ISCTE Business School
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TRANSSHIPMENT PORT SELECTION IN THE STRAIT OF GIBRALTAR

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Abstract

The purpose of this study is to understand which factors impact more in the transshipment container port selection process in Gibraltar range.

Analytical Hierarchy Process is applied through a survey. A random sample of 27 respondents ranked criteria based on pairwise comparisons and evaluated transshipment container ports through a 5-point Likert scale.

The results suggest that vessel turn-around time, the proximity to the main navigation routes and the handling and storage cost of containers are the criteria that most impact in the transshipment port selection process.

Further analysis could also extend to the switching costs in the transshipment business through previous cases, framing a cost-benefit analysis. Another future direction for research is a study in transshipment port selection with a higher number of respondents, comparing different perspectives, from maritime carriers to terminal managers, amongst others stakeholders.

The results suggest that Port of Algeciras is the one that most fulfills productive criteria; Port of Tanger is the most competitive regarding costs; Port of Valencia has been able to balance transshipment and gateway services.

This study is one of the first attempts to demonstrate the theoretical concepts of transshipment in one of the busiest bottleneck areas. The value of this study relies that academics and professionals may have supporting evidence that costs and productivity are the most valuable transshipment port criteria. The current situation in the transshipment in Gibraltar range could also be valued by port managers to define and prioritize new investments.

Keywords: Transshipment; Port Selection; Strait of Gibraltar; Containers

JEL Classification System: L920; R420

Resumo

O objetivo deste estudo é perceber quais os fatores mais relevantes na tomada de decisão de um porto de contentores de *transshipment* na zona do Estreito de Gibraltar.

O método *Analytical Hierarchy Process* é utilizado através da construção de um questionário. Os 27 inquiridos hierarquizaram um conjunto de critérios através de comparações aos pares e avaliaram os portos através de uma escala de Likert de 5 níveis.

Os resultados obtidos sugerem que o tempo de transbordo, a proximidade com as principais rotas marítimas e o custo de transbordo e armazenagem de contentores são os critérios mais relevantes aquando a tomada de decisão.

É recomendada uma maior investigação, abrangendo os custos de troca de um porto *transshipment*, através do estudo de casos anteriores, construindo uma análise custo-benefício. Outra possibilidade passa pelo estudo do processo de seleção de um porto *transshipment* com um maior número de inquiridos, comparando perspetivas de diferentes intervenientes.

Os resultados sugerem que o porto de Algeciras é o que melhor preenche os critérios de produtividade; o porto de Tanger é o mais competitivo em termos de custos; o porto de Valência tem sido capaz de apresentar um equilíbrio como porto de *transshipment* e como porto *gateway*.

Este estudo é um dos primeiros a aplicar os conceitos teóricos associados ao *transshipment* a uma das áreas geográficas mais relevantes para o negócio. Académicos e profissionais dispõem assim de evidência prática de que os custos e a produtividade são dos critérios mais relevantes no processo de decisão, ajudando-os a definir e priorizar novos investimentos.

Palavras-chaves: *Transshipment*; Seleção de Portos; Estreito de Gibraltar; Contentores

Sistema de Classificação JEL: L920; R420

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1. Executive Summary

This research intends to study the transshipment port selection process in the Strait of Gibraltar, namely which are the most relevant decision factors to choose a transshipment port, which are the most attractive transshipment ports and which factors present a greater gap between importance and performance, in the addressed environment.

According to Panayides & Song (2008), ports are recognized as the springboards for economic development, since economies are dependent of international trade. Thus, both the maritime transport of cargo and the port industry have been important players in the integration of economies. For shipping container companies, the goal is to maximize the usage rate of vessels, leading to a growing importance of intermediates locations between origins and destinations in which containers are transshipped between vessels (Notteboom, Parola, & Satta, 2014). In the last 15 years, long-distance transshipment more than tripled and nowadays represents 28%-30% of all TEUs handled by ports (Rodrigue, Port Economics, 2015). However, transshipment activities aren't spread across the world uniformly. Notteboom referred that "*Strait of Gibraltar is strategically located on some of the most important East-West trade lanes"* (Port Economics, 2015). The author gives special importance to the role of 5 ports in the region: Sines, Valencia, Malaga, Algeciras and Tanger Med. Algeciras is considered the largest container port in the Mediterranean, achieving a transshipment incidence of 95%. The second largest container port is Valencia, combining its gateway function with relevant transshipment flows. Tanger Med and Sines are considered by Notteboom (2015) *"the new kids on the transshipment business block"*. Malaga has a constant transshipment incidence of 90% over years (Notteboom, Parola, & Satta, 2014)

Several authors have studied the ports choice model from different perspectives. Lirn, Thanopoulou, Beynon, & Beresford (2004) developed one of the few studies regarding transshipment port selection. The authors concluded that the final 5 most important transshipment port selection criteria were: handling cost of containers, proximity to main navigation routes, proximity to feeder ports, proximity to import/export area and basic infrastructure condition (water access, depth). In the recent literature, it is also enhanced the importance of value-added services in ports. Nam & Song (2011:201) stated that customers began "*to ask ports to provide a greater variety of services*" specifically value-added logistics services.

The Analytic Hierarchy Process was implemented through a survey based on the research developed by Lirn, Thanopoulou, Beynon and Beresford (2004), Te survey was divided in 3 sections: the first section required the respondents to make pairwise comparisons of the thirteen criteria, according the nine-point fundamental scale (Saaty & Vargas, 1994); the second section ask the respondents to ranked the ports for each one of the thirteen criteria, according a 5-point Likert scale as suggested by Min, Mitra and Oswald (1997); the third section was related with the profile of each respondent and port use behavior.

From the analysis of data collected it is possible to conclude that the vessel turn-around time and proximity to main navigation routes were recognized by respondents as the two criteria to have more impact in the final decision to choose a transshipment port, respectively with 11.2% and 10.6%. On the opposite, management and administration efficiency and port security and safety were considered with lower importance in the final decision. Taking in consideration the overall score, Algeciras is the best choice for the transshipment of containers, followed by Valencia and Tanger.

Furthermore, vessel turn-around time is the most important criteria and is one of the criteria that presents greater standard deviation, meaning that there are significant differences of quality between the transshipment ports under this criterion. In practice, Sines and Malaga are the transshipment ports with the higher gap for Algeciras (considered the best port regarding vessel turn-around time).

The addition of a 13^{th} criteria (availability of additional services) on the research, compared with 12 criteria used by Lirn, Thanopoulou, Beynon and Beresford (2004), does not seem to have significant differences between twelve and thirteen criteria analysis. Nevertheless, when calculated the final choice of a transshipment port assuming the performance score attributed by respondents, several changes occur. Sines, Tanger and Algeciras improve their overall performance if we consider twelve criteria instead of thirteen. If availability of additional services was not considered, Tanger will place as the second in the Gibraltar range to realize transshipment services. Moreover, Sines increases the overall score distance to Malaga, as well as Algeciras that improves its rank as the best transshipment port.

2. Introduction

2.1. The importance of maritime transportation, of ports and of its evolution

By creating value in an economy, transport represents a link between regions and economic activities, being an indispensable asset of any economy. Also being one of the key drivers of human economy all over the world, it "*plays a major role in spatial relations between locations"* (Rodrigue, Comtois, & Slack, The Geography of transport Systmes, 2013:5). The role of ports in an economy is assumed as an important issue to improve the competitiveness of a country as UNCTAD (2014:69) wrote: "*port development is an essential process for any country wishing to successfully engage in international trade and shipping is one of the most cost-effective means of transport over long distances".* According to Panayides & Song (2008), ports are recognized as the springboards for economic development, since economies are dependent of international trade. Gonçalves (2015) complemented with the idea that ports are not just important for the globalization process and international trade, but also for the whole national economy of each country, since they are responsible for a higher percentage of cargo inflows and outflows than other transport modes, between national regions. In addition, UNCTAD (2014) pointed that the growth of international trade tended to be higher than the growth of world economy. Thus, both the maritime transport of cargo and the port industry have been important players in the integration of economies. Yercan & Yildiz (2012:29) stated that "*global economic growth affects the world seaborne trade volumes as maritime trade is the most commonly used transport mode in international trade, which is about 85 percent of the total transport volume in most of the years".* According with Autoridade da Concorrência (2015) 74 % of trade, between Europe and the rest of the world, is made by maritime transport.

The role of ports in an economy has changed over the years. Containerized shipping is at the forefront of maritime transportation as an engine of globalization (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013). Effectively, the use of containers brought several benefits, taking, today, an important role in the globalization process (Gonçalves, 2015). The advantages associated with it, for instance, efficiency improvements surpass the difficulties associated with distance and geography constrains (Gonçalves, 2015). According with UNESCAP's report (2005) there were three evolution stages of port. The first pattern happened until 1960: ports were just a link between sea and inland transport systems. The main activities were cargo handling and

cargo storage. In the second stage, regarding ports built between 1960 and 1980, the activities of ports increased. At this time, activities like packaging, labeling and physical distribution were added to the previous functions. It was perceived that customers are important stakeholders to satisfy and moreover, it was realized that would be better keep long-term relationships with them. Thus, were created several companies in ports and freight forwarders and cargo owners started to have tighter agreements. The last stage, started in 1980 with the increased importance of intermodal transport systems. The activities of production and transportation were linked to form an international network UNESCAP (2005). Ports began to be not only the connection to inland transportation, but also to logistics services and distribution. In other words, this was the starting point of the third-generation ports, which had to embrace in their strategy the analysis of customer's needs and marketing in order to improve engagement. At this stage, not only ports improved their services, but also customers began "*to ask ports to provide a greater variety of services*" (Nam & Song, 2011:201), specifically value-added logistics services.

In the last 20 years, there were several authors that studied the performance and efficiency in maritime transportation since the containerization and globalization phenomena has raised new challenges (Culinnane & Song, 2005) for different maritime stakeholders: "*forced the development of infrastructure facilities, increased the vessel transport capacity and favored the emergence of hub port"* as it was stated by Fleming and Hayuth, cited by Caldeirinha & Felício (2013:1). Additionally, The Economist cited by World Shipping Council declared that the "*container has been more of a driver of globalization than all agreements in the past 50 years together"* (Council, 2014). This argument is reinforced by Marc Levinson (2006) suggesting "*that the container and container shipping are largely responsible for the growth of global trade"* (Council, 2014).

Ducruet & Notteboom (2012:77) developed "*a comparison between world container traffic and world container throughput revealing that a container on average was handled 3.5 times between the first port of loading and the last port of discharge, in 2008, while, in 1990, this figure was 3 times*". These achievements were possible due to the effort to reach an international standard agreement, in the early stages, concerning official container's dimensions (Hayashi & Nemoto, 2012). Hayashi & Nemoto (2012) referred that the most important benefit of container evolution is the decrease of

terminal costs by the conversion of labor intensive industry to a capital-intensive industry, based on the use of gantry cranes to unload and load containers.

Since "*customers seek a service that is quick, reliable and flexible and yet also offers the lowest price"* (Lee, Nam, & Song, 2012:16), and this is directly related with efficiency and effectiveness, the measure of how well the resources are used is an important issue (Lee, Nam, & Song, 2012). Tongzon was one of the first authors to study port performance and efficiency and he stated that, in order to achieve and to keep a competitive position in the international maritime markets, it is necessary to continually understand the factors of port competitiveness and continually measure its performance in relation to the rest of the world, in order to design and to apply the best port strategies (Tongzon, 1995). Rodrigue, Comtois and Slack (2013:8) also stated that "*a better understanding of spatial relations is essential to assist private and public actors involved in transportation to mitigate transport problems".*

From a network perspective, the choice of a container port isn't always guided by the proximity to the final destination (hinterland region) (Notteboom, Parola, & Satta, 2014). For shipping container companies, the goal is to maximize the usage rate of vessels, leading to a growing importance of intermediates locations between origins and destinations in which containers are transshipped between vessels (Notteboom, Parola, & Satta, 2014). In the last 15 years, long-distance transshipment more than tripled and nowadays represents 28% to 30% of all TEUs handled by ports (Rodrigue, Port Economics, 2015).

According with Monteiro (2013:47) "*the transshipment of containers at a container port or terminal can be defined as the number of containers (in TEU) of the total container flow that is handled at the port or terminal and transferred to another ship to reach their destinations*". Thus, transshipment incidence refers to the share of transshipment containers, taking in consideration the total volume handled by the port (Rodrigue, Comtois, & Slack, 2013). The higher the transshipment incident, the greater its consideration to be a transshipment hub.

However, transshipment activities aren't spread across the world uniformly. Geography takes an important role in the definition of transshipment markets, since they are commonly established in the crossroads of shipping routes or near bottlenecks, such as straits or canals (Rodrigue, Comtois, & Slack, 2013) (annex 2). Monteiro (2013) stated that most of the transshipment ports are located along the circum equatorial route that

goes through Panama, the Strait of Malaca, Suez and Gibraltar. In addition, Notteboom, Parola & Stata (2014) also consider Straits of Gibraltar, Malaca and Suez and Panama Canal as the most prominent locations for transshipments activities. Furthermore, the authors defended that the "*creation of transshipment hubs does not occur in all port systems, but around specific regions, thanks to geographical, nautical and market-related advantages*" (Notteboom, Parola, & Satta, 2014:9)

Rodrigue, Comtois & Slack (2013) discussed the existence of seven major transshipment markets, however, they have highlighted three of them, as well as Monteiro (2013): Southeast Asia (hubs of Singapore and Tanjung Pelepas); Caribbean region and Mediterranean (hubs of Algeciras, Gioia Tauro, Marsalokk, Port Said). Notteboom also referred that "*Strait of Gibraltar is strategically located on some of the most important East-West trade lanes"* (Port Economics, 2015). The author gives special importance to the role of 5 ports in the region (annex 3): Sines, Valencia, Malaga, Algeciras and Tanger Med. First, Algeciras is considered the largest container port in the Mediterranean, achieving a transshipment incidence of 95%. The second largest container port is Valencia, combining its gateway function with relevant transshipment flows. From a transshipment incidence of almost 20% in 2004, Valencia, achieved in 2012, a transshipment incidence of 50% (Notteboom, Parola, & Satta, 2014). Tanger Med and Sines are considered by Notteboom (2015) *"the new kids on the transshipment business block"*, since "*both ports have managed to significantly increase their share in the past five years: Sines from 2.7% in 2008 to 9.2% in 2014, Tanger Med from 10.7% in 2008 to 23% in 2014"*. Sines increased its transshipment incidence from near 0% in 2004, to almost 60% in 2012 (Notteboom, Parola, & Satta, 2014). Lastly, Malaga has a constant transshipment incidence of 90% over years (Notteboom, Parola, & Satta, 2014), however, the volume of TEUs handled decreased from 542 thousand TEUs in 2007 to 100 thousand TEUs in 2014.

2.2. Goal and research questions

Having selected the broad area of study (port and maritime economics), and having identified a topic (transshipment port choice), the first step in defining this research process involves defining the goal and research questions, in accordance with the topic and area of study.

The dissertation has three main goals:

- to identify the relevant and irrelevant decision factors to choose a transshipment port in the Strait of Gibraltar market;
- to identify the transshipment ports with the best offer of services, in the Strait of Gibraltar market;
- to identify, to each port, the gap between performance and importance, for each decision factor.

The research questions that arise from the goal definition above are:

- Research question 1: Which are the most relevant decision factors to choose a transshipment port in the Strait of Gibraltar transshipment area?;
- Research question 2: Which are the most attractive transshipment ports for maritime carriers, in the transshipment market near Strait of Gibraltar?;
- Research question 3: Which factors present a greater gap between importance and performance, in the addressed environment?

The rationale for research questions arises from the observation of literature review: there isn't a homogeneous consensus between authors regarding the decision factors influencing ports' choice behavior, depending on actors and on which geographical area was applied the investigation. Besides, to have some authors that indicated successful factors for a transshipment port, this factors were not, yet, applicable to the Gibraltar transshipment market. Moreover, it is important to port authority or operator to understand which are the priorities of customers, in order to make better investment decisions and overcome competition. Furthermore, for some authors, the greater the variable total throughput (in TEUs), the greater the success. However, ports have different strategies, different roles in the network, different infrastructures and resources, and even the performance variables are not consensual between port managers and academics. Thus, it seems relevant, to understand from the point of view of customers, which are the transshipment ports that better fit their needs.

3. Literature Review

3.1. Maritime logistics and its value

Logistics is defined "as part of supply chain management that plans, implements and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in

order to meet customers' requirements" (Council of Supply Chain Management Professionals, 2015)

Regarding logistics management, it is well-defined that there are several activities included in this concept: fleet management, inbound and outbound transportation management, warehousing, order fulfillment, materials handling, logistics network design, inventory management, supply/demand planning and management of third parties' logistics services (Council of Supply Chain Management Professionals, 2015). It is also assumed that logistics function also includes sourcing and procurement, production planning and scheduling, packaging and assembly and customer service. (Council of Supply Chain Management Professionals, 2015). Thus, maritime transportation is integrated in logistics management process and, in the last years, has evolved to a wider concept – maritime logistics.

In literature, academic researchers assume differences between maritime transportation and maritime logistics. Maritime transportation is one of the key logistics systems, responsible for carrying and handling cargoes across oceans and, consequently, connect suppliers and customers. Furthermore, it is related with specific sea transportation activities, as contracting, shipping, sea voyage, moving, loading and unloading cargo (Lee, Nam, & Song, 2012). Also, maritime transportation is a part of maritime logistics, defined as the process of plan, implement and manage the movement of goods and information involved in ocean carriage (Lee, Nam, & Song, 2012). While maritime transportation's scope is to improve competitiveness of transport terminal operators and sea transportation, maritime logistics involves not only maritime transportation, but also other logistics services as warehousing, inventory management, offering distribution center, quality control, assembly, packaging, repairing, among others (Lee, Nam, & Song, 2012).

Effectively, maritime logistics is composed by several players: maritime carriers, freight forwarders, shippers, port authorities, port terminal managers and stevedoring companies. However, other players are linked with maritime logistics, for instance, road and rail carriers, assembling and packaging industries, warehousing companies and tugboats.

The three key players that comprise the maritime logistics system are shipping lines, port or terminal operators and freight forwarders (Lee, Nam, & Song, 2012). These are considered the three main players and their activities in the maritime logistics can be

divided in main function and supportive logistics activities. First of all, maritime carriers have as main function the movement of cargos between ports, but also developed supportive functions, such as pick-up services, delivery notification, container tracking and intermodal services (Lee, Nam, & Song, 2012). Regarding port terminal operators (include stevedoring companies and terminal manager), its role concern on loading or unloading cargoes into or from a vessel and to link it with inland transportation. Additionally, port terminal operators could offer warehousing services, storage and packaging (Lee, Nam, & Song, 2012). At last, freight forwarders are a third intermediate party that is engaged in the process of maritime transportation, facilitating the booking of vessels and preparing documentation, being also able to offer logistics services, for example, inventory management, warehousing and packaging. Regarding the maritime logistics process, these three players act as suppliers and customers with each other's mutually. For instance, shipping lines choose a port for their vessels to be anchored and freight forwarders work for shippers by preparing documentation and booking vessels. With all of this interactions Supply Chain Management (SCM) has become an important issue in international maritime transportation. Lee, Nam & Song (2012:9) believe that a critical strategic objective of maritime industry is the "*maximization of the maritime logistics value and it successful integration into global logistics".*

Considering, simultaneously, the requirements of senders and receivers, ports can develop an integrated logistics supply chain management system (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013). This way, it will be possible to deliver a better service to customers. However, maritime logistics would not be limited only to ports or shipping lines, since "*all of the activities in a logistics system are interconnected with each other and their operations are directly or indirectly affected by others. For instance, delays in shipping may cause serious problems, not only with processing other successive work but also with delivering goods on time to the final customers"* (Lee, Nam, & Song, 2012:16).

