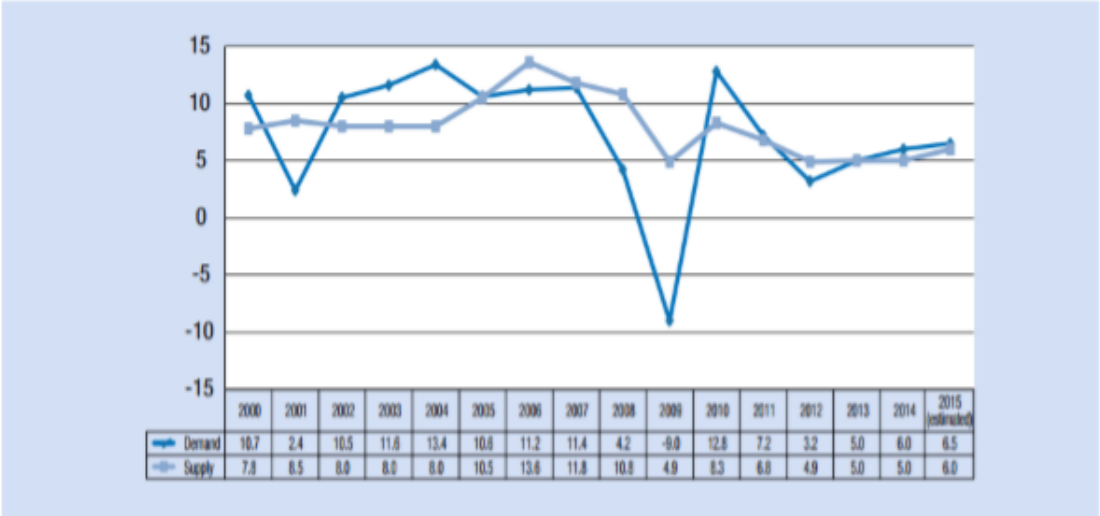
— Continuous alignment with developments: As has already been demonstrated, shipping companies use state-of-the-art ships for their shipping operations and high-precision machinery for handling and handling goods. On such a basis, harmonization with these requirements is essential to enable a company to compete and survive in the shipping market. Otherwise, leaving the market will be a natural consequence (Panaydes & Song, 2012).

1.14 Relationship Between Demand and Supply

Globalization has been the most critical factor in changing the conditions and conditions for the shipping market, creating the on-going need for global coverage of service delivery, with the need to create extensive production, transport and distribution chains (Bohi, 2013). On a global scale. At the initial stage of the transition to the new situation, the efforts of shipowners and freight managers to adopt more extensive coverage networks worldwide have resulted in a significant increase in fares (Esper et al., 2010).

Based on the above, line shipping has become more extensive, integrated and reliable, with the cost of providing services still high even after the maturity of the transition to the new situation, given the increased demand for market services (De Stefano, 2015).

Figure 1. Demand and supply of services from 2000 to 2015



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 (estimated)
Demand	10.7	2.4	10.5	11.6	13.4	10.6	11.2	11.4	4.2	-9.0	12.8	7.2	3.2	5.0	6.0	6.5
Supply	7.8	8.5	8.0	8.0	8.0	10.5	13.6	11.8	10.8	4.9	8.3	6.8	4.9	5.0	5.0	6.0

Source: UNCTAD (2015) Review of maritime transport, Chapter 3: Freight rates and maritime transport costs.

The higher demand for shipping services than the opportunity offered ultimately led shipowners to respond by increasing new ship orders, with today's shipping market having a state-of-the-art fleet capable of responding to customers' needs and requirements (Zhou et al., 2009). Shipowners' investment behavior is and will continue to be directly linked to the fleet parameter and its technological evolution since only through a fully harmonized fleet development can a shipping company be able to cope with competitive costs by efficiently covering costs. , time and quality (Krishnamurthy, 2012)

With the most pressing demands online shipping coming from the preceding, market players are urged to meet the demands of shippers for fast and reliable shipment of goods, taking into account trends (Christopher et al., 2013; Bakker & Van Veldhoven, 2010):

— For freedom of negotiation: In order for carriers to negotiate freight rates, surcharges and other terms associated with the shipping process individually and always in the context of increased confidentiality (Wong et al., 2011).

— For contract protection: By allowing carriers to protect the basic terms contained in the contracts and especially the terms relating to fares while ensuring that the rights of freighters are not circumvented (Hamari & Lehdonvitra, 2010).

— For free co-operation between carriers: Based on the perception that carriers should be able to co-operate freely on issues related to functionality and capacity, in order to improve services and reduce costs, by, however, the condition is that no high-powered alliances can be created that can distort market competition (Hamari & Lehdonvitra, 2010).

2 Trends and Developments in Transshipment

Globalization in the field of shipping coupled with the financial crisis that erupted in 2008 has resulted in trends in shipping lines that enable companies operating in the field to cope with competition and ensure their continued viability in an environment severe financial distress (Tan & Holmola, 2012). These developments were mainly related to:

— The "giantess" of ships.

— Vertical and horizontal integration.

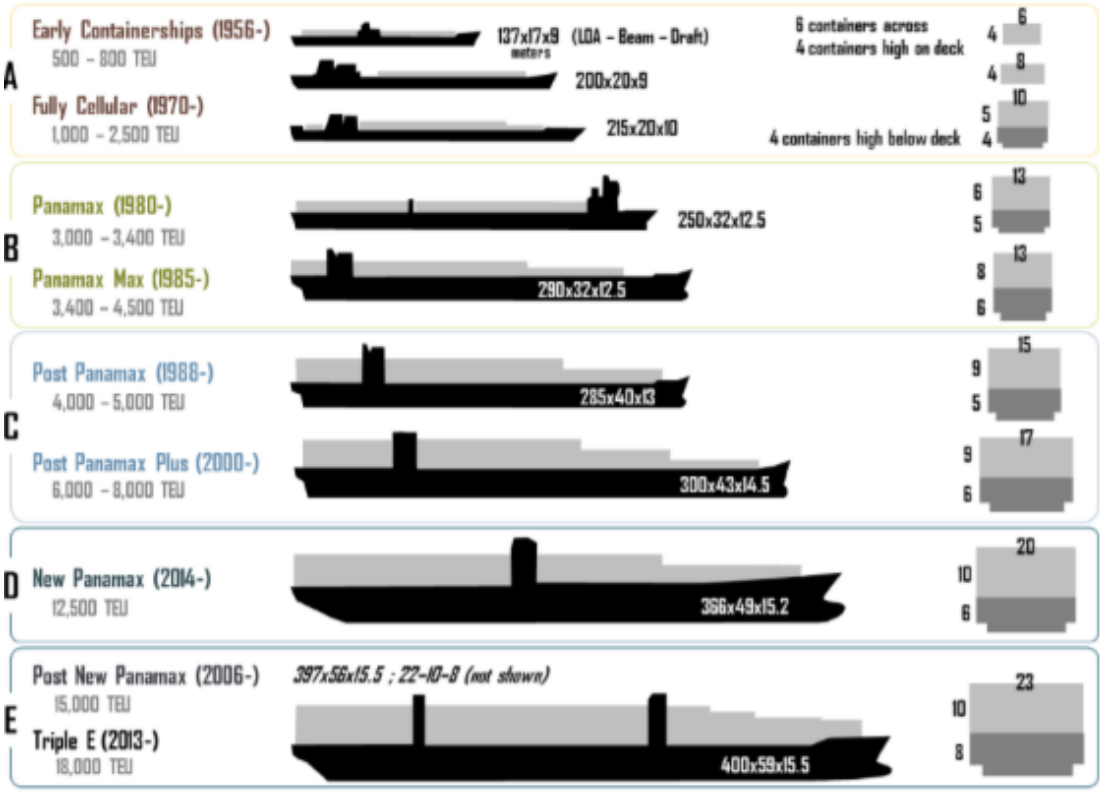
— The creation of alliances (Wang & Ducruet, 2012).

2.1 The “Giant” Vessels

In recent decades, there has been a strong trend in the shipping sector for G / C shipping, with the trend becoming more pronounced in the Asian - Northern European (mother vessels) and Asian - American trading lines (Carlo et al., 2014). Rapid growth and developments in the trade have led to new demands for product transfers, as the globalization of the market with the increasing global consumption has gradually led to new data, such as increased demand for TEUs and the need for to achieve economies of scale and further reduce transport costs to increase competitiveness. On such a basis, the need to adjust the size of ships to new data seemed unenviable (Schulze & Prinz, 2009).

The following table shows the ship size change over time in the various stages of line shipping development (Chandrakumar et al., 2016).

Table 1. Ship size change over time 1956-2014



Source: Container Sinka (2016): http://www.containersinka.com/bigger-risks-at-sea/

The above table shows the tendency for ships to be "giantized." As one can see, the first generation of container ships included ships with a capacity of up to 1000 TEUs and a draft of nine meters (Carlo et al., 2014).

As for the second generation, it is characterized by slightly larger vessels (draft of 10 meters) and capacity ranging from 1000 to 2500 TEUs (Zhang et al., 2015).

With the main focus on achieving economies of scale and improving competitiveness, we are moving to the third generation of ships characterized by even larger structures, with capacities ranging from 3000 to 4,500 TEUs and a draft of approximately 12.5 meters (Macioszek et al., 2017).

The tendency for a steady increase in ship size can be found in the fourth generation where ship capacity now reaches 5000 TEUs with the draft reaching 13 meters Carlo et al., 2015).

The fifth generation comes into the forefront in the early 21st century, with the maximum capacity of boats launching at 8000 TEUs and the maximum draft reaching even 14.5 meters (Moore et al., 2012).

Finally, the sixth-generation ships (from 2006 onwards) have a capacity of up to 15000 TEUs and a draft of 15.5 meters reaching today's structures where the capacity of vessels exceeds 20,000 TEUs, and their dimensions refer to giant structures (Carlo et al., 2015).

The following table shows the list of the 15 largest container ships today, with this map demonstrating the gigantic shape and associated increasing capacity of today's structures (Macioszek et al., 2017).

Table 2. 15 largest container ships today

Built	Name	Length overall (m)	Length overall (ft)	Beam (m)	Beam (ft)	Maximum TEU	Owner	gt (tn)
2017	OOCL Hong Kong[1]	399.87	1,311.9	58.8	193	21413	OOCL (Hong Kong)	210,890
2017	OOCL Germany	399.87	1,311.9	58.8	193	21413	OOCL (Hong Kong)	210,890
2017	Madrid Maersk[2]	399	1,309	58.6	192	20568	Maersk Line	214,286
2017	Munich Maersk	399	1,309	58.6	192	20568	Maersk Line	214,286[3]
2017	Moscow Maersk	399	1,309	58.6	192	20568	Maersk Line	214,286[4]
2017	MOL Triumph[5]	400.0	1,312.3	58.8	193	20170	Mitsui O.S.K. Lines	199,000
2017	MOL Trust	400.0	1,312.3	58.8	193	20170	Mitsui O.S.K. Lines	199,000
2017	MOL Tribute	400.0	1,312.3	58.8	193	20170	Mitsui O.S.K. Lines	199,000
2016	MSC Jade[6]	398.45	1,307.3	59.07	193.8	19224	Mediterranean Shipping Company	194,308
2016	MSC Ditte[7]	398.43	1,307.2	59.08	193.8	19224	Mediterranean Shipping Company	194,308
2016	MSC Reef	398.43	1,307.2	59.08	193.8	19224	Mediterranean Shipping Company	194,308
2016	MSC Mirja	398.43	1,307.2	59.08	193.8	19224	Mediterranean Shipping Company	194,308
2016	MSC Erica	398.43	1,307.2	59.08	193.8	19224	Mediterranean Shipping Company	194,308
2017	MSC Tina	398.43	1,307.2	59.08	193.8	19224	Mediterranean Shipping Company	194,308
2016	MSC Diana[8]	399.994	1,312.32	58.839	193.04	19224	Mediterranean Shipping Company	193,489

Source: Zhang et al. (2015)

A significant impact of the above-mentioned developments in terms of capacity and size of the vessels was the need to upgrade existing port facilities so that ports and terminals can accommodate and manage ships of this size (Wang et al., 2017). Significant constraints in this direction have been and continue to be physical constraints (shallow water etc.) related to port topology but also financial constraints due to the high cost of investments to be made (procurement of better equipment, further deepening projects, etc.) (Rodrigue & Ashar, 2016).

In any case, the transition from a situation where ships were built based on technological developments in the port facility sector, to a situation where ports are adapted to the requirements of the maritime industry, is evident (Leiras et al., 2014).

2.2 Horizontal Integration in Transshipment

Horizontal integration is characterized by the specialization and continuous development of a company in a particular field of production (Wyler & Cook, 2009). In the case of shipping companies, horizontal specialization is related to the development of the business of a shipping company either by acquiring a more significant number of ships of the same type or by adopting acquisition procedures of a competitor/merger with another company (Murshid, 2011). The primary purpose of shipping companies in shipping liners is to reduce unit shipping costs, aiming primarily at reducing operating costs (Loon, 2009). In addition to optimizing the purchase of vessels and using slow steaming while sailing, a key element of minimizing the unit transport costs that have prevailed in recent years is to achieve economies of scale through horizontal integration (Rodrigue & Nottebom, 2010).

Container shipping liner will refer to both the prevailing trend for acquisitions and mergers as well as to partnerships and alliances between significant companies in the industry (Miyake et al., 2010). Through acquisitions and mergers, capacity is increased, costs per unit of cargo are reduced, and the services and interconnection with the hinterland are optimized. Also, through alliances, large companies seek to tackle the oversupply and the difficulty of chartering large ships by achieving economies of scale (Rosca et al., 2014).

A takeover is defined as the process by which one company buys another in order to gain full control of its assets (Yang et al., 2017).

The merger of two or more companies is called the act of merging those companies in order to create a more substantial business (Yang et al., 2017).

The high level of competition in the shipping sector makes it almost impossible for the small shipping companies to survive and above all to adopt the extensive and costly investment programs needed to cope with the constantly evolving conditions. On such a basis, the smaller businesses in the area are forced to participate in horizontal integration actions (Lee et al., 2011).

Going one step further, as has already been said in recent decades, the tendency for container ships to become giant in the shipping industry is strongly dominated. In this case, too, smaller companies cannot purchase such large vessels so that we are de facto driven into an oligopolistic market as a result of horizontal integration actions (Pham et al., 2016).

In general, horizontal integration in the field of line shipping occurs in three forms (Muntean et al., 2010):

— In conferences through conferences,

— In operating agreements,

— In mergers.

The policy of conferences relates to the use of ports where there is a growing demand for consumer goods to establish lines facilitating the trade and transport of such products (Yang et al., 2010).

In the practical application of this policy and in order to achieve conditions for optimization of the transport process, not only ports where there is an increased demand for products but also other ports are used as intermediate stations for the transport of products to the ports of demand through the use of smaller vessels in size, the so-called feeder vessels (Liao & Acharya, 2011).

Concerning operating agreements, these agreements relate to contracts between shipping companies with the ultimate aim of filling any gaps in the operation of conferences, mainly as a result of the complex conditions and requirements created by multinationals and shippers for global freight transport at low cost (Muradian et al., 2014).

The objectives of this type of agreement based on the above objectives are (Kilianova et al., 2017):

- Achieve economies of scale mainly about the extensive Transpacific and Asia-Europe lines.
- Enhance the frequency of the services performed on the three central maritime routes, Transpacific, Transatlantic, and Asia-Europe, to provide daily services to the members of the alliances created.
- Optimization of on-board cargo distribution processes.
- The establishment of regular ferry services.
- Cooperation at the level of terminals belonging to the various members of the alliance, at the level of submarine ships (intermediate and central port ships) and at the level of combined transport operations (using both maritime and inland infrastructure and means).
- Optimizing the pricing policy and marketing action of alliance participants (Ng et al., 2016).

Moving forward, the mergers carried out in the context of horizontal integration are primarily aimed at achieving economies of scale by reducing fixed costs, optimizing

the use of ship capacity and within such a framework, reducing the overall cost of transport using transport (Bauer et al., 2014).

The most important features of global freight managers are the following (Gallegos, 2009):

- The pursuit of continuously expanding their activity to a broader geographical scale.
- Designing and coordinating worldwide ship schedules.
- Joint venture risk and investment with companies adopting horizontal integration.
- The effort to optimally combine purchasing power and ship volume.
- The orientation towards achieving economies of scale.
- Continuous effort to enter new markets and increase workload (Chen et al., 2017).

Optionally, the reasons that drive shipping companies today to conclude all kinds of partnerships, as mentioned above are the need to share investment risk, achieve economies of scale, control costs, and continually increase frequency. Routes so that they can meet the ever-increasing needs of customers in a globalized environment (Alkan et al., 2017).

2.2.1 **Exports and Mergers**

In recent years, as companies build larger ships to take advantage of the resulting economies of scale, the capital-intensive strategy puts intense competitive pressure on carriers and encourages mergers and acquisitions in an industry that has previously resisted this merger (Cullinane et al., 2016).

Below are the mergers and acquisitions that took place between the liner shipping companies for the period 1998-2007 (Table 3.1) and then the timing of management volumes in TEUs of the larger companies (Table 3.2) (Zondag et al., 2010). Their momentum to this day. Maersk, after its merger with Sealand, is the dominant carrier. MSC, CMA, and Hapag Lloyd have significantly increased their momentum, while COSCO and Evergreen continue to be critical players in the liner market (Merchan Duenas, 2015).

Table 3.1. Acquisitions and Mergers of Transport Companies, 1998 2007

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Maersk Line	Maersk Line	Maersk Sealand	Maersk-SeaLand	Maersk Sealand	Maersk Line	Maersk Line	Maersk Line	Maersk Line	Maersk Line
2	Evergreen	Evergreen	Evergreen Line/Unigla	P&O Nedlloyd	P&O Nedlloyd	MSC	MSC	MSC	MSC	MSC
3	P&O Nedlloyd	P&O Nedlloyd	P&O Nedlloyd	Evergreen	Evergreen	P&O Nedlloyd	Evergreen	Evergreen	P&O Nedlloyd	CMA-CGM
4	Sea-Land	MSC	Hanjin/DSR-Senator	Hanjin/DSR-Senator	Hanjin/DSR-Senator	Evergreen	P&O Nedlloyd	P&O Nedlloyd	Evergreen	Hapag Lloyd
5	COSCO	Hanjin	MSC	MSC	MSC	Hanjin/DSR-Senator	CMA-CGM	CMA-CGM	CMA-CGM	COSCO
6	Hanjin	Sea-Land	COSCO	NOL/APL	NOL/APL	COSCO	Hanjin/DSR-Senator	NOL/APL	NOL/APL	CSCL
7	MSC	COSCO	NOL/APL	COSCO	COSCO	NOL/APL	COSCO	Hanjin/DSR-Senator	CSCL	Evergreen
8	MOL	NOL/APL	NYK	NYK	CMA-CGM	CMA-CGM	NOL/APL	NYK	COSCO	NOL/APL
9	NYK	NYK	CMA/CGM/ANL	CP Ships	NYK	MOL	NYK	COSCO	Hanjin/DSR-Senator	Hanjin
10	HMM	MOL	CP Ships	CMA-CGM	CP Ships	CP Ships	MOL	CSCL	NYK	NYK
11	Zim	HMM	Zim	MOL	K Line	NYK	CP Ships	OOCL	OOCL	MOL
12	Yangming	Zim	MOL	K Line	OOCL	K Line	K Line	MOL	CSAV	OOCL
13	CMA-CGM	CP Ships	K Line	Zim	MOL	Zim	OOCL	Zim	MOL	K Line
14	OOCL	CMA/CGM	HMM	OOCL	HMM	OOCL	Zim	CP Ships	K Line	Yang Ming
15	NOL	Hapag-Lloyd	OOCL	Hapag-Lloyd	CSCL	CSCL	Hapag Lloyd	K Line	Hapag Lloyd	Zim
16	CP Ships	OOCL	Yangming	Yang Ming	Yang Ming	Hapag Lloyd	Yang Ming	CSAV	Zim	Hamburg Süd
17	K Line	K Line	Hapag-Lloyd	CSCL	Zim	HMM	CSCL	Hapag Lloyd	Hamburg-Süd	HMM
18	APL	Yangming	UASC	HMM	Hapag Lloyd	Yang Ming	Hyundai	Yang Ming	Yang Ming	PIL
19	Hapag-Lloyd	UASC	CSAV	CSAV	CSAV	PIL	CSAV	HMM	CP Ships	CSAV
20	Cho Yang	Safmarine	Cho Yang	Hamburg-Süd	Hamburg-Süd	CSAV	PIL	Hamburg Süd	HMM	Wan Hai
		Uniglory						Delmas		
		Lloyd Triestino								
		DSR Senator								

Source: Zondag et al (2010)

The successive acquisitions and mergers that took place during this period strengthened Maersk, which in 2001 had an annual throughput of 694 mm TEUs and in 2013 2,585 million TEUs (Herrera et al., 2009). The most significant increase was MSC, which rose from 247 thousand TEUs in 2001 to 2,306 million TEUs in 2013 and second place The CMA CGM came in third with 1,446 million TEUs in 2013, marking an enormous increase as 2001 was 10th with 142 thousand TEUs (Valery & Varvara, 2014).

Table 3.2. The ten largest carriers in TEU in 1980 2013

Ten largest carriers worldwide 1980/2001/2011/2013*

Rank	1980 Container Fleet		2001 Container Fleet		2011 Container Fleet (31st Dec)		2013 Container Fleet (1st of May)	
	Carrier	000 Teu	Carrier	000 Teu	Carrier	000 Teu	Carrier	000 Teu
1	Sealand	70	Maersk & Sealand	694	Maersk	2536	APM-Maersk	2585
2	Hapag Lloyd	41	P&O Nedlloyd	344	MSC	2,107	MSC	2,306
3	OCL	31	Evergreen	325	CMACGM	1,347	CMA CGM	1,446
4	Maersk	26	Hanjin/ Senator	258	Cosco	646	Evergreen	754
5	M Line	24	MSC	247	Hapag	644	Cosco	730
6	Evergreen	24	APL	224	APL	627	Hapag	700
7	OOCL	23	Cosco	206	Evergreen	609	Hanjin	643
8	Zim Line	21	NYK	171	CSCL	552	CSCL	606
9	US Line	21	CP Ships	148	Hanjin	473	APL	606
10	APL	20	CMACGM	142	MOSK	434	MOSK	529
	TOTAL	301		2,759		9,975		10,905
TOTAL WORLD FLEET		726		7,392		15,899		17,140

* Year to date May 2013
** Maritime Economics, Dr. Martin Stopford
*** Alphaliner

Source: Zondag et al (2010)

Table 3.3. The ten largest carriers in TEU in 2018

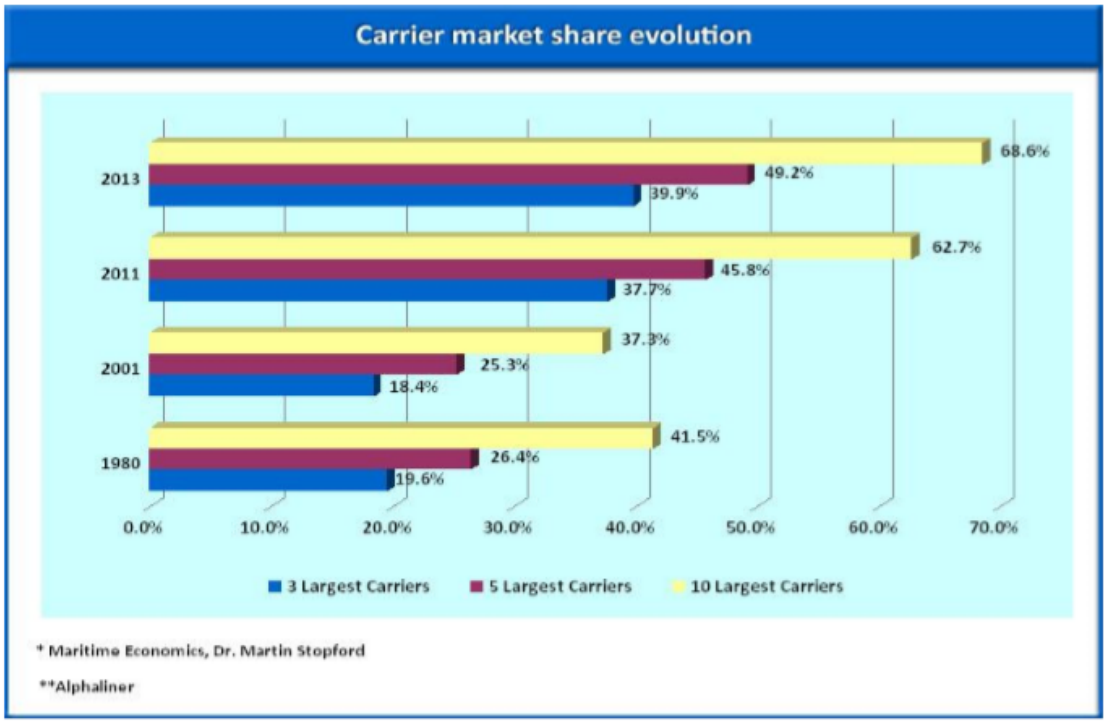
Company	Headquarters	Ships	Total TEU	Average TEU	Market share
Maersk Line	Denmark	700	3,879,439	5,542	15.3%
Mediterranean Shipping Company	Switzerland	473	3,118,108	6,592	12.3%
CMA-CGM	France	476	2,554,264	5,366	10.1%
China Ocean Shipping (Group) Company	China	330	1,972,491	5,977	7.8%
Hapag-Lloyd	Germany	217	1,550,874	7,147	6.1%
Ocean Network Express	Japan	228	1,536,312	6,738	6.1%
Evergreen	Taiwan	200	1,110,708	5,554	4.4%
Orient Overseas Container Line	Hong Kong	99	689,986	6,970	2.7%
Yang Ming	Taiwan	100	609,749	6,097	2.4%
Pacific International Lines	Singapore	132	413,334	3,131	1.6%

Source: United Nations Conference on Trade and Development

Looking at the market concentration over time, the ten largest carriers in 2001 held 37.3% of total transport capacity (Jumaniyazov, 2010). Within ten years, this figure has risen sharply to 63% and in 2013 to 68,6% creating oligopoly conditions. This concentration is even more significant in that the top 5 companies accounted for 49% of global capacity in 2013, while the top 3 accounted for 39.9% (Williams, 2013).

