

**ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ**



**ΤΜΗΜΑ ΝΑΥΤΙΛΙΑΚΩΝ ΣΠΟΥΔΩΝ  
ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ  
ΣΠΟΥΔΩΝ ΣΤΗΝ ΝΑΥΤΙΛΙΑ**

**DISTRIBUTION CENTERS: AN EXPENSIVE  
SOLUTION OR A COST-SAVING  
PRACTICE?**

Όνοματεπώνυμο: Παύλος Ηλιάδης

Επιβλέπων Καθηγητής: Παπαδημητρίου  
Ευστράτιος

Διπλωματική εργασία που υποβλήθηκε στο Τμήμα Ναυτιλιακών  
Σπουδών του Πανεπιστημίου Πειραιώς ως μέρος των απαιτήσεων για την  
απόκτηση του Μεταπτυχιακού Διπλώματος Ειδίκευσης στην Ναυτιλία

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## ΠΕΡΙΛΗΨΗ

Σκοπός της διπλωματικής εργασίας είναι να εξετάσουμε πως τα κέντρα διανομής έχουν εξελιχθεί σε ουσιαστικό μέρος στη διαχείριση της εφοδιαστικής αλυσίδας και στο σύστημα των Logistics και αποτελούν την βελτίωση από τις παραδοσιακές αποθήκες. Παίρνουν διάφορους ρόλους, όπως: (1) κέντρο διάσπασης χύδην παραγγελιών, (2) κέντρο διασταύρωσης, (3) κέντρο μεταφόρτωσης, (4) εγκατάσταση συναρμολόγησης, (5) κέντρο ολοκλήρωσης προϊόντων, (6) αποθήκη για επιστρεφόμενα αγαθά και άλλους διάφορους ρόλους. Αλλά και τα κέντρα διανομής αποτελούν ουσιαστικό μέρος για τις ναυτιλιακές επιχειρήσεις, επειδή οι ναυτιλιακές εταιρείες αποθηκεύουν τα ανταλλακτικά για τα πλοία τους, έτσι ώστε να τους τα παραδίδουν μέσω των διανομέων. Η αποθήκευση ανταλλακτικών στις εγκαταστάσεις τους ή η αποστολή τους απευθείας από τους κατασκευαστές, όταν τα έχουν έτοιμα, είναι πολύ δύσκολη και δαπανηρή. Μέσω ενός ερωτηματολογίου, όπου απαντήθηκε από τα τμήματα αγορών / προμηθειών των ναυτιλιακών εταιρειών, μπορούμε να καταλήξουμε σε συμπέρασμα αν η χρήση κέντρων διανομής εξοικονομεί κόστος για τις ναυτιλιακές εταιρείες.

## ΛΕΞΕΙΣ-ΚΛΕΙΔΙΑ

Εφοδιαστική Αλυσίδα, Logistics, Κέντρα Διανομής, Ρόλοι, Αποθήκες

## ABSTRACT

Aim of this master thesis is to examine how Distribution Centers have evolved as an essential part in supply chain management and logistics system, and are an improvement from traditional warehouses. They play various roles such as: (1) make bulk/bulk consolidation center, (2) cross-dock (CD), (3) transshipment facility, (4) assembly facility, (5) product-fulfillment center, (6) depot for returned goods, and other miscellaneous roles. But also Distribution Centers are an essential part for Maritime business, because shipping companies store the spare parts for their vessels so as to deliver to them through distributors. Storing spare parts in their own premises or sending them directly from the makers, when they have them ready, it is very difficult and expensive. Through a questionnaire, which purchasing/supply departments of shipping companies answered, we can come to a conclusion if the use of distribution centers saves costs for shipping companies.

### Key Words

Supply Chain Management, Logistics, Distribution Center, Roles, Warehouses



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## CHAPTER 1: INTRODUCTION

The aim of this master thesis is firstly to analyze the role of the distributions centers in general and additionally in maritime business, as they are a must-have storage facilities of the spare parts for the vessels of the shipping companies, and a necessary part of the maritime logistics.