Each one of maritime players should keep in mind a common and fundamental goal - improve operational efficiency and service effectiveness – in order to reach a greater customer satisfaction (internal customers and final customers).

3.2. Advantages of containerization

Rodrigue, Comtois and Slack (2013) have identified several advantages that containerization introduced in maritime logistics. First of all, a container has regulated dimensions, respecting an ISO standard, which makes it a standard transport product. In addition, it can transport a wide variety of goods, bringing flexibility of usage. Third, in terms of management, a container has a unique identification number and a size type code, improving transport management (example: it is possible to know the location of containers or if it is carried by an authorized agent of the cargo owner and it enables to manage priorities, the destination and available transport capacities.) Furthermore, containerization improves efficiency in transshipment operations, since it allowed to reduce transshipment times: for instance, it takes, on average, between 10 and 20 hours to unload 1000 TEUs compared to between 70 to 100 hours for a similar quantity of bulk freight. Ships were used to spend until three weeks in a port undergoing loading and loading, and now even the largest ships spend less than a couple of days in port. Assuming the same volume of cargo in a ship, before containerization, would be required 24 thousand man/hours to handle, while today are just required 750 man/hours. Moreover, it facilitated the process of warehousing since containers are resistant to shocks and weather conditions. The warehousing process is simpler, less expensive and can occupy less volume. Besides, containers fit together permitting stacking on ships, trains and on the ground. Containerization brings economies of scale, since a 5000 TEU vessel has operating costs per container 50 percent lower than a 2500 TEU container ship. Before containerization, maritime transportation costs could account between 5 to 10 percent of the final cost and nowadays this weight was reduced to about 1,5 percent.

3.3. Port choice models from different perspectives

Several authors have studied the ports choice model from different perspectives. Two of the most important variables that were proved to influence the ports' performance are the preferences of carriers and shippers, and number and frequency of maritime routes (Moreira, 2013; Heng & Tongzon, 2005; Caldeirinha & Felício, 2013; Ducruet & Notteboom, 2010). In addition, Rodrigue, Comtois and Slack (2013) stated that there are three major attributes that are linked with the performance and importance of terminals. First one is location, since the main goal of a transport terminal is to serve a long concentration of population and/or industrial services: the larger the range of the hinterland, the greater the importance and performance of a port. Secondly, the authors consider that the accessibility to the terminal and your own market area is another key

attribute to achieve importance in the maritime network. In others words, a terminal with few connections, either by rail, road or sea, to the hinterland and foreland would have smaller importance and consequently a smaller performance. The last key attribute is the infrastructure, whereas the main function of a terminal is to handle and transship freight: heavy investments should be done in order to accommodate current traffic and anticipate future trends to achieve a better performance.

On the other hand, Rodrigue, Comtois and Slack (2013) have identified constrains on maritime access and interface, weak land connections and poor infrastructures and equipments as the cause for the failure and uncertainty of some ports. Also, Wiegmans, Hoest & Notteboom (2008) studied the port and terminal selection by deep-sea container operators, Tongzon (2008) studied the port choice by freight forwarders, Nir, Lin & Lian (2003) explored the port choice behavior from the perspective of a shipper, Tongzon & Sawant (2007) investigated the port choice in a competitive environment from the shipping lines' perspective, Saeed (2009) analyzed the carriers' selection criteria when choosing container terminals in Pakistan, Aronietis, Voorde & Vanelslander (2010) investigated the port competitiveness determinants of selected European ports in the containerized cargo market; and Chang, Lee & Tongzon (2008) studied the port selection factors based on differences between trunk liners and feeder service providers. This way, there are some studies that investigated performance, efficiency and port choice behavior regarding ports and container terminals, but not exclusively, transshipment terminals. According to Saeed (2009) few studies have been performed to analyze the factors that improve attractiveness for its users. Regarding users, it is necessary to clarify that, not only shipping companies and shippers contribute to port choice, but also forwarders and terminal operators (Aronietis, Voorde, & Vanelslander, 2010). Whereas the former think in the short and medium term, the latter make decisions in the long-term (Aronietis, Voorde, & Vanelslander, 2010). Furthermore, the authors stated that different actors have different criteria for port selection. Through interviews to shipping lines companies, Aronietis, Voorde & Vanelslander (2010:9) clarify that "*seaport selection is always done by shipping companies, but (...) this choice is influenced by the range of clients that can be served through that port and links to particular destinations".* In general, the most relevant criteria seem to be cost, quality of hinterland connections, port capacity, and reliabilty (Aronietis, Voorde, & Vanelslander, 2010). Jafari, Saeidi & Karimi (2013) concluded

that the rate of loading and unloading, a reliable scheduling program, and an optimized multi-modal network to the port (land, railway and aerial) are the three most important quality attributes from the perspective of shipping expert's ports.

Chang, Lee & Tongzon, (2008:885) investigated the port selection factors by shipping lines taking in consideration the differences between trunk liners and service providers, concluding that "*the former was faced with more fierce competition requiring them to provide more comprehensive and value-added services than the later".* Hayashi & Nemoto (2012) praised that there are, already, shipping companies and forwarders offering not only maritime transport, but also third-party logistics (3PL), as packaging, warehousing and logistics processing. Furthermore, they also stated that some 3PL providers could manage the whole process of procurement. Baird (2012) investigated by survey the logistics services and value-added services offered by the top 20 container operators and world fleet, concluding: all of them offer inland transport services; 60 % offer warehousing and supply chain planning and 70 % provide vendor management. In addition, the author concluded that that 80 % of lines intend to further develop their logistics activities through strategic alliances with specialist logistics providers. With this study, the top 20 liner operators were ranked regarding the logistics services provided, based on the scope and extend of logistics services and also on the estimated total share of revenues derived from logistics services. He designed 3 tiers: the first one, composed by Maersk Line, APL an NYK, is a comprehensive global logistics services (carriers provide almost any logistics service demanded, logistics services provided virtually anywhere in the world and logistics services revenues exceed 3 billion dolars per annum; logistics income amounts to 20 to 40 percent of ocean transport income); the second one, composed by Cosco, K Line, MOL and OOCL, is a comprehensive regional logistics services (provide a wide range of logistics services, mainly in major regions; logistics services revenues between 1 to 3 billion dollars per annum, being 10 to 20 percent of ocean transport income); The third one is a limited logistics service (MSC, Evergreen, CMA-CGM, Hamburg-Sud, among others). However, Panayides, Wiedmer, Andreou, & Louca (2012), in their research, conclude that despite the desire of liner companies to offer more customer-oriented logistics services these don't want compete with forwarding agents that have been close partners and customers for the liner company.

Roso and Rosa (2012:185) stated that the existence of an inland port or dry port is a way to improve added-value and competitiveness of a port, because seaports "*compete not only on tariffs and transshipment capability"*. They stated that inland ports are also a way to increase port throughput. Thus, the authors explained that a dry port is "*an inland intermodal terminal directly connected by rail to seaport(s) where customers can leave/pick up their units as if directly to a seaport"* Roso and Rosa (2012:183). Additionally, other services can be offer in a dry port such as maintenance of containers and customs clearance. In this study the authors defend that the existence of a dry port brings several benefits to the competitiveness of a seaport, as for example it would reduce congestion at the seaport gates and its surroundings. Besides, it could increase the terminal capacity and solve the problem of lack of space, enabling to increase the productivity, since bigger container ships could call at the seaport. Moreover, a dry port not only carry advantages to seaports but also to carriers and to the region. Carriers will face less congestion at the terminals and consequently fewer delays and fewer financial losses. The dry port will also improve the attractiveness of the region with the establishment of new business, which lead to new jobs (Roso & Rosa, 2012). One of the most successful dry ports is located in Coslada, Spain, distancing 600 km to Barcelona, 400 km to Bilbao, 660 km to Algeciras and 360 km to Valencia. Madrid's dry port is managed by this four ports and the main goal is to "*facilitate transport organization, customs and administrative procedures for a competitive position of the ports in the region"* (Roso & Rosa, 2012:189). Van der Lugt and De Langen cited by Centin (2012) asked "why should port authorities get involved in the hinterland?" and Centin (2012) stated that is to ensure port competitiveness. Cited by Centin, several authors explained this point of view: Bichou and Gray stated that ports are central nodes in supply chain; Notteboom explained that port, foreland and hinterland are closely bound together in a symbiotic relationship; Notteboom and Winkelmans explained that ports are not competing as sole entities but as parts of complete transport and supply chains. In addition, Centin (2012:262) stated that "*to develop effective ports within logistics chains, port authorities should function as a coordinator, integrator and facilitator in logistics chains, follow market developments, promote and sustain an efficient intermodal transport system, develop strategic relations with the hinterland and supply chain partners, invest in the port community system and cooperate closely with inland terminals and neighboring ports".* Thus, ports have to adopt different strategies according to their aspirations: either to become a hub port, or a regional feeder (Chang,

Lee, & Tongzon, 2008). However, an overview of world trade flows indicates that although long distance trade is steadily growing, trade within regions is still more significant than trade between regions (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013).

Another phenomenon is that the growth of containerization traffic has leaded to a huge increase of competition between shipping lines in order to obtain economies of scale, by ordering of larger vessels (Nam & Song, 2011:275), since "*huge vessels make it possible for only few ports to accommodate them, leading to the division of container ports into hub and feeder ports".* Tongzon (2008) cited by (Nam & Song, 2011) has provided some factors as strategic location, large capacity port area, and port capability for larger vessel. To be a hub port should be located near the most important trade lanes, in order to enable the "spoke" activity (Nam & Song, 2011). These authors also stated that a "*maritime logistics hub is a nodal point (...), a principal distribution center (...) on the regional and/or international scale"* (Nam & Song, 2011:282).

Tongzon & Sawant (2007) also researched the port choice in a competitive environment from the shipping lines' perspective, using an interesting method. They started by elaborating a survey and sending it to shipping lines, in order to obtain the importance of various factors. Then, they used an observation method to confirm the first statements about factors. This way, it was possible to conclude "*the inconsistency between the stated preference and the revealed preference of shipping lines for factors influencing their port choice"* (Tongzon & Sawant, 2007:478). Tongzon & Sawant (2007:486) also stated that port charges influence a lot the port choice and "*although several studies have shown that quality always takes precedence over price, there is only a maximum price that the shipping lines would be willing to pay".* Considering that price is an important decision factor, it seems important to analyze seaports costs. Rodrigue, Comtois and Slack (2013) stated that terminal costs represent an important percentage of transport costs and could be divided in infrastructure costs (include investment and maintenance of structures such as piers, runways, cranes, offices and warehouses), transshipment costs (mostly associated to unloading and loading freight) and administration costs. These authors also explained that over the last decades significant efforts have been made to reduce terminal costs, through the introduction of information management systems and through the mechanization of loading and

unloading activities. Furthermore, more efforts can be made, through the use of more fuel-efficient vehicles and larger ships.

Yercan & Yildiz (2012:35) highlighted one specific type of shipping transportation: liner shipping, defined as a "*vessel carrying cargo that operates on a route with a fixed schedule".* In this situation, when the main advantages are the regular schedule of vessels anchoring at many ports in specific dates and times, the author stated that relative position on the network is an important issue that impact cost transportation. Thus, the location factor becomes a strategic issue for the competitiveness of the port and directly linked with port performance. Furthermore, Ducruet & Notteboom (2012) concluded that when shipping companies design their networks, they have to do a trade-off between the requirements of customers and operational costs. In one hand, shippers make a strong pressure to realize their requirements, as preferred ports of loading and unloading, schedules, feeder linkages, among others (Ducruet & Notteboom, 2012). On the other side, shipping line companies have to optimize their costs looking for ship utilization and benefit the most from scale economies in vessel size. Ducruet & Notteboom (2012) praised that the port selection process of liner shipping companies is related with the trade route analysis. The identification of possible ports of call is done just after the identification of the trade route. The second step is to take in consideration the demand, supply and market profile of ports and behavioral impacts on port selection (Ducruet & Notteboom, 2012). For the demand profile of ports are listed factors as flow orientation and geographical specialization, port scale and growth, frequency of ship visits and connectivity. For the supply profile of ports, are considered factors as capacity, costs and quality, reliability of nautical access, terminal operations and hinterland access. For the market profile of ports is listed the market structure, logistics focus on port and port reputation. Lastly, regarding the human behavioral aspects, are listed aspects as the port selection in strategic alliances, "must" port of calls (shippers), the use of dedicated terminal capacity, among others.

According to Saeed (2009), who developed an analysis of carriers selection criteria when choosing container terminals in Pakistan, figured that carriers look for service quality offered at each terminal, the loading/discharging rate and the handling charges. On the other hand, they don't consider the governance management model, their personal contacts or the duration of their relationship with terminal authorities. Another important finding from this study was that "*large and modern vessels prefer a quicker*

turnaround time and that is why they had selected the terminal that offers a fast handling rate and a consequently shorter stay at berth" (Saeed, 2009:280).

Nir, Lin & Liang (2003) researched about port choice behavior from the perspective of the shipper, based on international container ports of Taiwan, concluding that location and cost are two important factors on ports' choice. Furthermore, it is stated that "*the more travel cost, the more negative effect to the shipper"* (Nir, Lin, & Liang, 2003:170). In addition, the following choice will be influence by the latter choice as it is possible to read: "*the last choice experience will influence their future port behavior and they won't be affected by different competiton factors such as frequencies, routes, port facilities or level of port service"* (Nir, Lin, & Liang, 2003:172). In fact, Hayashi & Nemoto (2012:57) allege that, shipping companies are influenced by shippers, since the "*location of shippers have expanded to inland areas and their trasnport demand has extended from port-to-port to door-to-door".* According to Panayides & Song (2008:83) there is a "*positive association between the relationship with the shipping lines and performance effects in the supply chain".* Actually, long-term relationships have a great impact in any partnership as it is stated by Kalwani & Narayandas cited by Panayides & Song (2008:76), concluding that long-term relationships "*are able to retain or even improve their profitability levels"*. Nam & Song (2011) also stated that the relationship with shipping lines is also important, looking for inter and intra-region port's connections, instead of only analysing ports performance through container throughputs in Twenty-Foot Equivalent Units (TEU). On the other hand, seems important, not only, to enhance the positive effect of long-term relationships with shipping lines, but also relationships between ports.

Ducruet & Zaidi (2012) stated that the "degree of centrality is a key indicator of the situation of ports in the maritime network", referring that "throughout history, various groups of ports have emerged based on frequency and density of trade linkage". Actually, not only the number of links to other ports is important, but also the frequency, convenience directness and transit time (Tongzon, 1995). For definition, a hub port has several connections, while a regional port has few, implying that hub ports that are inserted in complex networks need to address distinct features (Ducruet & Zaidi, 2012). According to Notteboom & Wilkelmans (2011), hub ports face higher risk since their traffic is more volatile, depending "on the strategy of shipping lines with respect to their service networks". In addition, Ducruet & Notteboom (2012) referred

that maritime networks evolved over time and, due to that formation of shipping networks, port hierarchies and maritime regions became an issue. Nam & Song (2011) praised that a "greater level of connectivity with neighbouring ports via shipping lines" is also a good criteria to evaluate ports. Ducruet & Notteboom (2012) studied the worldwide maritime network of container shipping and they have reached interesting conclusions/propositions such as: a) Service frequency, vessel capacity, fleet mix, vessel speed and the number of port calls are service variables that are linked with shipping lines network and consequently with port hierarchy; b) "The largest ships operate on multi-port itineraries calling at a limited number of ports"; c) Most shipping companies and alliances based their networks on traffic circulation through specific hubs; d) The location of transshipment hubs become more and more important since it can reduce the deviation distance to/from the main trade lines which is the main goal of shipping companies; e) Shipping lines seek for differentiation and competitive advantages and they choose several hubs rather than one mega-hub, in order to spread the risk; f) Market players change of port and hub selection and the changing geography of container demand make such networks highly dynamic; g) There is a great influence of geography and distance on the distribution of traffic, showing the dominance of intraregional links and a slight decline of transatlantic linkages. Regarding competition between shipping line companies, it's interesting to realize that, rarely, the container carriers have the same port hierarch (Ducruet & Notteboom, 2012). One terminal can be a regional feeder for one carrier and a strategic hub port for another. For instance, "Antwerp in Belgium and Valencia in Spain are some of the main European hubs for MSC while they receive only few vessels from Maersk Line. Zeebruge and Algeciras are among the primary European ports of call in the service network of Maersk Line while these container ports are rather insignificant in the network of MSC" (Ducruet & Notteboom, 2012). In addition, Gonçalves (2015) stated that a maritime carrier could have a lower market share at an international level, but could have a dominant position in one specific maritime route.

Lirn, Thanopoulou, Beynon, & Beresford (2004) developed one of the few studies regarding transshipment port selection, using the Analytic Hierarchy Process (AHP). The AHP methodology is used in decision problems and is a multi-criteria decision-making approach that employs pairwise comparisons to arrive at a scale of preferences among a set of alternatives (Ugboma, Ugboma, & Ogwude, 2006). Lirn, Thanopoulou,

Beynon, & Beresford (2004) designed a survey distributed across 20 global ocean carriers and across 20 transshipment service providers (port operators/authorities). The 12 port selection criteria included in the study were, previously, discussed and selected among experts in industry and academia. From that point, the authors concluded that the final 5 most important transshipment port selection criteria were: handling cost of containers, proximity to main navigation routes, proximity to feeder ports, proximity to import/export area and basic infrastructure condition (water access, depth). Additionally, the authors asked 18 carriers to evaluate the performance of 6 transshipment ports. Thus, they were able to compare importance and performance surveyed. This research allowed to understand, in a global perspective, not only the most relevant decision factors to choose a transshipment port, but also which factors should be targeted by policy-makers and port managers in order to fill the gap between importance and performance. The conclusions of the academic experts were that "*once the location of a port/terminal is determined, port operators can only compensate for unfavorable deviation costs that carriers might have to incur through either reducing Handling Costs or investing on Basic Port Infrastructure"* (Lirn, Thanopoulou, Beynon, & Beresford, 2004: 86)

3.4. New challenges in maritime transportation

Today, the challenges that ports face are different from the past. According with Tang, Low, & Lam (2011) the container shipping industry has noticed some improvements in the last two decades. For instance, Ducruet & Notteboom (2012) calculated that the overall length of the network doubled between 1996 and 2006, from 5 to 10 million kilometers. They also observed that the traffic density increased from 331 to 407 TEU per kilometer between 1996 and 2006. Besides this, they also stated that the first full container vessel at the end of 1950s could load only 166 containers, while today, there are vessels able to install 14 thousand TEU. "*Shipping lines have increased the average vessel sizes deployed on the route from around 4500 TEU in 2000 to over 8000 TEU in early 2011"* as it was affirmed by Ducruet & Notteboom (2012:398). The Suez Canal and the Panama Canal are representative of "maritime shortcuts" that bring more accessibility and flexibility to carriers. The Suez Canal allowed to reduce the journey from Asia to Europe by about 6500 km by avoiding the route around the Cape of Good Hope (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013). 15 percent of the global maritime trade is explained by traffic in the Suez Canal, which

handle, on average 55 ships per day (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013). The Panama Canal reduced the maritime distances between American East and West coasts by 13 thousand km and it is the shortest operational route between Atlantic and Pacific Oceans. 5% of the global maritime trade is explained by traffic in the Panama Canal (Rodrigue, Comtois, & Slack, The Geography of transport Systems, 2013). This situation leaded to a "*downward pressure on the average number of European port call per loop on the Far East-North Europe trade: 4.9 ports of call in 1989, 3.77 in 2000 and 3.35 in December 2009"* (Ducruet & Notteboom, 2012:399).