Over the last five years and as we can conclude from table 3.3 and Figure 2 the 10 largest carriers in 2018 held 68.8 % of total transport capacity. So from 2001 to 2018 this figure increased by 27.3 %.

Figure 2. Carrier Market Share Evolution



Source: Wang et al., 2013

As part of the industry's horizontal integration for 2016, the acquisition of NOL and the APL trademark by CMA CGM is noteworthy. The merger of Cosco Shipping and China Shipping Container Lines with China Cosco Shipping was also completed in February 2016 (Bandara et al., 2015). Hapag-Lloyd and Arab Shipping Company also

agreed to merge. Other mergers have been made between CSAV and Hapag Lloyd as well as between the Compañía Chilena de Navegación Interoceánica and Hamburg Süd (Alikulov, 2010). The current picture of the fleet of major carriers, their proprietary vessels, the capacity they charter from other companies and their order book are presented in the table below.

Table 4. The fleet of the 25 largest R & D carriers in 2016

		TOTAL		Owned		Chartered			Orderbook		
Rnk	Operator	TEU	Ships	TEU	Ships	TEU	Ships	% Chart	TEU	Ships	% existing
1	APM-Maersk	3,280,821	631	1,763,776	263	1,517,045	368	46.2%	367,130	27	11.2%
2	Mediterranean Shg Co	2,847,269	486	1,073,470	192	1,773,799	294	62.3%	275,835	22	9.7%
3	CMA CGM Group	2,137,125	452	825,826	110	1,311,299	342	61.4%	235,624	24	11.0%
4	COSCO Container Line	1,616,962	290	452,031	76	1,164,931	214	72.0%	551,796	34	34.1%
5	Evergreen Line	992,905	188	548,041	105	444,864	83	44.8%	324,000	36	32.6%
6	Hapag-Lloyd	965,669	169	527,189	72	438,480	97	45.4%	31,767	3	3.3%
7	Hamburg Süd Group	606,146	117	319,413	47	286,733	70	47.3%	30,400	8	5.0%
8	OOCL	575,561	97	410,739	54	164,822	43	28.6%	126,600	6	22.0%
9	Yang Ming Marine Tran	570,018	100	217,386	46	352,632	54	61.9%	98,396	7	17.3%
10	UASC	525,008	55	406,103	37	118,905	18	22.6%	29,986	2	5.7%
11	NYK Line	518,897	98	267,544	45	251,353	53	48.4%	154,156	11	29.7%
12	MOL	495,383	79	151,316	22	344,067	57	69.5%	120,900	6	24.4%
13	Hyundai M.M.	455,859	66	165,080	22	290,779	44	63.8%			
14	PIL (Pacific Int. Line)	366,330	139	301,382	120	64,948	19	17.7%	142,200	13	38.8%
15	K Line	350,937	60	80,150	12	270,787	48	77.2%	69,350	5	19.8%
16	Zim	306,329	66	27,800	6	278,529	60	90.9%			
17	Wan Hai Lines	218,252	87	169,598	71	48,654	16	22.3%	15,200	8	7.0%
18	X-Press Feeders Group	160,296	101	26,734	21	133,562	80	83.3%			
19	KMTC	125,550	62	44,811	26	80,739	36	64.3%	5,355	3	4.3%
20	IRISL Group	102,155	48	102,155	48				58,000	4	56.8%
21	SITC	95,861	76	62,082	47	33,779	29	35.2%			
22	TS Lines	83,877	40	1,578	1	82,299	39	98.1%	7,200	4	8.6%
23	Arkas Line / EMES	72,547	41	60,408	35	12,139	6	16.7%	23,416	8	32.3%
24	Simatech	60,020	20	18,144	6	41,876	14	69.8%			
25	Transworld Group	56,728	34	35,133	20	21,595	14	38.1%			

Source: Kos et al., 2012

The largest company in terms of fleet size and total capacity in TEUs is APM-Maersk while MSC and CMA are the next companies in fleet size. Also crucial in the field are COSCO, Evergreen, and Hapag Lloyd. MSC and COSCO base their strategy on chartering ships of other companies for 2016 while COSCO and Evergreen intend to increase their capacity by 36% and are in the top two positions in the order book

(Kobuta, 2015). It is worth noting that Hanjin went bankrupt this year, which would cause changes in the market as a whole and the indexes (Profir, 2011).

Concentration in this sector continues to increase in 2016 at the level of the five largest companies as they provide 51.6% of total capacity. This is mainly due to the rise of the CMA CGM and COSCO. However, the results are in contrast to the top 10 companies that managed 67% of the global fleet of containerships cumulatively, compared to 69% in 2013 (Blecker et al., 2010). The top 20, however, control 83% of total capacity (UNCTAD, 2015) that the companies following the 10th position have strengthened their role through their partnerships with large companies (Finlay, 2009).

Freight shipping is capital intensive as it requires high entry costs for carriers mainly in the current season of oversized ships. The standardization of services provided and the difficulty of differentiating them from competitors coupled with the pursuit of economies of scale have led transport companies to cooperate through joint ventures and cost control alliances (Averkieva et al., 2017).

2.3 Creation of Alliances

The conclusion of strategic alliances, i.e., agreements for the mutual benefit, of shipping companies in order to achieve their business objectives is not a new phenomenon, as in the shipping industry, in particular, this has happened repeatedly (Cartwright & Cooper, 2012). The continued increase in trade through the use of containers, coupled with the internationalization of shipping companies, has increased this tendency to create strategic alliances (Austin, 2010).

Going a step further, the outbreak of the global crisis in mid-2008 led the major shipping companies to seek and conclude alliances in order to benefit from the economies of scale that can be created (Prashant & Harbir, 2009).

As already mentioned, the continual increase in container shipping has been an essential factor in the search for alliances to reduce the cost of operating supply chain companies (Van Dyke & McCammon, 2010). The following table illustrates the parties involved in the container supply chain with each related process being completed by a member of a strategic alliance to minimize costs based on the expertise of each member of the alliance (Hess & Rothaermel, 2011).

Overall, through strategic alliances, liner shipping companies succeed (Gulati & Wohlgezogen, 2012):

- Ensure, beyond the scope of operations, economies of scale crucial to the viability and further development of companies, areas of construction and R&D, ultimately offsetting the costs earmarked for necessary actions such as the introduction of new products and services into the market.
- Reduce the time and financial resources needed to penetrate new markets.
- Reduce difficulties and increase efficiency in case of ventures requiring specialization in more than one area of action.
- Entering emerging markets where the involvement of a local business partner is deemed essential to the success of the venture.

Today in the field of line shipping, strategic alliances between companies are divided into the following categories (Cartwright & Cooper, 2016):

- In functional alliances.
- In pricing alliances and,

— Logistical support alliances.

Functional alliances are the most common type of line shipping and can take place at four levels, at the marketing level, at the co-op level, at the co-op level, and the co-ordination level of navigation programs (Das & Rahman, 2010).

As far as pricing alliances are concerned, such alliances mainly involve companies with high market shares, which wish to control the level of fares and hence market movement. In a more specific context for achieving these objectives, the undertakings involved in such alliances seek to control the full capacity of transport services within the alliances with the ultimate aim of avoiding situations of excess capacity (Wu et al., 2009). Based on this orientation, the companies that lead this type of alliances call on the other members/carriers of the alliance to exploit a particular part of the profits or a specific market share (Meier, 2011).

Finally, in terms of logistical alliances, they are part of the effort of companies to expand the range of their services beyond the port-by-port transport of goods, without at the same time increasing the cost geometrically (Flatten et al., 2011). On such a basis, freight carriers are increasingly involved in onshore and offshore activities in order to reduce the costs and risk of their actions, resulting in logistical alliances although not as widespread as operating alliances and pricing alliances are now on the rise as companies continuously expand their offshore support actions (Nielsen & Nielsen, 2009).

The main alliances developed in the field of maritime transport to date are illustrated in the following table (Rothaermel, 2013).

Table 5. Strategic alliances in maritime transport

2000			
	NEW WORLD ALLIANCE	GRAND ALLIANCE	UNITED ALLIANCE
MEMBERS	APL-NOL, MOL, HMM	HAPAG-LLOYD, P&O NEDLLOYD, OOCL, MISC	CHO YANG, DSR/SENATOR, HANJIN
NUMBER OF SHIPS	90	93	85

2006			
	NEW WORLD ALLIANCE	GRAND ALLIANCE	CKYH
MEMBERS	APL, MOL, HMM	HAPAG-LLOYD, NYK LINE, OOCL, MISC BERHAD	COSCO, K-LINE, YANG MING, HANJIN
NUMBER OF SHIPS	223	350	354

2010			
	NEW WORLD ALLIANCE	GRAND ALLIANCE	CKYH
MEMBERS	APL, MOL, HMM	HAPAG-LLOYD, NYK LINE, OOCL	COSCO, K-LINE, YANG MING, HANJIN
NUMBER OF SHIPS	282	288	400

2012				
	2M	OCEAN THREE	G6	CKYHE
MEMBERS	MAERSK LINE, MSC	CMA-CGM, CSCL, UASC	APL, HAPAG-LLOYD, HYUNDAI MERCHANT, MOL, NYK LINE, OOCL	COSCO, YANG MING, HANJIN, EVERGREEN, K-LINE
NUMBER OF SHIPS	185	126	240	89

2017 TO TODAY			
	2M ALLIANCE	OCEAN ALLIANCE	THE ALLIANCE
MEMBERS	MAERSK, MSC, HMM, HAMBURG SUD	CMA-CGM, COSCO, OOCL, APL, EVERGREEN	NYK LINE, HAPAG LLOYD, K-LINE, MOL, YANG MING
NUMBER OF SHIPS	483	539	347

Source: Rothaermel, 2015

The significant alliances and market dominators were four until recently: 2M, G6, CKYHE, and Ocean Three" (UNCTAD, 2015). In 2014, 3 of the largest liners in the market - Maersk, MSC and CMA CGM - tried to create the "P3 alliance" but were hampered by the Chinese regulators and the resulting "2M" between MSC and Maersk (the two largest container carriers) signing a 10-year "Vessel sharing agreement" for the Asia-Europe, Transatlantic and Transpacific routes, which decided to ship 185 ships (Agarwal & Croson, 2010). This alliance covers part of the excess capacity and stabilizes the tariffs. The investment of 2M in more extensive and more efficient ships will motivate other companies to buy newer and more efficient ships so that they can remain competitive in the light of the ship's operating costs and subsequently unit transport costs (Holmberg & Cummings, 2009). Hapag-Lloyd, APL and Hyundai transporters formed the G6 alliance in 2011 serving the Asia-Europe trading line, and then Mitsui O.S.K. Lines, Orient Overseas Container Lines, and Nippon Y.K. Ocean alliance consists of CMA CGM, China Shipping and UASC while CKYHE consists of Evergreen, COSCO, Kline, Hanjin, Yangming (Brouthers & Nakos, 2015). Table 6 shows the overall picture of the alliances that changed in April 2017 and resulted in 3 new broad alliances (Sluyts et al., 2011). 2M is renamed '2M Alliance' with the addition of 2 more shipping lines, HMM and Hamburg Sud. 'Ocean Three' becomes 'Ocean Alliance' with CMA CGM, Cosco, Orient Overseas Container Lines, APL, Evergreen. Finally, Nippon Y.K., Hapag Lloyd, Kline, Mitsui O.S.K. Lines, Yangming create 'The Alliance (Nielsen, 2010).

The three alliances represent 44% of the global fleet. 'Ocean Alliance' comes in first with 539 ships (4.08 million TEUs), '2M Alliance' comes in second with 483 ships (3.3 million TEUs) and third in 'The Alliance' with 347 ships (2.7 million TEUs) (Panaydes & Wiedmer, 2011). The Ocean Alliance holds the largest share in the Far

East-North America market and relies mainly on COSCO's potential to deliver 203 ships and 1.6 million TEUs. Hyundai's incorporation offered the 2M only 18 ships at Maersk's 268 and MSC's 197 (Isoraite, 2014). The main carrier in "The Alliance" is Hapag-Lloyd which, following its merger with UASC, has a fleet of 121 ships and 1.07 million TEUs assisted by the NYK Lines of 68 ships and 0.5 million TEUs (Container). (Gomes et al., 2011). Also, in the new broad alliance, a carefully designed service network has been designed to cover allies' needs as well as customer requirements. The UASC annexation is an integral part of the alliance's success as Hapag Lloyd is the alliance's only major corporation (Warner & Sullivan, 2017). Initially, they already have 89% of their capacity in operation as opposed to the 2M of 82% and the Ocean alliance of 79%. However, in terms of their stability and reliability, 2M has a 10-year vessel sharing agreement, while cooperation with the other two alliances initially covers five years (Jiang et al., 2013).

Smaller companies cannot compete with corporate alliances because:

- They cannot follow the purchase of new, more massive, and more efficient ships.
- Sharing capacity through partnerships minimizes any prospects for recovery.
- The case of sub-chartering their ship to large companies is no longer highly probable due to the ever-increasing overcapacity and capacity sharing among them.
- Through partnerships with international terminals management companies for their exclusive use, Mega-Carriers achieve through the

alliances the priority or exclusive use of more terminals around the world.

— The economies of scale they achieve reduce the unit transport costs for these companies by making them more competitive as opposed to the small ones that are driven out of the market (Haeussler et al, 2012).

2.4 Vertical Integration in Transshipment

Vertical integration is the extension of the business to successive stages of production and distribution of a particular product. The choice of this development strategy is widely applied today in the field of shipping, with ample space businesses now offering integrated transport services through the adoption of a door-to-door system that ensures customer service not only during delivery of the main transport activity but both before and after it (Shao & Krishnan, 2011).

This form of integration is a strategic choice in the case of businesses that want full control and optimal organization at all stages of the transport service, including terminals, storage systems, distribution systems, etc. (Sharma & Patil, 2011)

The adoption of this type of integration mainly by the leading companies in the field leads to high barriers for new competitors to enter the field as conditions for gaining control and influence of these companies on their market shares are created (Cichenski et al., 2017).

Figure 3. Vertical integration in maritime transport

Source: Rodrigue, 2010

Mega-carriers are the most characteristic form of vertical integration in today's reality of shipping lines, with them having evolved into value-added networks that produce at all stages of the shipping process. In the case of mega - carriers, the port no longer has a role to play, but is simply another link in the overall supply chain, with the use of modern information systems and in-ground support stations being critical drivers of mega - carriers' success (Chou & Ding, 2013).

Going a step further, the main goal of mega-carriers is to acquire terminals so that they can continuously expand their operations both in the maritime and inland areas, thus acting as global operators (Van Reeven, 2010).

For example, A.P. Moller-Maersk Group has founded APM Terminals which is one of the largest terminal management companies, having 72 terminals under its management and providing services not only to the company itself but also to other shipping companies (Rinto, 2012). In 2013, it managed 36.3 million TEUs, accounting for 5.5% of the total terminal market share and ranks third on the global list. COSCO owns and manages 32 terminals (Viswanadham & Gaonkar, 2009) while MSC has set up Terminal Investment Limited with a stake in 30 terminals, 35% of which is owned by Global Infrastructure Partners with a strong portfolio in both terminal management and logistics services (Ji et al., 2017). We, therefore, see shipping companies through their subsidiaries managing terminals but, in many cases, leaving their management to manage companies or managing them jointly (Chandler et al., 2009).

3 Trends and Developments in the Port Industry

According to the analysis carried out earlier, it is evident that the port is an essential link in the whole shipping chain in shipping and as a result, it must be continuously harmonized (Carlo et al., 2015):

- The ever-increasing need for further integration of the supply chain in order to minimize intermediate stops.
- The ever-increasing demand of customers for a package of quality services at the port.
- The global challenges of adapting ports and related services to periodic structural changes taking place in liner shipping.
- The constant evolution of terminals networks.

3.1 The Port Industry

The ports are commercial areas close to the water that is deep enough to allow watercraft to move. Modern ports are the link between maritime and inland transport. They are more service-oriented inland and are usually located within walking distance of urban centers (Woo et al., 2012). They are now part of the supply chain and offer integrated solutions for combined transport. Their primary role is to provide services to reduce the cost not only of the port services offered but also of the total cost of shipping products (Pallis et al., 2010). In these areas, there are port companies operating on existing port infrastructure as well as conventional road and rail infrastructure. The port market is regulated by a competent authority to have supervisory control over the procedures and legality of actions (Lee et al., 2018).

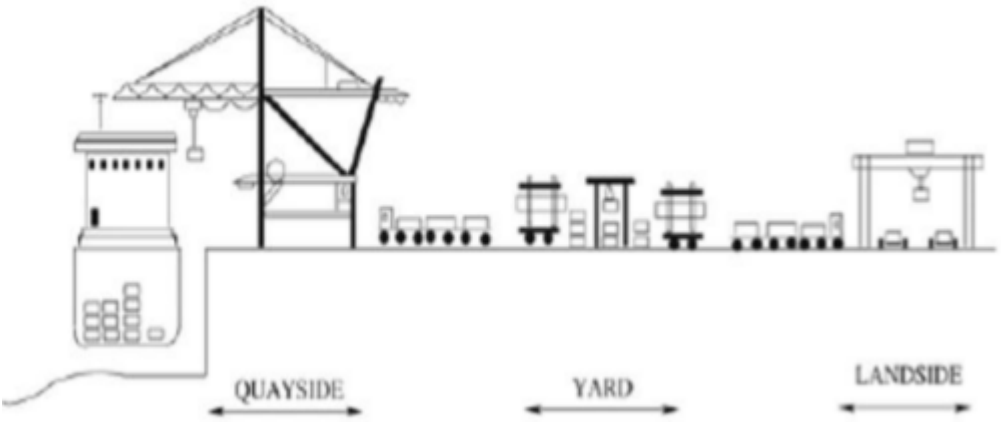
Modern Port Terminal is defined as the port sector, which consists of one or more paratroopers dedicated to the management of a particular cargo (Ng, 2013).

The port industry is the industry that deals with the commercial exploitation of ports, in which organizations aim to increase their profitability through the exploitation of ports (Song & Panayides, 2012).

3.2 The Contemporary Role of The Port as the Core of Transshipment Logistics

In the new reality of liner shipping, the transition to a regime where ports are adapted to the requirements of the shipping industry is visible, not the opposite as it used to be. Ports are now another critical link in the overall supply chain process and not an autonomous unit around which transport operations depend (Bernacki, 2014). With the advent of "logistics," the port is no longer the central point through which all transport is carried out, but a link in the integrated transport system (Van de Voorde & Vanlslander, 2010; Notteboom et al., 2013; Pallis et al., 2011).

Figure 4. The typical shape of a container station



Source: Bernacki, 2014.

Modern shipping ports are necessarily container terminals with the components that make up such a station can be grouped into three categories of activities related to arrival, storage, and departure processes.

The port is called upon to play a role that is now essential in the integrated logistics process. As a result of the new requirements formulated by port customers, they are continually being transformed into centers that provide services across the entire transport chain, starting from the producer to the final recipient (Robinson R, 2002). In this way, ports change their role and become "logistics" centers (Creightney C.D., 2003).

The introduction of the modern organization, management, communication and automation of operations in the operation of R & D managed ports will eventually require the creation of a more automated port (Slack B, 1993) that integrates full logistics functions into both its internal and inland operations. Its services provided and its relationships with users of port services (Llanto G, Basilio E, 2005).

3.3 Competitiveness of Ports in Transshipment

Critical elements in enhancing port competitiveness for better, faster, and more efficient completion of liner shipping processes are the existing physical infrastructure, operational infrastructure, and existing technological equipment.

Port authorities, given the fact that ports are a vital link in the chain of activities of shipping companies, should continuously look for ways to improve their competitiveness based on the above data (Pardalis, 2007).

The trend nowadays seen by terminal managers worldwide is the adoption of a new co-operation strategy. The co-operation is being developed to transform ports into

flexible transport centers. Container ports, in order to cope with the alliances that have developed in line shipping and survive in this highly competitive environment, are developing strategic alliances mainly with neighboring (strategic port alliances, strategic port alliances) (Avery P 2000).

At the global level, on the one hand, there is a tendency to compete on strategic port alliances and the other hand on logistics chains and strategic shipping alliances (DongWook Song, 2003 / Midoro R, Musso E. & Parola F., 2005).

We conclude, therefore, that while competition existed at the port level a few years ago, it is now developing at the level of container terminals. This comes from the deployment of more than one terminal in the same port which is not managed under a single operator (whereas a few years ago by the port authorities), but there are many and different variations. Competition between terminal managers is influenced by the demand, the specific factors of production, the particular industries associated with each manager, and the particular capabilities and performance of each manager and its competitors.

Below we look at the three types of port competition as they are today shaped by the competition that develops between the logistics chains worldwide:

1. Intra-port competition at operator level exists when in a port having more than one container terminal, each terminal has or is managed by a different authority (Pardali A & Stathopoulou C, 2005). The competition is growing between these companies, and every effort is made to enable each company to gain a more significant market share than the total port traffic. In this way, the efforts made by the companies are focused on optimizing the operation of the terminal that each handle at the level of the product offered and the prices to its customers. 2. Inter-port competition at operator level

Inter-port competition takes place between managers in different ports. This type of port competition occurs mainly between managers who usually cover the same inland (Pardali A & Stathopoulou C, 2005). 3. Inter-port competition at the port authority level is the type that expresses the classical form of competition at the regional or local level (Pardali A & Stathopoulou C, 2005).

In all the above three types of port competition, competition can be developed at two levels: hinterland competition and transshipment competition.

Today, competition is shifted to the level of logistics chains with the port being a vital link in the transport chain, making it clear that the port is not chosen but selected by users of port services (logistics chains) based on the efficiency of the terminal.