In the first part the system of supply chain management will be presented, its definition and all of its functions as they are commonly known, as well as how it reduces the costs of the companies that fully complies with, and how maritime chain works.

Subsequently, the logistics part will be analyzed, its definition, functions, significance, etc. and how seaports were evolved to become major logistic centers.

Furthermore, the definition of the distribution centers will be given as well as their role in the supply chain management. Moreover the running and operational costs of those centers will be presented extensively, as of course their role in maritime business.

Finally, before we draw conclusions from this master thesis, the methodology and the results we have collected from a questionnaire, which was answered from the purchasing/supply department of shipping companies regarding the distributions centers and how helpful they are for their transport of purchased spare parts from the makers to their vessels, will be presented. Also will be examined if the cost of using them is very high or a way to save money for their companies.

## CHAPTER 2: SUPPLY CHAIN MANAGEMENT

### 2.1 Definition

In business world, **supply chain management (SCM)**, the administration of the stream of merchandise and ventures, includes the development and capacity of crude materials (work-in-process stock), and of a completed product from its initial stages to the last ones (end customer). Interconnected or interlinked systems, channels and hub organizations combine in the acquisition of items and administrations required by end clients in a supply chain. Supply-chain management has been characterized as the "outline, arranging, execution, control, and monitoring of supply chain activities with the target of creating net value, fabricating a focused foundation, leveraging global logistics, synchronizing supply with demand and measuring performance worldwide. SCM practice is largely based on the areas of industrial and systems engineering, operations management, logistics, purchasing, information technology and marketing and makes progress towards an incorporated approach. Marketing channels assume an essential part in supply chain management. Based on a current research in supply chain management concern is expressed about points identified with sustainability and risk management, among others, whereas the "general population measurement" of SCM, moral issues, internal integration, visibility, and talent management are issues that have, yet far, been underrepresented on the research plan.

Supply chain management is a cross-utilitarian approach that compromises managing the movement of raw materials into a business, certain parts of the inside preparing of materials into finished goods, and the movement of those goods out of the business and towards the final customer. As businesses endeavor to focus on core competencies and be more flexible, they decrease their ownership of raw materials sources and distribution channels. These functions are progressively working better or more cost adequately. The result is to increase the number of businesses involved in fulfilling customer demand, while lessening managerial control of daily logistics operations. Not so much control but rather more supply chain partners results in the creation of

the idea of supply chain management. The motivation behind supply chain management is to enhance trust and coordinated effort among supply chain partners, thus improving inventory visibility and the speed of stock development (Wieland; Wallenburg, 2011).



**Supply Chain Management (Wikipedia SCM)**

**(Figure 1-1)**

## 2.2 How to succeed the SCM

A successful SCM demands a change from the management of individual functions to the integration of activities into the main processes of the supply chain. An example that can be given is, if the sales department announces some requirements it has, these requirements must be satisfied (Wikipedia SCM). The marketing department, in report to customer demand, communicates with various distributors and retailers, as it attempts to find ways to meet this demand. The information is exchanged between the supply chain partners, as there is only perfect information through the completion of the process (Jacoby, 2015).

The process of integrating SCM involves collaborating work among buyers and suppliers, joint product development, common systems and shared information. The operation of an integrated supply chain demands a continuous flow of information. However, in many organizations, management has come to conclusion that products flow optimization cannot be achieved without the implementation of a business process approach (Hines, 2010).

The basic processes of the supply chain are as follows:

- Managing customer relationships
- Customer Service Management
- Demand Management Modes
- Execution of orders
- Industrial flow management
- Managing relationships with suppliers
- Product development and commercialization
- Return Management

Much has been written about demand management. The top companies have similar characteristics, including the following: a) internal and external co-operation b) time reduction initiatives c) feedback from customer and market demand d) customer level forecast.

One could suggest other key critical business processes that combine these processes such as:

1. Customer Relationship Management.
2. Supply.
3. Product development and commercialization.
4. Industrial flow management / support.
5. Physical distribution.