Furthermore, ports operators and authorities are losing control over their destinies (Tongzon & Sawant, 2007). This is shown by the raise of the bargaining power of global shipping lines (Chang, Lee, & Tongzon, 2008), which implied the decrease of monopoly of the ports and the increased influence of shipping lines in port development (Tongzon & Sawant, 2007). The development of port infrastructure in emerging economies, the larger vessels and the improvement in logistics systems and in cost efficiency for shipping lines results in higher accessibility to ports (Tang, Low, & Lam, 2011). This way, it is possible for shipping companies to choose a wide range of ports, either hub and spoke or gateway ports (Tang, Low, & Lam, 2011).

Moreover, shipping lines are making efforts to reduce costs and improve efficiency, reaching agreements concerning sharing routes and vessels and even making mergers and acquisitions. For instance, in July 2014, MSC and Maersk announced a new vessel sharing agreement for the following 10 years. In this agreement, two of the most important shipping lines companies share 185 vessels with an estimated capacity of 2.1 million TEUs. This partnership, that began in 2015, has as main objective to reduced costs and share infrastructures. This agreement runs for 21 routes, but each company keeps its independency on the customer service, price policy, marketing investments and sales force (Noronha, 2014). Therefore, now, the amount of cargo controlled by a single shipping line or alliance is higher, having more capacity to influence the business of a port, comparing with what has been in the past (Tongzon & Sawant, 2007). For instance, "*when Maersk-Sealand switched its transshipment base from Singapore to the Port of Tanjung Pelepas, which may have influenced the ensuing movement by Evergreen to Port of Tanjung Pelepas"* as stated by Chang, Lee, & Tongzon (2008:877). On the other hand, port industry should also look for emerging

opportunities, for instance associated with shipping companies' strategy or concerning shipping schedules and adjustments on their routes, since carriers are constantly looking for improvements (Tang, Low, & Lam, 2011).

Heng & Tongzon (2005:409) referred that "*carriers and shippers are showing less loyalty to specific ports"*, implying that ports are facing a constant risk. Thus, became important for ports to be able to adapt to constant changes in market environment. Several ports are trying to make long-term agreements with shipping companies in order to decrease the risk of losing costumers, but for that it is necessary to match the supply of services with the needs of the shipping companies (Tang, Low, & Lam, 2011). According to Heng & Tongzon, (2005:410) "*the seaports that will succeed in the 21st century will be those that are "consumer-led", with a good understanding of customer needs".* Thus, a port authority or operator needs to understand the needs of customers in order to make better investment decisions and overcome competition (Tongzon, 1995). As this trend of alliances and mergers continue, ports have two paths: "*become a stronger hub in the region or shrink its role to a feeder port in the regional "hub and spoke system"* (Chang, Lee, & Tongzon, 2008:877).

Additionally, as it was stated before, maritime carriers are ordering bigger and bigger ships, evidencing that they are more concerned with economies of scale than distance navigated (Gonçalves, 2015). Gonçalves (2015) emphasized that, for the first time in recent history, 52% of maritime trade between Asia and USA East Coast have been realized through Suez Canal. The new developments planned for the Panama Canal will almost certainly reduce this percentage, but still before its opening it is certain that biggest ships, with capacity to 12/13 thousand TEU, won't able to navigate it. Moreover, the more dynamic segment of shipbuilding industry in the next years will be related with ships bigger than 13 thousand TEU. These limitations can develop other maritime routes in international trade. The recent developments in ships' size orders also contribute to changes in the current transshipment model (Gonçalves, 2015). Maritime carriers are using bigger ships in order to increase economies of scale, giving more importance to main hubs and intermediate hubs (associated with interlining and relay transshipment) than final destinations hubs (associated with hub and spoke transshipment) (Gonçalves, 2015). In practice, main hubs and intermediate hubs are earning more importance since they form a network able to link different maritime routes, such as the East-West to North-South maritime routes (Gonçalves, 2015). In the

past, the biggest container ships scaled in the main hubs that were connected with final port destinations through feeder services (Gonçalves, 2015). Today, Ultra Large Container Vessels (ULCV) scale in a smaller number of main hubs that are connected with intermediate hubs. The connection to hub and spoke ports (associated with feeder services that feed final port destinations) is made by these intermediate hubs. Thus, hub and spoke ports are losing weight in the maritime network, to the main and intermediate hubs, meaning that they have been decreasing their influence and feeding a smaller geographic area (Gonçalves, 2015).

Another issue that ports should take in consideration is the lack of balance of cargo flows from and to Asia compared with USA and Europe (Gonçalves, 2015). The outflows from Asia are more significant than inflows to Asia, meaning that there are some problems not only in the occupation rate of ships, but also regarding freight prices (Gonçalves, 2015) . It means that it is easier but more expensive to charter a ship from Asia to Europe or USA than the inverse.

The possible exploration of Artic Polar route would be a possible issue for the ports in South Europe (Gonçalves, 2015), since this route would link China to North Europe, reducing transit time. However, some challenges are still in place, namely, the speed of a container ship in this route must be lower, the most important Chinese ports are located in the south and not in the north (the benefits regarding transit time are greater for ports in the north), security issues (the number of accidents with vessels have been increasing, "Arctimax" vessels won't be able to compete with last-generation vessels and would need an icebreaker ship to pass through the Artic (Gonçalves, 2015).

3.5. Transshipment and maritime network importance

First of all, it is important to refer the most relevant maritime routes. Traditionally, the most important maritime route is the East-West, which links the 3 most relevant world economies (USA, Europe and Far East). The North-South route has lower weight in total throughput of cargoes, however, it grants the provision of cargoes to South America, Africa and Australia (Gonçalves, 2015).

In the East-West axe, Gonçalves (2015) distinguished 3 routes: Far-East route that link Asia and Europe, through the Suez and Med (servicing also India and Persian Gulf region); transpacific route connecting Asia and West Coast of USA; transatlantic route linking East Coast of USA to Europe. The 2 most important flows of containers in 2012

were Asia-North America (13.3 million TEUs) and Asia-Europe (13.7 million TEUs). Additionally, Gonçalves (2015) give special importance to the Europe intra region route, through feeder services. Regarding the North-South axe, Gonçalves (2015) stated that some routes are fed by the East-West through transshipment ports. The author enhanced 5 routes: Europe-Africa East Cost; Europe-South America; Europe-Australia; North America-South America; North America-Australia.

The shipping industry has shown an incredible growth consequent of the quick globalization process and the developments of shipyards. As it was stated previously, the worldwide container port throughput increased from 36 million TEUs in 1980 to 623 million TEUs in 2012 (Notteboom, Parola, & Satta, 2014). The use of bigger ships in order to take advantage of economies of scale and minimize unit costs has been leading to changes in the maritime network. Shipping lines have been designing not only their maritime network, since some container ports aren't able to accommodate the new bigger ships, but also their strategies. Thus, transshipment has been assuming an important role to the major maritime carriers. In the first stage, transshipment was developed to service smaller ports unable to accommodate large containerships, mainly because of the existence of some constraints in port infrastructures such as quay depth and length (Rodrigue, Comtois, & Slack, 2013). As the growth in the global trade increased significantly and consequently greater the number of containers in circulation, maritime carriers are relying in transshipment ports to connect different regions of the world (Rodrigue, Comtois, & Slack, 2013).

According with Monteiro (2013:47) "*the transshipment of containers at a container port or terminal can be defined as the number of containers (in TEU) of the total container flow that is handled at the port or terminal and transferred to another ship to reach their destinations*". Thus, transshipment incidence refers to the share of transshipment containers, taking in consideration the total volume handled by the port (Rodrigue, Comtois, & Slack, 2013). The higher the transshipment incidence, the more a port can be considered as a transshipment hub. Thus, Rodrigue, Comtois & Slack (2013) classified transshipment in four levels: up to 10 %, a port is considered a gateway or feeder port (low incidence), implying that the most of their activities are connected with hinterland services (New York, Los Angeles and Felixstowe are examples of gateways with low transshipment incidence); with a average of 25% of transshipment incidence, a port could be considered a regional gateway (average

incidence), meaning that a port handles mainly hinterland traffic, but also acts as a hub for a specific transshipment market (Antwerp, Hamburg and Hong Kong); with a transshipment incidence of 50% to 90% a port is considered a hub port (high incidence) but is also servicing an hinterland (Valencia, Barcelona and Cartagena are ports that are significant transshipment hubs as well as servicing their respective hinterlands); with more than 90% of transshipment incidence is considered a pure transshipment hub (very high incidence), meaning that its exclusive function is transshipment of cargoes (Singapore, Colombo and Balboa are examples of pure transshipment hubs – many of them are built for this sole purpose).

Transshipment activities aren't spread across the world uniformly. Geography takes an important role in the definition of transshipment markets, since they are commonly established in the crossroads of shipping routes or near bottlenecks, such as straits or canals (Rodrigue, Comtois, & Slack, 2013). Monteiro (2013) stated that most of the transshipment ports are located along the circum equatorial route that goes through Panama, the Strait of Malaca, Suez and Gibraltar. In addition, Notteboom, Parola & Stata (2014) also stated that Straits of Gibraltar, Malaca and Suez and Panama Canal are the most prominent locations for transshipments activities. Furthermore, the authors defended that the "*creation of transshipment hubs does not occur in all port systems, but around specific regions, thanks to geographical, nautical and market-related advantages"* (Notteboom, Parola, & Satta, 2014:9). Moreover, they have identified common characteristics of hubs, namely nautical accessibility, proximity to main shipping lanes and ownership by carriers or multinational terminal operators. Regarding competitiveness, the authors stated that a hub port can increase their role in the network improving the operational performance (fast and reliable) and practice a price strategy similar to the market. In fact, it is easy for shipping lines to change from one hub to another, even 500 or 1000 nautical miles apart (Notteboom, Parola, & Satta, 2014). Intermediate hubs have emerged since the mid-1990's and have a range of common characteristics in terms of nautical accessibility, proximity to main shopping lanes and ownership, in whole or in part, by carriers or multinational terminal operators (Ducruet & Notteboom, 2012). Rodrigue, Comtois & Slack (2013) also identified a group of factors in order to select a transshipment: proximity to major shipping routes (low deviation), intermediary location connecting feeder and deep-sea services, greater depth (more than 13.5 meters) to accommodate post-panamax ships (the biggest container

ships), large yard area for the temporary storage of containers, high capacity equipment, lower operations costs (100$ per container are considerable acceptable), high berth productivity (average 35-40 mover per hour per crane is considered a desired level of productivity) and a reliable service. Additionally, considering that transshipment market is highly dynamic, hub ports can offer services that add value to cargo, instead of only moving containers between vessels. Thus, the creation of logistics zones within the port area and/or free trade zones are considered valuable assets to delivered a quality service and improve the competitiveness of the transshipment port (Lee, Nam, & Song, 2012).

The advantages to shipping lines and consequently to the final customers are evident, since transshipment ports allows multiple shipping options, improving connectivity within the network (Notteboom, Parola, & Satta, 2014). Monteiro (2013:48) stated that "*the increasing number of transshipment hub ports also allows smaller ports to have better service as feeder vessels have more service choice making it possible to create feeder services that would be otherwise impossible".* On other hand, some authors defend that pure transshipment ports are vulnerable since the transshipment market is highly dynamic (Notteboom, Parola, & Satta, 2014) and the switching costs are lower. Thus, the possibility to easily switch between ports is a determinant factor that has been increasing competition between ports and keep freight rates at a lower level (price effect) (Monteiro, 2013).

Transshipment can assume 3 forms (annex 1): Hub-and-spoke; Interlining; Relay. The different forms of transshipment are linked with the configuration of maritime networks, specifically, with the liner shipping market. The liner shipping market is characterized by the existence of a regular maritime transport service, in some maritime routes, which is previously defined on schedule and stops. A regular liner shipping service has a minimum frequency fixed and it is always realized, independently, of the occupation rate (Gonçalves, 2015). So, why is it important to address the configuration of liner shipping services and networks? According Ducruet & Notteboom (2012:78), "*the expansion of traffic has to be covered either by increasing the number of strings operated, or by vessel upsizing, or both".* This way, the increased cargo availability has brought changes in liner service schedules and in the structure of liner shipping (Ducruet & Notteboom, 2012). The answer to this question is based on *bundling.* Ducruet & Notteboom (2012:79) stated that "*bundling is one of the key drivers of container service network dynamics"* and could be within an individual liner service or

by combining/linking two or more liner services. *Bundling* allow to collect containers by calling at various ports along the route instead of focusing on an end-to-end service (Ducruet & Notteboom, 2012).

Regarding an individual liner service, it is possible to observe line bundling service (symmetric and asymmetric), round-the-world service and pendulum service. On one hand, line bundling operations are symmetric when the ports of call are the same in both directions. On the other hand, they are asymmetric when the ports of call are different on the way back (Ducruet & Notteboom, 2012). Usually, liner services scale between 2 and 5 ports of call in each of the main markets. On other side, as it was referred there are liner services by combining two or more liner services: hub-and-spoke; interlining, relay (the 3 forms of transshipment stated above) (Ducruet & Notteboom, 2012).

Hub-and spoke is characterized by the combination of long distance deep-sea lines and short distance feeder services. The literature defends that a hub and spoke port must have a central location in the region, able to serve a wide hinterland through their feeder connections (Rodrigue, Comtois, & Slack, 2013). Port of Gioia Tauro, in the Mediterranean market, and Port of Kingston, in the Caribbean market, are examples of ports which the main focus is hub-and-spoke. Secondly, it is presented the interlining services that, as the name mentions, is the linkage between several long distance shipping routes (Rodrigue, Comtois, & Slack, 2013). Hubs that are able to offer interlining services should have the capacity to harbor the biggest ships, since it involves the movement of cargo between large ships. Additionally, the most suitable locations to the development of this kind of hubs are near bottlenecks, such as Strait of Gibraltar. Hub ports of Algeciras, Tanger Med and Singapore are good examples of hub ports specialized in interlining services. Lastly, it is referred the relay: *"the transshipment hub becomes an interface between shipping routes along the same maritime range, but servicing different port calls. Ship capacity can differ since regional routes can be serviced by smaller ships"* (Rodrigue, Port Economics, 2015).

Concluding, transshipment gained relevance in the strategy of several maritime carriers, as an answer to the evolution of market needs and innovation in shipyards. Thus, it was possible to improve connectivity between regions and reduce costs by economies of scale. However, ports engaged in transshipment should be consumer led, since the market is highly volatile and the switching cost for shipping lines are lower.

As it was possible to understand, there are a lot of factors that influence port choice behavior, from location, to connectivity, cost, and efficiency, amongst others. There is not a homogeneous consensus between authors regarding the decision factors influencing ports' choice behavior, thus depending on actors and on which part of the world was applied the research. Still, the position of a port in the maritime network and the development of the supply chain integration by ports are issues that influence the performance of a port and consequently its competitiveness. Besides, some research has been done in successful factors of transshipment ports and transshipment ports model choice, but there isn't any study applied to bottlenecks zones, in specific the Strait of Gibraltar. Thus, it seems relevant to fill the gap in this literature issue.

4. Research Methodology

This chapter will address the methodologic steps adopted in the conduction of the research. The main topics covered are the methodology model selected, the geographical scope and port selection process as well as criteria selection, the conceptual model schema, the survey design and data collection.

The port choice issue has been discussed over time, not only from different perspectives, but also with a great diversity of the methodologic models used to reach conclusions. Aronietis, Voorde and Vanelslander (2010) aggregated in their research the different studies realized related with port choice, stated that the most popular method to address this issue is surveying the decision makers. Additionally, they also noted that other approaches were used like analytic hierarchy process, literature analysis, multivariate and discrete choice analysis. In fact, Tongzon and Sawant (2007) surveyed shipping lines and developed a binary logistic regression; Chang, Lee and Tongzon (2008) also surveyed shipping companies and analyzed data through Explanatory and Confirmatory Factor Analysis; Wiegmans, Van Der Hoest and Notteboom (2008) analyzed existent data and conducted interviews; Grosso and Monteiro (2008) developed a survey and analyzed data collected using Factor Analysis method; Saeed (2009) conducted a questionnaire, developeded a regression model, Explanatory Factor Analysis and Principal Components Analysis; Jafari, Saeidi and Karimi (2013) performed a survey and took conclusions through an Importance-Performance matrix; Lirn, Thanopoulou, Beynon and Beresford (2004) adopted the Analytic Hierarchy Process (AHP) model to reveal and evaluate the criteria used for transshipment port

selection from a global perspective, as well as C.Ugboma, O.Ugboma and Ogwude (2006) applied to Nigerian ports.

4.1. Analytic hierarchy process (AHP)

It is argued that AHP is an important management tool, applied in several fields, improving the decision process and obtaining stronger decisions (Ugboma, Ugboma, & Ogwude, 2006). Moreover, Lirn, Thanopoulou, Beynon & Beresford (2004) stated that besides AHP has not been used for transshipment port selection, it has been recording successful applications in the transport domain. The AHP methodology is a measurement theory able to deal with multiple criteria decision-making, being a flexible tool that can be used to wide range of fields. Cited by Lirn, Thanopoulou, Beynon and Beresford (2004), Saaty listed 10 advantages of the AHP as a decision making-tool: "*Unity; Complexity; Interdependence; Hierarchy Structure; Measurement; Consistency; Synthesis; Tradeoffs; Judgement and Consensus; and Process Repetition;".* In fact, AHP methodology is ready to deal with quantifiable and/or intangible criteria, since it applies pairwise comparisons to arrive at a scale of preferences among a set of alternatives (Ugboma, Ugboma, & Ogwude, 2006), leading to solve multi decision problems: resource allocation; priority rating; performance evaluation (Lirn, Thanopoulou, Beynon, & Beresford, 2004).

According with Zahedi (1986) AHP involves 4 main steps:

1. Designing the decision hierarchy by breaking down the decision problem into a hierarchy of interrelated decision elements;
2. Collecting input data (survey) through pairwise comparisons of decision elements;
3. Using the eigenvalue method to estimate the relative weights of the decision elements;
4. Aggregating the relative weights of decisions elements to arrive at a set of ratings for decision alternatives.