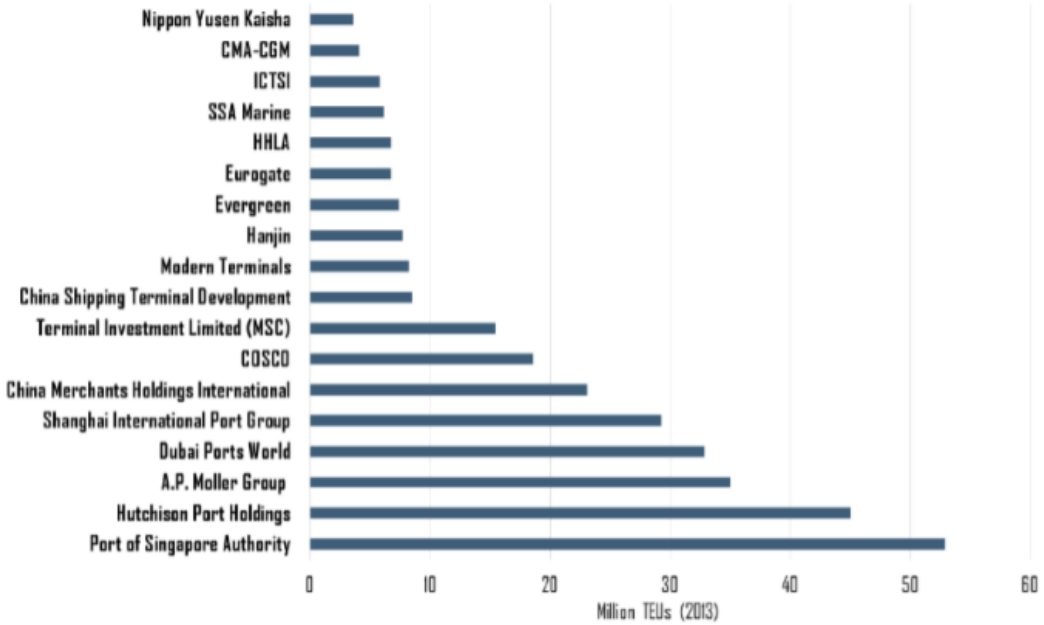
On the other hand, container terminal managers are urged to step up the process of regional decentralization by taking into account factors such as congestion, increased running costs and the limited management and production capacity available to meet the needs of an increasingly global market. Strengthening regional decentralization processes enhances port competitiveness (Gouvernal E, Debrie J & Slack B, 2005). In this way, the development of competition between container terminals is purely local, that is to say, within a specific market.

3.4 World Terminal Transshipment Station Managers

From the above, it is clear that terminal operators are an integral part of the competitiveness of R / C terminals as they are the business unit that delineates port strategy and investment policy. Transportation companies, through vertical integration or terminal management companies. Depending on the agreement, operators can maintain part of the functions of a terminal (Gonzalez et al., 2016). In 2013, 18 companies were designated as international terminals (as listed in the table below).

The list is volatile due to significant acquisitions and mergers. For example, COSCO and China Shipping have been merged, CMA CGM has acquired APL, and APM Terminals has acquired TCB Group. All of these moves reflect the merging of shipping companies and management companies into alliances aimed at vertical integration, aligning their interests. The following Figure shows the top management companies of terminals for 2013 and Table 6.1 the top 5 for the years 2014-2015.

Figure 5. International terminal management companies in 2013



Source: People Hofstra (2013):

https://people.hofstra.edu/geotrans/eng/ch4en/conc4en/largestportoperators.html

Table 6.1. The five largest international terminal management companies for the years 2014-2015

Top 5 global/international terminal operators' total throughput, 2014-2015 /

Million teu / % share of world container port throughput

		2015		2014			
Ranking	Operator	Million teu	% share	Million teu	% share	Growth / decline (m teu)	Growth / decline (%)
1	Hutchison Port Holdings	81.0	11.8%	80.2	11.8%	▲ 0.9	▲ 1.1%
2	APM Terminals	69.3	10.1%	71.7	10.6%	▼ 2.4	▼ 3.3%
3	PSA International	63.8	9.3%	65.2	9.6%	▼ 1.4	▼ 2.1%
4	Cosco Group	62.8	9.2%	61.9	9.1%	▲ 0.8	▲ 1.4%
5	DP World	60.5	8.8%	58.6	8.6%	▲ 1.8	▲ 3.1%

Source: Maritime Intelligence-Loyds List (2016): https://maritimeintelligence.informa.com/~/media/...Shop.../Reports/LL_Top_Ports.pdf

Table 6.2. The five largest international terminal management companies for 2018

2018 ranking	Operator	2018 throughput (mteu)
1	PSA International	60.3
2	Hutchison Ports	46.7
3	China Cosco Shipping	46.1
4	DP World	44.2
5	APM Terminals	42.8

Source: Drewry Maritime Research, Global Container Terminal Operators Annual Review and Forecast 2019

The Port Singapore Authority is the largest terminal management company with an annual throughput of more than 50 million TEUs in 2013. 50% of its total cargo

relates to its operations in the Singapore port while the remaining 50% to its international portfolio in Singapore, which does not include Africa, North Europe, and North America (Notteboom & Rodrigue, 2012). In 2014 and 2015, however, it came in third, reporting a drop of 3.3% to 69.3 million TEUs.

Hutchison Port Holdings were in second place in 2013. It has its headquarters in Hong Kong with three terminals, four terminals in China, and a total of 15 terminals in South and East Asia. It does not vary significantly geographically as it operates mainly in Western European ports outside the Far East. With a total throughput of 78.3 million TEUs in 2013 and 80.2 million TEUs in 2014, it comes in first but has a smaller market share than PSA because 20% of its shares are owned by PSA (Hutchison Ports website). HPH managed 81 million TEUs throughout its terminal portfolio in 2015, maintaining the first position, posting a 1.1% year-over-year increase.

H A.P. Moller Terminals (a sister company of Maersk Lines) based in The Hague in the Netherlands, is in third place with 5.4% market share and geographical presence in 65 ports and 39 countries for 2013. It is worth mentioning that it holds 30% of Global Ports, the largest Russian state-owned company. In 2014 and 2015, however, it was second only to PSA, although sales declined 2.1% in the same period (APM Terminals website).

The top five for 2013 are Dubai Ports World and Shanghai International Port Group. However, that is changing later, as Cosco Group dominates instead of SIPG.

DP World based in Jebel Ali (UAE) is the most geographically diversified of global terminal operators with a network of more than 65 terminals spanning six continents. Recent projects include the DP World London Gateway and Embraport (Brazil), both

of which began operating in 2013. The existing facilities were expanded with the opening of Terminal 3 at its headquarters in Jebel Ali and a new R / D terminal at Southampton, United Kingdom. In 2014 it managed 58.6 million TEUs (DP World website) with an increase in its sales volume of 3.1% in 2015 making it fifth in the world.

COSCO, based in Beijing and 80% of its portfolio comprised of terminals in East Asia, is the fourth power in the management companies for the years 2014-2015. By December 2012, COSCO had invested in 33 terminal projects in mainland China, Hong Kong, Taiwan, Singapore, the US, Europe and the Middle East and the number of berths it reached 150 In 2014, COSCO's total traffic was 61.9 million TEUs, with an annual growth rate of 9.1% (COSCO website). COSCO and China Shipping have reportedly merged their port operations, and even HPH has reason to fear for its top position.

The growth in global container traffic is slowing down significantly in 2015. It was not surprising, then, that top terminal operators felt the demand decline.

The top five operators for year 2018 are shown in the table 6.2. PSA and Hutchison hold first and second places respectively, with PSA’s pre-eminence due to its 20% stake in Hutchison Ports. Fortunes varied – PSA volume was up 7% compared to 2017 and topped 60 million TEU while Hutchison was largely unchanged at just under 47 million. Cosco moved up to third place in 2018 (from fifth in 2017) by achieving over 30% growth, boosted by the OOCL acquisition. This meant that DP World and APMT each dropped one place to fourth and fifth respectively. The latter registered nearly 8% growth, helped by the closer relationship with Maersk Line resulting in more of the carrier traffic directed to APMT facilities. China Merchants

(35 million TEU) and TiL (26.5 million TEU) remained in sixth and seventh places respectively despite both recording double-digit growth in equity-adjusted volume. (Drewry Shipping Consultants Limited website)

From the above we can conclude that during these years significant changes have taken place in the terminal market. The protagonists are still their own but their position and market share has changed significantly.

3.5 Horizontal Integration in Ports/ Terminals

In recent decades major changes have taken place in the market structure of container shipping companies affecting the structure of the port industry, container terminals, and leading terminal managers to horizontal integration, which was then through horizontal integration, mainly through synergies, had a small market share (Pardali A., 2007). After the horizontal integration between the container shipping companies, which are the main users - clients of container management terminals, the terminal managers had to deal with a small number of very large companies, which were very well informed about the market as each these controlled a large proportion of container transport (Jean-Paul Rodrigue, Theo Notteboom, 2010). Global container terminal operators are changing their strategy due to the slowdown in growth, based on expanding port infrastructure and superstructures while aiming to achieve larger alliances.

The oligarchic policy and vertical integration of shipping companies put pressure on terminal managers and has led them to pursue economies of scale through horizontal integration either through port acquisitions around the world or through corporate alliances that are usually led by mergers or acquisitions. The oligopoly of

international terminal management companies is the answer to the oligopoly of shipping companies.

Also, some financial institutions entered the terminals market, whose managers saw opportunities to invest in new markets with promising return on capital, and the further competition was inevitable.

So to counter this competition and the fact that with the creation of 'logistics' and global supply chains, global carriers may not be more selective (Slack, B., Comtois, C. and Sletmo, G., 1996 the respective terminal but another more competitive in the same or even a different port, the terminal managers invest in new terminals in the same or different ports, have an expansion policy and are driven to horizontal integration through mergers and acquisitions. Sera. Horizontal integration has also been facilitated by the privatization of ports since 1980, a period of liberal economic policy, as well as by the high fixed costs involved in the operation of modern terminals which inevitably lead to mergers and acquisitions. Acquisitions (Jean-Paul Rodrigues, Theo Notteboom, 2010).

Continuous mergers and acquisitions have resulted in global dominance in the market of few global freight managers who invest and stock in many different container terminals, whether in ports or even in ports or even in the same ports from economies of scale. Also, barriers to entry are created (JeanPaul Rodrigue, Theo Notteboom, 2010) and make it difficult for ambitious competitors to enter the market.

The economies of scale with unit cost reduction are implemented by the supply of operating systems and equipment (information systems, cranes, etc.) to the terminals in their possession by the same suppliers with agreements which, due to the volume of supplies, are economically advantageous. The acquisition of container management

terminals has become quite complicated as further agreements are being made between global freight managers to acquire small percentage shares of each other as well as freight forwarding agreements with shipping containers or cargo containers or financial controllers. Terminals. Freight managers benefit from more open access to finance and financial institutions from return on investment.

Examples of a joint venture are between APM Terminals and SIGP for the creation of a state-of-the-art terminal at Waigaoqiao (APM Terminals website) and Cosco with PSA formed Cosco-PSA Terminal Pte Ltd (CPT) in 2003 to manage and operate two terminals in the port Pasir Panjang where this year they provide services through 3 standard terminals (PSA website). We should note, however, that partnerships within the R&D terminal management market usually result in a potential merger or acquisition (Van De Voorde & Vanelslander 2009).

During the period 1996-2008, horizontal completions were intense. During this period, management companies through acquisitions and mergers declined but also invested in new terminals with more excellent geographical coverage. 2001 stands out as the year of acquisitions. During 2005-2007 there was an intense activity of mergers and acquisitions. The pioneer was DP World, through the acquisition of the portfolio of CSX World Terminals (2005) and P&O Ports (2006). These two acquisitions have strengthened its presence in container shipping in China, Hong Kong, Southeast Asia, Australia, America, and Europe. In addition to the DP World acquisitions, another significant deal was the acquisition of 20% of Hutchison Port Holding's global terminal portfolio by PSA, while PSA also made strategic growth moves in the Hong Kong area in 2005 (Van De Voorde & Vanelslander 2009). In 2015 it was decided to

merge COSCO and China Shipping with China Cosco Shipping being the world's second largest (Dupin, 2015).

Table 7. Mergers and acquisitions between terminal management companies

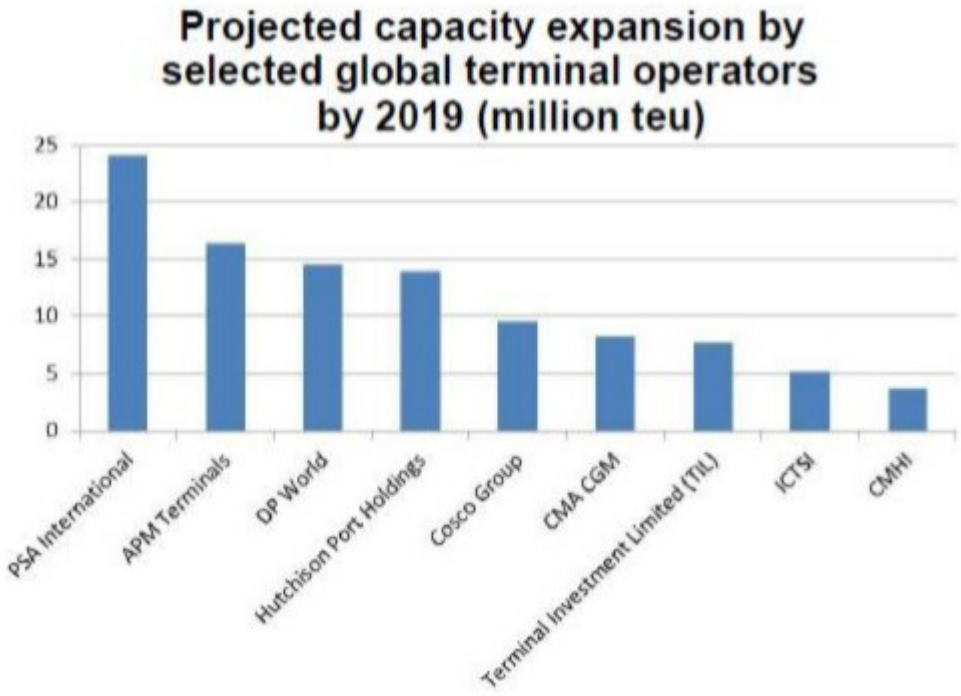
	1996	2001	2003	2006	2008
1	PSA	HPH	HPH	HPH	HPH
2	HPH	PSA	PSA	PSA	PSA
3	P&O Ports	APM Terminals	APM Terminals	APM Terminals	APM Terminals
4	Maersk	P&O Ports	P&O Ports	DP World	DP World
5	Sea-Land	Eurogate	Eurogate	Cosco Pacific	Cosco Pacific
6	Eurokai	DPA	Cosco	Eurogate	Eurogate
7	DPA	Evergreen	Evergreen	SSA Marine	SSA Marine
8	ICTSI	Cosco	DPA	APL/NOL	APL/NOL
9	SSA	Hanjin	SSA	HHLA	HHLA
10	Hamburger Hafen und Lagerhaus Aktiengesellschaft (HHLA)	SSA	APL/NOL	? Hanjin	Hanjin
11	Pacific Ports Co.	HHLA	HHLA	MSC	MSC
12	Ceres Terminals Inc.	APL/NOL	Hanjin	NYK	NYK
13	Europe Combined	NYK	MSC	OOCL	OOCL
14	Bremer Lagerhaus Gesellschaft	Hyundai	NYK	CSXWT	CSXWT
15	NYK	CSXWT	OOCL	Mitsui OSK Lines	Mitsui OSK Lines
16	APL/NOL	Mitsui OSK Lines	CSXWT	Dragados	K Line
17	OOCL	OOCL	Mitsui OSK Lines	K Line	TCB
18	Hanjin	K Line	Dragados	TCB	ICTSI
19	Mitsui	Dragados	K Line	ICTSI	
20	Evergreen	TCB	TCB		
21	K Line	MSC	ICTSI		
22	Cosco	ICTSI	P&O Nedlloyd		
23	CSXWT	Yang Ming Line			
24	Terminal Contenedores de Barcelona (TCB)				
25	Yang Ming Line				
…	Hyundai				
…	Hessenatie	Hessenatie			
…	Noord Natie	Noord Natie			
…	Contship Italia sa				
…	Sinport Sinergie Portuali				
…	Egis Ports	Egis Ports			

Source: Van De Voorde, E., Vanelslander, T. (2009), Market Power and Vertical and Horizontal Integration in the Maritime Shipping and Port Industry, International Transport Forum, Joint Transport Research, Centre Department of Transport and Regional Economics, University of Antwerp, BELGIUM

Terminal managers, in order to cope with the emergence of ship stagnation, the creation of alliances and the demand increase of 4.2% by 2019, are aiming to expand their capacity over the next three years. APM Terminals and DP World have made the most of their investment moves, with PSA International adding more capacity, mainly

based in Singapore's port. Hutchison, Cosco, CMA, TIL, ICTSI, and CHMI complete the list of global terminal managers aiming to increase their capacity. It should be noted, however, that this increase will not be achieved through mergers and acquisitions but by the development and formation of underutilized areas in emerging markets (Drewry, 2015).

Figure 6. Expected capacity increase by international terminal management companies by this year



Source: Drewry (2015) Global Container Terminal Operators Annual Report 2015, http://worldmaritimenews.com/archives/169704/mega-boxships-and-risingdemandfueling-port-investment-race

3.6 Vertical Integration in Ports/ Terminals

Vertical integrations are also a part of container freight managers to gain more influence at other stages of the global supply chain (Pardalis, 2007). Consequently, they turned to partnerships or even acquisition of land terminals, which also served as

extensions of large marine terminals (Notteboom, 2002), warehouses and investing in distribution networks and logistics services. The result is the creation of an oligopoly in the port industry.

Also, in many cases, freight managers focused on rail and land networks by partnering, buying shares, or exporting them. It is true that freight managers made vertical completions for the most part inland, but there were cases where freight managers invested and developed "feeder" services.

Through vertical integration, therefore, the further boom of container freight managers was inevitable and reflected in response to the oligopoly of container shipping companies.

The basic form of vertical integration is the phenomenon of companies that are shipping companies and terminal management companies such as COSCO and APM Group. Also, as mentioned above, terminal management companies often purchase offshore terminals that are offshore, acquire rail and inland vehicles, and invest in distribution networks and logistics services. For example, in Europe Maersk Line is served by the European Rail Shuttle Rail Services (ERS - part of the AP Moller / Maersk group). In addition, HPH with its ECT subsidiary in Rotterdam are pursuing an active strategy for the acquisition of crucial inland terminals (e.g a railway terminal in Venlo (The Netherlands), DeCeTe terminal in Duisburg (Germany) and TCT Belgium in Willebroek) These inland terminals serve as extensive gateways to deep-sea terminals (Notteboom, 2007).

3.7 The Hub and Spoke Transshipment System

Although shipping always required some transshipment service when transporting various goods and goods, ports that operated in general, before the emergence of

commercialization in the early 1970s, always functioned as gateways to sea with their inland. As the containerization of the general cargo made it possible for ships to increase their size and achieve lower unit costs, to be rapidly loaded and unloaded at ports with the necessary equipment, the containers were and to smaller boats and barges to serve shallow-water ports that were unable to accommodate large ships and collect small cargo numbers (Zheng, Neng & Sun, 2015). So, the concept of the hub & spoke system evolved in this way.

A transshipment process involves unloading products in one port and transferring them to another ship in order to reach their final destination. Such a process may involve the use of more than one ship for the carriage of products but may in no way involve actions to handle the cargo carried by the shipper (Stavrou & Ventikos, 2017).

Transshipment is adopted at transport hubs worldwide, and most of the transshipment processes take place in customs areas, thus avoiding lengthy customs procedures as well as costly customs procedures, thus making the shipping process more efficient (Fontes & Goncalves, 2017). Of course, this does not mean that the proceedings are not legal. On the contrary, they are legitimate actions that are found daily in large part of world trade (Baird, 2017).

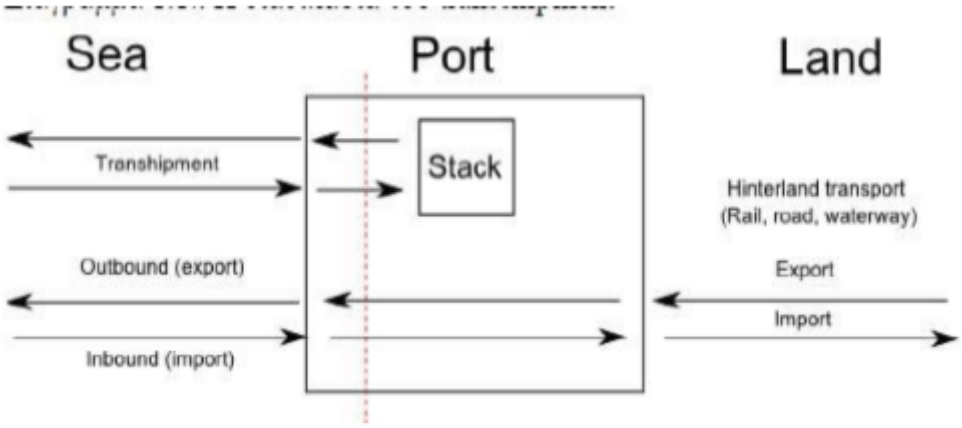
In this system, shippers of different goods each small ship batches of cargo to a hub, where cargoes are collected and transshipped to more substantial ships to be transferred to another hub port. In reverse, the cargoes are directed to the importing buyers, that is, to a large, central port (Hub Port), often located on a maritime trade route, with depths and platforms enabling it to receive and serve ships. Giants (mother ships) collect the cargo, and then feed the neighboring smaller ports (Spoke Ports) with the help of smaller ships, the so-called “Feeder ships” or only “feeders.” Such

transshipment services involve interrupting ship-to-ship freight (Musso & Parola, 2017). The congestion and delays resulting from the mixing of transshipment with imports and exports and the consequent competition for stacking sites have served as an incentive for the transfer of transshipment centers to offshore terminals and the creation of dedicated terminals. The purpose (dedicated terminals). These ports then developed into transcontinental transshipment hubs that served other smaller ports and were selected by shipping companies based on various criteria such as their geographical location, depth of water, infrastructure and superstructure, efficiency and productivity — etc. (Musso & Parola, 2017).

The mother ships strive to minimize the total time and the total cost of travel and thus to reach as few ports as possible. The smaller feeder ships, on the other hand, aim to feed the neighboring smaller ports with as much speed and flexibility as possible (Musso & Parola, 2017).

The following Figure describes the transshipment process in both ports, maritime, and inland transport components.

Figure 7. The transshipment procedure



Source: McCleery, (2011), The shipping man, 2nd edition, Marine Money, Inc.

The Hub and Spoke System is the essential form of transshipment in the shipping liner today. The process of transshipment and Hub and Spoke ports was borne out by the trend in the shipping market for shipping ships to "giantize" as mentioned above. It is well known that ports are adapted to the requirements and trends of shipping liner and not the other way around.

As the capacity for containerization of general cargo evolved rapidly, the ability to rapidly load and unload cargoes at ports was increased, while increasing ship size and achieving lower unit costs. Ports to have the necessary equipment. Also, the containers can now be transshipped to smaller vessels so that shallow-water ports, which are unable to accommodate large vessels, are also served. Based on this approach, the concept of the hub & spoke system was developed (Rodriguez et al., 2016).

In this system, consignors of different goods each ship smaller lots of cargo to an intermediate port, where these cargoes are collected and transshipped to more substantial ships to be transported to another port (hub port).

The system also includes a reverse process whereby products are transported to a large port (hub port) that has the technological and physical infrastructure to accommodate large ships, and from there they are shared in smaller ports by smaller vessels.

Figure 8. The Hub and Spoke system

In the Hub and Spoke system, larger ships aim to minimize the total time and cost of travel for the transport of products, while at the same time organizing an effort to reach the smallest number of ports, while smaller vessels have as their primary objective the supplying as many neighboring ports as possible in the unit of time.

The terminals mentioned above, in addition to being included in the most important ports worldwide in terms of a total number of containers managed, also play an essential role in transshipment. Consequently, Singapore, Hong Kong, and Shanghai ports are not only important import and export hubs but also major transshipment hubs (Notteboom et al., 2014). In particular, in the port of Singapore, the download rate exceeded 85% in 2013. The main download centers for 2013 are Singapore, Shanghai, Shenzhen, Hong Kong, and Busan (Port Technology website). These harbors are located on the central East-West interconnection line passing through the Panama and Suez canals and act as a hub and spoke to serve the feeder lines

connecting the East-West and North-South line. 85% of the 32.63 million TEUs managed by the Singapore port in 2013 were transshipments for another port as it interconnects with about 600 ports in 123 countries. The Shanghai port shipped 15 million TEUs (40% of the total throughput) in the same year, while in the Shenzhen port, of the 23.32 million TEUs, 50% were shipments. Finally, Busan with 9 million TEUs and Hong Kong with 5 million TEUs are essential South East Asian transshipment hubs (Notteboom et al., 2014 / Port Technology website).