6. Outsourcing / Partnerships.
7. Evaluation of performance.
8. Storage Management (Ketchen; Hult, 2016).

## 2.3 Reduction of SCM cost

Supply chain cost diminishment might wind up being applied bottom up, but the start should be top down. This helps keep the general idea in mind, as well as expanding the odds that you will examine the greater part of the correct regions, divisions, classifications and components (Simchi-Levi; Kaminsky; Simchi-Levi, 2015)

1. **Transaction costs.** The demonstration of placing or accepting an order can be shockingly costly. The activities of issuing and overseeing invoices, organizing deliveries, answering back to client queries and checking progress all add to the general cost. Following a work process, like placing an order through delivery and invoicing, is one approach to assess these costs, in spite of inefficiencies in the work process, there may still be more concealed expenses. A portion of the cost transactions originates from overly complicated processes, and some other originates from poor data sharing due to a reluctance to collaborate. As an outcome, technology such as e-commerce platforms can take care of some issues, however other parts of cost reduction might only happen if individuals work better together.

2. **Mismatched procedures.** Inside an overall procedure, for example arranging supplies and producing finished goods, there might be a few different procedures, such as the supplier's own procedures to deliver, the reception and stocking procedure within the customer enterprise, and so on. If the end of one procedure does not dovetail with the start of the following one, there might be interference and duplication of work, both of which scale up costs. For instance, if a supplier's codes of product or pallet sizes do not fill in with those used by the enterprise, these products will have to be recoded and reorganized. In the customer packaged goods sector, this issue is significant enough to have incited the use of collaborative planning, forecasting and replenishment (CPFR)

amongst makers and retailers. A similar thought can be applied in other sectors too.

**3. Uncertainty.** The individuals who do not recognize what will happen must take out insurance. At the point the uncertainty is in product supply and demand, the insurance is the stockpiling on inventory “just in case”. This can influence both makers that do not know which orders they will get and resellers and final customers that stockpile because of uncertainty about the producer’s ability to supply as required. These safety stocks can increase at each juncture of supply chain, from crude materials to work in progress, from finished products to regional distribution centre holdings, and more. Holding stocks costs money in many more ways than one. Stock costs money to store and to manage, it expends working capital and blocks possible revenue from that capital, and it builds up the risk of having to write off obsolete inventory. Depending on the product concerned, stock holding costs of as short as one month can gobble up the entire profit margin on that product. (Heaver, 2015).

From these three territories portrayed above, it is clear that cost savings rely on having the right information and procedures. Quickening a fundamentally inefficient procedure, for example the recoding and re-organizing of products received, still leaves potential cost reduction on the table, in manner of speaking. On the off chance that the right strategic procedures are being used, at that point opportunities for tactical improvement might be many.

- **Economies of scale.** These might be accessible terms of supplies ordered, yet additionally in terms of batches of goods made or collected, spreading overheads like setup time over larger quantities of products. Moreover, learning time to create a specific article or provide a certain service can be better amortized over a bigger number of iterations of the same procedure.

- **Smarter use of storage.** Using much space or having staff spending too much time trying to discover items are both costly. Better usage of space and information on stored products can make reserve funds. Note that the system you utilize will be the one that makes sense for your company. For example, online retailer Amazon uses its own system of “enormous storage”

based on barcodes, not product categories, which in reality makes its operations more exact and more efficient.

- **Accelerated movement of supplies.** At the point when supplies move quicker, you can order later and store them for less time, which implies less inventory holding costs, and of course less risk of misfortune or damage.
- **An improved ordering system.** One central system and the strict least of individuals needed to raise and approve an order are good ways to begin.