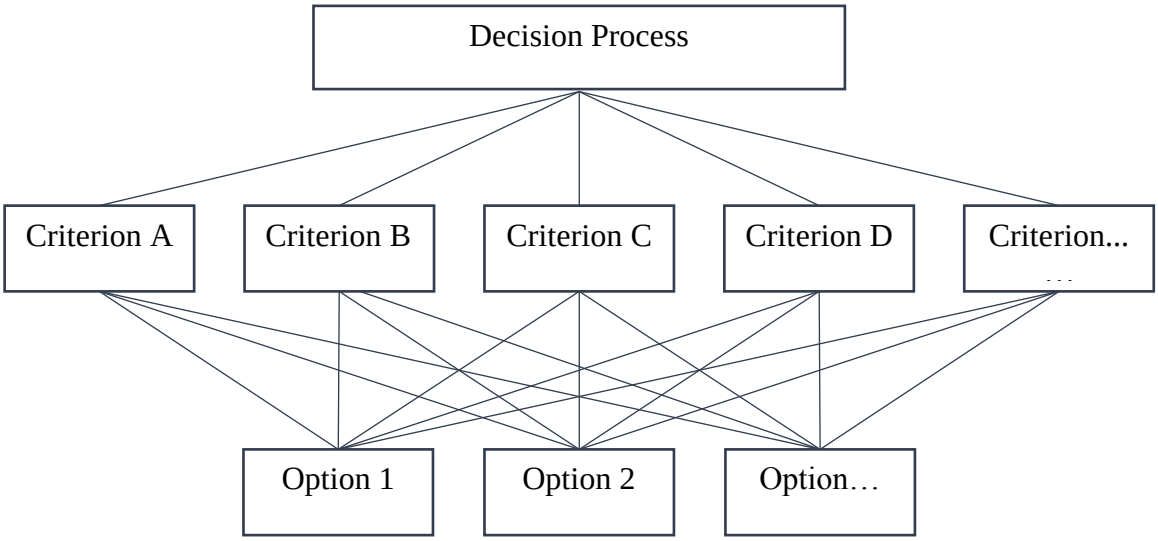


Figure 1: Decision Hierarchy based on AHP model
Source: Zahedi, F. (1986)

4.2. Geographical scope and port selection

In the past 15 years, sea-sea transshipment more than tripled and nowadays represents 28% to 30% of all TEUs handled by ports (Rodrigue, Port Economics, 2015). In fact, transshipment activities aren't spread across the world uniformly. Monteiro (2013) stated that most of the transshipment ports are located along the circum equatorial route that goes through Panama, the Strait of Malaca, Suez and Gibraltar. In addition, Notteboom, Parola & Stata (2014) also stated that these are the most prominent locations for transshipments activities. The focus of this research is the transshipment port selection in the Gibraltar range. Indeed, Notteboom (Port Economics, 2015) also referred that "*Strait of Gibraltar is strategically located on some of the most important East-West trade lanes"*. The author attributes special importance to the role of 5 ports in the region: Algeciras, Valencia, Tanger, Sines and Malaga. First of all, Algeciras is considered the largest container port in the Med, achieving a transshipment incidence of 95%. The second largest container port is Valencia, combining its gateway function with relevant transshipment flows. From a transshipment incidence of almost 20% in 2004, Valencia, achieved in 2012, a transshipment incidence of 50% (Notteboom, Parola, & Satta, 2014). Tanger Med and Sines are considered by Notteboom (2015) *"the new kids on the transshipment business block"*, since "*both ports have managed to significantly increase their share in the past five years: Sines from 2.7% in 2008 to 9.2% in 2014, Tanger Med from 10.7% in 2008 to 23% in 2014"*. Sines increased its transshipment incidence from near 0% in 2004, to almost 60% in 2012 (Notteboom,

Parola, & Satta, 2014). Lastly, Malaga has a constant transshipment incidence of 90% over year (Notteboom, Parola, & Satta, 2014), however, the volume of TEUs handled decreased from 542 thousand TEUs in 2007 to 100 thousand TEUs in 2014. Monteiro (2013) designed a transshipment traffic map for the Mediterranean container ports, highlighting five container ports, near the Strait of Gibraltar: Sines and Valencia (transshipment share in 2008 between 25% and 75%); Algeciras, Malaga and Tanger (transshipment share in 2008 is more than 90%). Since transshipment activity is a very competitive business, allowing maritime carriers to switch to any other port in the region with significant low switching costs, it seems relevant to analyze the transshipment activity in the Gibraltar range, namely regarding Sines, Valencia, Tanger, Algeciras and Malaga (since they are observed as the more important transshipment ports in region). The choice of the ports to include in this research was validated not also by literature review and analysis of existing data but also by two international maritime experts in the container business (through LinkedIn private message).

4.3. Criteria selection

Beyond port selection process, another important step in AHP is the selection of criteria. Lirn, Thanopoulou, Beynon and Beresford (2004) stated that there is limited literature on transshipment port selection, unlike general port selection. Thus, the authors assessed two rounds of Delphi surveys with ten experts, five from academia and five experts from the shipping industry, in which were discussed 47 criteria previously listed by reviewing literature. Similarly, Ugboma, Ugboma & Ogwude (2006) based on the literature review and focus groups identified 7 criteria (port efficiency, adequate infrastructure, frequency of ships visits, quick response to port users' needs, location, port charges and ports reputation for cargo damage). Regarding the research developed by Lirn, Thanopoulou, Beynon and Beresford (2004), the authors developed the investigation taking in consideration a global perspective, obtaining 4 major criteria divided in 12 sub-criteria (basic infrastructure condition, technical infrastructure, intermodal links, proximity to import and export areas, proximity to feeder ports, proximity to main navigation routes, management and administration efficiency, vessel turn-around time, port security/safety, handling cost of containers, storage cost of containers and terminal ownership/exclusive contract policy). Since this research was applied on a global perspective and the 12 sub-criteria are similar and consistent with the criteria already identified previously in the literature review, they were assumed as

the most appropriated to include in this research. Additionally, to the 12 criteria of the paper "An Application of AHP on Transshipment Port Selection: A Global Perspective" it was decided to add an 13th criteria based on the recent port selection studies. In fact, in the past years some authors warned to the growing importance of value-added logistics services in the port selection process. For instance, Notteboom and Rodrigue (2005) stated that customers began "to ask ports to provide a greater variety of services", in specific value-added logistics services; Hayashi & Nemoto (2012) praised that there are already shipping companies and forwarders offering not only maritime transport, but also third-party logistics (3PL), as for example packaging, warehousing and logistics processing; Roso and Rosa (2012) also stated that the existence of an inland port is a way to add value and improve competitiveness of a port; Baird (2012) was able to rank the top 20 liner operators regarding the logistics services provided. One real practical example could be observed in Madrid where it is installed a dry port distancing 600 km to Barcelona, 400 km to Bilbao, 660 km to Algeciras and 360 km to Valencia. Dry port Madrid is managed by this 4 ports and the main goal is to "*facilitate transport organization, customs and administrative procedures for a competitive position of the ports in the region"* (Roso & Rosa, 2012:189).

In order to improve the interpretation and to be clear and objective to the readers and inquiries, the meaning of each criteria was included in the survey and in the annex.

4.4. Conceptual model scheme

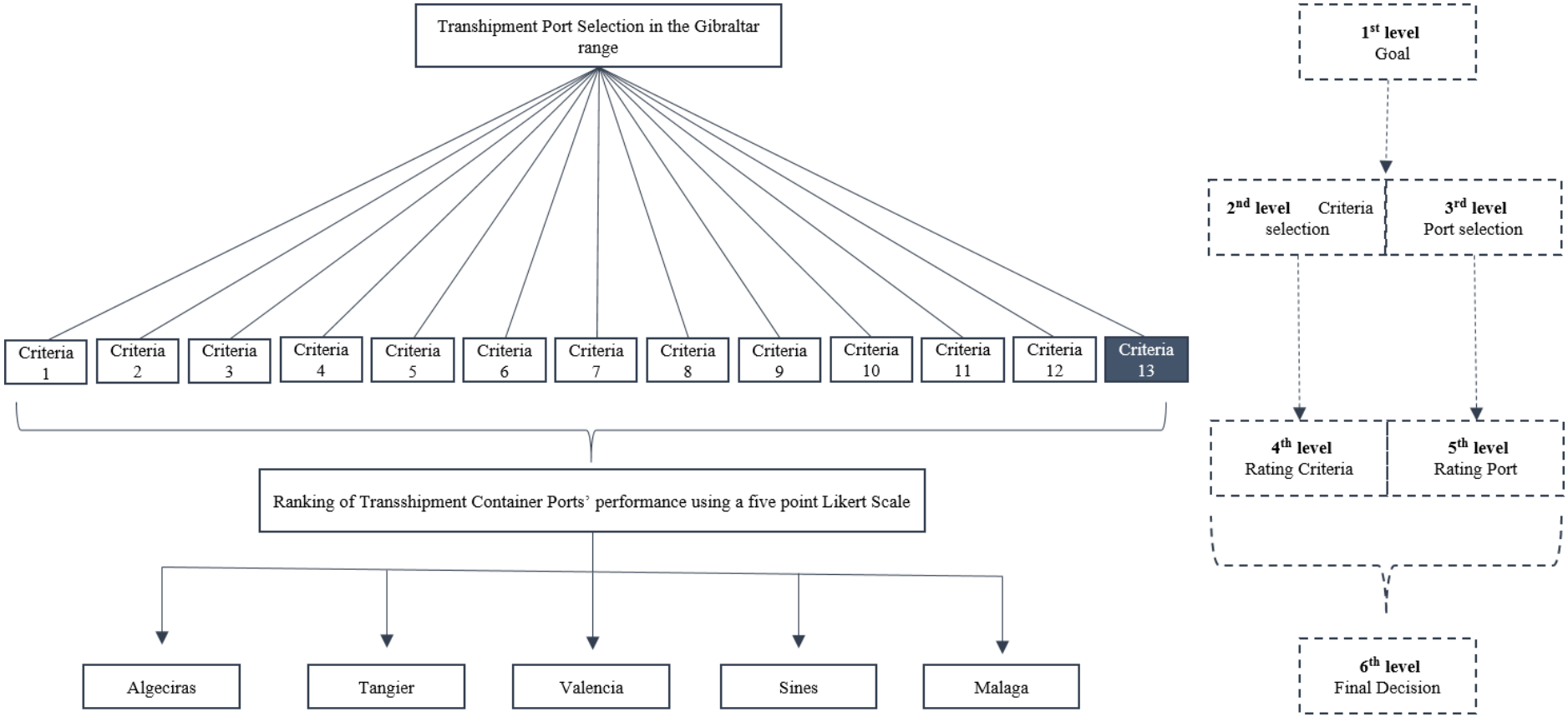


Figure 2: Conceptual model scheme
Source: Own elaboration

4.5. Survey design

The survey was designed based on the survey applied by Lirn, Thanopoulou, Beynon and Beresford (2004). Additionally, it was added a subset of questions in order to facilitate the general characterization of respondents, namely the role of respondent in maritime supply chain, the geographic location of the company, amongst others. Since the survey was designed to be applied online, it was developed using Qualtrics software, a well-known software between several research fields used by 99 of the top 100 business schools (Qualtrics, 2016).

Initially, it was developed a pilot test to enhance the final survey, allowing to identify any difficulty in understanding the questions and to identify any missing, duplicate and/or irrelevant questions. The pilot testing was applied to ten ISCTE Business School colleagues that already submitted their thesis and are familiar with this type of questions and scales. The principal suggestions made were related to the grammar and vocabulary used. Moreover, since survey was design to be applied online, they suggested to repeat in all pairwise comparisons questions the link to the appendix (annex 8) with the description of each criterion.

Since the geographical scope of the research includes Portuguese, Spanish and Moroccan ports the survey was designed in Spanish, Portuguese and English. The survey was initially developed in English and Portuguese and then translated to Spanish by a professional translator with many years of experience in translation and used to work with maritime issues.

The survey (annex 9) was divided in three sections, similarly as Ugboma, Ugboma & Ogwude (2006). The first section required the respondents to make pairwise comparisons of the thirteen criteria, according the nine-point fundamental scale (Saaty & Vargas, 1994). Detailed instructions on how to use the scale to complete pairwise comparison of the criteria and a briefly description of criteria were given on the beginning of each question, as well as an example for pairwise comparisons of two criteria. Thus, it was possible to familiarize the respondents with pairwise comparisons of the AHP survey and minimize inconsistent replies. The second section ask the respondents to ranked the ports for each one of the thirteen criteria, according a 5-point Likert scale as suggested by Min, Mitra and Oswald (1997). The third section was related with the profile of each respondent and port use behavior.

4.6. Data collection

This research tries to understand which are the most relevant decision factors to choose a transshipment port and which are the transshipment ports most attractive for maritime carriers. The target of the survey was maritime carriers, however, in order to obtain a higher number of answers, it was asked to freight forwards, port authorities, terminal managers, logistics services' providers, stevedoring companies and maritime customs brokers to give, from their day to day interactions with maritime carriers, their opinion about the factors that influence carriers' transshipment port choice.

The survey was available through a link from March 23rd to June 30th were440 emails to maritime carriers, freight forwards, stevedoring companies, port authorities, terminal managers, maritime customs brokers and logistics services' providers that run their business mainly in Gibraltar range. Additionally, were contacted, through private message in LinkedIn, about 150 executives of maritime carriers in order to answer the survey. Moreover, several other dissemination actions were taken: the survey was share, fortnightly, in several international maritime experts' LinkedIn groups; it was schedule a meeting with AGEPOR (Portuguese association of shipping companies) in order to share the survey with Portuguese shipping companies and with European Community of Agents and Ship Brokers Association. In spite of all these efforts, were obtained 30 answers to the survey, however 3 of them were excluded because for lack of coherence and consistency. Thus, it was considered 27 answers of which 11 didn't answer to the second section of the survey.

Even though it was a small sample, Chang, Lee and Tongzon (2008) and Tongzon and Sawant (2007), in their port selection researches, were able to reach conclusions and draw out generalizations with, respectively, 28 and 31 answers. Additionally, not all maritime carriers operate in the Gibraltar range. For instance, in Sines and Valencia, MSC is the primer maritime carrier and in Algeciras and Tanger, Maersk fulfill the first position, since they have dedicated terminals in cooperation, respectively, with PSA and APM Terminals (annex 5 and 6). Furthermore, was referred in the literature that there is a higher concentration in the container market. According with Gonçalves (2015) there is more than 400 maritime carriers, however the top 100 and top 10 of maritime carriers represents 96,4% and 63% of the total of container market, respectively. The author also stated that due to alliances, mergers and acquisitions the concentration in the container market has been increasing, since in 1995 were need 16 carriers to achieve 50% of the container market and nowadays, the top 7 already achieves 53% (Gonçalves, 2015). For instance, by 2017 is expected to have 3 big alliances (annex 4): Ocean Alliance composed by CMA CGM, COSCO, Evergreen, OOCL; The

Alliance composed by Hanjin, Hapag Loyd – UASC, K Line, MOL, NYL, Yang Ming; 2M composed by Maersk and MSC (Mouftier & Sanchez, 2016). Thus, this response rate has provided a sufficient basis for drawing out generalizations and conclusions as there is a higher concentration in the container market and not all maritime carriers operate in the Gibraltar range.

5. Data Analysis and Results

This chapter reports the results of the analysis of the data collected. First of all, is presented a briefly characterization of the sample, followed by the results of the first (Criteria Ranking) and second (Transshipment port ranking) sections of the survey. Lastly, it is presented an importance-performance analysis and the results of the change in the number of criteria in analysis.

5.1. Sample characterization

Regarding the first section of the survey, in which respondents were asked to do pairwise comparisons for the 13 criteria, the majority has headquarters in Europe (59%), followed by 26% in Asia, 11% in America and 4% in Africa. Since not all respondents gave feedback regarding the port ranking section, the second section has a slight change: 83% of respondents has headquarters in Europe and 17% in Asia.

Taking in consideration the role of the respondents in the maritime supply chain, 41% of the respondents didn’t give feedback, whereas the remaining are distributed between port authorities (15%), maritime carriers (15%), terminal managers (11%), freight forwarders (11%), stevedoring companies (4%) and logistics services' providers (4%).

5.2. Criteria ranking

The chart 1 presents the results of pairwise comparisons of criteria for transshipment port selection. It is possible to conclude that the vessel turn-around time and proximity to main navigation routes were recognized by respondents as the two criteria to have more impact in the final decision to choose a transshipment port, respectively with 11.2% and 10.6%. On the opposite, management and administration efficiency and port security and safety were considered with lower importance in the final decision. In fact, from the 13 criteria, only 4 were considered above the possible average (7.7%). The 4 factors that most weight in the final decision sum about 40%. Additionally, the handling cost of containers and storage cost of containers are in the top 4. Port productivity, loading/discharging rates, berthing delay,

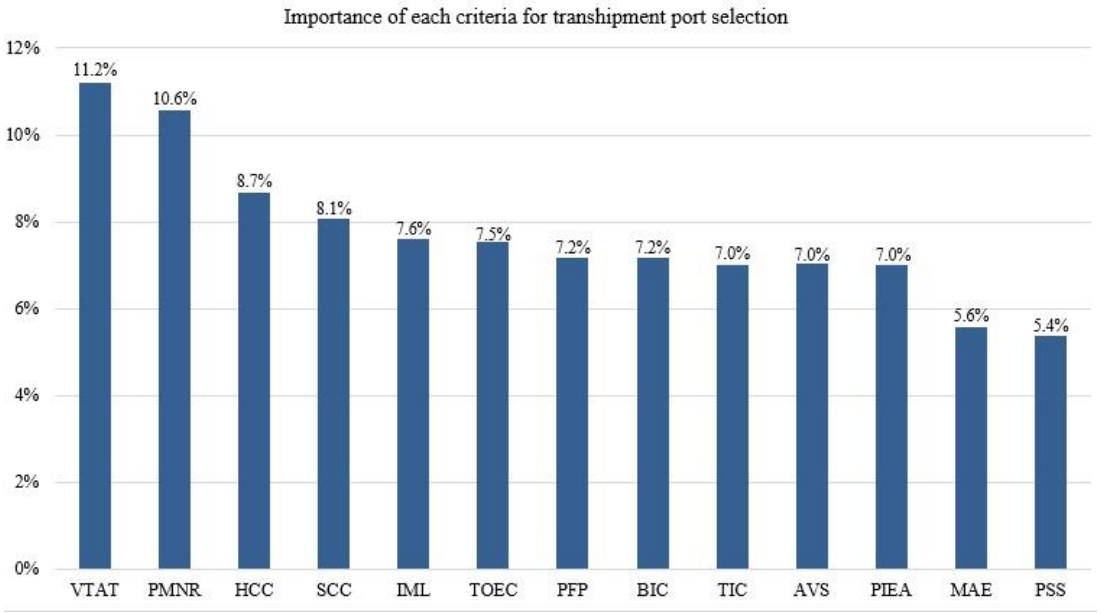


Chart 1:Importance of each criterion for transshipment port selection
Source: Own elaboration

congestion and port berthing time length, included in the definition of vessel turn-around time, are the most relevant factors in the moment to choose a transshipment port.

5.3. Transshipment port ranking

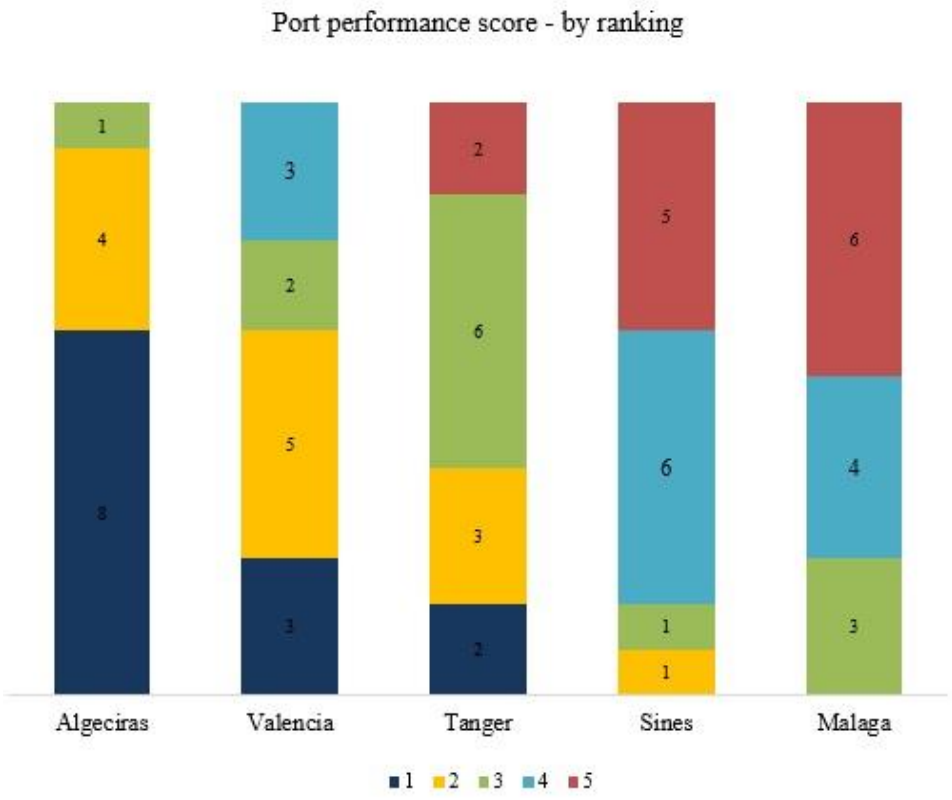


Chart 2: Port performance score – by ranking
Source: Own elaboration

Taking in consideration transshipment port ranking (chart 2) and the sum of all the scores from respondents (annex 7), it is possible to state that, from the 13 criteria in analysis, the port of Algeciras was favorite in 8 criteria and the second best in 4 criteria. On the opposite, Malaga and Sines were never chosen as first option in any criteria, being selected as the least favorite port in, respectively, 6 and 4 criteria. Please note that this ranking doesn't mean that, for instance, Algeciras was for 8 criteria always chosen has the favorite option by all the respondents.