3.8 The Interline Transshipment System

According to this system, two main lines meet in a large central port and exchange cargo. The intermediate junction acts as an interchange point and is located on the major maritime trade routes joining long-distance ports. As the volume of containers moving in the intercontinental trade was continually increasing, the need for redistribution of containers at crossing points was evident in liner shipping resulting in the emergence and establishment of such ports. In these ports, the containers are transshipped between large vessels and not from larger to smaller vessels or vice versa, as is the case with maritime hubs operating under the hub and spoke system. Their privileged geographical locations are their main feature, while Singapore Port is a prime example of such a hub (Rodrigue, 2014). This system requires capital-intensive investments so that ports and terminals operating as transshipment centers can receive and service oversized container ships (Pardalli, 2001). However, the requirements for high-cost infrastructure investment involve high risk, and therefore, it is quite challenging to find willing investors and to find the required capital (Rodrigue, 2014). In the foreseeable future, the volume of trade between East and West in the Southern Hemisphere is expected to increase in parallel with trade between Europe and South Africa. This has resulted in several expectations in

international literature for the critical role that South African ports are expected to play in the system described earlier (Anon., 2011). The following chart describes the process of transshipment in the context of the Interline system.

Figure 9. The Interline system

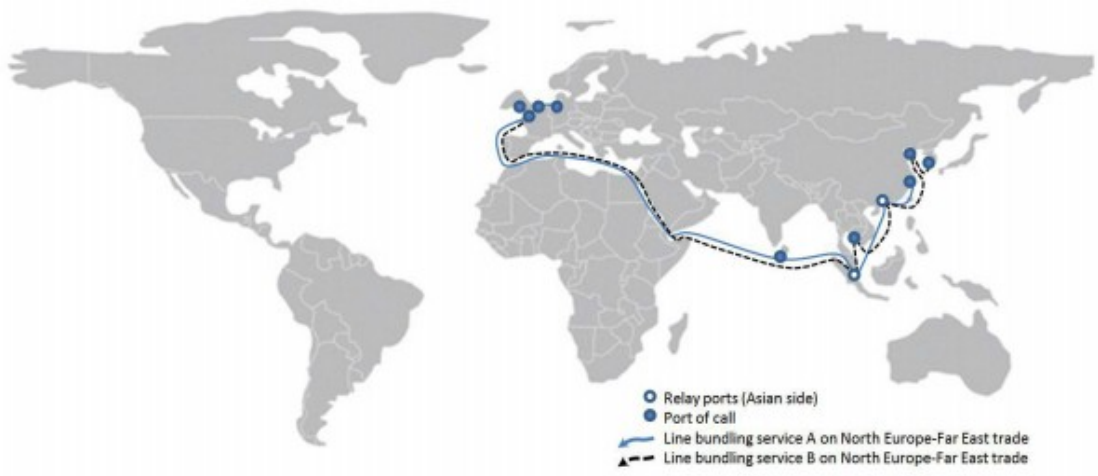
Source: Rodrigue, D. J.-., P., 2014. THE GEOGRAPHY OF TRANSPORT SYSTEMS. [Ηλεκτρονικό] Available at https://people.hofstra.edu/geotrans/eng/ch4en/conc4en/insertionoffshore.html

3.9 The Relayed Transshipment Hub System

Above are analyzed the two most important categories of transshipment hubs that appear in modern economic and commercial reality. However, there is one more category of lesser importance. These are relayed transshipment hubs. At these hubs the transshipment of containers between large ships, usually on the leading maritime trade routes, takes place. The junction acts as an interconnection between sea routes but serves many different ports. In other words, containers coming from distant world markets are transported by large vessels to transshipment hubs where they are transshipped to other large container vessels and then transported to other distant world markets. (Park et al., 2012)

Ports of this type are an innovation, enabling shipping companies to take advantage of transshipment across long continental routes. (Rodrigue, 2014) The following chart describes the process of transshipment under the system of relayed transshipment hubs.

Figure 10. The relayed transshipment hubs system



Source: Rodrigue, D. J.-., P., 2014. THE GEOGRAPHY OF TRANSPORT SYSTEMS. [Online] Available at https://people.hofstra.edu/geotrans/eng/ch4en/conc4en/insertionoffshore.html

The above hubs, despite their differences, are distinguished by several standard features, such as easy maritime accessibility, proximity to major maritime trade routes, high water depth, requirements for suitable high-cost infrastructure, etc., which will be discussed below. , while they can often be manufactured in areas away from developed urban centers (Offshore transshipment hubs) (Notteboom, 2014). Studies have shown that the Hub and Spoke system accounts for about 85% of all transshipment activity, while the other two systems account for about 15%. This is because the transshipment was developed mainly to serve smaller ports characterized by poor maritime accessibility or lack of infrastructure, problems which are addressed

by the Hub and Spoke system. In general, however, we can claim that all forms of transshipment allow different levels of connectivity between international maritime transport networks. (Park et al., 2012).

4 Reasons for the Transshipment Development

The reasons that led to the emergence, dominance, and development of transshipment activity and by extension, mega transshipment hubs in the 1970s are many. The most important of these are detailed in the following pages.

4.1 The Basic Functions of a Transshipment Hub

A transshipment center performs those essential functions also carried out at a common container terminal, such as cargo handling, towing and navigation services, cargo ship repairs and maintenance, ship supply, etc. (Suarez-Aleman et al., 2016). However, mainly transshipment hubs perform specific functions related to loading, unloading the goods, and subsequently downloading them from one container ship to another or another. So, in more detail, the main activities carried out in such a center are presented in the following chapters.

4.1.1 **Unloading and Reloading of Goods**

This function includes all the necessary actions to transport the various cargoes from the ships to the dock and vice versa, with the help of the available mechanical equipment of the ship, such as deck cranes, or more commonly the port itself or the port terminal itself (Maknoon, Soumis & Baptiste, 2017). The aim of the port during this process is to minimize loading and unloading times and to release the ship as quickly as possible.

A container can be loaded in two ways (Wei et al., 2018). With the immediate, which is the most desirable, and whereby the crane moves the load from the original conveyor to the final conveyor where it is placed (Wei et al., 2018). The load, therefore, is handled only once by the crane. There is also the process of indirect

downloading, which may be necessary due to various restrictions (Wei et al., 2018). During this process, the cargo is transported between the different areas of the port, after being unloaded from the original ship and up to the final ship. Each container, therefore, is operated more than once by one or more cranes and other cargo handling systems (Wei et al., 2018).

There can, therefore, be three cases (Peres et al., 2017). In the first case, the place of origin and destination of the consignments are located in the same area of the crane carrier, so immediate transshipment is possible. In the latter case, the cargo origin and destination are located in the same crane area but on different sides of the conveyor. Depending on the length of time the ships are staying at the transshipment node, direct or indirect transshipment may be necessary (Nikolopoulou et al., 2017). In the third and last case, the places of origin and destination are located in different areas of the crane, and the use of the conveyor is necessary. For transshipment falling under the first and second indents, immediate transshipment should be preferred if the times of stay of the ships at the port are overlapped. Otherwise, the indirect way is chosen (Velan, 2016).

4.1.2 **Storage and Security of the Containers**

The above functions include the transportation and handling of cargo on the dock and its storage. Storing and storing cargo is only short term and is necessary in cases where the loading and unloading times of the goods are not the same. The main objective during the storage process should be to protect the containers from adverse weather conditions, possible damage, loss, or theft. Storage is rarely long-term, and only when extensive port facilities and adequate infrastructure are available (Baird, 2017).

4.1.3 **Bureaucratic Work**

Another type of service performed by the users of a transshipment center is to carry out the necessary bureaucratic tasks such as preparing documents, stamps, checks and health certificates, receipt and dispatch documents, various entry and exit documents, payment invoices, etc. These tasks are performed by port workers in collaboration with specialist agents or shipping companies so that all tasks are completed promptly and to facilitate fast service to ships. It is essential for modern and developed ports and port terminals to have systems that minimize the burden of bureaucratic work required for port users, as any delays resulting from inefficiencies in management processes result in high financial costs. For shipping companies but also a reduction in the competitive power of the hubs themselves (Lam, 2016).

At times, the European Union (EU) has drawn up various directives aimed at adopting by port authorities the simplest administrative and modern technology and information systems aimed at speeding up bureaucratic work in European ports. The European Commission proposes measures to reduce the unnecessary administrative burden for the port sector but also to ensure the safe transport of goods to and from the EU. as well as inside. For example, it seeks to achieve a customs formalities restriction regime for ships carrying mainly cargo within the European Union countries between the same European ports regularly. The aim is to introduce a new tool, the "e-Manifest," a harmonized electronic cargo declaration, which will allow proof of the Union or non-Union character of the goods, even when the cargo has left the customs territory of the Union countries. This facility responds to a long-standing demand for a harmonized EU level. Manifest for maritime trade. These initiatives, as well as several others of a similar nature, are designed to improve the competitiveness of the industry by reducing administrative burden and costs, improving the

attractiveness of maritime transport and in particular the commercial activity of transshipment, stimulating employment and reducing the environmental impact of maritime transport. According to the European Shipowners Association (ECSA), based on data gathered by its members (shipping companies), the amount that can be saved by simplifying administrative procedures can be as high as € 25 per container. At the same time, time-saving, elements of enormous importance for the efficient operation of the transshipment process, will also be essential (Artuso et al., 2016).

4.2 Changes in Ship Characteristics

4.2.1 **Changes in Ship Size**

The increased use of large container ships in maritime transport has led to the development of mega transshipment hubs that operate as container collection and distribution centers (Martin, Martin & Pettit, 2015). In recent decades, there has been a strong tendency for giant cargo containers to operate, mainly operating in the Asia-Northern Europe and Asia-America trade routes. Rapid growth and developments in the trade have led to new demands on transport, as increased world consumption has gradually led to several chain effects, such as increased demand for TEUs, the need to achieve economies of scale and a reduction in unit costs. Costs to improve competitiveness and create the possibility of lowering product prices and ultimately increasing the capacity of ships. Consequently, the vessel sizes have to be adapted to the new data and requirements in order to maintain the frequency of the scheduled voyages (Stafilas, 2012).

The first generation of container ships included ships with a capacity of up to 1000 TEUs and a draft of nine meters, while the second generation, vessels of between 1000 and 3000 TEUs and a draft of ten meters. (Martin, Martin & Pettit, 2015) One of

the overriding goals is to achieve economies of scale; in the early 1980s larger ships were built, the so-called third-generation (Panamax) with a capacity of 3000 to 4000 TEUs and a draft of about 11.5 meters and fourth-generation ships (Post Panamax), with available capacity of 4000 to 5000 TEUs and draft up to 13.6 meters. At the beginning of the 21st century, the fifth generation Post Panamax Plus was manufactured with a capacity ranging from 5000 to 8000 TEUs and a maximum draft of 14 meters. Next, sixth-generation container ships, known as the Suezmax Ultra Large Container Ships (ULCS), with a capacity of up to 14500 TEUs and a draft of 15.5 meters were constructed (Rodrigue, 2014). The following Figure illustrates the evolution of container ships over time.

Today the size of these ships exceeds 18,000 TEUs (Post Suez-max), with the largest ship in the world (Triple-E) approaching the height of the iconic New York City skyscraper, the Empire State Building, about 75 meters. As shown in the following figure, its length reaches 400 meters and its width 59 meters, while the empty one weighs about 55,000 tons. The Danish company A.P. Moller-Maersk took a considerable business risk after ordering twenty such ships from the DSME shipbuilding company to transport containers between China and Northern Europe. (Martin, Martin & Pettit, 2015) Such a decision, coupled with forecasts for further growth in ship size, is enough to bring us to the forefront of changes in the structure of the global container shipping fleet shortly.

These ships, therefore, on the one hand, fail to reach several ports, but on the other, they offer several advantages, such as better hydrodynamic design, more excellent stability and empty spaces, thereby providing more effortless loading and faster loading processes, and unloading. However, above all, these ships are capable of

achieving economies of scale. These were also the reasons that contributed to their prevalence (Wikipedia, March 29th, 2014). The following table presents some of the largest ships in the world today. Most belong to Maersk and CMA CGM companies with a length of up to 400 meters and a capacity exceeding 18000 TEUs.

As a result of the above-mentioned developments in the capacity of ships, there was a need to upgrade existing port facilities and to design new container and port management terminals capable of accommodating and servicing large and large vessels. In other words, there was an urgent need for the various port terminals or ports to have adequate water depth, easy accessibility, equipment of appropriate specifications, high operating efficiency, suitable seating positions, etc. This was, of course, only possible if they were allowed for further deepening and expansions, but above all, if the competent authorities could afford the financial cost of such investments.

The solution to the above problem was the introduction of the institution of transshipment and the creation of mega transshipment hubs. Thus, while ships were initially built and developed based on technological changes in ports, now the reverse is happening, and ports follow changes in shipping (Pardallis, 2001).

4.2.2 **Changes in Ship Technology**

Changes in ship characteristics and technological developments have also been important factors. Technological changes on ships have led to technological changes in ports, namely costly infrastructure and superstructure projects, as well as new specialized cargo handling equipment (An, 2016· Aps et al., 2015). As ships evolve, so does the need to increase their productivity. As a result, port terminals today adopt automated systems in the dock area to increase their efficiency. Thanks to the

evolution of communications and the proliferation of the Internet, financial opportunities are provided by transshipment activity, allowing real-time communication, facilitating transactions and logistics operations. At the same time, it offers the possibility of flexibility and rapid change within the operation of supply chains to meet the changing needs of the modern globalized market (Gharehgozli, Roy, D & de Koster, 2016).

If the characteristics of ships continue to change at the same rate, then the way cargo handling at terminals is expected to become ineffective soon, as it will not be possible to reduce the time spent in ports. Therefore, in order to be able to accommodate modern large container ships, the various hubs must adopt modern cargo handling instruments in line with the characteristics of the vessels. For example, cranes need to be modernized while individual processes need to be automated (Ma et al., 2017). At this point, it is worth noting the need for workforce training to enable it to operate modern port-based cargo handling equipment transporting modern large vessels approaching mega transshipment hubs (Pietrzykowski, 2010).

4.3 Limitations on Port Coverage

In the maritime transport network, there are often several practical constraints on port coverage. When the freight is too long, the concept of a shuttle service from Source: to the final destination may not be possible in most cases, while almost no shipping company can cover all ports around the world. The world with a single service. Consequently, services are separated into commercial lines (Parthenis, 2016).

For example, suppose there is a sea route connecting the port of Durban, South Africa with Singapore. We also assume that there is a cargo shipment from Durban to the port of Manila in the Philippines by a ship, which in our example we call A. Since

ship A cannot reach Manila as part of its journey, the cargo will have to land at one of the ports that ship A will approach. Suppose this port in Singapore. The cargo should, therefore, be unloaded in Singapore and then loaded on another vessel, which will perform a route linking Singapore with Manila. Let us call this ship B. A such, the cargo that left Durban on board A will reach Manila by ship B via a transshipment process to Singapore. The bill of lading issued by the customer will indicate ship A, but the arrival notification received by the recipient in Manila will show ship B.

Most of the major shipping companies, such as MSC, Maersk, etc., have services covering almost all corners of the globe through various connections between two or more ports. On these lines, they choose those transshipment hubs that offer the most and the best options to connect to other parts of the world to serve their routes. An example is a fact that MSC's transshipment hub for its service to Australia is Port Louis, while Maersk's for the Middle East is the port of Salalah in Oman. It is therefore evident that the concept of transshipment connects the whole world and makes it possible to transport cargo from anywhere to anywhere on a global scale (Rodrigue & Ashar, 2016).

4.4 Cost and Time Factor

Another critical factor is the pursuit of achieving the lowest possible costs, as is the continued effort of ports to reduce their costs, a significant proportion of which is labor costs. An example is that in the European Union this figure accounts for 51% of total port costs while in the USA. The percentage of labor costs is 70% (Oliveira & Botter, 2018). Therefore, ports, through the automation of their operations and the development of new technologies, seek to improve the quality of their services while reducing their costs. Research has shown that the operation of transshipment offers

greater flexibility and cost savings by achieving economies of scale by reducing the unit cost of transport, management, and insurance of goods. However, it must be carefully designed to achieve high levels of efficiency and effectiveness.

In many cases, the cost of this operation is not justified by the cost savings of shipping, and quite often its cost has to be reduced to such a low level that it can reach USD 40 per container to justify it as an activity (Zhen et al., 2016). The demand for carriers to further improve the speed of delivery of goods has also contributed to the prevalence of transshipment. This commercial activity helps to ensure the timely delivery of goods, reduce the risk of technological depreciation and the competitiveness of marketable products, etc. (Nakalada, Lau & Zhang, 2017).

4.5 Deviations from Standard Routes

Another critical factor for the prevalence and development of mega transshipment hubs is the need to avoid derogations from significant sea routes. Competition between the transport chains and the need to find that maritime route at the lowest possible cost has resulted in the deviation of the leading maritime routes over time. This reduced the number of ports of access and the need to create transshipment hubs (Syahputra & Komarudin, 2018).

4.6 Mergers of Carriers

Carriers' mergers also played an essential role in the emergence of this phenomenon. While by 1995 independent shipping companies numbered twenty, today the significant alliances do not exceed four, while there are also a smaller number of companies. Modern carriers, therefore, have significant economic and commercial power and as a result put high pressure on their suppliers (Du et al., 2015). At the same time, large companies in the industry are moving towards vertical integration,

that is, mergers and acquisitions with other stages of the logistics chain, to increase their control, reduce costs and improve the quality of their services (Crotti, Ferrari & Tei, 2019). At the same time, they aim to strengthen their position in order to create barriers for new players to enter the market and to find the required investment funds (Tawada, 2017). In other words, as the volume of containers being moved has increased, liner companies have formed alliances to achieve economies of scale. This has led them to integrate vertically and horizontally with other operators in order to operate terminals around the world and meet their needs for transshipment cargo management (Zhen, Wang & Wang, 2016).

4.7 Marine Routes

Route marking is another important reason for the development and prevalence of commercial transshipment activity. Over the decades, the global merchant fleet and the fleet of container ships have grown steadily. This has led to the need to create "sea routes" for cargo ships, which have not remained physically stable all these years. Decisions to "map" them are based on various criteria such as political, social and economic (e.g., wars in the Middle East, the decision to exclude Iraq, the financial situation of the countries of the former Soviet Union and the former Soviet Union). Eastern Europe after the fall of Communism, etc.), its technology and development (ships built are larger in size and capable of sailing at higher speeds, thereby causing more and more significant environmental problems (Kim, Lam & lee, 2018). The ports approaching must have the appropriate equipment and water of sufficient depth to minimize the potential impact on the environment to the minimum possible.), globalization of the supply chain that has united markets and continents etc. The most important sea routes followed by container ships are the following (Ozcan, Eliiyi & Reinhardt, 2019).

4.7.1 **Transpacific Trade**

The Transpacific Trade, North American and Far East Pacific line, with total annual traffic of approximately 16 million TEUs, or nearly 17% of the world total (Capaldo, Izurieta & Sundarma, 2016). They include lines between the US East Coast, the West Coast or the Gulf of Mexico and the industrial centers of Japan, the Far East, and some extend as far as the Middle East. Some routes to the US East Coast are served via the Panama Canal, while others are shipped with a single shipment to the West Coast, and from there they are shipped by rail to the East Coast (Mobbs, 2018). Although the Pacific Ocean is the largest ocean on the planet, it is not the most critical maritime commodity (Mobbs, 2018).

4.7.2 **North Atlantic Trade**

The North Atlantic Trade Line. This is the line from which containers were first transported in the mid-1960s, connecting Western Europe with North America, the world's two largest industrial centers. In 2004, 5.7 million TEUs crossed this line or about 6% of worldwide container traffic. It is worth noting that there has been an imbalance of flows over time as only 2 million TEUs traveled to the US and about 2.5 million to Europe (Guo & Yang, 2018). This line serves major European ports, such as Hamburg, Rotterdam, Le Havre, Antwerp, and others. However, also America such as Canada, Montreal, Boston, New York, and more (Johnson & Garnett, 2017). The northern and southern parts of the Atlantic Ocean are covered by ice and away from the most important economic centers of the earth. They are therefore characterized by low rates of maritime traffic (Pascali, 2017).

4.7.3 **West Europe to Far East Trade**

West Europe to Far East Trade Line. It covers trade from North Europe (from Sweden to France), with the Far East (Western Malaysia, Singapore, Thailand, Hong Kong, the Philippines, Taiwan, South Korea, China, and Japan) (Guerrero, Grasland & Ducruet, 2015).

4.7.4 **Round the World Services**

It includes the route from the ports of Northern Europe to Northeast America via the UK and to the western USA. Through the Panama Canal. From there it reaches the Mediterranean via Japan and the Far East after crossing the Suez Canal to return to the ports of Northern Europe via the Gibraltar Strait (Li, Xu & Shi, 2015).

Large transshipment hubs are thus set up, on sea routes or at intersections of two or more of them, to serve ships passing through these areas.

5 Transshipment Hubs' Contribution to Supply Chain

As mentioned in the previous section in the modern age of globalization and intense competition, terminals or ports that want to establish and develop as transshipment hubs aim at increasing their competitiveness and efficiency (Colicchia et al., 2010). Studying modern scientific literature, it is easy to see that in today's commercial and economic environment, competition no longer exists between individual ports or port terminals, but between entire supply chains (Rodrigue & Notteboom, 2010). That is why ports seek to integrate into them and become an integral part of them. Then an attempt will be made to review the existing literature in order to demonstrate the integration of transshipment hubs in the supply chains, the importance of their position within them, and how they can contribute to improving the competitiveness of the chains globally (Wilding et al., 2012).

5.1 The Transshipment Hubs' Position within the Logistics Chain

Modern times are dominated by multinationals, whose way of working requires high levels of the organization, production, and distribution of products and services. The concept of supply chain denotes the process of designing, implementing and controlling the efficient transportation and storage of raw materials, intermediates, and finished products from production points to end-points worldwide (Gujar, 2009)). The critical functions involved in this process are shipping and distribution of products, inventory management, order processing, storage, handling of materials, protective packaging, supplies, and information support (Fransoo & Lee, 2013). Essential factors in all these functions are cost, time, and of course, the quality provided (Wang & Ducruet, 2012).

Mega transshipment hubs are an integral part of the supply chain, as they are intermediate stations of goods when they are transported from their original production points to their delivery to the final consumer. A transshipment node as part of a supply chain influences and is affected by it (Asgari et al., 2013). It is affected by the way it is organized and operated but at the same time contributes to enhancing its efficiency and effectiveness (Lam & Yap, 2011). So these relationships are not static, but dynamic and two-way. How the supply chain is organized and operates as a whole affects the competitiveness and efficiency of each node. As a result, ports are at risk of losing customers not only in the case of infrastructure shortages, port quality, etc., but also because of the poor organization of their supply chain (Pallis et al., 2011). In other words, the competitiveness of a port is increasingly dependent on external coordination and control of the entire supply chain, and conversely, the efficiency of a supply chain is affected by the operation and characteristics of the transshipment hubs it comprises. The section that follows provides a detailed overview of how a transshipment node contributes positively to the development of the supply chain to which it belongs (Gouvernal et al., 2016).

5.2 The Transshipment Hubs' Position within the Worldwide Supply Chain

The growth of the world economy and trade, coupled with the massive increase in the volume of containers requiring transshipment services, has resulted in a dramatic change in the factors that determine the attractiveness of each port and contribute to improving the efficiency of the entire supply chain were owned by (Scmid et al., 2013). In order to survive in the modern economic environment of intense competition, transshipment hubs are therefore required to place particular emphasis

on their efforts to achieve a competitive advantage. To this end, they focus on several criteria, which are detailed in the following pages (Nam & Song, 2011).

5.2.1 **Strategic Decisions of Shipping Carriers**

Initially, the contribution of maritime carriers and their strategic decisions can be considered necessary. It would not be an exaggeration to claim that the big fortunes of any carrier or port are in the hands of the major carriers who can choose which port they will use as their central freight hub for each area (Creazza et al., 2010). The main goals of these companies are speed and quality in handling their cargoes at the lowest possible cost. Therefore, under these circumstances, the node that maintains their competitiveness and attracts carriers remains those who offer services that meet their desires (Yang & Chen, 2016).

Without any interest in specific terminals, shipping companies can easily indulge in “hub-hopping.” However, in order to avoid this, maritime carriers are seeking to invest in a terminal that acts as a transshipment center, usually through a satisfactory mutual agreement with the port authorities, allowing a high rate of return and productivity to be achieved — best possible financial result (Dekker et al., 2012).