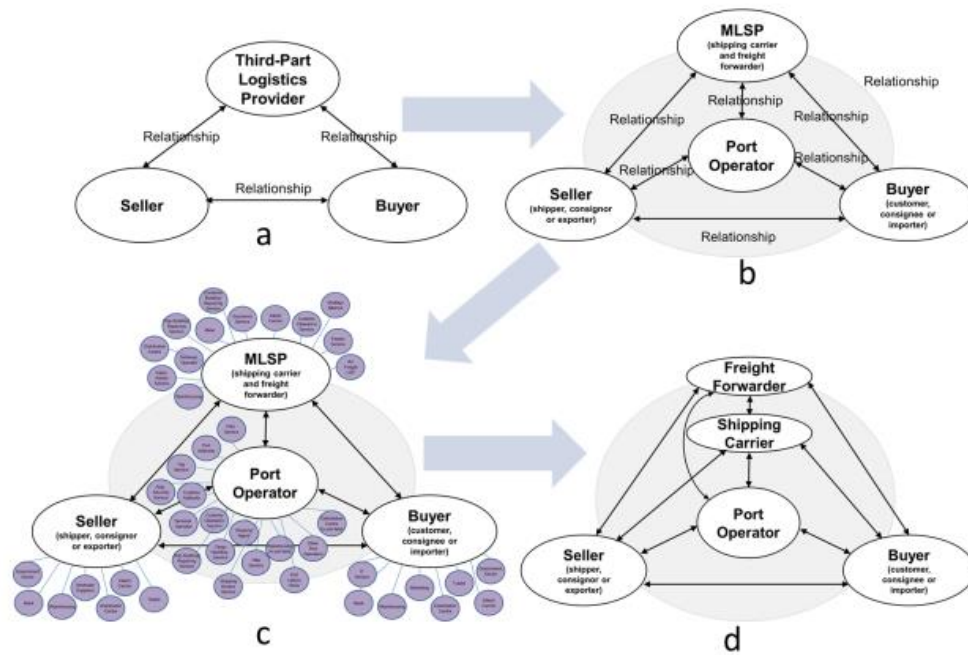
It is unlikely to expect that each kind of cost reduction is beneficial. As an example, slashing transport spending costs might result in holding higher levels of stock. At the time when stock expenses contribute more than transport to general supply chain costs, as is frequently the case, this approach is back to front. Actually, overall costs might be reduced by increasing transport expenses on the other hand. A major obstacle for some organizations is however their own mindset: they assume that the transport department solely as a cost centre, and look for only to reduce those particular costs, resulting in false savings in general.

To demonstrate that even the most prestigious organizations can get their cost-cutting incorrectly, take for example the case of car maker Porsche's ill-fated choice to pare certain suppliers down to one per category. When the sole maker it was using for the string in its seat belts went bankrupt (in 2009), Porsche was compelled to suspend production for almost two weeks (O Byrne, 2016).

## 2.4 The Maritime Chain of Transportation

After we analyzed how supply chain management works, and how to succeed and reduce its costs, it is now the time to examine how it works in maritime business.





## Maritime Chain

(Figure 2-1)

(Heaver evolving roles of shipping lines in international logistics, 2012)

### 2.4.1 Parties in maritime chain

Firstly, we must refer to the parties that are taking part in maritime chain:

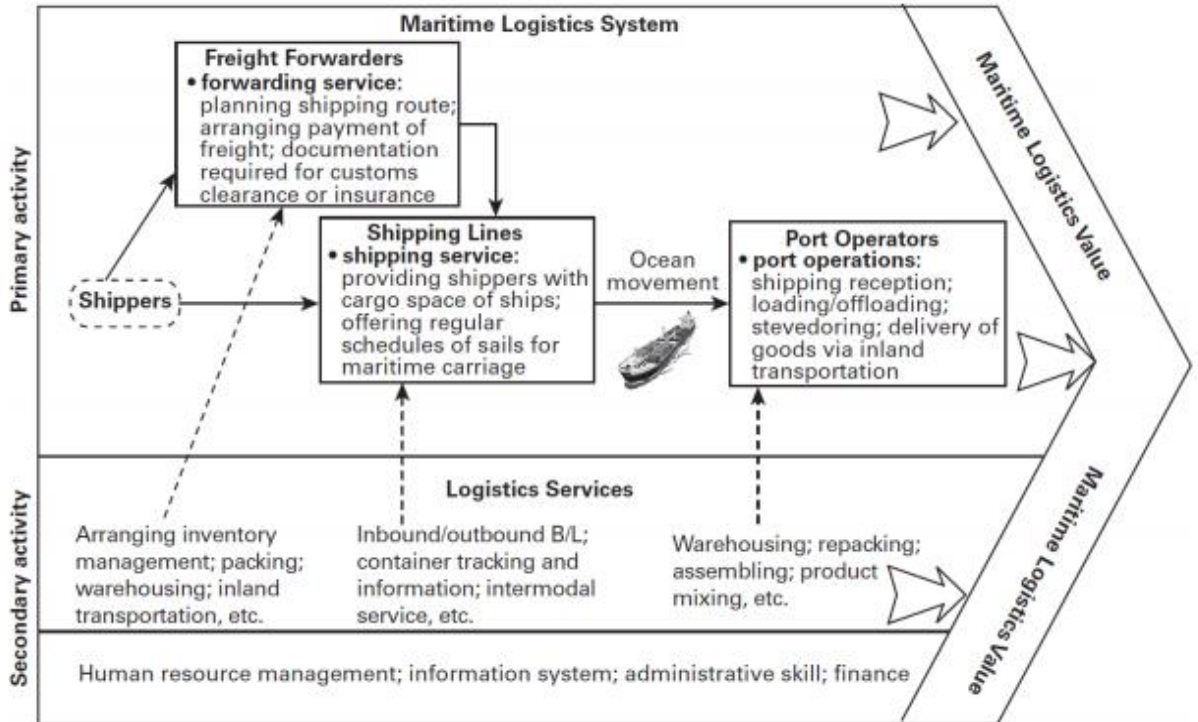
- **The Seller-Shipper:** He is the one who has the cargo and wants to sell it.
- **The Buyer:** He is the one who wants to buy the cargo from the seller.
- **Freight Forwarder:** is a person or an organization that organizes shipments for individuals or partnerships to get their goods from makers to a market, or a client or a final point of distribution
  - **Shipping carrier:** is a shipping company or a shipping operator that carries goods from port A to port B
  - **Port operator:** is port authority or organization that contracts with port authority to take cargo through port at a contracted minimum level of productivity (Lin, 2015).

## 2.4.2 Who adds value in maritime chain

A maritime transport chain can best be conceptualized as a system through which carriers (e.g. shipping companies or operators) and outsiders (third parties such as terminal administrators, freight forwarders, etc) provide services for the movement of cargo provided by shippers.

The primary actors in maritime chain of transportation who add value to the consignor by moving products from regions with excess supply to territories with excess demand. In this procedure a number of (independent) outsiders-third parties- may provide a number of services. The shipper or potential transporter will utilize these agents if the rise in costs is more than remunerated by the value of the service. The third parties, on the other hand, can only exist if they provide value added services to other third party service providers or the carrier.

From a financial perspective value is made when a business earns income that surpasses the expenses. In many sectors, although, value is progressively being made by more intangible drivers such as research, branding, innovation, ideas and networks which usually provide indirect instead of direct benefits. This is also the case within maritime chain. Third parties may add value through (1) quality, (2) improve the level of service, (3) time and (4) cost reduction (Roslyng Olesen, 2015).



### Add Value in Maritime Chain

(Figure 2-2)

(Roslyng Olesen, Value Creation in the Maritime Chain of Transportation: The role of Carriers, Ports and Third Parties in Liner and Bulk Shipping, 2015)