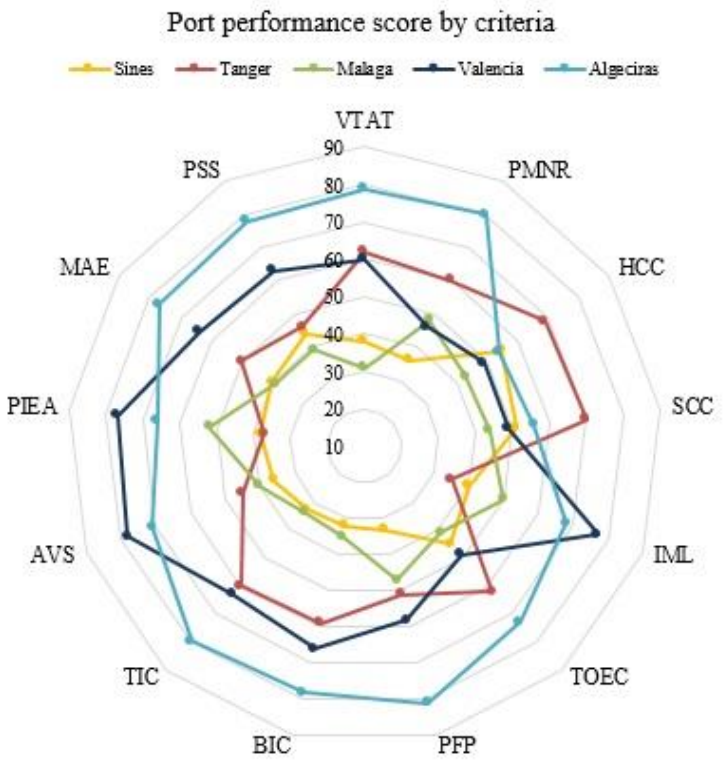


Chart 3: Port performance score by criteria
Source: Own elaboration

Complementarily, chart 3 represents the sum of the scores of all respondents for the 13 criteria by transshipment port. Thus, it is possible to compare the score obtained for each port by criteria. In general, Algeciras was considered, by far, the best option in the 2 most important criteria - vessel turn-around time and proximity to main navigation routes. However, Algeciras was also considered the best option regarding terminal ownership/exclusive contract policy, proximity to feeder ports, basic infrastructure, technical infrastructure, management and administration efficiency and port safety and security. Valencia was considered to be a good option taking in consideration intermodal links, availability of additional services and proximity to import/export areas. Regarding criteria

related with costs, namely, handling cost of containers and storage cost of containers, Tanger was considered the best option. However, it is in this 2 criteria that seems to exist a greater competitive environment, since there is a proximity between the overall score of the five transshipment ports.

Considering the weight of each criteria and the performance score attributed to each transshipment port, Algeciras is the best choice for the transshipment of containers, followed by Valencia and Tanger. Sines beats Malaga regarding the transshipment port choice.

5.4. Importance-Performance analysis

According to Lirn, Thanopoulou, Beynon, & Beresford (2004), importance and performance analysis has been used to highlight areas for improving customer satisfaction. For instance, Jafari, Saeidi, & Karimi (2013) assessed an importance and performance analysis of ports' services quality from the perspective of containerized liner shipping in the Imam Khomeini port.

Thus, following the methodology proposed by Lirn, Thanopoulou, Beynon, & Beresford (2004), the combination of the weights for criteria and the port performance scores will guide the importance-performance analysis. The results can provide insights about future investment decisions and strategy developments for ports.

In the vertical axis are represented the weights of each criteria under analysis (importance), while in the horizontal axis are represented the standard deviations of the performance scores for the criteria. The intercept of the axis was set at the level of the median of the values, as suggested by the authors. Chart 4 represents the importance-performance matrix for the transshipment port choice in the Gibraltar range.

From the analysis of chart 4**,** it is possible to understand that vessel turn-around time is the most important criteria and is one of the criteria that presents greater standard deviation, meaning that there are significant differences of quality between the transshipment ports under this criterion. Although it is the second most important criteria, the proximity to main navigation routes is highly interrelated with location, being difficult for ports to improve their own situation. Additionally, the third and fourth most important criteria present the lowest dispersion, meaning that there is already a competitive environment regarding costs factors.

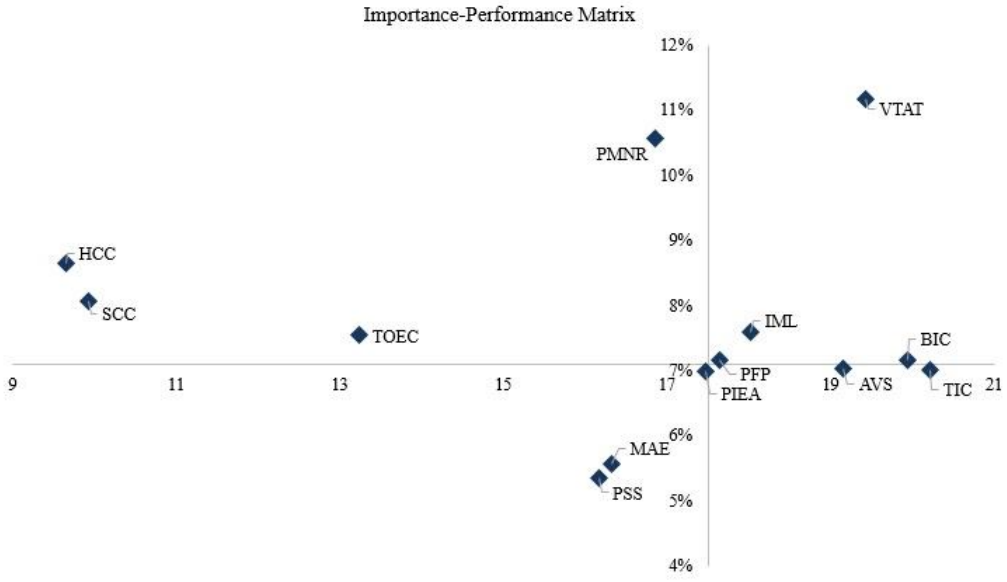


Chart 4: Importance-Performance Matrix for the transshipment port choice in the Gibraltar range
Source: Own elaboration

Thus, looking to the 4 most important criteria alone, there is a gap to fulfill between ports regarding the criteria vessel turn-around time. In an individual basis, Sines and Malaga are the transshipment ports with the higher gap for Algeciras (considered the best regarding vessel turn-around time).

5.1.Twelve versus thirteen criteria' analysis

This chapter will address the results obtained, taking in consideration the introduction of one additional criteria compared with the criteria selected by Lirn, Thanopoulou, Beynon, & Beresford (2004).The authors selected twelve criteria in order to analyze the transshipment port choice but, as it was explained in the criteria selection chapter, the availability of additional services was also considered a relevant criterion. In chart 5 is compared the weight calculated to each criteria considering twelve and thirteen criteria. In both approaches there are 5 criteria above the average, yet there is a change between the fifth and sixth most important criteria. Regarding the twelve criteria analysis, terminal ownership/exclusive contract policy has a higher weigh than intermodal links. Moreover, the introduction of one additional criteria did not imply a significant change regarding distance to the average. The most relevant variation concerned vessel turn-around time, since the distance to the average weight increased about 0.2 p.p..

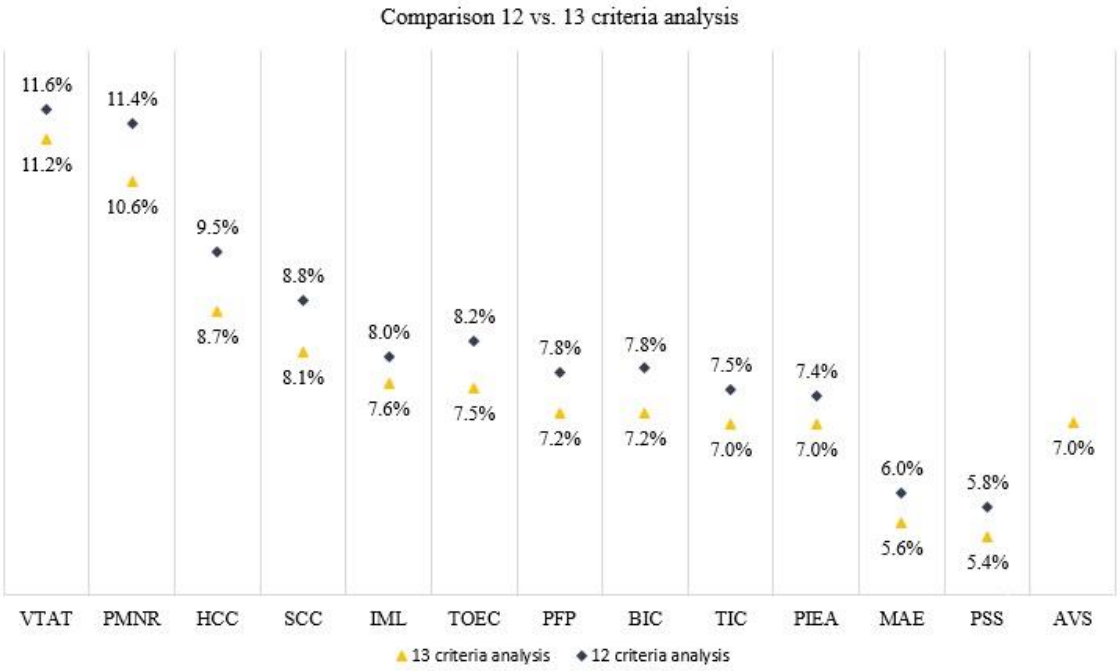


Chart 5: Comparison twelve vs. thirteen criteria analysis
Source: Own elaboration

Taking in consideration just the criteria, it does not seem to have significant differences between twelve and thirteen criteria analysis. Nevertheless, when calculated the final choice of a transshipment port assuming the performance score attributed by respondents, several changes occur. Chart 6 compares the overall score from both analyses.

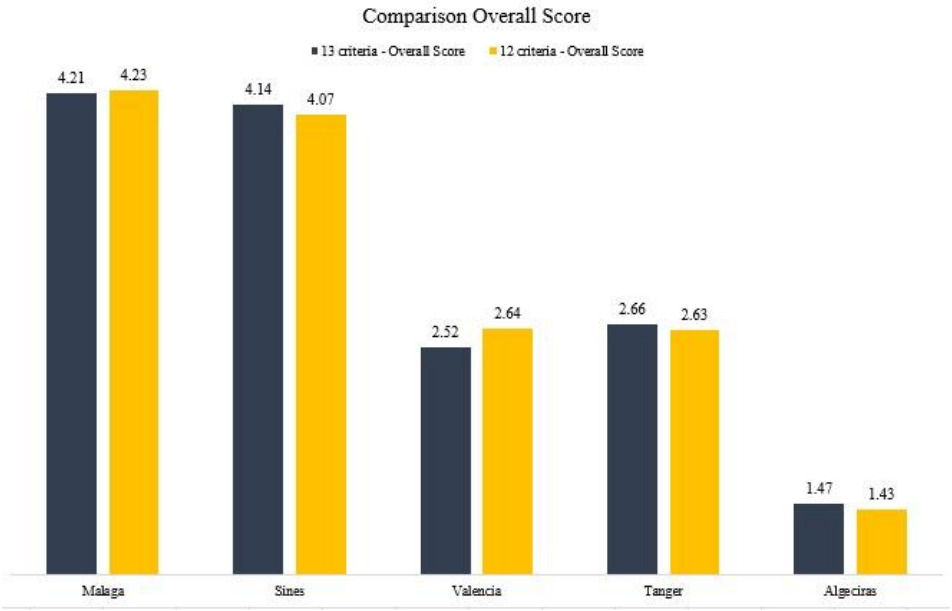


Chart 6: Comparison Overall Score
Source: Own elaboration

From the chart 6 there are 2 main results: the first one is that Sines, Tanger and Algeciras improve their overall performance if we consider twelve criteria instead of thirteen; the second one is that if availability of additional services was not considered, Tanger will place as the second in the Gibraltar range to realize transshipment services. Moreover, Sines increases the overall score distance to Malaga, as well as Algeciras that improves its rank as the best transshipment port.

6. Conclusions

This chapter will address the main conclusions of this research, as well as and implications for further research

6.1. Main conclusions

Taking in consideration the transshipment port market in the Gibraltar range, vessel turn-around time, proximity to main navigation and handling and storage costs of containers were revealed through the AHP survey to be the four most important criteria beyond the transshipment port choice process. In practice, can be defined 3 major attributes to the choice of a transshipment port: productivity, location and costs. The results obtained are aligned with previous researches, specifically regarding the importance of the geographic location of ports for transshipment.

The proximity to main navigation routes is a location attribute under the control of port authorities/terminal ports, being difficult to improve their current situation. In other words, it is possible to conclude that ports have no way, through investments, to improve their geographical location. Thus, as concluded by Lirn, Thanopoulou, Beynon, & Beresford (2004), once the port location is established, port operators and authorites can only compensate for unfavourable deviation costs through reducing handling and storage costs, improving port productivity and loading and discharging rates or diminishing congestion and berthing delay. Regarding handling and storage costs, there is already a competitive environment in the Gibraltar range and it seems to exist a greater gap between ports concerning vessel turn-around time and technical infraestruture. In this context, Algeciras appears to be the transshipment port that mostly fits the profile required, followed by Valencia and Tanger. It is commonly accepted, and as presented in this study, that container terminals in Tanger are seen as the most cost competitive. The lower labour costs are one of the key drivers of Tanger container terminals since, for instance, for low level positions the average payment is around 15$ per day.

Essentially, maritime carriers are using bigger ships in order to increase economies of scale and slow steam strategies to increase savings. In the current context, is possible to observe an environment of alliances, mergers and acquisitions amongst the main maritime carriers in order to surpass financial constraints, as well as a weak economic growth. The costs take an important burden in the decision making of maritime carriers. Thus, for port authorities and terminal managers, new investments regarding port automatization could be a way of reducing labor costs and decrease prices applied to the transshipment carriers (PortStrategy, 2014). In the Gibraltar range several ports are making efforts to improve their capacity and productivity. In Tanger, APM Terminals conquered a 30-year concession to operate container terminal 4, investing 758 million euros in a new 5 million TEUs terminal, which is expected to be completed in 2019. The technology to be installed in Tanger is similar to the APM Terminals Maasvlakte II in Rotterdam (The Maritime Executive, 2016). In Valencia, terminal operator Noatum invested 100 million euros to increase capacity, step up productivity and be able to deal with megaships of more than 18 thousand TEUs (PortStrategy, 2016). Algeciras Bay Port Authority recently issued a tender for the construction and operation of its third container terminal, for a 50-year concession of the 680 meters' berth with 18.5 meters of draft and semi-automated equipment, able to deal with neo-panamax vessels (PortStrategy, 2016).

Even if in the short-term the capital costs increase, the labor cost reduction and new customers' attraction could compensate in the medium and long-term (PortStrategy, 2014). In addition, terminal managers are usually the investors that take the risk to invest in new equipment, improve facilities, acquire cranes in order to increase productivity and port capacity. In order to maintain this level of investments and to keep customer-led strategy government authorities should negotiate long-term contracts with terminal managers. Additionally, the implementation of a more attractive fiscal policy can lead to a reduction in prices asked to the market. For instance, Morocco government introduced a free trade zone in Tanger, in which foreign companies can operate tax-free. These agreements were accomplished with more than 55 countries leading to the installation of 400 companies and creation of 60 thousand jobs (US News, 2016). Terminal managers, port and government authorities should cooperate in order to be able to improve the existing facilities and increase capacity to attract more customers. As it was stated for several authors, only costumer-led transshipment ports will be succeeded since the transshipment market is highly dynamic and the switching costs are lower. These arguments take more importance since in the Gibraltar range there are several international terminal managers that do not have any presence in the

zone, such as Hutchinson, DP World, Cosco Pacific, CMHI, ICTSI and SSA Marine, and taking in consideration the recent port developments in Tanger, the transshipment ports under analysis can be facing a lot more competition (PortStrategy, 2016).

6.1.Limitations and future research

From a methodological point of view could be relevant to address the transshipment port choice process taking in consideration a higher number of answers and only a few number of criteria, since from Lirn, Thanopoulou, Beynon & Beresford (2004) and my own research there are few common relevant attributes.

The indirect approach used in order to increase the respondents' number could introduce some bias. Terminal managers, port authorities, stevedoring companies, freight forwarders and logistics services' providers could introduce its own version and interpretation, instead of only trying to express maritime carriers' opinion.

The choice of the relevant transshipment ports could also be an issue, since there are others smaller container ports in the Gibraltar range that could also provide transshipment services in a lower scale. Moreover, the interlining or relay transshipment developed in the Gibraltar range could also be provided by other ports in the Mediterranean. Nevertheless, the five ports selected were the ones that most fulfilled the goals of the research at the beginning of the study.

From the beginning, the most important was to give priority to the anonymity of respondents in order to get a greater number of answers, but this resulted in a poorer characterization of the sample. This trade-off should be managed according to author's goals.

Furthermore, the survey was available during a period of labor pressures and strike of workers in some Portuguese ports, which may have led to some bias in the evaluation of ports.

For future research, is recommended to apply this research to other bottleneck areas (such as Malacca, Suez and Panama) and compare with the results obtained for the Gibraltar range. The results obtained could be relevant to conclude if each bottleneck area has is its own characteristics or if there is a common pattern between them. Lastly, since it is assumed by several authors that the switching costs in the transshipment business are small, it could be pertinent to analyze such cases, trying to understand which reasons lead to the change, framing a cost-benefit analysis.

7. Bibliography

Aronietis, R., Voorde, E., & Vanelslander, T. (2010). ***The Port Competitiveness Determinants of selected European ports in the Containerized cargo market***. Antwerp: Association for European Transport and contributors.

Autoridade da Concorrência. (2015). ***Estudo sobre concorrência no setor portuário.*** Portugal: Autoridade da Concorrência.

Baird, A. (2012). Logistics strategy in container shipping. Em S. Dong-Wook, & P. Panayides, ***Maritime logistics - a complete guide to effective shipping and port management*** (pp. 125-146). Kogan page.