A typical example of the powerful influence of carriers is given below. Before 1999, the Singapore port undoubtedly occupied the first place in the carrier's choice of transshipment of their goods. It was the central container hub on the broader region and the second busiest port in the world in the year 2000 (Notteboom & Rodigue, 2009). This success is mainly due to its ideal geographical location, its high operating efficiency (including due to the excessive use of sophisticated Administrative Information). Systems), high-quality port services offered, etc. (Lam, 2016). However, following a series of privatization and investment initiatives undertaken by

the Malaysian Government in cooperation with various Malaysian investors, the Singapore Port Authority (PSA), had to face two new competitors in the field of container transshipment. Port Klang Port and Tanjung Pelepas Port (PTP) (Saeed & Aaby, 2013). In 1999 these two ports were able to improve their ability to provide improved services at extremely competitive prices. Taken together, these developments have changed the region's dynamics, which has led to the decline of PSA's position in the transshipment market (Ng & Liu, 2014).

Along with these developments, in 2000, Maersk Sealand transferred its main activities in the field of transshipment from the port of Singapore to the port of Tanjung Pelepas in Malaysia (Lam & Yap, 2016). The impact of this operation on the regional structure of the transshipment market was significant. Maersk Sealand was then the largest shipping company in Singapore. This led to a decline of about 11% in Singapore's total business, while in 2001 total container traffic fell by 8.9%. During the same period, container traffic in the Malaysian port increased from 0.42 to 2.05 million TEUs (Rodrigue & Notteboom, 2009).

As shipping companies created strategic alliances to achieve economies of scale, the interdependence between small and medium-sized companies grew. Therefore, Maersk's decision to change the port is used as a transshipment hub caused similar decisions between the various related entities. Maersk Line (16.7% of its traffic), Evergreen (11.7%) and some of the largest companies transferring their operations, which amounted to approximately 1 to 1,200,000 TEUs per year, the CMA-CGM. Since then, other shipping companies have followed a similar strategy (Mallidis et al., 2012).

In the case of competition between the two ports of Singapore and Malaysia, the attempt to obtain transit trade is crucial. Both ports are subject to strict restrictions but are in an excellent geographical location (Slack & Gouvernal, 2016). Transshipment activity is an excellent opportunity for these ports to expand their operations and, most importantly, leverage international freight flows to achieve higher profits (Yang, 2009)). An essential factor in the competition between the above ports was, therefore, the decisions of the major players in the container market (Musso et al., 2017).

From the above example, we, therefore, understand the importance of the role of maritime carriers and the urgent need for terminal managers to attract the investment of these companies.

5.2.2 **Geographical Location**

Also important is the criterion of the geographical location of the ports operating in the commercial sector. The importance of the place where transshipment activities are carried out by shipping companies is mainly apparent from examining the geography of existing hubs and the economic advantages that have caused rivalry (Monaco et al., 2009). Various studies and researches determine the geographical location of a terminal port hub or more generally a port that acts as a transshipment hub, as a critical factor in enhancing the competitiveness of the same and the entire supply chain where it belongs and the achievement of significant strategic competitiveness (Zhen, 2013).

Singapore's port, which continues to be the largest transshipment hub for East-West maritime trade and Asian intra-Community trade, is facing stiff competition from the ports of Port Klang and Tanjung Pelepas in Malaysia (Campbell & O'Kelly, 2012). Among the other advantages that these transshipment hubs offer, they are also

characterized by an exquisite geographical location as it is located on the sea routes connecting East Asia, Australia, and India with Africa, the Middle East, and the Mediterranean. Still, the ports of Algeciras in Spain, Gioia Tauro in Italy, and Freeport in Malta in the Mediterranean are all located on the large Asia-Europe Maritime Trade Route and close to loading and unloading sites in Southern Europe and North Africa (Zhen, 2014). Finally, one might argue that one reason that the ports of Israel and Cyprus in the Mediterranean have not experienced much growth is the fact that they are far from the main shipping route crossing the Mediterranean Sea (Sarraj et al., 2014).

Therefore, terminals that wish to evolve into mega transshipment hubs should be strategically located on the main sea routes or at least in locations that allow the minimum possible deviation from the main sea routes. The main east-west trade route and several of the essential transshipment centers along it are shown in Map 3.1. So, it is easy to see that the world's largest maritime centers are not by accident on this route (Notteboom, 2011).

Figure 11. The main east-west trade route

Source: Notteboom, 2011

As another example, we will mention the case of South Africa. The creation of a transshipment hub in the specific geographical area to link traffic between India and Brazil have been proposed informal talks between the three countries, though more precise details of a specific project have not yet been discussed (Notteboom, 2011). Discussions, however, have taken place over the construction of a terminal where the cargo could be collected, stored, if necessary, and subsequently downloaded. However, although South Africa is an excellent geographical location for the construction of a Hub and Spoke system or even an Interline line, at present trade between India and Africa and India and Latin America is not large enough (Ishfaq & Sox, 2011). To justify the cost of such an investment. Later, if the development of the world economy and trade allowed such an investment, South Africa would be an

excellent geographical choice (Tavasszy et al., 2011). For the time being, this maritime traffic is mainly served by the Suez Canal, with other cargoes being transported directly or via the junction to Mauritius and from there to East Africa or vice versa (Panayides et al., 2013).

5.2.3 **Water Depth and Natural Characteristics of Hubs**

A prerequisite for enhancing the competitiveness of the hubs and therefore of the entire logistics chains are those terminals or ports that operate as transshipment hubs to have deep water. The activity of transshipment, as already mentioned in the preceding pages, requires the existence of ports and port terminals with such a depth of water that they can accommodate modern large vessels (Zeng et al., 2018). The depth of the waters of each terminal should be such as to allow a fully loaded vessel to enter the port regardless of whether there is a tidal effect or not, although such a phenomenon reduces productivity and shipping companies prefer tidal ports (Hunke et al., 2012). Indeed, shortly with the anticipated further ship giantization, the size and size of container ships is projected to increase even more (Basu, 2013).

Those shallow-water ports are required to carry out the necessary dredging procedures. However, such a process is also accompanied by negative impacts on the environment and the balance of ecosystems, which adversely affect the reputation of the terminal (Gelareh et al., 2010). At the same time, the dredging process is accompanied by increased costs, which depending on the flexibility of demand, pass on to end-users of the port product and ultimately to the end-users of the goods, which works to achieve a competitive advantage over the entire supply chain (Rodrigue & Notteboom, 2010).

Also, the depth of the water on the piers and canals is perhaps the most severe constraint on the development of port infrastructure that wants to operate as transshipment hubs coupled with the availability of container stacking spaces. Often, the nature of trade and cargo leads to the imbalance of trade and the existence of many empty containers, making the depth of unloading vessels less than maximum, allowing ports in shallow water (Fang & Cho, 2014). For many years, ships from Europe to South Africa were unloading cargoes at the ports of Cape Town and Port Elizabeth while sailing to Durban and thus being able to receive ports that otherwise would not be able to receive them if they were fully available — loaded with no deep water. By diverting trade to the Far East and entering the market for large ships, South African ports with anchors without sufficient depth of water of at least 15 meters will be degraded to feeder ports (Musso & Parola, 2017).

5.2.4 **Existence of Temporary Storage Areas**

Adequate space for stacking the containers is another essential requirement for those ports that want to evolve into mega transshipment hubs, although it can be argued that behind the idea of transshipment is the attempt to move containers at a fast pace. Between ships without storage required (Chen et al., 2017). However, simultaneous unloading and reloading of cargo between ships is a prospect that requires excellent logistical planning which is not yet possible in some ports, although this is the case in most of Europe and the Far East (Jeevan et al., 2015).

The example of African ports is typically mentioned. Except for the Ngqura port, all South African container ports are close to the city's central business districts, and the lack of space has given rise to the so-called 'off-dock' concept of stacking cargo (Amador & Cabral, 2016). Since this concept cannot be applied to transshipment

ports, the lack of space imposes some constraint on their development in large transshipment centers of any of the existing container ports in South Africa (Van Baalen et al., 2009).

5.2.5 **Existence of Suitable Infrastructures**

It is also worth stressing the importance of the infrastructure and superstructures available at the terminals and the available port equipment. The number of paratroopers, available cranes and cargo handling equipment, the existence of breakwaters and jetty, etc., as well as their technological status and efficient operation, enhance the overall efficiency of the terminal/port and thus its competitiveness (Roni et al., 2014).

The available capacity of terminals/ports is also considered essential. For example, the overall performance of the ports of Shanghai and Ningbo has been heavily influenced by events related to their healthy growth, coupled with the stagnation of the capacity of the Kaohsiung and Busan ports in Korea. The last two have achieved a dominant position on the Europe-Far East sea route (Giallombardo et al, 2010).

Ports take into account their capacity when setting their pricing policy. A more critical port may set lower prices in order to increase its demand, as it is more likely to have excess capacity and, consequently, reduced congestion (Gelareh & Pisinger, 2011). Several studies have even concluded that in the modern competitive environment the capacity difference between two terminals becomes more critical than congestion situations, provided that, of course, their capacity is sufficient to offset the cost of congestion delays (Christiansen et al., 2013).

However, it is worth noting that the significant Hub And Spoke centers, as they invest in developing and expanding their capacity, face the risk of large scale economies of

scale, which may benefit the smaller neighboring ports and attract the first customers (Liu et al., 2013). Since 1990 in Europe, medium-sized transshipment centers have been able to attract from the most critical ports around 150,000 to 200,000 TEUs per year. For example, the port of Antwerp is trying to steal customers from Rotterdam. However, in their attempt to compete with the larger ports, they are forced to invest in new infrastructure at the risk of being over-invested (Hall & Jacobs, 2012).

5.2.6 **Innovations and Flexible Procedures**

The importance of devising and implementing innovations is also noteworthy. In order to remain competitive in the transshipment centers and survive in the modern globalized economic environment, they must adopt innovations aimed at increasing productivity and reducing their total costs. Key to achieving a competitive advantage is the ability to make rapid changes to environmental and demand changes (Montreuil, 2016). They must, therefore, consider themselves part of a global maritime market and optimize their short-term tactics at an operational level, while at the same time ensuring that they determine their long-term investment strategies at a global level. To this end, it would be useful to follow technological developments and incorporate modern and innovative techniques in their organization and production processes (otteboom & Rodrigue, 2009).

Flexible procedures and how the individual functions are organized are of paramount importance. An effective way of organizing and operating that gives flexibility, and the ability to adapt the terminal or port to changes in global markets is an integral factor in improving its competitiveness and achieving the competitive advantage of a logistics chain (Meng et al., 2012. Bureaucratic and other functions that hamper or delay the processes necessary to complete the transshipment processes are a deterrent

to the decision to integrate the terminal/port on the ship's route Wilmsmeier & Monios, 2013).

At the same time, the existence of optimal organizational structures is of great importance. The structure of a port as a supply chain subsystem includes the following aspects: port equipment (infrastructure and superstructure such as piers, storages, etc.), mechanical equipment (cargo handling equipment, cranes, etc.), information systems (Hardware, Software, database management etc.), work, business policy (storage and stacking system etc.) (Qiu et al., 2015). Full utilization of resources and the proper management of operational policies are required, along with long-term and steady partnerships and unified flow of information in order to reduce the uncertainty in decision-making and increase their flexibility and competitiveness (Lee & Ducruet, 2009).

5.2.7 **Effective Handling of Cargo**

The ports and terminals that specialize in transshipment services are the only ports limited to the procedures for unloading, temporary storing and reloading on another ship, and do not require the simultaneous development of inland and combined transport (Sheffi, 2012). Even in this case, however, the effective operation and execution of their activities are required in order to develop and enhance their effectiveness and competitiveness (Park & Min, 2011).

A key element in enhancing the competitiveness of a transshipment hub is the ability to handle containers effectively. Studies have shown that the adoption of efficient procedures during loading and unloading of containers positively contributes to improving the efficiency of the overall operation of the terminal/port. This would only

have a positive effect on the formulation of the ports' choice of port (Vacca et al., 2010).

At the same time, the more technologically advanced and efficient the port equipment available (material, technological, etc.), the higher the efficiency of port operations and activities. Thus, the port/terminal can provide port product users with reliable transshipment services characterized by high quality, flexibility, and speed (Guerrero & Rodrigue, 2014).

Therefore, there is a need to invest in the construction of the necessary infrastructure as well as the acquisition of specialized equipment, i.e., tailor-made docks, piers and adjacent land for the service of ships and cargo, as well as cranes, waterfronts, staging areas, etc. (Ducruet et al., 2010). In general, we can distinguish installations in real estate (seating areas, stacking areas, internal transport, tanks, buildings and shelters, breakwaters, etc.), and mobile (cranes, horizontal transport, mechanical equipment, etc.). (Wang & Ng, 2011).

An essential element of any port/terminal is, of course, human capital. Workers in a transshipment center can have various specialties, such as onshore crane operators, workers, managers, heavy machinery operators, heavy-duty spare operators, mechanical engineers, technicians, lubricants, tire technicians, assistants, customs officers, customs officers, etc. (Parkan & Dbey, 2009) The workforce is mainly responsible for the efficient operation of the station and the administrations concerned must ensure that it is continuously trained and specialized and that harmonious working relationships are established (Parkan & Dubey, 2009).

Finally, the development of information and communication systems could not be applied to this particular maritime sector, contributing positively to its effective

operation in a variety of ways. The use of information systems helps to determine precisely the position of containers and their handling equipment at all times (Yap & Notteboom, 2011). This gives end-users not only control but also transparency in all transactions. There is enough pressure to speed up transactions and processes to reduce ship travel times with the ultimate goal of increasing overall productivity, partly offset by the use of information systems (Henesey et al., 2009). Other benefits are improved resource utilization (equipment, docks, etc.) and labor productivity, the reduced port stays and thus reduced port congestion, better delivery times for finished products, etc. (Stauffer et al, 2016) Thanks to these systems, communication, collaboration and information sharing between the necessary members have become more straightforward and more accessible, resulting in improved customer service levels and faster port response to changing demand and changing market conditions (Pan et al., 2015).

5.2.8 **Cost and Quality of the Port Product**

The factors of the applicable pricing policy and the overall shipping cost are also crucial, as the essential criteria for selecting a transshipment node from the shipping companies are the costs they incur when approaching and staying at it. (Fernandes & Rodrigues, 2009) As previously mentioned, carriers take into account the total cost of transporting their goods for making their decisions, indicating that the ideal location of a transshipment node is not necessarily the dominant factor for its use. So, deciding which ports the ships will reach is often related to the total cost of the network (Xiang et al., 2013).

This cost of the port product offered has many aspects and includes port costs and cargo handling costs, as well as the costs of additional services such as navigation and

towing costs, cargo costs, port charges, opportunity costs, etc. (Verdouw et al., 2016) In today's reality, and mainly due to the recent global economic downturn and the rise in fuel prices, shipping companies and carriers are aiming to minimize their costs and achieve economies of scale (Tovar et al., 2015). To this end, they will choose to reach those terminals that contribute to this goal. Many analysts argue that the cost factor is a critical element of intra-company competition. In recent years there has been a surplus of capacity worldwide, and in many respects, competition has been particularly intense, often leading to a price war (Rais et al., 2014).

When ports operate effectively on an important main sea route, it may be worthwhile to serve the needs of shipping companies for transshipment. An example is the 1,300 nautical mile offshore east-west route to service from Jebel Ali port in the United Arab Emirates, as well as the 163 nautical mile transshipment only to Salalah port in Oman. Shipping companies often opt for these ports as they manage to minimize the shipping costs incurred per trip (Pan et al., 2014).

The quality of the port services offered is also considered crucial. This element includes two factors. The time of stay of the ships for entry and stay at the terminal and security matters. More specifically, any delays in service of ships or the presence of congestion are elements of enormous importance Xiao & Lam, 2017). Shipping companies tend to approach ports that have such problems more often, and it is quite challenging to change their reputation. Carriers prefer speed in their service and minimize their time in ports, as they are non-productive times for the ship and do not generate profit. (Acciaro et al., 2014) After all, nowadays, consumers are demanding an ever-increasing variety of products and have higher demands for their reliability and quality. The short product life cycle and technology developments that

continuously introduce new products lead to an increase in the number of products that need to be transported by ship. This trend is expected to become even more pronounced in the next five years (Qiu & Huang, 2011). For their part, companies are adopting flexible structures to cope with the needs and changes of the globalized market, while pursuing economies of scale. Therefore, fast completion times, requiring anchoring and sailing processes without delay and high productivity in loading and unloading containers, reduce shipping costs, and contribute to faster delivery of goods to final consumers (He et al, 2015). Consequently, these terminals, in order to integrate and contribute effectively to the supply chains, but also to justify their existence, aim to serve ships as fast as possible, reducing their time in ports as much as possible (Prause, 2014).

Safety is also another important parameter of port product quality. Ports characterized by high rates of theft, damage or damage during the loading and unloading process, but mainly during the temporary storage and stowage of containers, are low on the carrier preference lists (Tran et al, 2015). Therefore, the contribution of transshipment hubs is significant by reducing overall transport costs and improving the quality of the product offered. To this end, ports must shift their efforts in these two directions (Wang & Meng, 2012).

5.2.9 **Information Technology**

Information technology is also of paramount importance in enhancing the competitiveness of ports and terminals operating as transshipment centers, as well-developed and modern information systems can offer the ability to serve ships quickly and easily adapt to changes in demand and demand. Economic environment (Zhang et al, 2015).

Significant benefits also come from managing the flows. Today, ports play an essential role in managing and coordinating material and information flows, as transport is an integral part of the entire supply chain. The aim is, therefore, to create synergies between the players in the port industry, in order to ensure the reliability of the port services provided and a right level of productivity (Konings et al, 2013). Information is also the key to a high degree of integration. There is no doubt that the progress made in the provision of these services could not have been possible without the corresponding improvements in information technology (Notteboom & De Langen, 2015). Today, electronic data sharing techniques are widely used to manage supply chains that span many different industries. The process of transshipment requires the management of many data on storing, storing, and tracking containers and their contents. It is now widely accepted that we live in the information age, and only a few industries remain unaffected by the impact of information technology (Akhavan, 2017). Ports today are required to handle a large volume of data at high speed. At the same time, members of the supply chain, e.g., ships, freight companies, inspectors, final recipients, etc. must exchange free data quickly and safely (Jung, 2011). Most shipping companies in the world are equipped with e-commerce portals, contributing positively to improving world trade. In order to improve world trade and speed up transport, all ports should be integrated into the integrated maritime transport network (Pallis et al, 2010).

5.2.10 **Strategic Alliances**

Significant results can be achieved by the cooperation of transshipment hubs with other members of the supply chain. Enhancing the competitiveness of terminals depends on their performance as well as the degree of their active cooperation with other players in the supply chain (shipping companies, labor force, public opinion,

environmental organizations, etc.), whose interests are often conflicting. Working together can initially lead to specific types of loads and improve production, thereby enhancing productivity and efficiency (Ng & Pallis, 2010). At the same time, it facilitates the quick and secure exchange of reliable and highly relevant information between individual players and the cooperation in the long-term planning and strategy (Naeem & Ombiki-Berman, 2010). This can be achieved through strategic partnerships and the achievement of flexibility that enables easy and rapid adaptation to a rapidly changing global environment (Ducruet & Itoh, 2014).

Ports, in particular, should prevent and not react. For example, terminal operators will need to obtain advance arrival information in order to be prepared and execute the required time figure promptly (Homsombat et al, 2011). This explains the fact that the better the information strategy adopted, the more effective the supply chain becomes. Research has shown that a credible and robust strategic partnership contributes to providing sufficient resources (such as cranes and other cargo handling equipment) to meet customer needs promptly (Sislian et al, 2016). When a terminal has a high level of strategic information exchange, it reduces the service life of ships and increases port capacity (Rimmer& Comtois, 2009). As Fleming and Baird have argued, cooperation between all players in the supply chain is essential (Felicio et al, 2015).

At the same time, the practice of horizontal and vertical integration is increasingly applied by members of the supply chain, as evidenced by global alliances between carriers, the increasing size of terminals, the continued effort of more players to become members, etc. Indeed, the degree of integration is such that the individual parts of the supply chain are now difficult to separate into separate markets (Lee & Lam, 2016). Organizations with experience in terminal management are now able to

expand their role in providing logistics services by managing multiple ports at the same time. The advantages of mergers and acquisitions are increasing participants' bargaining power, controlling flows on specific sea routes where large vessels are employed, better-controlling demand requirements, tailoring the services offered by their terminals and maximizing productivity — the latter exercise more effective control over logistics (Lun et al, 2013).

5.2.11 **“Green” Procedures**

Finally, the importance of green processes and functions should not be overlooked. An essential element of a port's competitiveness is its environmental friendliness. Companies like Maersk Line have identified sustainability as a critical element of their strategy and an essential criterion for choosing which port to approach (Delfmann et al, 2010). Therefore, when individual terminals adopt environmentally friendly processes and sustainable development techniques, they increase their attractiveness as well as the entire supply chain (Cheng & Tsai, 2009).

5.2.12 **Other Factors**

Other criteria of great importance for achieving competitive advantage are the degree of influence of various political, social, economic and other disturbances, as carriers prefer ports intact from such situations, existing working conditions and working hours, working hours and hours. of transshipment sites, their reputation (Accorsi et al, 2018), the marketing strategies that follow, etc. (Schlik & Seemann, 2012).

In the previous pages, therefore, some of how a transshipment center can affect the performance and attractiveness of the entire supply chain to which it belongs have been analyzed. Ports are, therefore, inferred to be dynamic members of different supply chains, as parts of which they compete (Lee & Lam, 2015). The success and

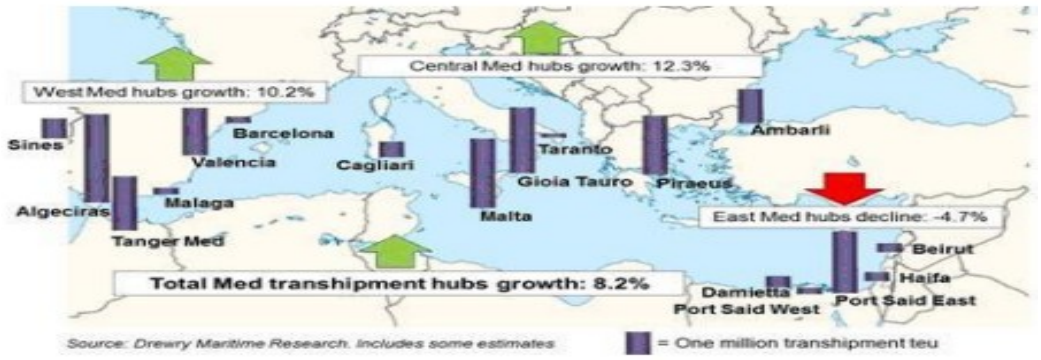
effectiveness of logistics chains depend on the members operating within them, their effectiveness, and the quality of the relationships developed between these businesses (Schlik & Seemann, 2012). Organizational coordination is needed for the success of any supply chain that has to compete with other chains and other forms of combined transport (Accorsi et al, 2018).

6 Transshipment in the Mediterranean

6.1 Transshipment Activity in The Area of The Mediterranean

The development of transshipment worldwide has been particularly spectacular over the last twenty years. In the Mediterranean Sea more specifically, according to studies carried out, it was found that transshipment traffic amounted to 7.071.000 TEUs in the year 2000, about 15.525.000 TEUs in the year 2007, i.e., a percentage increase of about 12.2 %, and nearly 18,956,000 TEUs in the year 2012 (Rodrigue & Ashar, 2016). In other words, there has been a growth of approximately 168% in this sector over the last thirteen years. It is worth noting that despite the global economic downturn of 2008 and the corresponding decline in world trade, the number of containers seeking transshipment services in the Mediterranean region has not only remained static but has grown dramatically (Wiseman & Giat, 2015) .The following Figure 12 shows the growth recorded by the Mediterranean regions in 2013 compared to 2012, while Figure 13 shows the transshipment container traffic handled by the various hubs and ports in particular. of the Mediterranean in the year 2012 (Guerrero & Rodrigue, 2014).

Figure 12. The evolution of the transshipment movement in the major Mediterranean Hub Ports in 2013



Source: Mounime et al, 2014

Figure 13. Transshipment traffic rates in 2012

Source: Mounime et al, 2014

It is worth commenting here on the geographical distribution of transshipment activity in the Mediterranean region, which is of considerable interest. Central and western Mediterranean countries recorded the highest growth in 2013 with 12.3% and 10.2%,

respectively, while hubs in the Eastern Basin recorded a decrease of almost 5%, except Port Said Port an increase of 9% (Slack & Gouvernal, 2016). The development of this port is mainly due to its geographical proximity to the Suez Canal, which also made it the largest transshipment hub in the Eastern Mediterranean region, accounting for more than 60% of the total volume of transactions in that region (Buiza et al, 2015).