Caldeirinha, V., & Felício, A. (2013). The relationship between position-port, hard-port and soft-port characteristics and port performance:conceptual models. ***Maritime Policy & Management.***

Centin, C. K. (2012). Port and logistics chains: changes in organizational effectiveness. Em P. Panayides, & D.-W. Song, ***Maritime Logistics: a complete guide to effective shipping and port management*** (pp. 233-263). KoganPage.

Chang, Y.-T., Lee, S.-Y., & Tongzon, J. (2008). Port selection factors by shipping lines: Different perspectives between trunk liners and feeder service providers. ***Marine Policy,*** 877-885.

Council of Supply Chain Management Professionals. (09 de 11 de 2015). Obtido de Council of Supply Chain Management Professionals: https://cscmp.org/about-us/supply-chain-management-definitions?XX=1

Council, W. S. (15 de Novembro de 2014). *Industry Globalization: World Shipping Council*. Obtido de World Shipping Council - Partners in Trade: http://www.worldshipping.org/about-the-industry/history-of-containerization/industry-globalization

Culinnane, K., & Song, D.-W. (2005). The Application of Mathematical Programming Approaches to Estimating Container Port Production Efficiency. ***Journal of Productivity***, *24*, pp. 73-92.

Ducruet, C., & Notteboom, T. (2012). Developing liner service networks in container shipping. Em D.-W. Song, & P. Panayides, ***Maritime logistics - a complete guide to effective shipping and port management*** (pp. 77-100). Kogan Page.

Ducruet, C., & Notteboom, T. (2012). The Worldwide Maritime Network of Container Shipping:Spatial Structure and Regional Dynamics. ***Global Networks***, 395-423.

Ducruet, C., & Zaidi, F. (2012). Maritime constellations: a complex network approach to shipping and ports. ***Maritime Policy & Management: The flagship journal of international shipping and port research***, 151-168.

Gonçalves, F. C. (2015). ***O mercado do transporte marítimo de carga contentorizada***. Lisboa: Chiado Editora.

Grosso, M., & Monteiro, F. (2008). ***Relevant strategic criteria when choosing a container port - the case of the port of Geno****a.* Association for Europena Transport.

Hayashi, K., & Nemoto, T. (2012). Intermodal freight transport and logistics. Em D.-W. Song, & P. Panayides, ***Maritime logistics - a complete guide to effective shipping and port management*** (pp. 45-58). Kogan Page.

Heng, W., & Tongzon, J. (2005). Port privatization, efficiency and competitiveness: some empirical evidence from container ports (terminals). ***Transportation Research Part A***, pp. 405-424.

Jafari, H., Saeidi, N., & Karimi, M. (2013). Importance-performance analysis of port's services quality from perspective of containerized liner shipping. ***Management Science Letters***, 1743-1750.

Lee, E.-S., Nam, H.-S., & Song, D.-W. (2012). Defining maritime logistics and its value. Em D.-W. Song, & P. Panayides, ***Maritime Logistics - a complete guide to effective shipping and port management*** (pp. 9-21). Kogan Page.

Levinson, M. (2006). ***The Bo****x.* Princeton: Princeton Univesity Press.

Lirn, T., Thanopoulou, H., Beynon, M., & Beresford, A. (02 de 2004). An Application of AHP on Transhipment Port Selection: A Global Perspective. ***Maritime Economics and Logistics***, pp. 70-91.

Min, H., Mitra, A., & Oswald, S. (1997). Competitive benchmarking of health care quality using the analytic hierarchy process: An example from Korean cancer Clinics. ***Socio-Economic Planning Science****s*, pp. 147-159.

Monteiro, M. F. (2013). ***PhD Thesis: Productivity in the Container Port Business - ocus on the Mediterranean Range***. University of Antwerp: Antwerp.

Moreira, P. (2013). ***O Contributo de Sines na Eclosão de um Cluster Regional***. Lisboa: DINAMIA'CET.

Mouftier, L., & Sanchez, R. (17 de Setembro de 2016). *Port Economics Thematic Areas: Containers.* Obtido de Port Economics: http://www.porteconomics.eu/2016/07/29/the-puzzle-of-shipping-alliances-in-july-2016/

Nam, H.-S., & Song, D.-W. (2011). Defining maritime logistics hub and its implication for container port. ***Maritime Policy & Management***, 269-292.

Nir, A.-S., Lin, K., & Liang, G.-S. (2003). Port choice behaviour-from the perspective of the shipper. ***Maritime Policy & Management:The flagship journal of international shipping and port research***, 165-173.

Noronha, A. (11 de Julho de 2014). *Negócios Online*. Obtido de Jornal de Negócios: http://www.jornaldenegocios.pt/empresas/detalhe/maersk_e_msc_anunciam_nova_alianca_depois_do_falhanco_da_p3.html

Notteboom, T. (13 de Novembro de 2015). Obtido de Port Economics: http://www.porteconomics.eu/news/noticeboard/item/603-mega-vessel-stop-over-transhipment-near-the-straits-of-gibraltar

Notteboom, T., & Rodrigue, J. (2005). Port Regionalization: towards a new phase in port development. ***Maritime Policy and Management***, 297-313.

Notteboom, T., & Winkelmans, W. (2011). Structural changes in logistics: how will port authorities face the challenge? ***Maritime Policy and Management: The flagship journal of international shipping and port research***, 71-89.

Notteboom, T., Parola, F., & Satta, G. (2014). ***State of the European Port System - market trends and structure update.*** European Union: PORTOPIA Consortium.

Panayides, P., & Song, D.-W. (2008). Global supply chain and port/terminal: integration and competitiveness. ***Maritime Policy & Management: The flagship journal of international shipping and port research,*** 73-87.

Panayides, P., Wiedmer, R., Andreou, P., & Louca, C. (2012). Supply chain integration ofshipping companies. Em S. Dong-Wook, & P. Panayides, ***Maritime Logistics - a complete guide to effective shipping and management*** (pp. 101-124). Kogan Page.

PortStrategy. (29 de October de 2014). *News - Insight and Opinion - The Strategist - Labour saving revolution*. Obtido de PortStrategy insight for senior port executives: http://www.portstrategy.com/news101/insight-and-opinion/the-strategist/labour-saving-revolution-underway

PortStrategy. (21 de June de 2014). *News - Planning and Design - Follow the leader?* Obtido de PortStrategy insight for senior port executives: http://www.portstrategy.com/news101/port-operations/planning-and-design/lemmings-and-costs

PortStrategy. (26 de March de 2016). *News - World - Africa - High risk, high reward?* Obtido de PortStrategy insight for senior executives: http://www.portstrategy.com/news101/world/africa/high-risk,-high-reward

PortStrategy. (11 de August de 2016). *News - World - Europe - Algeciras to build third box terminal*. Obtido de PortStrategy insight for senior port executives: http://www.portstrategy.com/news101/world/europe/algeciras-to-build-third-box-terminal

PortStrategy. (3 de August de 2016). *News - World - Europe - Centre Stage*. Obtido de PortStrategy insight for senior port executives: http://www.portstrategy.com/news101/world/europe/centre-stage

Qualtrics. (19 de 09 de 2016). *Market research Qualtrics*. Obtido de Qualtrics: https://www.qualtrics.com/market-research/

Rodrigue, J.-P. (09 de 11 de 2015). Obtido de Port Economics: http://www.porteconomics.eu/news/viewpoints/item/660-transshipment-hubs-connecting-global-and-regional-maritime-shipping-networks

Rodrigue, J.-P., Comtois, C., & Slack, B. (2013). ***The Geography of transport Systmes*** (Third Edition ed.). New York: Routledge.

Roso, V., & Rosa, A. (2012). Dry port in concept and practice. Em P. Panayides, & D.-W. Song, ***Maritime Logistics: A complete guide to effective shipping and port management*** (pp. 179-194). KoganPage.

Saaty, T., & Vargas, L. (1994). Decision Making in Economic, Political, Social and Technological Environments with Analytic Hierarchy Process. ***RWS Publications***.

Saeed, N. (2009). An analysis of carriers' selection criteria when choosing container terminals in Pakistan. ***Maritime Economics & Logistics***, 270-288.

Tang, L. C., Low, J., & Lam, S. W. (Março de 2011). Understanding Port Choice Behavior - A network perspective. ***Networks and Spatial Economics***, pp. 65-82.

The Maritime Executive. (3 de March de 2016). *Africa to Get First Automated Container Terminal*. Obtido de The Maritime Executive - Intellectual Capital for Executives: http://www.maritime-executive.com/article/africa-to-get-first-automated-container-terminal

Tongzon, J. (1995). Determinants of port performance and efficiency. ***Transportation Research***, 245-252.

Tongzon, J., & Sawant, L. (2007). Port choice in a competitive environment: from the shipping lines' perspective. ***Applied Economics***, 477-492.

Ugboma, C., Ugboma, O., & Ogwude, I. (Setembro de 2006). An AHP Approach to Port Selection Decisions - Empirical Evidence from Nigerian Ports. ***Maritime Economics and Logistics***, *8*, pp. 251-266.

UNCTAD. (2014). ***Review of maritime transport***. New York and Geneve: UNCTAD.

United Nations Economic and Social Comission for Asia and the Pacific. (2005). ***Development of Shipping and Ports in North-East Asia***. New York: UNESCAP.

US News. (5 de July de 2016). *Bigger, but not necessarily better*. Obtido de US News: http://www.usnews.com/news/best-countries/articles/2016-07-05/is-bigger-the-best-path-to-development

Wiegmans, B., Hoest, A., & Notteboom, T. (2008). Port and terminal selection by deep-sea container operators. ***Maritime Policy & Management: The flagship journal of international shipping and port research***, 517-534.

Yercan, F., & Yildiz, T. (2012). International maritime trade and logistics. Em D.-W. Song, & P. Panayides, ***Maritime Logistics - a complete guide to effective shipping and port management*** (pp. 23-44). Kogan Page.

Zahedi, F. (Julho de 1986). The Analytic Hierarchy Process — A Survey of the Method and its Applications. ***INTERFACES***, pp. 96-108.

8. Annex

Annex 1

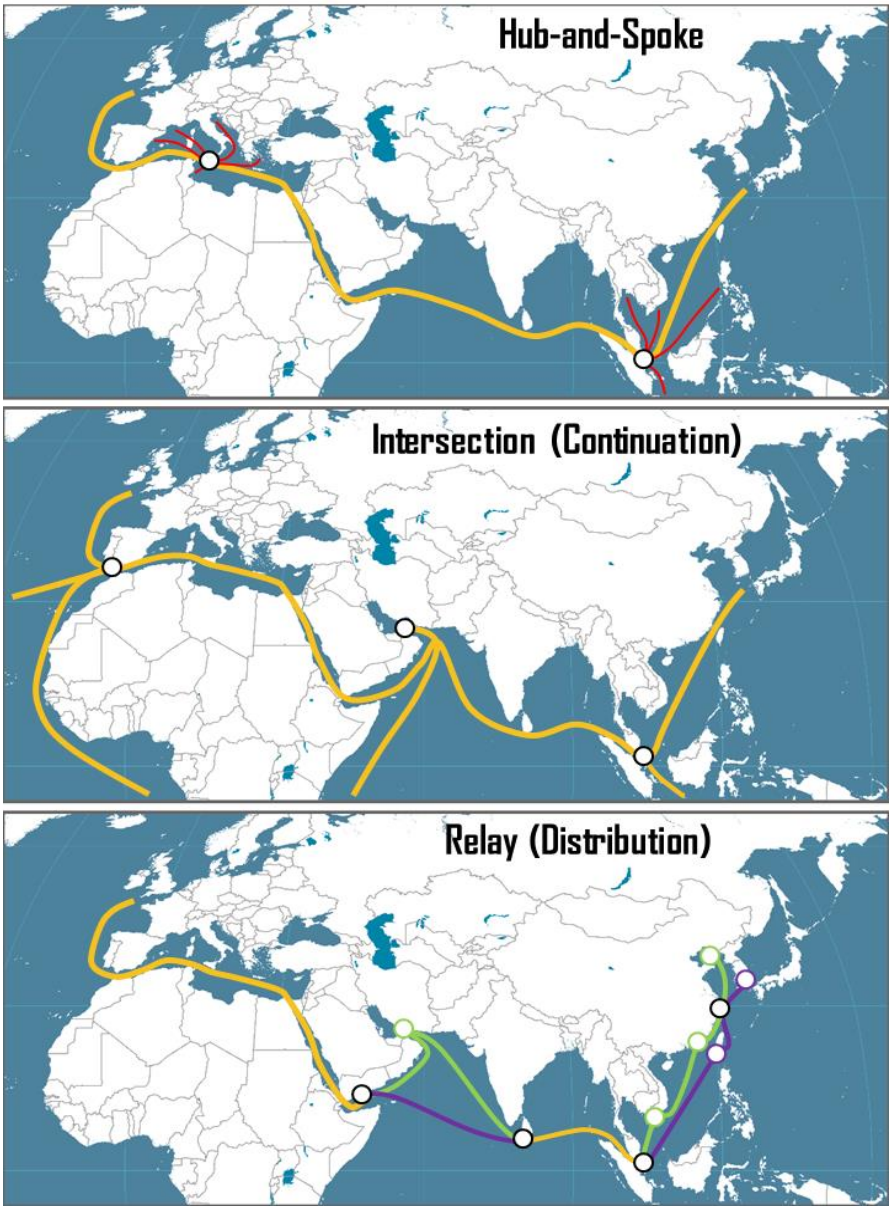


Figure 3: The insertion of transshipment hubs
Source: Rodrigue, Comtois & Slach, The Geography of transport Systems, 2013

Annex 2

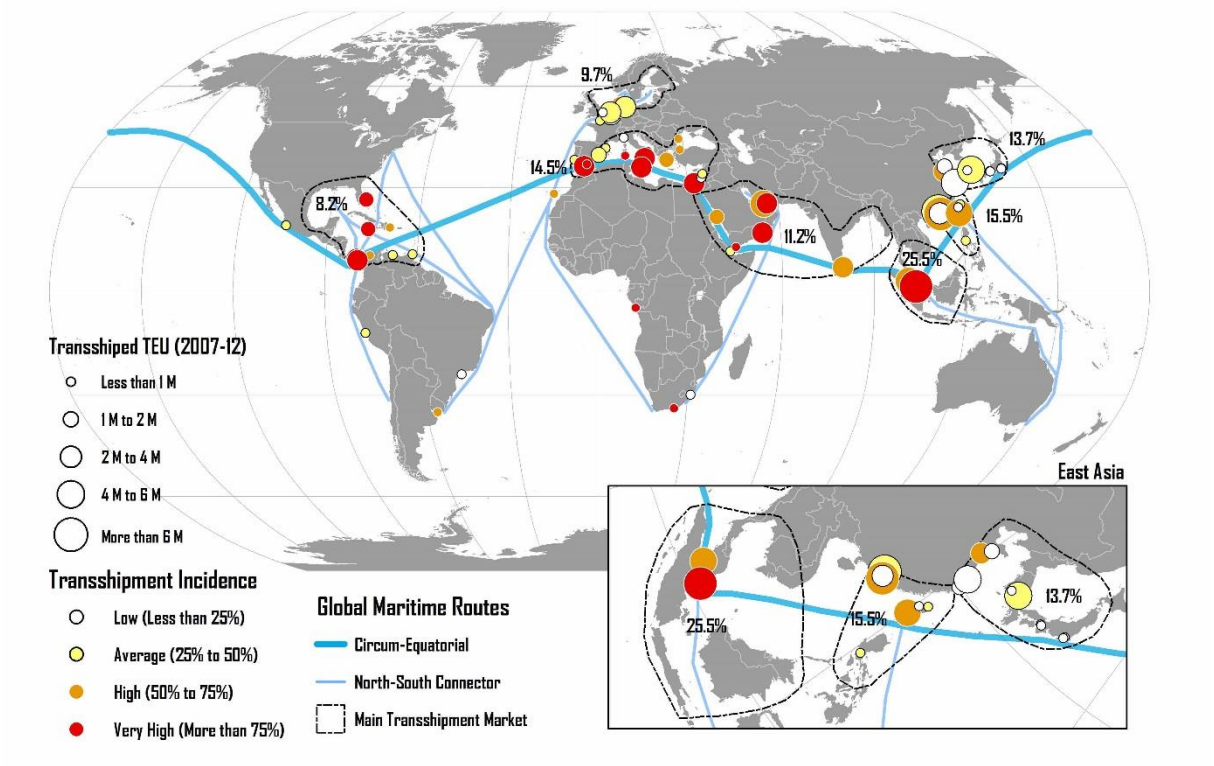


Figure 4: Transshipment market across the world
Source: Rodrigue, Port Economics, 2015

Annex 3

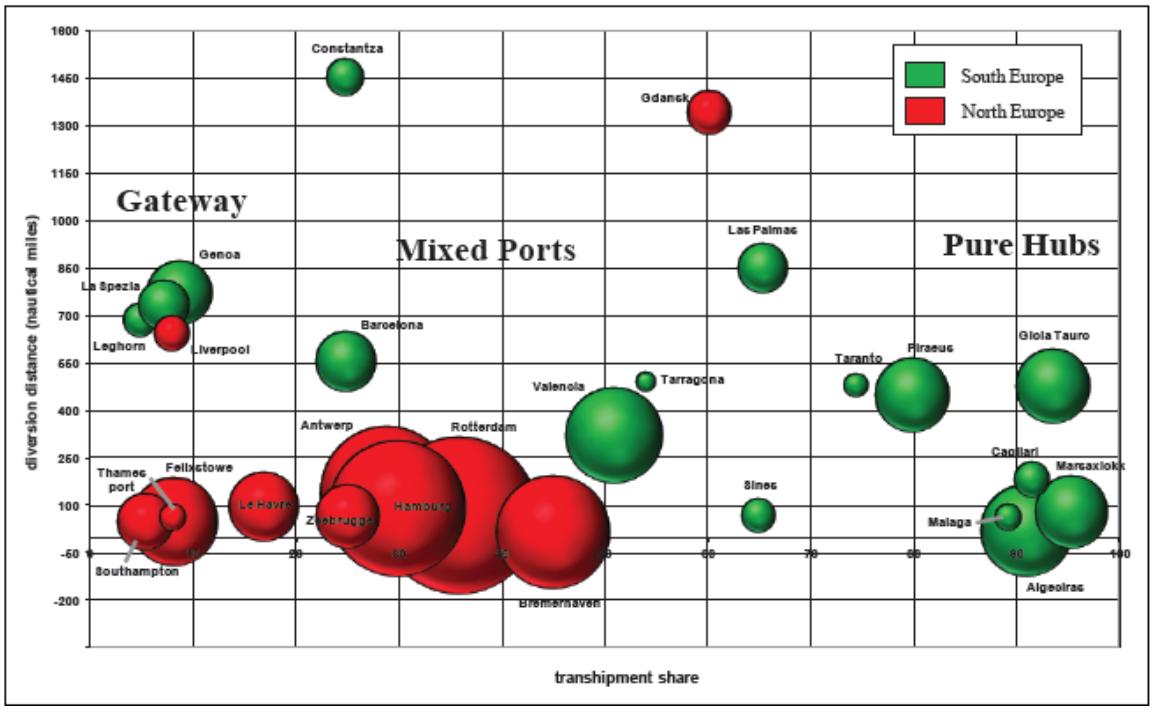


Chart 7: Transshipment incidence vs diversion distance for a sample of European containers ports – year 2012
Source: Notteboom, Parola & Satta, 2014

Annex 4

Figure 5: The puzzle of shipping alliances
Source: (Mouftier & Sanchez, 2016)