In the Mediterranean, the main transshipment ports recorded a 3% increase in 2016 according to the table 8. The fastest growing port from 2015 to 2016 was the port of Malaga which recorded a 317% increase. Significant growth rates were also recorded in Piraeus and Damietta ports with 14 % and 13 % respectively, while negative growth rates were recorded for Port Said East and Tangier Port.

Table 8. The transshipment movement in the major Mediterranean Hub Ports in 2013-2016

Mediterranean Hubs Volumes	2013	2014	2015	2016	2016 vs 2015
Algeciras	4,349,742	4,556,465	4,511,322	4,759,598	6%
Port Said East	3,124,900	3,400,400	2,954,200	2,547,600	-14%
Piraeus Container Terminal	2,545,700	2,986,900	3,034,200	3,471,000	14%
Gioia Tauro	3,087,000	2,969,802	2,546,805	2,797,070	10%
Marsaxlokk	2,750,000	2,900,00	3,060,000	3,064,000	0%
Tangier	2,543,610	3,004,308	2,964,324	2,896,600	-2%
Damietta	688,070	707,342	719,547	810,311	13%
Cagliari	655,734	656,186	685,972	671,176	-2%
Malaga	293,599	87,276	28,714	119,847	317%
Taranto	197,317	148,519	0	0	0%
TRANSHIPMENT TOTAL	20,235,672	21,417,198	20,505,084	21,137,202	3%

Source: Contship Italia group

6.2 Factors Affecting the Development of The Mediterranean Transshipment

Given the above, it would be interesting to study the criteria that shaped how the transshipment hubs developed and functioned. Until the early 1990s, the Mediterranean ports were mainly used as gateways to connect the inland waterways (Gianfranco et al, 2014). Since 1990, however, significant demographic, social, and economic developments have led to the development of the wider region, trade, and transshipment activity (Arvs et al., 2018). The factors that contributed to this direction were many and are discussed below.

6.2.1 **The Increase of Maritime Trade**

In recent years there has been a significant increase in maritime trade along the maritime trade route linking Europe with the Far East. Over the last twenty years, the economic growth of the Far East and the relocation of production processes in these countries have triggered the growth of trade flows between China, South Korea, Japan, Taiwan, etc. with the major European countries (Ewell et al., 2017). This maritime route gradually gained traffic, increasing its share from 18% in 1985 to 42% in 2011, representing container traffic of approximately 22 million TEUs. As a result of this development in the early 1980s, the Mediterranean basin and its harbors have had the opportunity to become significant transshipment hubs, with virtually all ships passing through the Suez and Gibraltar straits (Hobson, 2016).

6.2.2 **The Development of China**

As mentioned in the previous paragraph, in 1990s Asia, and particular China experienced enormous growth rates, playing an essential role in the development of

trade. Thanks to the low cost of production mainly offered by China, many industries relocated their production activities there. As a result, large quantities of raw materials were now imported into China and finished products exported through containers (Anastasiou et al., 2016). The result of these events was to change the structure of global maritime trade routes. Whereas, until recently, the main flows were from the Far East to North Europe and North America, most of the bulk of the containers now shifted from the Atlantic Ocean to the Mediterranean Sea, resulting in many opportunities for the Mediterranean to play an essential role in satisfying international flows (Casoli et al., 2016).

6.2.3 **The Extension of The European Market**

The gradual enlargement of the European Union to other countries, and in particular to the East, has greatly benefited the Mediterranean and its ports. The lack of port infrastructure presented by countries such as Romania, Bulgaria, Poland, Russia, Ukraine, Turkey, etc., in combination with the relatively low international terms of trade that characterized these ports, led to the need for transshipment operations in Mediterranean ports to meet the growing needs of new markets (Deidum & Sciberras, 2016). The ports of Gioia Tauro in Italy, Algeciras in Spain and Port Said in Egypt are just a few examples of ports that served as transshipment hubs in the Mediterranean basin (Chaziza, 2018).

Also, the enlargement and development of the European Union have contributed significantly to the development of maritime transport. Maritime trade flows to Eastern Mediterranean countries have increased thanks to the opening up of these new financial markets, as most economies in Europe, and in particular Mediterranean countries, have experienced significant economic growth (Skordeli, 2015).

6.2.4 **The Global Maritime Transport**

The market has undergone many changes in the last five years. Transport companies, as already mentioned and detailed in the previous pages, have advanced vertical and horizontal integrations, increasing their bargaining power, making individual terminals around the world face intense competition pressure (de Saxce, 2016). For the Mediterranean, however, this presents more opportunities than threats as the three largest carriers, Maersk Line, MSC, and CMA CGM have invested heavily in major Mediterranean ports, (Russel & Knapp, 2017), thereby This sea basin on their trade routes to cover trade between the Middle East, Northern Europe and the Americas (Leidwanger & Green, 2015).

6.2.5 **The Economic Crisis and The Crisis in Trade**

In the years since the emergence and prevalence of containerization, the 2008 global financial crisis was the first to emerge. This year world trade collapsed by about 9%, which of course could not leave the maritime trade in the Mediterranean region untouched. For this reason, many direct commercial lines between ports (e.g., China with the Black Sea) were replaced by indirect links through transshipment, resulting in several ports showing increased rates of this operation (Pettegrew, 2016. At the same time, global carriers have become more stringent in their decision to choose the transshipment node, with the need to reduce their costs resulting in several ports facing reduced traffic rates (e.g., the port of Gioia Tauro) (Hmiden et al., 2014).

6.2.6 **Prospects for Northern Africa Ports**

Many North African ports have the potential to evolve into mega transshipment hubs as they are distinguished by several advantages, such as excellent geographical location, high operational efficiency (speed and reliability), competitive charges,

flexible "legislative" system (simplification of administrative procedures). , government incentives, etc.), physical benefits (such as water depths, terminals with stacking and storage space available), etc. (Kadafici et al., 2019) That is why many carriers choose to approach these hubs, vis-à-vis those in the Mediterranean. This factor has been a significant incentive for the relevant Port Authority of the respective Mediterranean hub to further develop in order to face the fierce competition of new entrants to North Africa transshipment (Markusik et al., 2015).

6.3 Analysis of Demand

In general, it is quite challenging to find evidence of the transshipment movement recorded by the various ports over time. Some ports or port terminals collect and publish the necessary information, but most do not follow such a policy (Kurt et al., 2015). Most of the time, data on the transshipment movement are only accessible through various studies and surveys and sometimes only approximate. Often, these data are integrated within the percentages of the overall container management of each port (Bevan et al., 2014).

However, based on thorough research of modern scientific literature (Bevan et al., 2014; Santos & Soares, 2014; Vasconcelos, 2014), data collection on the main transshipment hubs of the Mediterranean has been made possible (Solomakakis, 2016). Thus, Table 9 first summarizes the data on the ten largest container stations in the Mediterranean region during the years 2003 to 2013. As we can see in Charts 4.2 and 4.4, the first port of Valencia comes, as in 2013 it handled a total of 4,470,000 TEUs of containers, accounting for about 18% of the region's total traffic, with Algeciras port second only to come in second, with only 4,336,469 TEUs handling the same Tosh, movement corresponding to a market share of approximately 17.50%

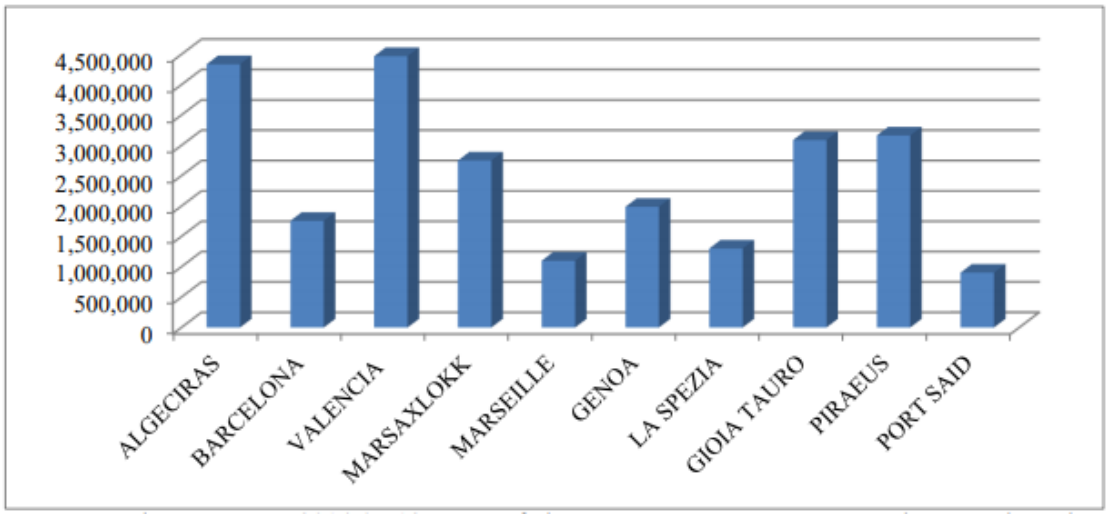
(Dedousis, 2016). So, we note that only the two largest hubs in the area along with the port of Piraeus hold almost 50% of the total traffic of the entire basin. As a result, this market has a relatively high concentration (Arnaud, 2017). It is noteworthy, however, that the most significant growth rate in 2013 compared to 2012 was the port of Piraeus, mainly due to the concession and management of Pier II by Cosco Pacific. Next is the neighboring port of Gioia Tauro, with slight declines in the ports of Genoa and Port Said (Alves, 2016).

Table 9. The largest Mediterranean ports and container traffic over the years 2003-2013 (in TEUs)

ALGECIRAS	BARCELONA	VALENCIA	MALTA	MARSEILLE	GENOA	LA SPEZIA	GIOIA TAURO	PIRAEUS	PORT SAID	TOTAL
2.515.908	1.765.000	2.012.000	1.300.000	833.000	1.605.946	1.006.631	3.148.662	1.606.000	566.470	16.359.617
2.937.381	1.910.723	2.137.137	1.460.000	916.277	1.628.594	1.040.438	3.261.034	1.541.563	821.536	17,654,683
16,75%	8,26%	6,22%	12,31%	10,00%	1,41%	3,36%	3,57%	-4,01%	45,03%	7.92%
3.160.000	2.071.000	2.415.000	1.321.000	90.800	1.419.335	1.024.455	3.160.981	1.401.000	846.686	16,910,257
7,58%	8,39%	13,00%	-9,52%	-90,09%	-12,85%	-1,54%	-3,07%	-9,12%	3,06%	-4.22%
3.244.640	2.315.000	2.615.000	1.485.000	941.000	18.550.261	1.137.000	2.938.176	1.413.000	921.066	35,560,143
2,68%	11,78%	8,28%	12,41%	936,34%	1206,97%	10,99%	-7,05%	0,86%	8,78%	110.29%
3.410.000	2.606.000	3.049.000	1.901.180	1.001.957	18.872.000	1.190.000	3.350.000	1.384.000	1.026.023	37,790,160
5,10%	12,57%	16,60%	28,03%	6,48%	1,73%	4,66%	14,02%	-2,05%	11,40%	6.27%
3.314.364	2.569.852	3.597.215	2.337.000	851.425	1.766.605	1.246.000	3.467.772	433.582	985.872	20,569,687
-2,80%	-1,39%	17,98%	22,92%	-15,02%	-90,64%	4,71%	3,52%	-68,67%	-3,91%	-45.57%
3.042.759	1.846.000	3.654.000	2.261.034	882.580	1.533.627	1.046.000	2.800.000	667.000	737.998	18,470,998
-8,19%	-28,17%	1,58%	-3,25%	3,66%	-13,19%	-16,05%	-19,26%	53,83%	-25,14%	-10.20%

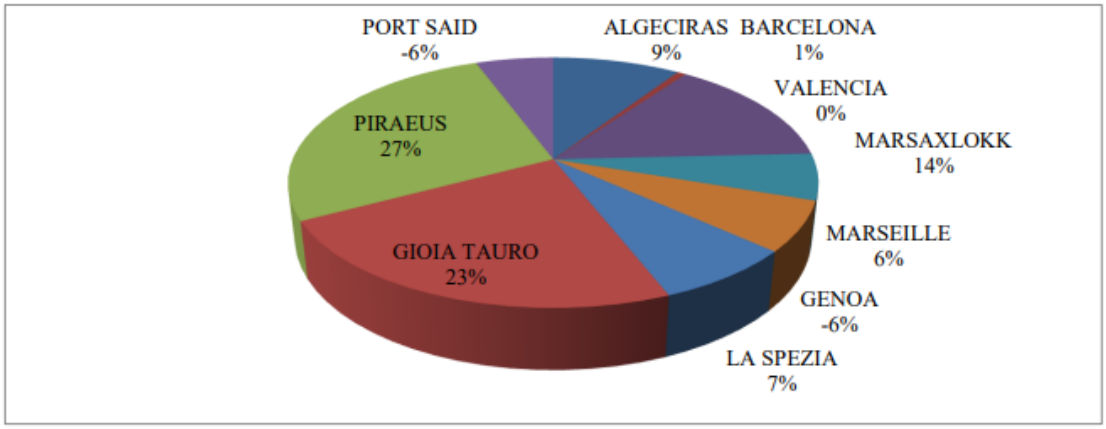
Source: Yetkili, 2015

Figure 14. Container traffic (TEUs) in 2013



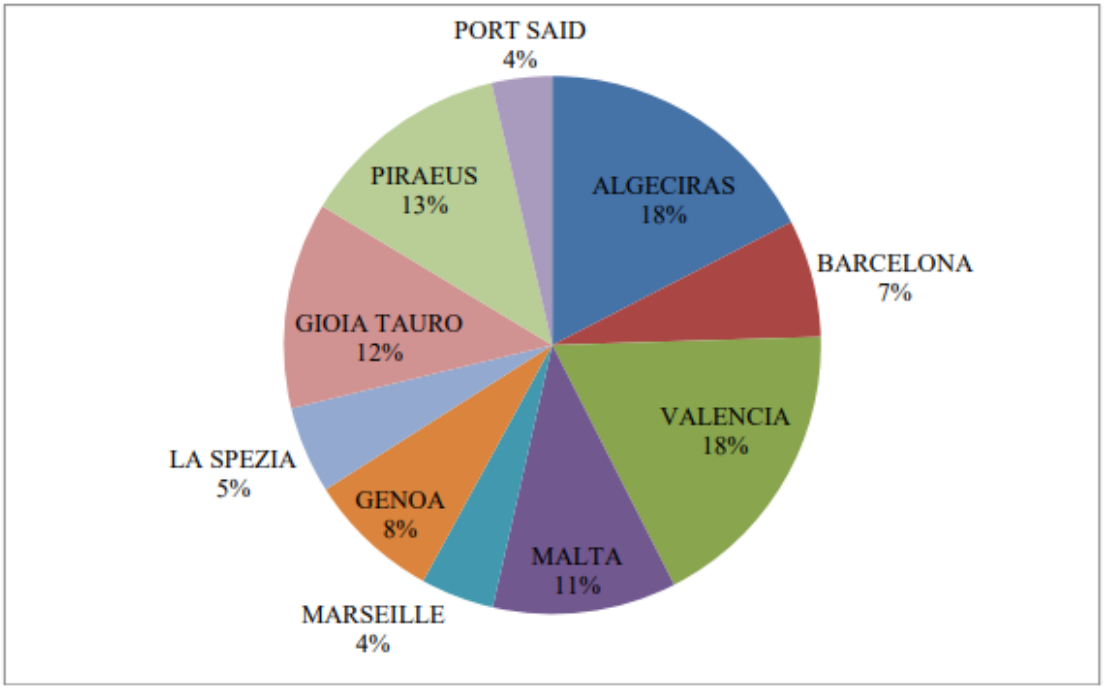
Source: Yetkili, 2015

Figure 15. Rates of change in the years 2012-2013



Source: Yetkili, 2015

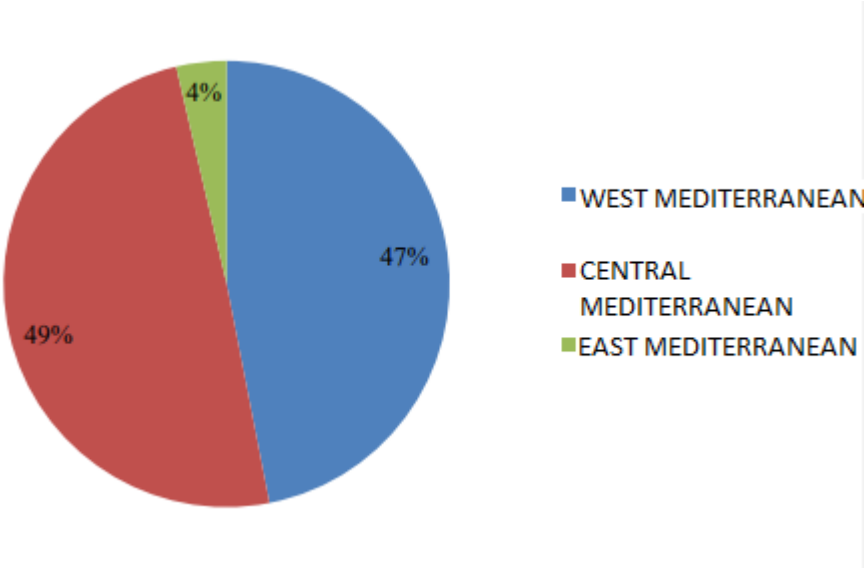
Figure 16. Market share of the central Mediterranean ports in 2013



Source: Yetkili, 2015

It is interesting to analyze the market share of each part of the Mediterranean. As shown in the following figure, the Central Mediterranean accounts for almost 50% of total container traffic, while at the same time having higher growth rates, while the Western Mediterranean accounts for only 47%. The Eastern Mediterranean ports managed in 2013 to handle only 4% of the region's total maritime freight traffic (Cukrov et al., 2014).

Figure 17. Market share of Mediterranean geographical segments in 2013



Source: Yetkili, 2015.

From the analysis above, one can easily conclude that most major Mediterranean ports have experienced significant growth rates in recent years, which is well above the regional and global average (Wilson, 2015). Overall, maritime container traffic in the ten largest Mediterranean ports has increased over the past 11 years, doubling over the past 11 years, marking an increase of 52% in 2013 compared to 2003. Slight declines occurred in 2008 and 2009, mainly due to the global financial crisis that has negatively affected trade. At the same time, the above hubs have shown significant growth rates in the field of transshipment as well, proving that in today's commercial and economic realities, global carriers have replaced most of the direct services they have made in their efforts to rationalize their service network (Schiffman, 2016). To and from West Africa by transshipment processes thanks to the use of the larger "mother ships" approaching the various hubs of the region (Flores & Cabaco, 2016).

So, the most crucial mega transshipment hubs one can find in the Mediterranean basin are shown in the table below along with their traffic in 2004, 2008 and 2012. As we

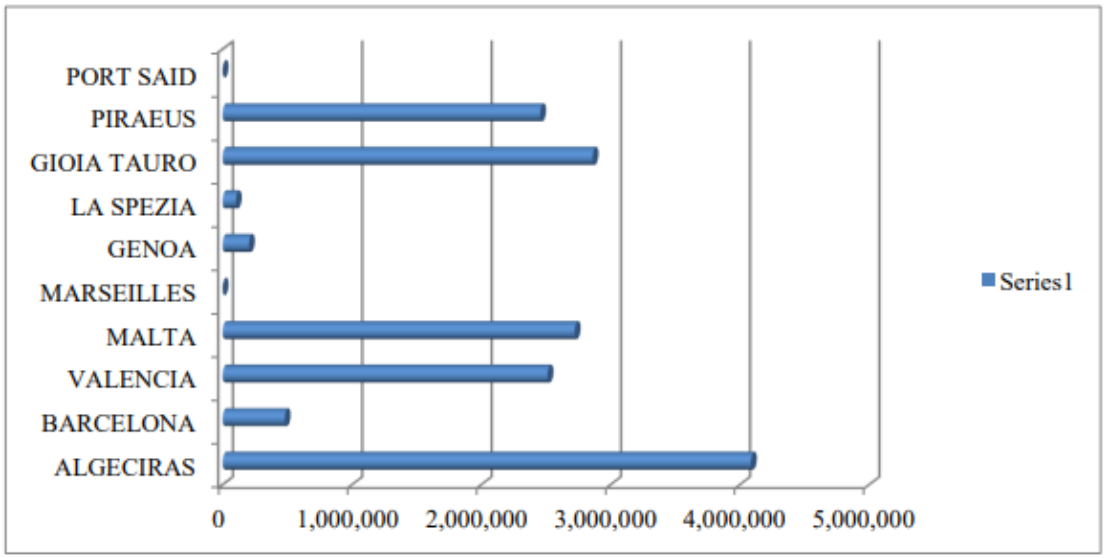
can see, most ports have seen significant growth rates (Christie, 2017). Unfortunately, however, there are very few ports that maintain and publish data on the movement of transshipment containers that they manage, and often not even on an ongoing basis. Of course, there are also those hubs that take into account the transshipment rates in the total amount of cargo they manage each year (Cardenete et al., 2015). For this reason, not all the data needed and desirable for the present investigation were available, and therefore, some data have been omitted. (Keay, 2016).

Table 10. The timing of transshipment movements (TEUs) in the major ports of the Mediterranean

TR/NT 2004	TR/NT INCIDENCE	TR/NT 2008	TR/NT INCIDENCE	MET/ΛH	TR/NT 2012	TR/NT INCIDENCE	MET/ΛH	TR/NT 2013	TR/NT INCIDENCE	MET/ΛH
2,487,609	84.69%	3,164,696	95.48%	27.22%	3,707,953	90.13%	17.17%	4,086,164	94.00%	10.20%
571,306	29.90%	999,588	38.82%	74.97%	435,817	24.90%	-56.40%	480,270	27.34%	10.20%
393,921	18.43%	1,578,482	43.88%	300.71%	2,280,701	51.03%	44.49%	2,513,333	56.23%	10.20%
1,382,818	94.71%	2,174,000	93.03%	57.22%	2,425,000	95.47%	11.55%	2,723,275	99.03%	12.30%
-	-	-	-	-	-	-	-	-	-	-
127,030	7.80%	169,560	9.60%	33.48%	181,128	8.77%	6.82%	203,407	10.23%	12.30%
72,831	7.00%	85,000	6.82%	16.71%	91,111	7.31%	7.19%	102,318	7.87%	12.30%
2,724,580	83.55%	3,221,000	92.88%	18.22%	2,548,000	93.64%	-20.89%	2,861,404	92.69%	12.30%
790,822	51.30%	-	8.20%	-	2,187,000	79.99%	-	2,456,001	77.65%	12.30%
-	-	-	-	-		-	-	-	-	-
7,168,099	40.60%	11,392,326	55.38%	58.93%	13,856,710	49.07%	21.63%	15,426,172	62.07%	11.33%

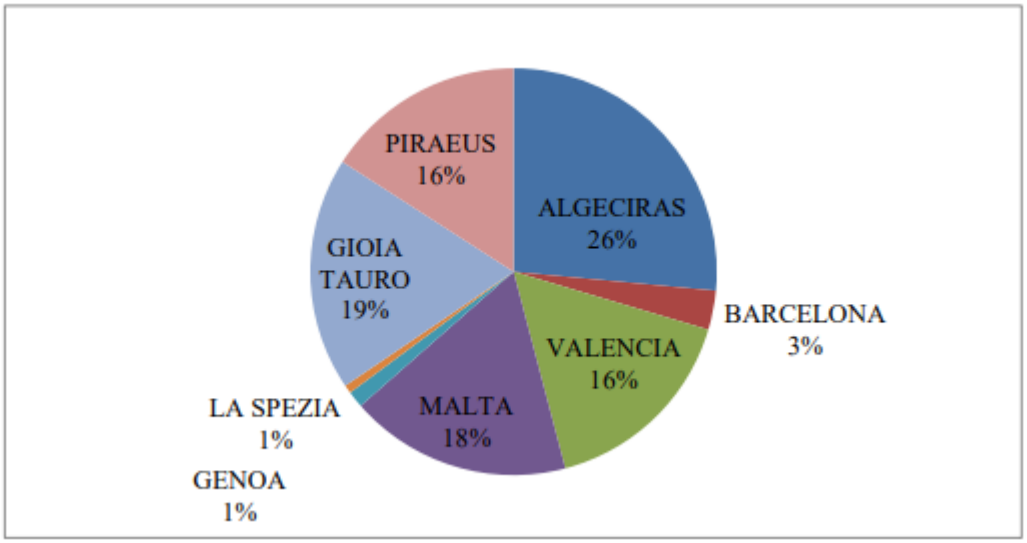
Source: Keay, 2016

Figure 18. Transshipment traffic (TEUs) in 2013



Source: Keay, 2016.