Annex 5

		GROWTH	2014	2013	2012	PORTO
RANK	AREA	14/'13	TEU	TEU	TEU	
1	PSA	3%	54 400 000	52 900 000	50 900 000	SINES
2	Hutchison	6%	47 700 000	45 000 000	44 800 000	
3	APM Terminals	5%	36 900 000	35 000 000	33 700 000	ALGECIRAS / TANGER
4	DP World	9%	35 653 600	32 800 000	33 400 000	
5	CMHI	13%	26 000 000	23 100 000	20 800 000	
6	COSCO PACIFIC	10%	20 400 000	18 600 000	17 000 000	
7	TIL	4%	16 000 000	15 400 000	13 500 000	SINES / VALÊNCIA / TANGER
8	Eurogate	3%	6 900 000	6 700 000	6 500 000	TANGER
9	ICTSI	17%	6 800 000	5 800 000	5 300 000	
10	SSA Marine	2%	6 200 000	6 100 000	6 000 000	
TOTAL		4%	256953600	241400000	231900000	
OTHER PORTS		5%	422046400	419200000	406900000	
SHARE GLOBAL TERMINAL OPERATORS		-	38%	37%	37%	

Table 1: Global terminal operators
Source: AGEPOR

Annex 6

	Maritime Carriers	Alliance	Terminal Manager
Sines	MSC	2M	PSA / MSC
Valencia	MSC	2M	NOATUM MSC
Algeciras	MAERSK HANJIN	2M CKYHE	APM TERMINALS TTI (HANJIN)
Tangier	MAERSK MSC CMA-CGM	2M OCEAN THREE	APM TERMINALS EUROGATE

Table 2: Maritime carriers and terminal managers in the Gibraltar range
Source: AGEPOR

Annex 7

Evaluation by 18 respondents (max=90 ; min=18)													
		Sines	Tanger	Malaga	Valencia	Algeciras	Weight	Standard Deviation	Sines	Tanger	Malaga	Valencia	Algeciras
VTAT	Vessel turn-around time	38	62	31	60	79	11.2%	19.4	4	2	5	3	1
PMNR	Proximity to main navigation routes	36	60	48	46	80	10.6%	16.9	5	2	3	4	1
HCC	Handling cost of containers	55	69	43	49	54	8.7%	9.6	2	1	5	4	3
SCC	Storage cost of containers	51	70	44	49	56	8.1%	9.9	3	1	5	4	2
IML	Intermodal Links	40	35	50	77	68	7.6%	18.0	4	5	3	1	2
TOEC	Terminal ownership / Exclusive contracts policy	45	62	41	49	73	7.5%	13.2	4	2	5	3	1
PFP	Proximity to feeder ports	33	51	47	58	81	7.2%	17.6	5	3	4	2	1
BIC	Basic Infraestructure	32	59	35	66	78	7.2%	19.9	5	3	4	2	1
TIC	Technical Infraestructure	33	60	34	63	80	7.0%	20.2	5	3	4	2	1
AVS	Availability of additional services	36	45	40	78	71	7.0%	19.1	5	3	4	1	2
PIEA	Proximity to import and/or export areas	38	37	52	77	66	7.0%	17.5	4	5	3	1	2
MAE	Management and administration efficiency	40	50	39	64	77	5.6%	16.3	4	3	5	2	1
PSS	Port security and safety	44	46	39	63	78	5.4%	16.2	4	3	5	2	1
							7.2%	17.5	4.14	2.66	4.21	2.52	1.47
							Median	Median	Overall Score				

Table 3: Evaluation analysis of data collected
Source: Own elaboration

Annex 8

Survey appendix

Factors:

1. Basic Infrastructure: depth of the port;
2. Technical Infrastructure: includes available number of berth, back-up space on terminal, port terminal capacity, number and size of cranes;
3. Intermodal Links: refers to the port accessibility by land and sea, number and frequency of road and rail links, hinterland size, intermodal platforms, inland freight rates;

4. Proximity to import and export areas: refers to the volume of containers to imports and exports, geographical advantage of the port to the manufacturing industry, cargo-generating effect, trade inertia;
5. Proximity to feeder ports: includes the frequency and number of feeder shipping services and its quality;
6. Proximity to main navigation routes: includes the number and frequency of maritime routes, transit time, proximity to alternate loading center;
7. Management and administration efficiency: includes labor problems, port tradition and customs, quality of customs handling, regulation level, container handling efficiency, flexible operation process, service ability, port operation and working hours;
8. Vessel turn-around time: refers to congestion, berthing delay and loading and discharging rates, port productivity, port berthing time length;
9. Port security and safety: includes terminal security, port safety, quality of handling and storage of containers;
10. Handling cost of containers: includes state aid and its influence on cost, port charges and price conditions, free trade zones;
11. Storage cost of containers: refers to the carriers' storage cost, transportation and post user cost;
12. Terminal ownership/Exclusive contract policy: refers to the ownership of port and terminal, privileged terms to carriers;
13. Availability of additional services: refers to logistics services (repair and maintenance services, tracking, assembling and packaging, dry port, integrated logistics processes).

Annex 9

Survey Applied

Context:

This survey is carried out within the framework of the master's thesis in Business Administration, at ISCTE-IUL.

Goal:

This survey intends to understand the decision factors that influence the choice of the

transshipment container ports in the Gibraltar range.

Information processing:

The answers to the survey are anonymous and all the information provided by the respondent will be handled strictly confidential.

Please continue to the next page. The survey will take about 10 minutes.

Contacts:

Pedro Miguel Alves

Email: pmcas@iscte.pt

The relative importance of the factors

For each pairs of factors below, select the relative importance, according with the following scale:

Intensity of Relative Importance	Definition
0	Equal importance in relation to other factor
1 or -1	
2 or -2	
3 or -3	
4 or -4	Important in relation to other factor
5 or -5	
6 or -6	
7 or -7	
8 or -8	Extreme importnace in relation to the other factor

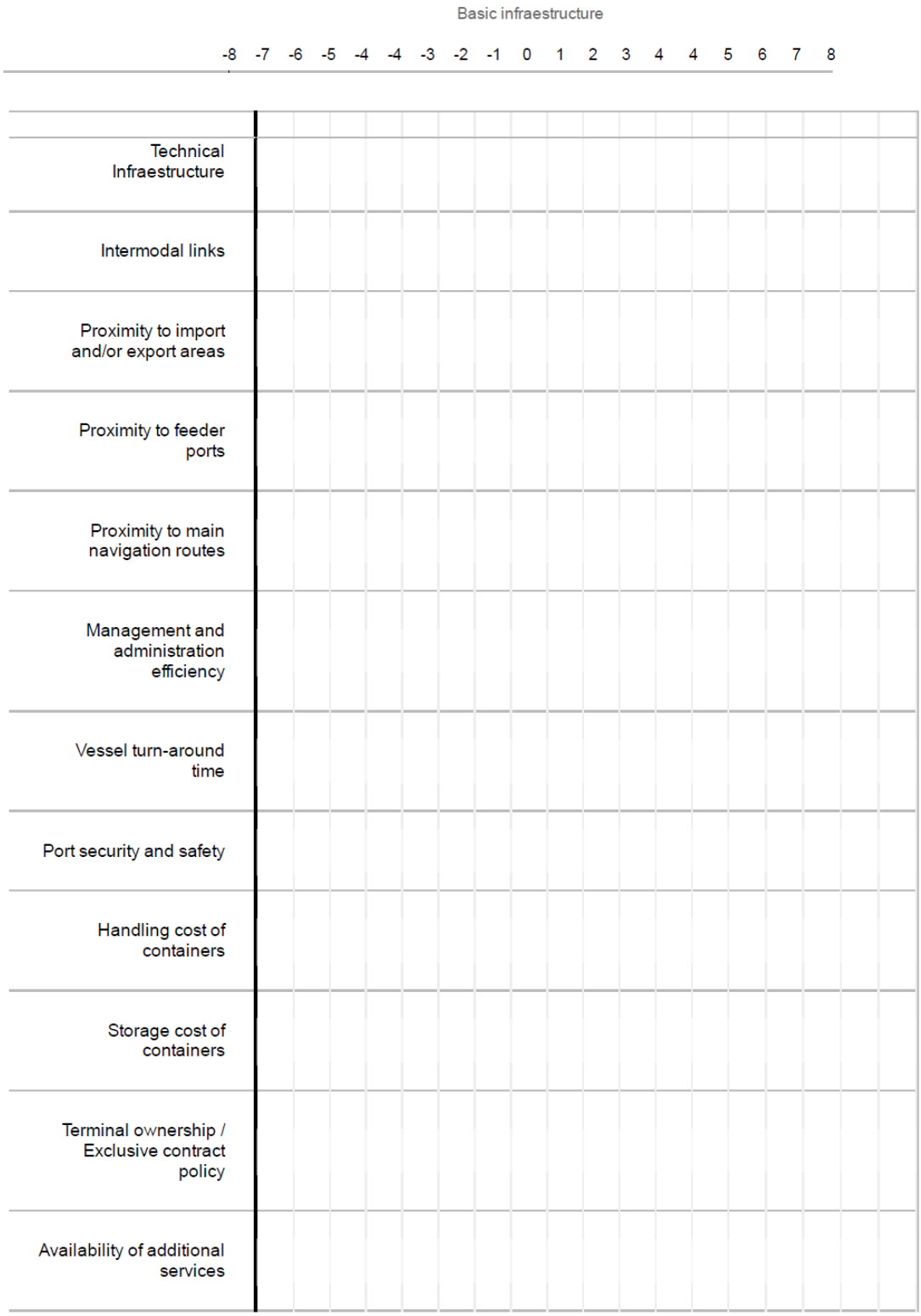
Completion instructions:

If Basic infraestructure factor is 8 times more important than Technical infraestructure it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Technical infraestructure is 8 times more important than Basic infraestruture it should be select 8 option.

Appendix - Factors explanation



Completion instructions:

If Technical infraestructure factor is 8 times more important than Intermodal links it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Intermodal links is 8 times more important than Technical infraestructure it should be select 8 option.

Appendix – Factors explanation

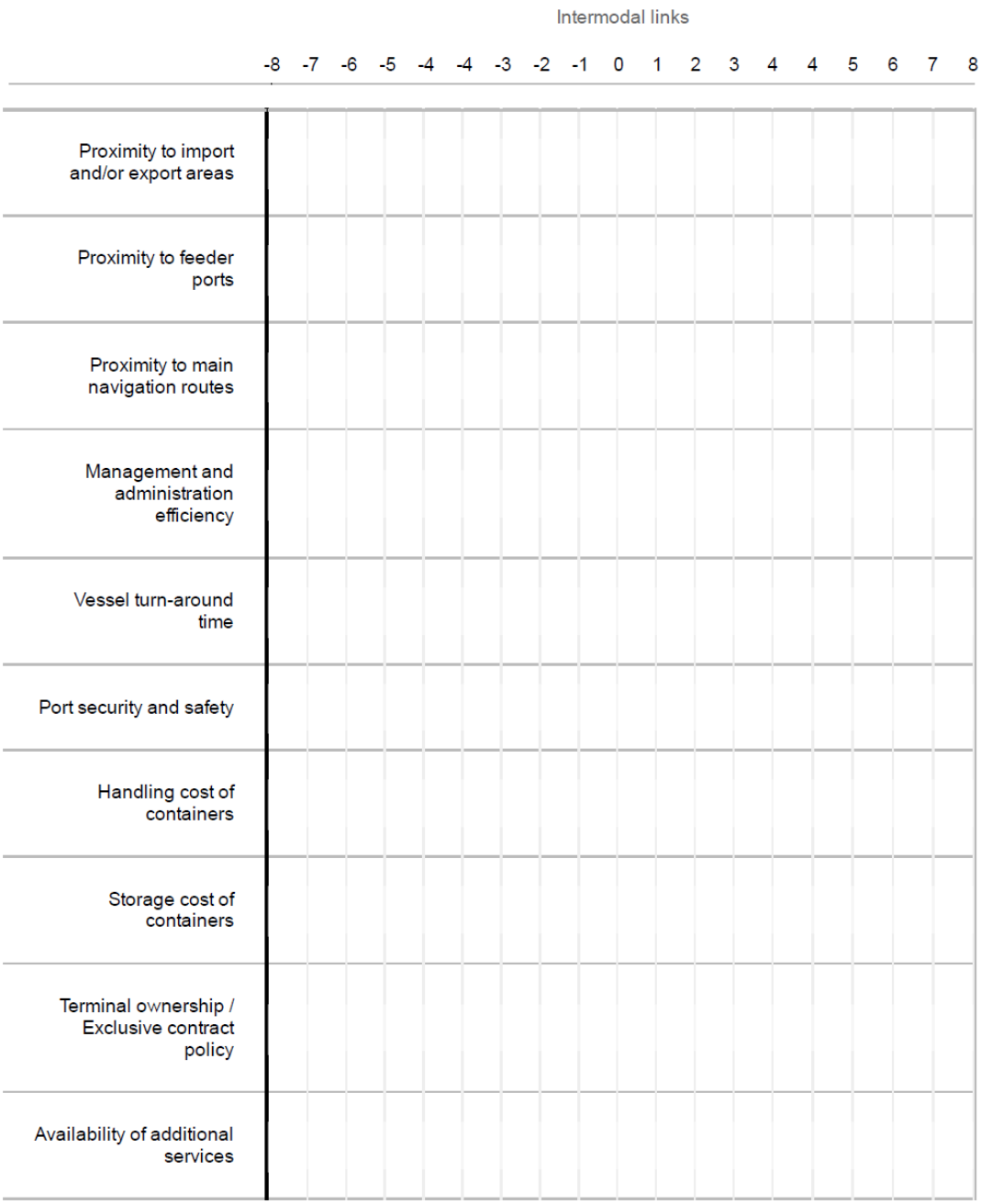
Completion instructions:

If Intermodal links factor is 8 times more important than Proximity to import and/or export areas it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Proximity to import and/or export areas factor is 8 times more important than Intermodal links factor it should be select 8 option.

Appendix – Factors explanation



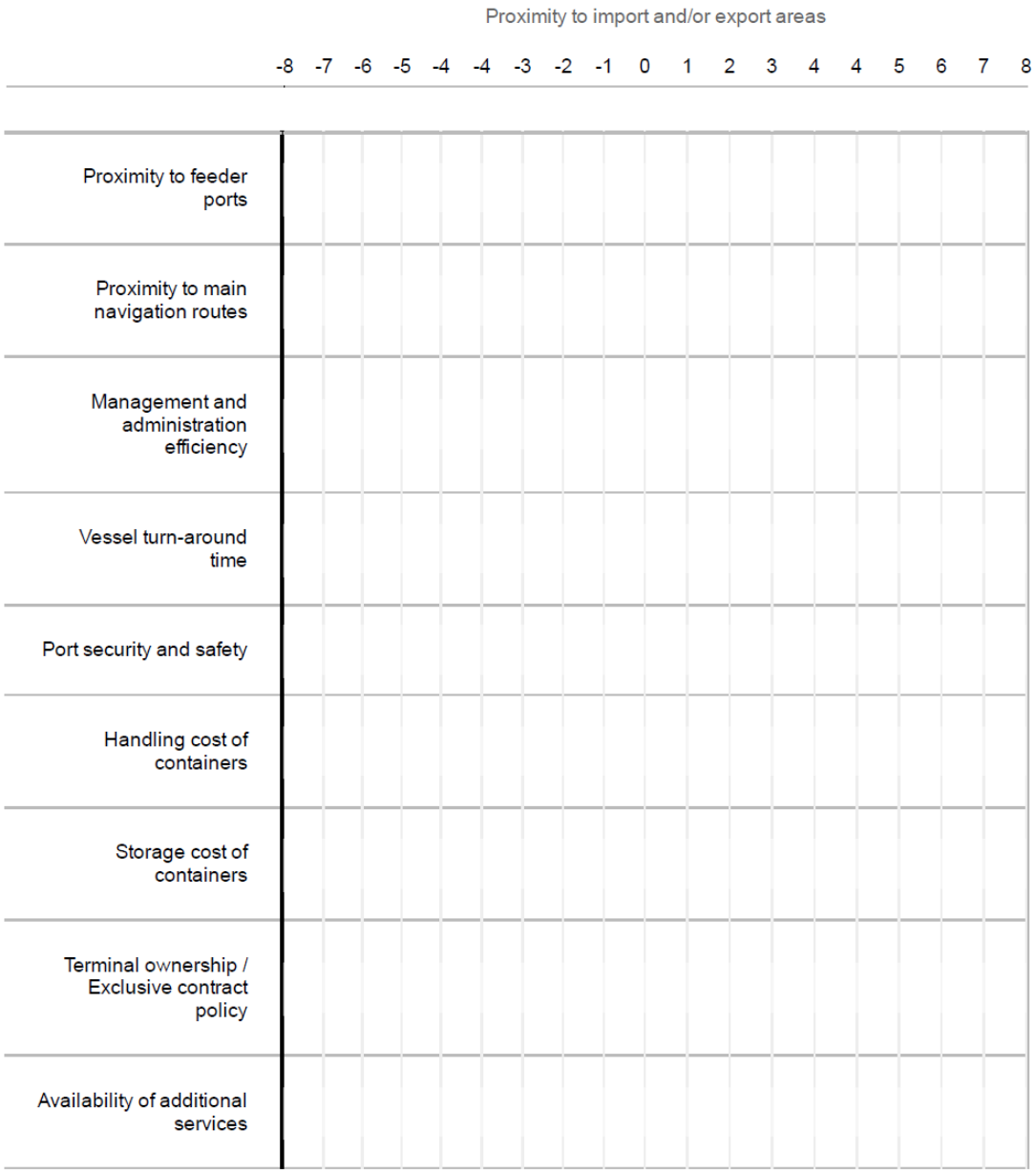
Completion instructions:

If Proximity to feeder ports factor is 8 times more important than Proximity to main navigation routes factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Proximity to main navigation routes factor is 8 times more important than Proximity to feeder ports factor it should be select 8 option.