Figure 19. Market share of the major transshipment hubs in 2013



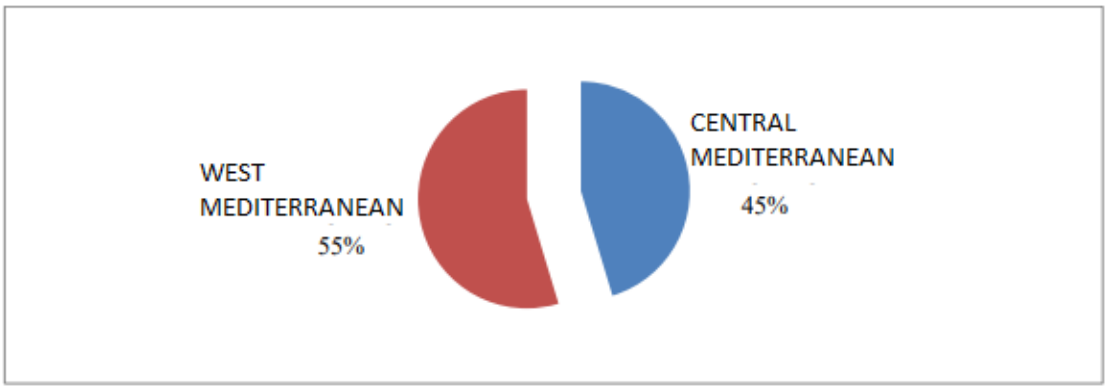
Source: Keay, 2016.

As we can see in Figure, the most significant move for 2013 was recorded by Algeciras Port, which managed 4,086,164 TEUs of transshipment containers, accounting for almost 94% of its total traffic and having a market share of 26%. Its first position is mainly due to its excellent geographical location, as it is located on the

Iberian Peninsula, a short distance from the Gibraltar Strait, making it the first or last transshipment node for those entering or leaving the Mediterranean Sea respectively (Notteboom et al., 2019). Second in line is the port of Gioia Tauro, Italy, with traffic of only 2.861.404 TEUs, or almost 93% of its total commercial traffic, representing about 20% of total transshipment traffic in the Mediterranean basin (Botter et al., 2014).

At the same time, we note that in the total transshipment traffic recorded by the ten largest Mediterranean ports has increased by approximately 115.2%, with 2013 reaching 15,426,172 TEUs representing 62% of total container management. This, coupled with the 11% increase during the recent global economic crisis, demonstrates the importance of this activity for the Mediterranean ports trade (Notteboom et al., 2019).

Figure 20. Market share of Mediterranean geographical areas in 2013



Source: Notteboom et al., 2019.

As one can observe in the Figure above, the largest market share in the western Mediterranean ports represents a total transshipment container traffic of about 10,073,370 TEUs, even though the central Mediterranean ports experienced more growth and much more growth than of the basin (Keay, 2016). This is mainly because

the ports of the first area offer the smallest possible deviation from the main maritime trade routes (Cardenet et al., 2014). This feature, which will be detailed in the following pages, is particularly important in the context of common carriers' efforts to reduce the overall cost and time of travel. Unfortunately, data on hubs in the Eastern Basin were not available (Christie, 2017).

Table 11. The largest Mediterranean ports and container traffic over the years 2015-2017 (in TEUs)

Country	Port Said	TEUs 2015	TEUs 2016	TEUs 2017
Spain	Valencia	4.615.196	4.732.136	4.832.156
Spain	Algeciras	4.515.768	4.761.444	4.380.849
Greece	Piraeus	3.327.778	3.736.644	4.060.000
Morocco	Tanger-Med	3.000.000	2.963.654	3.312.409
Malta	Marsaxlokk	3.064.000	3.080.000	3.150.000
Spain	Barcelona	1.965.241	2.236.961	3.006.872
Israel	Ashdod	1.308.000	1.443.000	1.525.000
Turkey	Izmir	656.000	1.323.000	1.440.000
France	Marseille	1.223.173	1.251.744	1.362.204
Israel	Haifa	1.215.000	1.265.000	1.343.000
Lebanon	Beirut	1.130.284	1.147.219	1.305.038
Egypt	Damietta	719.547	810.311	1.131.226

Source: Ports Europe website

In addition, we note that in recent years Mediterranean ports have continued to grow significantly. For the years 2015-2017, the port of Valencia still holds the first position with 4.832.156 TEUS in 2017, followed by the port of Algeciras, which recorded a slight decline from 2015 to 2017 about 134.919 TEUS. Within this three-

year period port of Piraeus the fastest growing port in the Mediterranean ,at a 22% growth rate for this three-year period, occupied the third position with 4.060.000 TEUS in 2017.

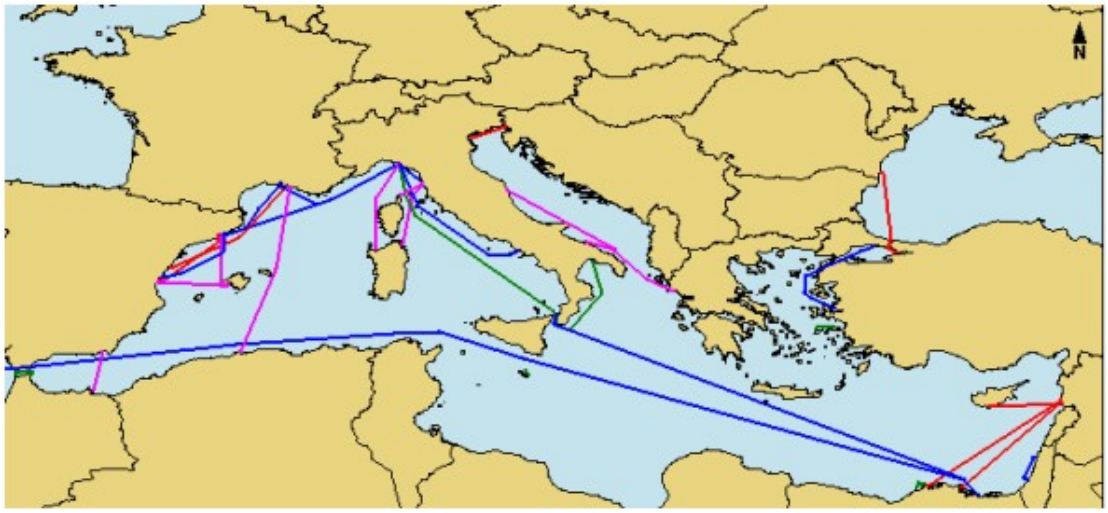
6.4 Analysis of The Supply

According to the above analysis, one can easily see the significant growth in recent years in the shipping of containers and in particular, the activity of transshipment in the Mediterranean region (Flores & Cabaco, 2014). The various hubs in the region choose to reach and integrate the world's largest shipping companies, such as Maersk Lines, CMA-CGM, Evergreen Lines, MSCs, etc. The criteria that led to the development and emergence of these hubs, but the above decisions of the carriers are discussed in the following sections (Schiffman, 2016).

6.4.1 **Deviation from the Main Commercial Marine Route**

One of the significant factors contributing to the development of the phenomenon of transshipment in the Mediterranean Sea area is the fact that a great maritime trade route passes through its waters (Wilson, 2015). As shown in Figure 21, the most crucial trade route crossing the region, joins the Gibraltar Strait with the Suez Canal, while offering several links to the Bosporus Strait, as well as several other Mediterranean ports, joining permanently three lakes, Asia, Europe and Africa with each other but also with America across the Atlantic Ocean (Wilson, 2015).

Figure 21. The leading maritime trade route of the Mediterranean Sea

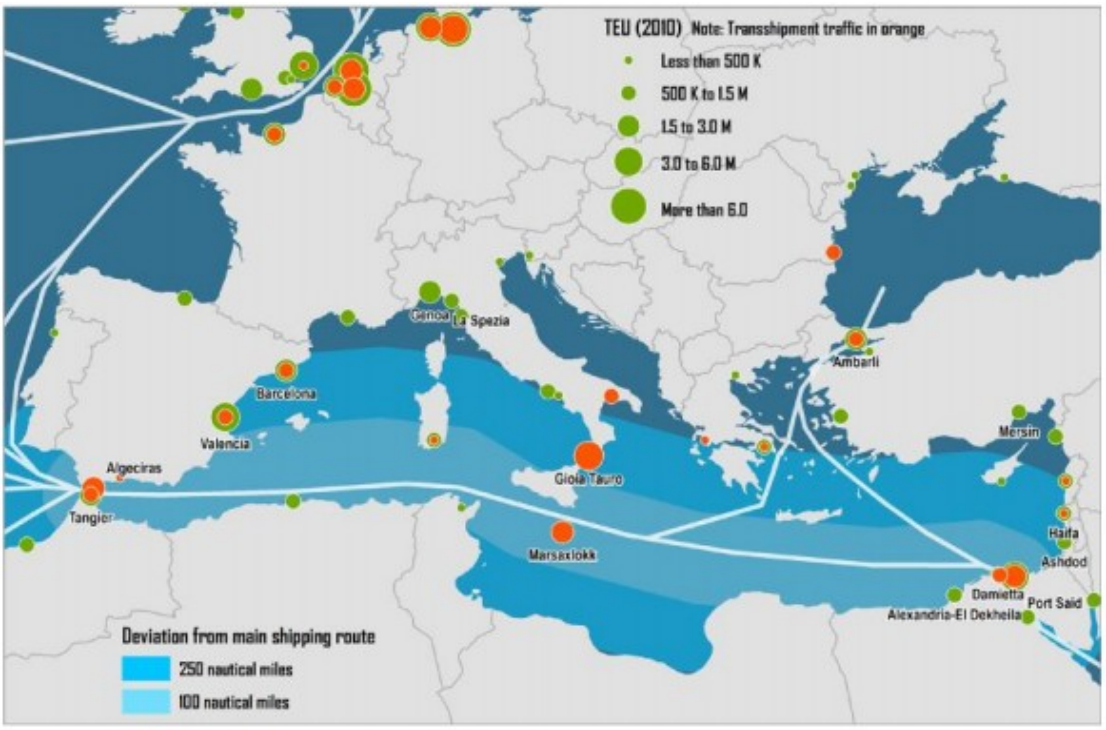


Source: Cukrov et al., 2014

About 30% of the world's maritime container trade crosses this major maritime trade route, even though the Mediterranean Sea represents less than 1% of the world's total maritime area (Yetkili, 2015). Maritime traffic is particularly intense in the narrow passageways through which ships enter and leave the Mediterranean Sea. These are the Gibraltar Strait to the west about 14 kilometers wide, the Suez Canal to the east, and the Marmara Sea Strait to the northeast, close to some of the major transshipment hubs after all (Alves, 2016).

The importance of the above trade route, coupled with the small geographical divergence of most Mediterranean transshipment nodes, was undoubtedly essential factors for their rapid development (Arnaud, 2017). Figure 22 depicts the divergence of the major Mediterranean mega transshipment hubs from the main maritime trade route.

Figure 22. Exclusions of transshipment hubs from the main sea route



Source: Cukrov et al., 2014

It is worth noting that the port of Algeciras, the largest transshipment hub in the Mediterranean, lies along the leading maritime trade route linking the Atlantic Ocean with the Mediterranean Sea. Likewise, Port Said's port next to the Suez Canal is a few nautical miles from the main trade route (Michaelides et al., 2019), while Gioia Tauro's port is only 66 nautical miles (Coppini et al., 2016). Therefore, we observe that most ports diverge less than 250 nautical miles from the main maritime trade route. This gives them an unparalleled competitive advantage, which is difficult to replace and has contributed significantly to their development, as in today's economically and highly competitive environment, almost all carriers are trying to reduce their overall costs and their times (Balakrishnan & Karsten, 2017). For round trips, they select those hubs with the least possible deviation from the main sea routes. The above hubs, therefore, outperform this feature, unlike the Cypriot ports, for

example, which failed to develop as transshipment hubs for this reason in particular (Reda et al., 2014).

The study and the comparative analysis of the individual features of the infrastructure and the anodization of the significant transshipment hubs of the Mediterranean are considered essential. The following table provides data on those hubs that have the most significant commercial activity in the field of transshipment. Unfortunately, many items in the table are missing as the corresponding data could not be found (Perry, 2019).

6.4.2 The Infrastructure and the Administration of Mediterranean Transshipment

Table 12. Infrastructure elements and superstructure of the significant transshipment hubs of the Mediterranean in 2012

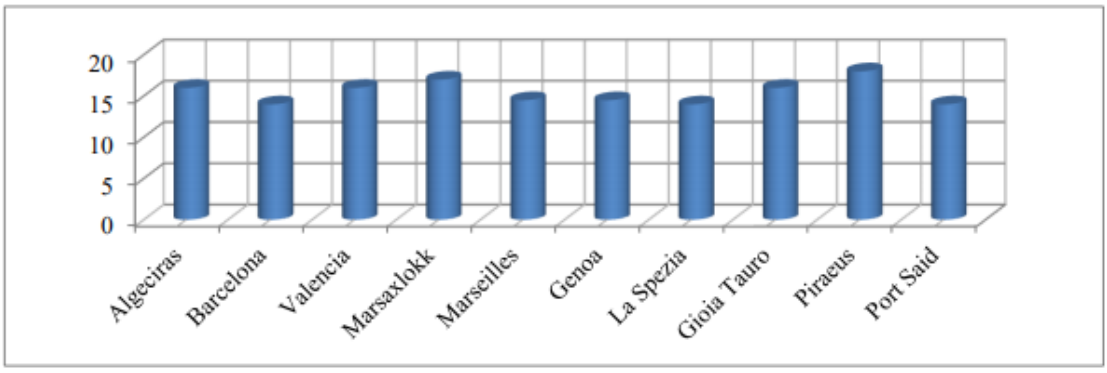
PORT	PORT AUTHORITY	TERMINAL	TERMINAL OPERATOR	PARABOLIC POSITION	LENGTH (m)	DEPTH (m)	AREA (m2)	TEUs	CRANES
Algeciras	Autoridad Portuaria de lla Bahia de Algeciras	APM Terminal	ApM Terminal Algeciras SA	3	1.642	16	667.340	37.872	23
		Isla Verde Container Terminal	Terminal de Contenedores de Algeciras SA	1	680	14.5	180.000	5	2
Barcelona	Autoritat Portuaria de Barcelona	Estibatora de Pnent	Estibadora de Ponent SA	4	630	11	45.000	700	
		Terminal Catalunya	Terminal Catalunya SA	1	1.448	14	380.700		8
		Terminal Port Nou	Terminal Port Nou SA	1	590	11	45.000	950	2
		Terminal Muele Sur	Terminal de Contenidors de Barcelona SA	2	1.380	16	580.000	10.370	18
Valencia	Autoridad Portuaria de Valencia	MSC Terminal Valencia	MSC Terminal VALENCIA SA	1	770	16	350.000	24.000	30
Marsaxlokk	Malta Freeport Terminals Ltd	Terminal One		1	1.000	16	457.500	10.238	10
		Terminal Two		3	1.550	17	222.500	4.849	12
Marseilles	Grand Port Maritime de Marseille	Fos Container Terminal		5	1.180	15	560.000		8
	Mourepiane Container Terminal			6	920	12	105.000	2.500	6
Genoa	Autoria Portuale di Genoa	Terminal Grendi	Grendi Transporti Marittimi	2	500	9	48.000	1.000	
		Messina Terminal	Ignazio Messina & C SpA	6	1.687	13	253.355	9.656	7
		Southern European Container Hub Terminal	Terminal Contenitori Hub Genoa SpA	1	526	15	205.000	13.000	5
		Voltri Terminal	Voltri Terminal Europa SpA	5	1.400	15	850.000	40.000	10
La Spezia	Autorita Portuale della Spezia	La Spezia Container Terminal	La Spezia Container Terminal SpA	4	1.360	14	332.000	21.000	14
		Terminal del Golfo	Terminal del Golfo SpA	2	310		100.000	7.500	
Gioia Tauro	Port of Gioia Tauro	Medcenter Container Terminal	Medcenter Continer Terminal SpA			16	1.600.000	75.000	22
Piraeus	Port of Piraeus Authority SA	Container Terminal – Piraeus II	Piraeus Container Terminal SA	7	2.307	18	776.000	30.500	3
		Container Terminal Pier II	Cosco Pasific	7	3.100	18	776.000	30.500	7
Port Said	Port Said Pot Aythority	Container Terminal	Port Said Container & Cargo Handling Co	1	950	14	467.130	24.000	5
		Abbas Quay		1	250	14	375.000		

Source: Arvis et al., 2018.

As we can see, most hubs have two or more parabolic positions in total, which enables them to serve a large number of container ships at the same time. This increases the speed of service of vessels, reduces congestion or other delays and thus increases the competitiveness of these hubs and their supply chains (Christy et al., 2017).

At the same time, it is easy to see that most ports have deep water depths that enable them to accommodate and service modern large vessels, an essential element for the operation and development of transshipment hubs (Mandalakis et al., 2014). The port of Piraeus, as shown in Figure 4.9, has a maximum depth of 18 meters, while the ports of Algeciras, Gioia Tauro, Malta, and Barcelona have a depth of water exceeding 16 meters (Kavirathna et al., 2018). This characteristic has undoubtedly contributed to the emergence of the above hubs as dominant in the field of transshipment in the Mediterranean basin. Even when this element is natural, and the costly dredging process is not required to achieve it, port competitiveness is further enhanced (Mandalakis et al., 2014).

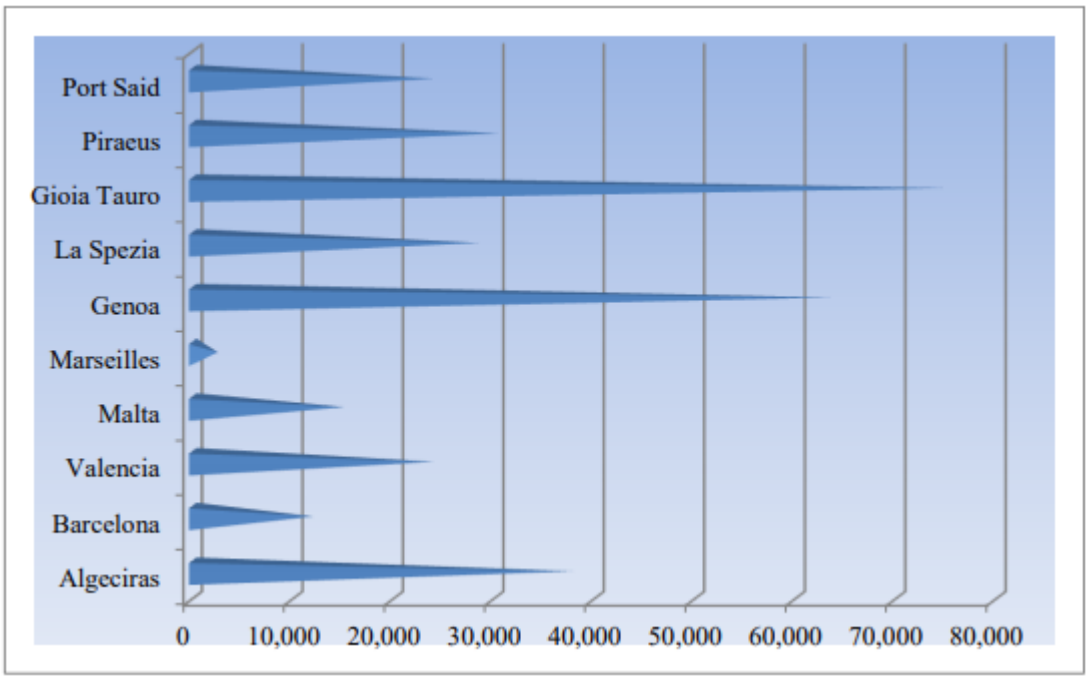
Figure 23. Maximum Water Depth (in meters) of the most important transshipment hubs in the Mediterranean



Source: Arvis et al., 2018.

Necessary for the effective operation and development of mega transshipment hubs is also the availability and availability of suitable and safe spaces for the temporary storage, storage, and storage of containers, whenever necessary. As we can see in the figure below, the ten largest Mediterranean transshipment hubs have areas suitable for storing transshipment loads with a total capacity of over 20,000 TEUs (Kurt & Boulougouris, 2014). The port of Gioia Tauro occupies the first position, followed by the port of Genoa with a slight difference. This feature enables them to store a large number of transshipment containers at the same time when their ship loading and unloading times do not coincide, resulting in no delays and bottlenecks in ship service (Kavirathna et al., 2018).

Figure 24. Storage space of the largest Mediterranean mega transshipment hubs (in TEUs)



Source: Source: Sricharan, 2018.

Finally, an essential element of the capacity of a transshipment hub is the availability and availability of suitable equipment for handling containers and their efficient operation. Table 13 below provides data on the total load handling equipment available at the various transshipment nodes. Unfortunately, not enough data was available and therefore missing (Cariou & Cheaitou, 2014). As we conclude, these hubs have sufficient and excellent mechanical equipment to handle containers that allow them to be handled as quickly as possible with the least possible damage. The various port authorities have in their future strategic planning incorporated the expansion, modernization, and upgrading of these nodes, such as the Barcelona port which plans to acquire two more technologically advanced and modern cranes by 2015 (Rothenberg, 2015).

Table 13. The available load handling equipment of transshipment nodes

PORT	SHIPSHORE CONTAINER GANTRIES	MOBILE CRANES	YARD GANTRIES	REACHSTACKERS	YARD CHASSIS/TRAILERS
Algeciras	25		36	4	69
Barcelona	28	1	10	34	35
Valencia	30		23	8	52
Malta	22				
Marseilles	14			13	46
Genoa	22		34	35	80
La Spezia	10	2	27	1	13
Gioia Tauro	24	1	11	11	76
Piraeus	10				42
Port Said	5	12	11	39	

Source: Serena, 2014.

Above, some of the features that undoubtedly contributed to the development and emergence of these hubs as dominant mega transshipment hubs in the Mediterranean Sea area, but at the same time determine the intensity of competition between them,

were presented and analyzed. However, they are certainly not the only ones (Tsamboulas & Karousos, 2014). The choice of the above ports to operate around the clock, almost 360 days a year, also plays a vital role in serving the vessels they choose to reach without loss of time. In addition to the apparent positive impact on speed and efficiency of service, this enormous environmental benefit will be achieved by this time of operation (Morata Fernandez, 2017). Ships will be able to consume less energy, and thus less fuel, which will result in lower costs for carriers and the entire supply chain network, as ships will not have to deploy at high speeds to prevent ports. " open, or they will not have to wait for the engines to run for any waiting time until the port terminal is open and serviced Coccossis & Papatheochari, 2014).

At the same time, stakeholders are continuously planning strategic plans to further develop existing infrastructure or modernize available equipment in order to continuously increase their productivity and efficiency to the maximum extent possible (Tsamboulas & Karousos, 2014). A typical example is the port of Piraeus, where Pier III is in the process of being built and expanded to handle transshipment containers and cargoes. Finally, the management of most European ports have adopted modern information systems for the adequate performance of their functions, and they place great importance on the continuous training of port staff to maximize their productivity. All of these factors have contributed to the emergence of the above ports at hubs of enormous strategic importance and have helped to dominate the Mediterranean Sea. (Tsamboulas & Karousos, 2014).

7 The Greek Port of Piraeus

7.1 The Hellenic Shipping

As we are well aware, Greece's relationship with maritime trade has emerged since antiquity. This talent, which has remained unchanged over the years, is justified by the country's geographical location at the crossroads of three continents. The Greek coastline covers an area of 16,000 km and the existence of 3,000 islands and islands in a Polynesian cluster of marine inhabitants (Maragkogianni & Papaefthimiou, 2015).

As a shipping country, its commercial shipping plays a significant role in shaping its social and economic development (Smailes, 2017). However, despite the perceived advantages, the Greek State was not interested in alternative ways of governing before 1990. The subsequent developments in the maritime trade and telecommunications development were not adopted by the then governors and ports of the country. They were able to follow the new trends while shipping and service divisions were rapidly transforming into a capital-intensive industry, Greece was experiencing infrastructure shortages (Van Der Putten, 2014).

The ports of the country are classified according to Joint Ministerial Decision no. 3514.96 / 02/92 (Meunier, 2015) of the Ministers of Economic Affairs, the Environment, Planning and Public Works, External and Commercial Shipping, in the following categories: 1. Ports of national importance (Piraeus, Thessaloniki, Volos, Patras, Igoumenitsa, Kavala, Alexandroupolis, Heraklion, Corfu, Mytilene, Rhodes, Chalkida, Kymi, Elefsina, Lavrion, Rafina, Kathouma, Rafina, Aegina, Rafina, Aegina, Rafina, Aegina of which the first eleven are of international interest). 2. Ports

of significant interest (Lagos, Moudania, Stylida, Corinth, Katakolo, Kyllini, Pylos, Gytheio, Nafplio, Itea, Zakynthos, Poros, Kefallinia, Preveza, Sitia, Kastelios Kissamou, Kalamos, Kissamos, Kalamos, Paros, Amphipolis). 3. Ports of local importance, including all other ports in the country (Barros & Athanassiou, 2015).

In the fegure below we will see the Greek ports that operate as Societe Anonyme, of which we are interested in the ports of Piraeus and Thessaloniki due to the massive traffic of containers made there (Garland, 2016).

Not earlier than 2002, following the report of the Ministry of Merchant Shipping, it was accepted that the objective of reorganizing the Greek ports was to increase their participation in the global share of shipping and to promote the most significant possible participation in the development of port services (Argyraki & Kelepertzis, 2014). With this policy, the government aimed to attract foreign investors, expecting an increase in international trade, which would offset the need for expensive investments, notably in infrastructure, technological equipment, and technical infrastructure (Sotiropoulos, 2014). The intention to reform the port system was based on the idea of improving ports' competitiveness in the new economic environment, improving maritime connectivity with dynamic exporting countries, sustainable port development, improving the social cohesion of island populations, tightening freight control. They move through the Greek ports. This strategy is in line with the reshuffle in ports of other Mediterranean European countries, such as Italy, France, and Portugal (Fotopoulos & Kaimaklioti, 2016).

Today, ships of Greek interest are estimated at 4,057, of which 839 are under the Greek flag. The remaining positions are occupied by Liberia, the Marshall Islands, Malta, Panama, Cyprus, and the Bahamas. Having this business acumen, Greek

shipping capital ranks 4th in global shipping (Pardali et al., 2016). It should also be emphasized that Greek shipping operates in the international maritime transport network, thus serving over 95% of its fleet capacity in cross-country transport needs (cross-trade). Greek interest ships are mainly tanker type and carry oil and other liquid petroleum products, with the remaining 5% corresponding to cruise ships and vessels serving the coast (Pallis & Vaggelas, 2017). The Greek fleet is a dominant force in the European Union, as it owns 50% of the total European merchant fleet (Kapetanis et al., 2016).

7.2 The Port of Piraeus in the Past

Until Cosco's appearance in Piraeus, the only station that operated was that of PPA. Total container traffic in 2007 reached 1,373,138 TEUs, making Piraeus barely 11th in Europe's ports. However, what followed in 2008 was a catastrophe. In 2008, with the onset of the financial crisis, traffic fell to 433,582 TEUs, a 50% drop, half of which was empty (Van der Putten & Mejinders, 2015). The main load at that time was that of China. The above is a result of the 2008-2009 strikes calling for the cancellation and cancellation of the Cosco and PPA agreement (Bagis & Dooms, 2014). All this time the freight was reduced with the risk of deleting the Piraeus terminal from the map as no company trusted the movement of its products through Piraeus. Having reached the bottom and having granted pier II to Cosco in 2009, it began with a slight rise, which continued the rest of the year (Musso & Parola, 2017).

The shipping of containers to SEVO from 1 June 2010 relates to the distribution of PWP I. SA the SEP SA from the same date it has the exclusive management of Pier II under its concession agreement with PPA. SA (Close, 2014).

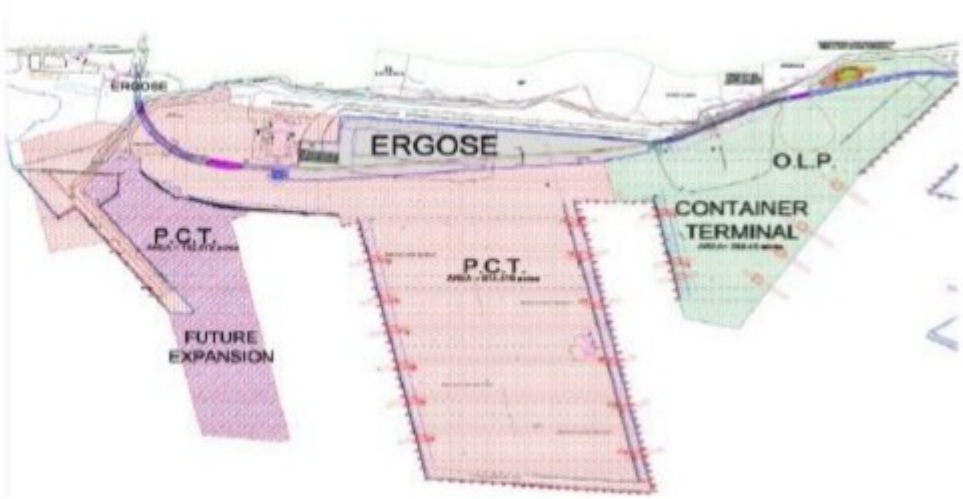
The following table shows the shipping of containers to PPA from 2007-2014:

Table 14. Total distribution of PPA 2007-2014

ΟΛΠ	2007	2008	2009	2010	2011	2012	2013	2014
TEUs	1.373.138	433.582	664.895	513.319	490.904	625.914	644.055	598.255

7.3 The Port of Piraeus Today

Figure 25. The pier of Piraeus



Source: Close, 2014

Piraeus is the most important port of Greece, with a critical strategic position at the crossroads of three continents of Europe - Africa and Asia. Until 2008 the containers were managed by PPA, and the station consisted of piers I and II (Barsitz & Radzyner, 2017). In 2008 COSCO PACIFIC LIMITED signed with PPA the Concession Agreement which became the Law of the Greek State, in the eyes of the President of China and the Prime Minister. Of Greece for the 35 years concession of Container II and III piers. Cosco has undertaken the construction of Pier III, which will bring the total port capacity to 4.7 million TEU (Dumitrescu, 2015). There are 6

Super PostPanamax cranes already installed in Pier II, and there were 12 more Post-Panamax already. Seven brand new Super Post-Panamax Cranes with the ability to service the largest container ships worldwide will be added to Pier III. So, by the end of 2015, PCT will have a total of 25 Cranes in full operation (Spyridakis, 2016). Also, since 2011, PCT has been running 16 state-of-the-art RMG semi-automatic cranes that facilitate transshipment loads, operate on electricity, and are environmentally friendly. The modernization of the PCT has been helped by the new technologies added, as well as the investment in new practices and applications (Chatzinikolaou & Oikonomou, 2015).

The Operating System (CATOS), an advanced Terminals operating system, has given the management credibility required by the world's largest shipping companies (Kilic & Tzannatos, 2014).

The Auto-Gate system, which has been in operation since 2010, enables transfer to all Drivers ID cardholders through a WEB application and offers truck drivers a quick service through the Terminal Gates via RFID card readers (Hatzopoulos et al., 2014).

Also, as part of troubleshooting and delays as well as process security PCT has enabled all customers to have 24-hour on-line information about their ships and containers through the WEB IP system (Paraskevopoulou et al., 2014).

One of the significant investments is participation in the expansion of the Logistic center that already exists in the port free zone. It is a 7000 sqm warehouse with the name PCDC S.A, consisting of 5200 47sqm. Dry load, 630 sqm maintenance, and freezing and 554 sq.m. dangerous load (Tzannatos & Papadimitriou, 2015). The next phase is to expand to at least 35,000 sq.m. in order to be able to service all the commercial agreements it has signed, the latter with Hewlett Packard providing for

the first phase of 20000 containers per year for promotion to central Europe. In addition to investing in making the port more competitive, there is the advantage of Piraeus' position on the map (Apostolopoulos et al, 2014). For example, via the rail network that completes a cargo from Shanghai to Budapest, it takes 23 days from Piraeus, via Trieste 28 and through Hamburg 33 days. From Shanghai to Warsaw via Piraeus, the journey takes 24 days, via Trieste 28 and Gdansk 36 and through Hamburg 25 days (Tonchev, 2017).

It is undeniable that Cosco's presence in the port of Piraeus, having invested in 2 of the three pier ports, has brought many benefits. Not only has the port been upgraded, but with the investments made since 2009, it has been steadily increasing (Verhoeven, 2014). Taking advantage of the port's main advantage, which is its geographical location, Chinese Cosco has decided to turn Piraeus into one of the largest transit ports linking Asia with Europe, making it an essential link in the Asian supply chain. Central Europe (Tsiotas & Polyzos, 2015).

Specifically, according to data from the International Association of Ports and Harbors, Piraeus Port saw the highest percentage increase in container traffic in five years (2009-2013), reaching 476%, among 50 ports worldwide, in particular, the piers II and III managed by Cosco (Fardellas & Prodi, 2017). That is, from 665,000 TEUs in 2009 to 3,163,000 TEUs in 2013. In 2014, container shipments to Piraeus port reached 3,585,155 TEUs, while by the end of 2015 it is estimated to reach 4,700,000 TEUs (Huliaras & Petropoilos, 2014).

With the presence of Cosco in Piraeus, there is a continuous increase in container traffic, which points to the development of the port and its productivity. All this in

just five years of being in port and not having yet utilized Pier III (Dragovic et al., 2018).

7.4 Prospects of the Port

Greece is a small country in terms of production, so the use of container shipping is of a limited nature. The most strategic option is to make full use of the port. Specifically, the port of Piraeus with the appropriate know-how and investment could be a reference point in global shipping and drive growth in the logistics sector. At present, port activity focuses on container traffic and is rapidly expanding Papadopoilou & Sambracos, 2014). This development, combined with storage and handling via road or rail network, will make the port a world leader. In the container industry, the port can be used as a transshipment or gateway. In the first case, the containers are transshipped to other ships to be transported to the final ports of destination. In the latter case, the containers change the mode of transport (from ship to train, truck) (Shortall et al., 2017). The lack of adequate storage and handling infrastructure in the mainland prevents the port's full potential from being fully utilized despite (Karampela & Kizos, 2015): 1. Unique geophysical location, connecting Asia-West trade routes. 2. Shorter travel time and lower fuel costs compared to the Black Sea and North European ports. 3. Natural depth port that can accommodate the world's largest ships without easy access. 4. Easy access congested, and 5. Fully operational all year long in exceptional weather conditions (Gagatsi et al., 2014)

However, all this requires modernization of inland transport and know-how to make full use of the port and rest of the hinterland. This will develop a whole new economic sector with a large number of regional services (Chlomoudis & Tzannatos, 2016).

7.5 Development of the Port

Undoubtedly, the development of Piraeus in recent years and its development into a transit hub for Europe is undeniable. The transformation of the port began when it was managed by PCC, a subsidiary of Chinese colossus Cosco (Tichavska & Tovar, 2017). With the investments it has made in the last five years, it has managed to make Piraeus Port the most significant Mediterranean port in 2014 with total traffic of 3,585,155 TEUs. By 2015, traffic is expected to reach 4,700,000 TEUs, which means that port demand can exceed many essential ports such as Port Said in Egypt and Algeria in Spain (Kaczmarski, 2015).

The employees of the SEP, except the executives, are all Greeks. Cosco employs about 350 people as permanent staff and 650 as temporary staff (Tichavska & Tovar, 2017).

It has increased traffic by 467% since it first took over the port and is giving at least 2.2m euros a month to the State Treasury. The move by the Chinese to invest in a downward country was of strategic importance. They managed to develop the port and break every record in container management (Chlomoudis & Tzannatos, 2016).

7.6 PCDC Storage Space

Cosco has entered into a strategic partnership agreement with the ELGEKA group for the storage and handling of goods, and recently, the two sides have entered into a new partnership to create new warehouses in the port of Piraeus covering a total area of 7,000 sq.m (Rothenberg, 2015). This is the new storage and distribution center called PCDC (Piraeus Consolidation & Distribution Center) in which Cosco and ELGEKA will participate in equal shares (50/50), and the entire project is reportedly expected to be funded by its Development Bank. China Development Bank (Serena, 2014).

It is the Piraeus Container Management and Distribution Center and is a modern logistics service facility at the Piraeus Container Station. It has spaces for management: 1. dry cargo, 2. Maintenance and freezing products and, 3. flammable materials (Tsamboulias & Karousos, 2014).

One of its significant advantages is that it is within the free zone of the port, so users have many customs and tax benefits, as no customs printing is required to receive the cargo (Coccossis & Papatheochari, 2014). Also, no duties and taxes are payable while staying in the PCDC. The operation of the PCDC plays a vital role in the service of combined transport and in the operation of the port as a transit center for the further promotion of goods by sea, by road and by air as a gateway for goods from the Far East to Greece and then to Europe, the Middle East and Africa. The goods can also be used by rail as the port connected to the network is completed and operational (Maragkogiani & Papaefthimiou, 2015).

PCDC aims to provide high-value services in combination with competitive costs, taking advantage of the port's strategic position, and offering operational opportunities and solutions that will change the data on the current freight map for Greece (Morata Fernandez, 2017).

8 Conclusions

8.1 Aim and Summary of the Study

In this study, an attempt is first made to describe the activity of transshipment, while examining the development and operation of modern mega transshipment hubs, as well as all the elements that contributed to their emergence and development. Next, a review of contemporary scientific literature is followed to determine the position of these hubs today within the global supply chains and how they contribute to shaping their competitiveness. The following section examines the development of this economic activity in the Mediterranean Sea region and presents the criteria that have formed in the past and which continue to affect the development of transshipment in that region today. Finally, a comparative analysis of the largest hubs in the Mediterranean follows, according to their movement data collected during the years 2003 to 2013, while identifying the factors that contributed to their emergence.

8.2 Discussion of Key Literature Review Findings

The introduction of containers was a precursor to the development of combined transport and logistics. The port industry is evolving and ports are now a link in the global supply chain and are being transformed into modern transshipment centers. The role of ports worldwide is no longer limited to arrivals and departures but takes a multidimensional form, creating a wide range of commercial opportunities and additional services. In todays globalized economic reality, mega transshipment hubs are instrumental in the efficient transfer of raw materials, intermediates and finished goods from production points to their consumption points. Transshipment hubs are integral parts of the supply chains they belong to, are influenced by the way they are organized and operated, but at the same time contribute to shaping their overall

profitability and productivity. The constantly increasing market competition has resulted in the respective nodes transshipment to seek continuously to improve and develop all those characteristics that enhance their effectiveness in order to join the modern chain logistics and thus to survive and grow. The use of modern technological equipment and efficient port management are the two elements that each port must adopt in order to maintain its market share but also to attract new customers - users. The investment required in infrastructure and superstructure is quite costly, but it is considered necessary to attract ports to the desired transshipment container movement and to accommodate and accommodate modern large vessels. In addition, we see that investments by private companies as well as their acquisition by liner shipping companies across the ports are an integral part, as they upgrade and make them more competitive. Mergers and acquisitions between ports s clearly show horizontal completions in the port industry, to obtain larger capacity and beyond. Another growing trend is the creation of alliances between carriers. The main incentives that drive carriers to co-operate are cost savings through economies of scale, reduced and shared capital costs, improved competitive position through increased frequency of departure, widening the geographical range of services and redistribution of additional capacity, Industry by reducing entry restrictions, reducing competitive volatility and excluding the best competitor partner. It is also noteworthy that a large part of the shift in production in the countries of the Far East is causing significant changes and highlights the particularly important contribution of the transport sector. Globalization and the increasing consumption of developed countries affect the map of maritime transport and competition the fare is between different conditions shipping lines on sea routes connecting Asia with Europe. In this way ship-owners regulate demand and supply. In addition, the increase in freight flows from Asia to Europe has increased

the market share of Mediterranean ports, which appear to be increasingly emerging as gateways to Asian freight for the rest of Europe. As it turned out, ports in the Mediterranean region have seen a significant increase in the total quantities of containers they manage over the last decade. At the same time, the activity of transshipment grew at a rapid pace, which was left unaffected by the global financial crisis of 2008 which affected both the maritime transport and trade sectors. It therefore becomes apparent that this activity occupies an important position in Mediterranean port activity.

8.3 Study Remarks on the Port of Piraeus

Concerning Greece and the essential part of the country, which is Piraeus, we come to the following conclusions-suggestions:

The granting of piers became the principle for increasing the port's capacity and making better use of it. - To make the port more competitive it has to adapt to the needs and changes of the vessels it serves - The concept of a port cluster needs to be promoted to stimulate competitiveness in the port area - The financial incentive for freighters is one of the main trends in shipping. Container companies and which had to be adopted by the port of Piraeus.

In 2009, after negotiating with major terminal managers, such as Hutchison, the Greek government granted Cosco Pacific a portion of the container terminal at Piraeus Port for 35 years. Cosco Pacific is ranked 5th in the world ranking of the largest terminal management companies, with 9% worldwide in container management. The company is based in Hong Kong and is listed on its stock exchange. About 57% of Cosco Pacific shares are owned by independent investors while the remaining 43% is

managed by China Cosco Holdings, which also owns Cosco Container Lines (5th in the world container shipping line), as well as China Cosco Bulk Shipping , which has the largest fleet of dry cargo ships. The concession made in 2009 concerned piers 2 and 3 of the container terminal. Pier 1 remained in the management of PPA, which prior to the concession was in charge of the entire terminal. According to the agreement, Cosco paid an initial amount of 50m euros to the Greek state. In addition, the Greek state will receive from her a percentage of the revenue as well as a rent related to the surface of the port. It is estimated that over the course of 35 years this sums up to 4.3 billion euros. Following this agreement, Cosco was required to invest in Pier 2 to increase the total volume of containers managed by the terminal. In addition, it is committed to work on Pier 3, which started operating in early 2014. To be able to organize its operations, Cosco Pacific established PCT (Piraeus Container Terminal) as a subsidiary, which started operations. of 1/10/2009.

Specifically, in Piraeus, there is a network of companies indirectly related to shipping, in the wider area of Triassion. Of these activities, carried out in the wider region, the value-added amounts to € 1.9 billion. In addition to the port, the wider area includes the industrial zone of Aspropyrgos, as well as liquid cargo terminals at Agioi Theodoros, Elefsina and Megara. In the future, it is estimated that with the increase of containers in the port of Piraeus and with Cosco's plans to develop a rail network that will attract various colossal companies, the non-shipping sectors will generate 2.5 billion euros. in 2018 from just 0.4 billion euros in 2012. The benefits will be even greater if we take into account the jobs created by such growth in the wider region.

Piraeus seems worthy of claiming the title of the fastest growing port in the Mediterranean, both in terms of its superstructure and infrastructure and in the cargo it

manages. His transshipment project has grown significantly both at the COSCO terminal (PCT) and at PPA Pier 1. There are many shipping companies that are interested and are considering making Piraeus their main port of shipment. But what are the factors that make Piraeus an ideal transshipment option in the Mediterranean? Its first and foremost reason is its geographical location and its distance from the Suez Canal. Observing the rapid growth of the Chinese market, in the Asia-Europe market, Piraeus is almost on the sea route that the ship will follow as soon as it crosses the Suez Canal. So, the operating costs of the ship, which will choose Piraeus for its transshipment, for example Marport to Constantinople, will be reduced as it will have a shorter route from the canal to Piraeus than to Constantinople. I consider geographical location to be of the utmost importance because, due to reduced demand for freight, freight rates are constantly decreasing 22, overcapacity continues to exist and shipping companies are trying to limit their losses by reducing costs in a variety of ways, one of them is the reduction of fuel.

The good Mediterranean seas but mainly the lack of socio-political upheavals in Greece, and thus in Piraeus, create a favorable climate so that ships can safely anchor without delay and without imposing a risk overrun approach 23 shipping companies.

The natural features of Piraeus Port are its key ally in the Mediterranean port battle in terms of transshipment. Its natural draft is on average 15.5 meters, with points reaching 18 meters. This means that, in combination with the high productivity of its cranes, 24 can serve, in good time, very large ships with a large draft. High productivity reduces the time spent at the parabola, thus making shipping profitable. lines and faster delivery to the final recipient. In addition, it helps create a competitive advantage for the port over the rest of the Mediterranean ports.

It seems that Cosco has greatly contributed to the development and enhancement of the port in many ways. In addition to its ongoing infrastructure investments, it aims to develop the rail network both for inland connectivity and to promote products arriving at the port of Piraeus in the Balkans and Central Europe. In addition, given that Cosco belongs to the CKYHE alliance, the ships arriving in Piraeus are also of K-LINE, YANG MING, HANJIN, EVERGREEN, immediately increasing the clientele that is "tied" to the terminal, thus leading Piraeus to gain. these colossal lines.

Finally, shipping costs to Cosco's terminal appear to be lower than other Mediterranean ports, while maintaining high productivity. This is an element that works favorably for shipping lines which, depending on their position in the terminal's clientele, can conclude compression agreements for these costs, making Piraeus highly competitive in the Mediterranean.

Shipping lines do indeed choose a port as a hub port, but this is not the case and it cannot be in such a rapidly changing and dynamic environment as maritime transport. Hub ports are changing because demand is changing, the flow of goods, the shipping policies and more. Based on the above framework we set out, we can say that, of course, both Port Said and Piraeus have all the elements needed to become a hub port in the Eastern Mediterranean, or more accurately we could say that some shipping line would could take advantage of the services offered by these two ports, in conjunction with their geographical location and what we have mentioned above, to ship its containers there for various destinations, since these ports are surrounded by different ports. a reliable network of feeder vessels. We reiterate that this is not permanent and does not mean that it cannot change again from the existing conditions and the complexity that distinguishes the maritime transport sector. In conclusion, according

to what has been said, and based on my own experience, we could say that in the Mediterranean port competition race, a transshipment center is likely to be chosen whichever port shows an upward trend in its domestic market would certainly be It is legitimate for the shipping lines to combine the elements of Piraeus and Port Said. This seems to have an interesting dimension, if we consider the following: with the shipwreck the shipping lines will have as their primary objective the maximum use of space to achieve economies of scale, but when the port of purchase is weak, the shipping line is trying to "fill" its premises either with transshipment cargo or with cargoes for other ports on the ship's route. This is causing uncertainty for the line, which in view of the low export and import activity of a port that is thinking of making a hub port, rightly wonders if the feeder vessels have enough cargo to maintain the reliability of their departures and be able to cope with their operating costs. It is next that they want a safety valve so that at times when the load to be downloaded can be low, the feeder service can be supported by local load. Finally, when a country's market is weak, it is next for shippers or consignees to claim a low freight ferry from the shipping line, which will switch to other markets to cover space on its ships with higher fare.

8.4 Recommendations for Future Research

The rapid growth that it has presented, as well as the promising prospects for its further growth in the future, requires mega transshipment hubs to continually look for new ways to improve their efficiency and competitiveness. Only in this way will they survive, increase their profitability and grow further.

To make the port more competitive it has to adapt to the needs and changes of the vessels it serves. Moreover, a concept of a port cluster needs to be promoted to simulate competitiveness in the port area.

The analysis of the port's activities should be studied at a further level by examining its operational stages in order to determine the right responsibilities for the right players for its faster development. The analysis of the port's activities should be further studied at a further level by examining its operational and operational stages in order to determine the right responsibilities for the right players for its faster development. Port managers could follow the design of viable investment plans in line with market and demand requirements. Taking advantage of the unparalleled natural advantage of their geographical proximity, they must undertake a thorough analysis of their demand and environment. In this way they will be able to meet the changing demands of the market and global carriers in a timely manner by undertaking the necessary investment projects to expand and upgrade their infrastructure and upgrades.

What is also needed is to improve the road network outside the port so as to combat congestion at the port and to allow all vehicles in and out of port to run smoothly without delay. In addition, sufficient stacking space for the containers is necessary so that there are no delays internally.

Further research and evaluation of the data to assess the potential of the Thessaloniki Port, which is the second largest port in the country, as well as the existing problems is proposed.

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