Appendix – Factors explanation



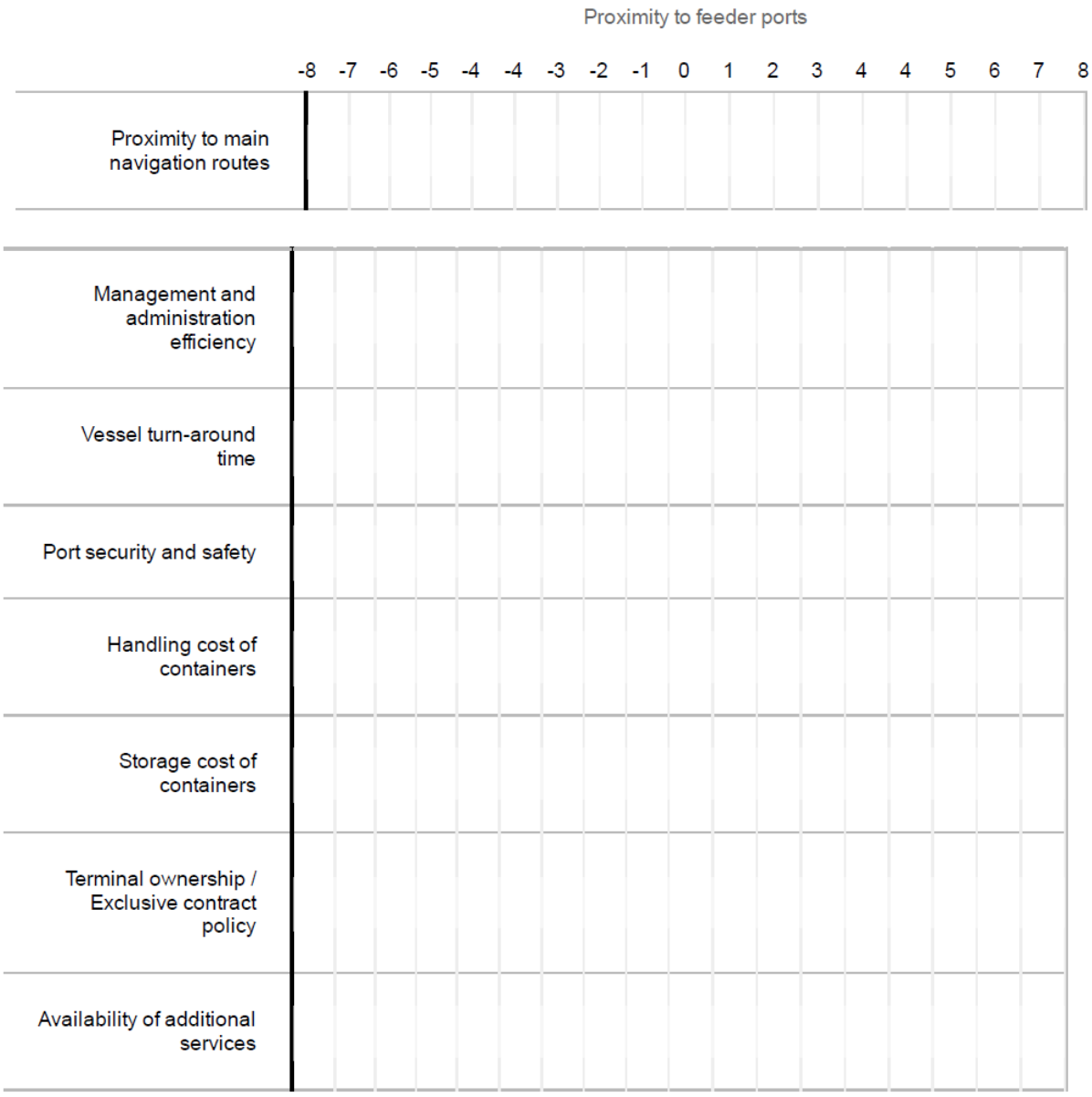
Completion instructions:

If Proximity to feeder ports factor is 8 times more important than Proximity to main navigation routes factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Proximity to main navigation routes factor is 8 times more important than Proximity to feeder ports factor it should be select 8 option.

Appendix Factors explanation



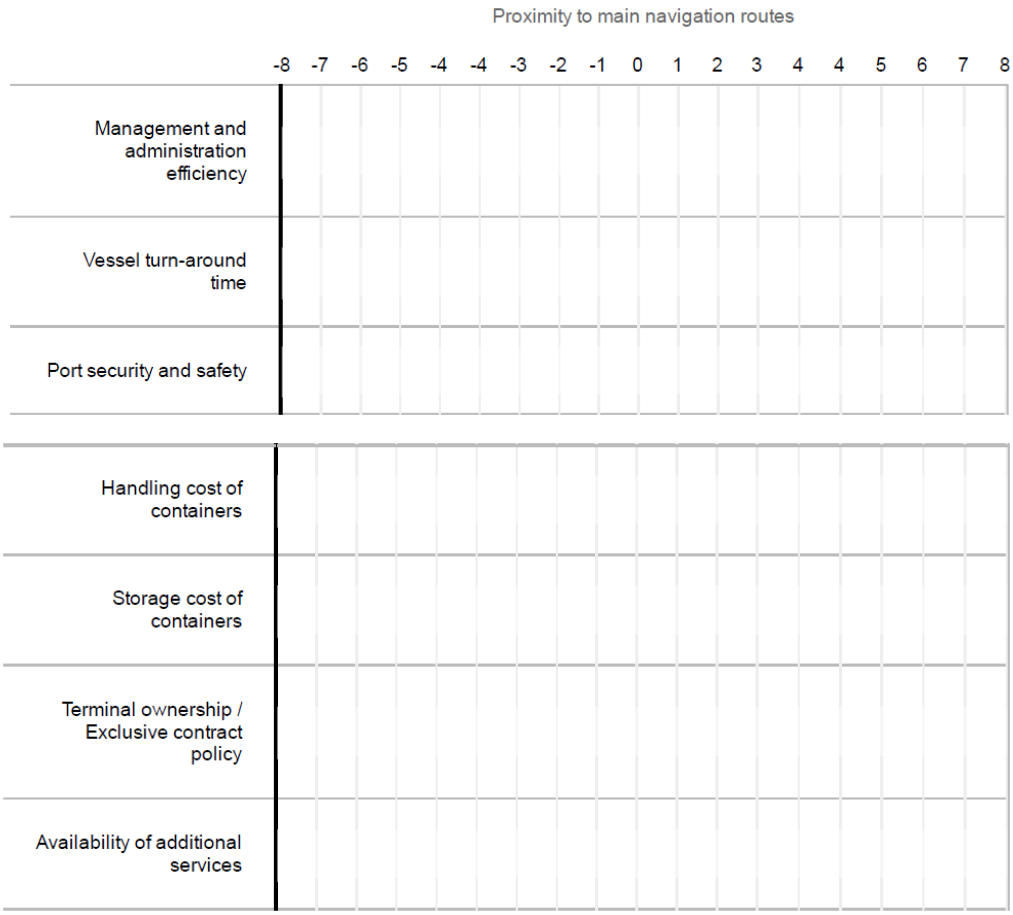
Completion instructions:

If Proximity to main navigation routes is 8 times more important than Management and administration efficiency factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Management and administration efficiency factor is 8 times more important than Proximity to main navigation routes factor it should be select 8 option.

Appendix - Factors explanation



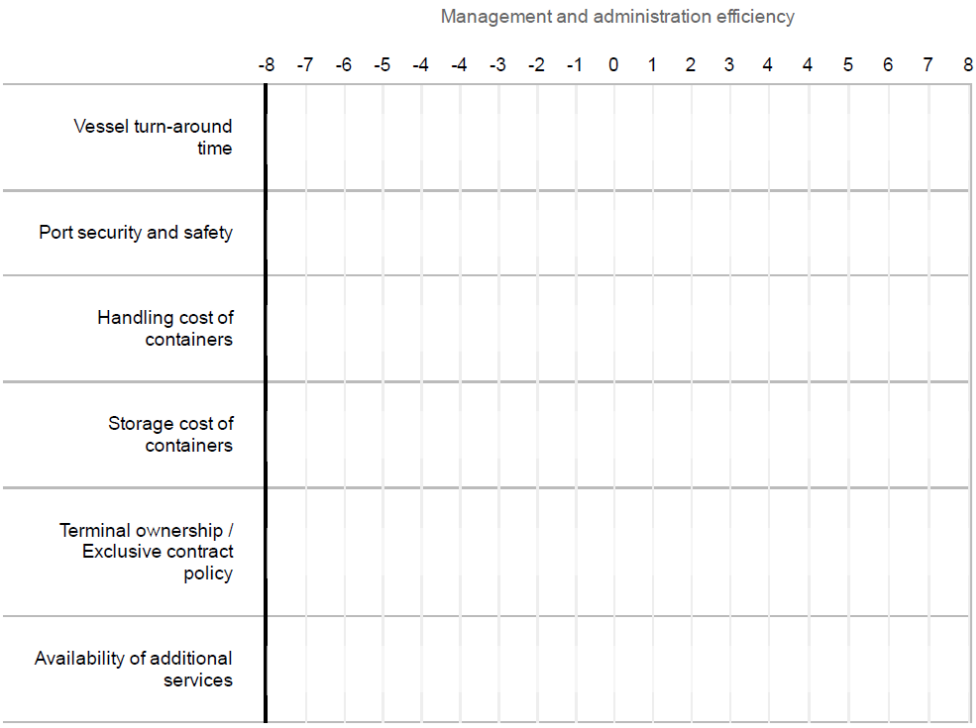
Completion instructions:

If Management and administration efficiency factor is 8 times more important than Vessel turnaround time factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Vessel turnaround time factor is 8 times more important than Management and administration efficiency factor it should be select 8 option.

Appendix – Factors explanation



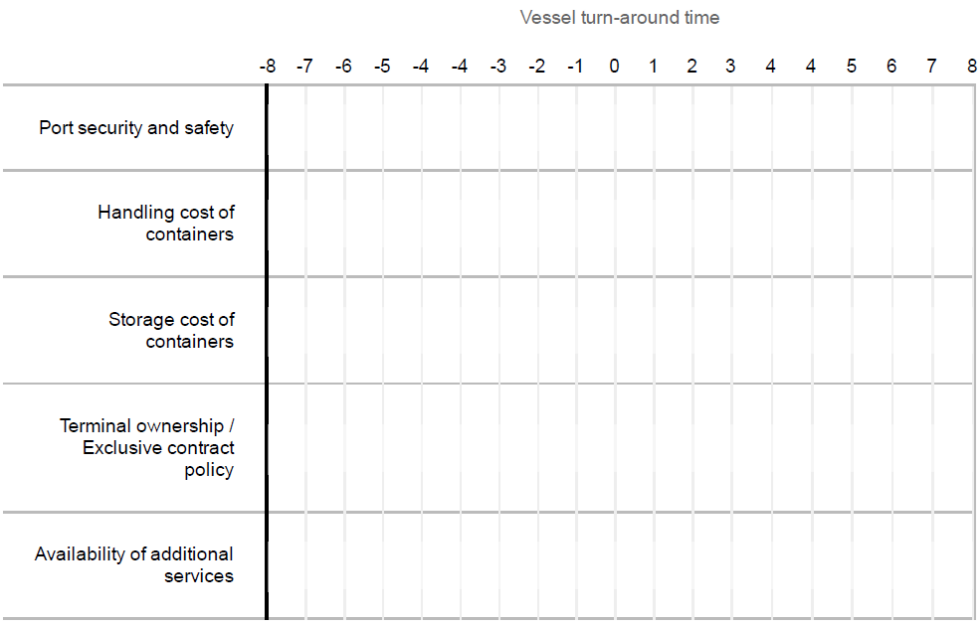
Completion instructions:

If Vessel turnaround time factor is 8 times more important than Port security and safety factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Port security and safety factor is 8 times more important than Vessel turnaround time factor it should be select 8 option.

Appendix – Factors explanation



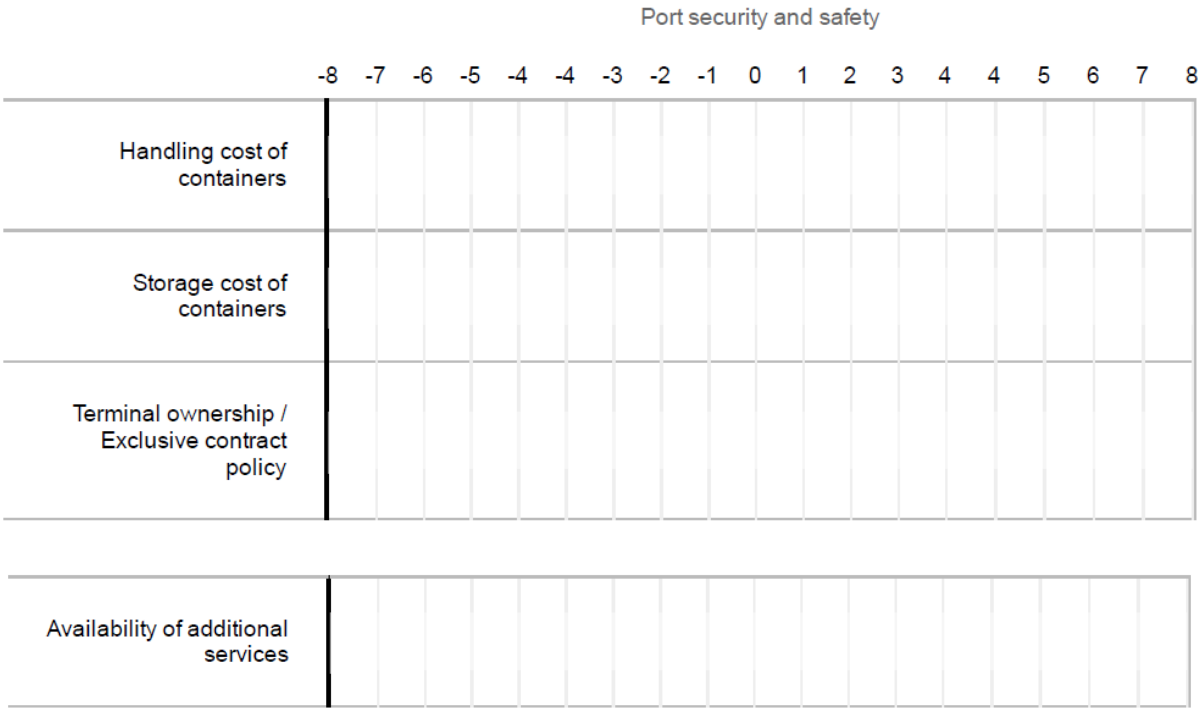
Completion instructions:

If Port security and safety factor is 8 times more important than Handling cost of containers factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Handling cost of containers factor is 8 times more important than Port security and safety factor it should be select 8 option.

Appendix – Factors explanation



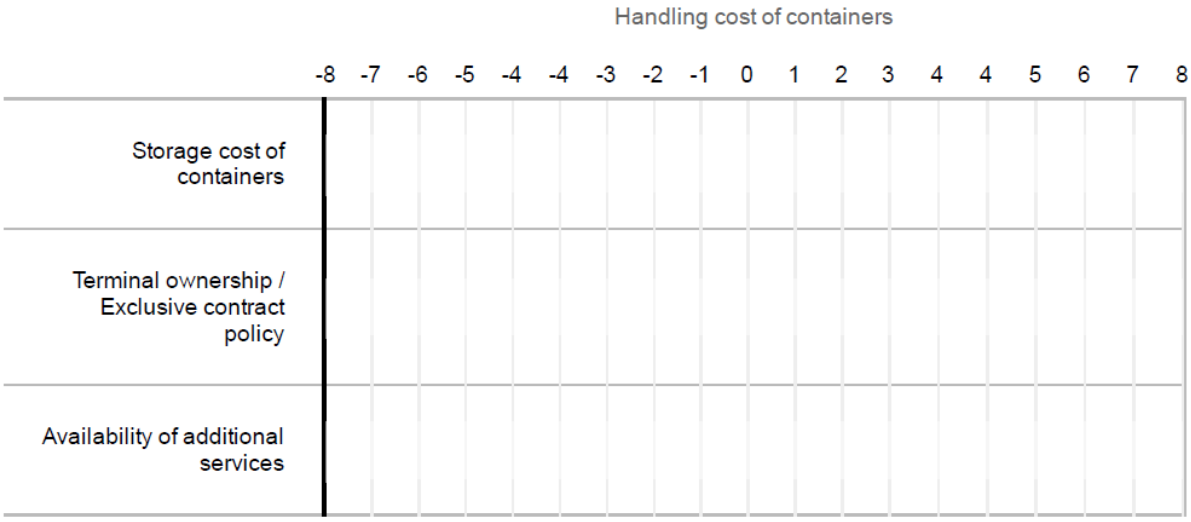
Completion instructions:

If Handling cost of containers factor is 8 times more important than Storage cost of containers factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Storage cost of containers factor is 8 times more important than Handling cost of containers factor it should be select 8 option.

Appendix – Factors explanation



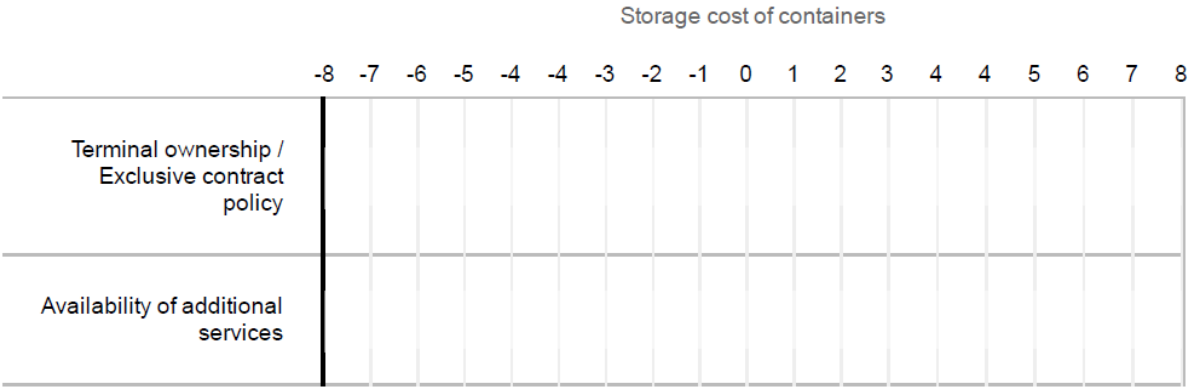
Completion instructions:

If Storage cost of containers factor is 8 times more important than Terminal ownership/Exclusive contract policy factor it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Terminal ownership/Exclusive contract policy factor is 8 times more important than Storage cost of containers factor it should be select 8 option.

Appendix – Factors explanation



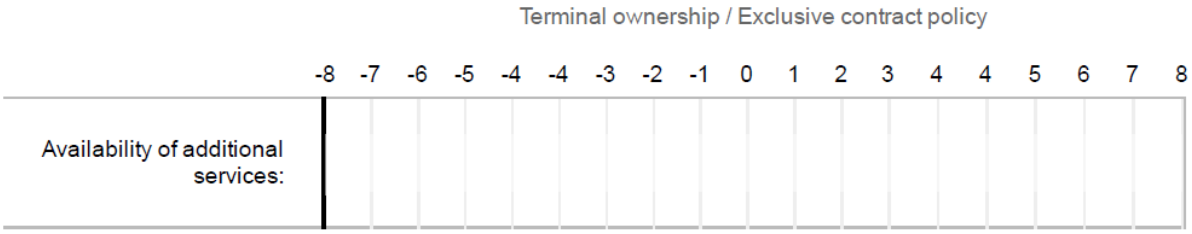
Completion instructions:

If Terminal ownership/Exclusive contract policy factor is 8 times more important than Availability of additional services it should be selected 8 option.

If both factors are equivalent (have the same importance) it should be selected 0 option.

Otherwise, if Availability of additional services factor is 8 times more important than Terminal ownership/Exclusive contract policy factor it should be select 8 option.

Appendix – Factors explanation



Attractiveness of the ports in analysis

Rank, for each one of the transshipment container ports, the performance level for each of the factors below.

Appendix – Factors explanation

Use the following scale: 1 = worst performance; 2 = performance below the average; 3 = performance average; 4 = performance above the average; 5 = best performance.

	Sines	Tanger	Málaga	Valência	Algeciras
Basic Infraestructure					
Technical Infraestructure					
Intermodal Links					
Proximity to import and/or export areas					
Proximity to feeder ports					
Proximity to main navigation routes					
Management and administration efficiency					
Vessel turn-around time					
Port security and safety					
Handling cost of containers					
Storage cost of containers					
Terminal ownership / Exclusive contracts policy					
Availability of additional services					

General information of the respondent

Taking in consideration your company, what is your role/position in the supply chain of shipping containers?

- Freight Forwarder
- Maritime Carrier
- Port Authority

- Maritime Customs Broker
- Logistics Services' Provider
- Terminal Manager
- Stevedoring Company

Which of the following container ports did you already had at least one interaction?

(Multiple selection available)

- Sines
- Tanger
- Malaga
- Valencia
- Algeciras

Which one of the following transshipment container ports do you use with greater regularity?

(Select only one option)

- Sines
- Tanger
- Malaga
- Valencia
- Algeciras

In which country is located your company?

For how many years is your company in business?