## CHAPTER 3: LOGISTICS

### 3.1 Definition

Logistics term is a multidimensional and complex concept. So the existence of several terms for rendering the same idea and perception means that there is a question of definition. According to the United States CLM ( Council of Logistics Management) logistics is defined as : "The completion of two or more activities to design, implement and control the efficient flow of raw materials, products under construction and final products from the point of origin to the point of consumption in order to fully comply with customer requirements."Alternatively, we can define logistics as the designing and operation of the physical, administrative and information systems that are necessary to allow goods to overcome time and space. Theoretically, logistics serve the profitability of a business, aiming at producing products at the lowest possible cost, ensuring the continued availability of its products and other resources, while allowing the smooth flow of operational processes (Panayides, 2013). Therefore, Logistics Management's mission is to bring the right products or services to the right time and place with the desired conditions, while at the same time to make the greatest possible contribution to the business. Logistics find application in two main fields. The first field is the business, which has to organize the inflow, internal movement and the flow of materials and products in such a way as to ensure the maximum satisfaction of its customers. The second field is the supply chain, which consists of all those companies and organizations that are needed so that a product, from raw materials to reach the final customer. Effective organization and management of the flow of products and information in this chain is imperative in a globalized and digital economy. As can be extracted from the above, logistics and the supply chain are inextricably linked, since the term logistics essentially represents the management of the supply chain of business. For this reason, these two terms are confused and are not identical. The term supply chain describes the process grid that is required for a product to pass from the production phase to that of consumption. Logistics, on the other hand, provide the answer to how the

supply chain processes need to be organized to achieve the best possible goal (Sifniotis, 2009).

### 3.2 Functions

The logistics concern:

**1. Requirements.** Logistics activities are involved in analyzing, synthesizing and defining the resources needed to achieve a goal or to bring an enterprise to business under particular circumstances. The overall goal of defining requirements is a designing function that involves both strategy and logistics. The allocation of the main available resources, if fewer than required, and the assessment of the outcome of the shortcomings to achieve the main objectives, are the main responsibilities of the strategy rather than the function of the logistics.

**2. Design.** This feature includes the whole design through detailed designing of products, systems and services, including development, testing and design assessment.

**3. Supply.** This field involves the physical supply and distribution of all available resources e.g. procurement, staff recruitment and training, production support, packaging, inventory management, transportation, traceability of products, ordering, storage, withdrawals, etc. There are functions that create temporal and spatial utility, in contrast to production operations using and marketing functions that create ownership of property.

**4. Maintenance.** The term Maintenance is widely understood as the upkeep of facilities, products, human resources, systems and services, producers and users, including the protection, conservation and recovery of all available resources.

**5. Resources.** Raw materials, equipment, facilities, staff, including funds and information. Logistics is often associated with material management, but materials management techniques can also be applied to the management of human resources, funds and information. Logistics activities complement and

support strategy and tactics. They support the goals, plans and operational activities of the systems. Supported systems may be organizations or individuals. The above definition of logistics does not indicate that logistics determine requirements, neither is mechanical design nor management. It only states that when predefined administration, specific technical methodology and specific technical activities are involved with specific support functions, then the combination of these factors is a logistics application. The implementation of logistics has different modes of action and different effects on a case-by-case basis depending on the environment in which it develops and the factors affecting it, factors such as: 1. the economic situation 2. the political situation 3. the social status 4. the educational level 5. the moral environment 6. the technological environment 7. the legal status 8. the natural environment (Giannatos; Andrianopoulos, 2010).

### 3.3 Objective-Significance

Logistics Management is a process that connects business production systems with Marketing in pursuit of business operations at the lowest possible cost. In other words, it tries to make available the right product, in the right quantity, at the right place and time with the right cost for the customer. In order for Logistics Management to work efficiently, two basic rules must be met. Low service costs but also high quality supply. (Binioris, 2014). Thus, the Logistics department has to organize the operation of the business in such a way that from the production process to the process of delivering the goods and merchandise to customers, high quality services are provided at the minimum cost. The quality of Logistics Management is as follows: 1. Availability: it is the ability of the company to supply its customers at any time with products and the only way to achieve it is to organize its warehouse properly. 2. Capacity: The capacity of a business indicates to what extent the business is able to organize its operations so that it can handle the execution and distribution of an order at the right time and place. 3. Coherence: The consequence of an enterprise ensures its credibility to customers, providing high-quality services such as the exact execution of an order as well as the provision to avoid

defective goods. Theoretically, all of these are all the necessary processes for the company to ensure the best possible operation, but as a result they have the cost increase (e.g. larger warehouses, organization of stock control system). In a few words, Logistics Management's goal is to offer alternative solutions where necessary to deliver high-quality services at the lowest possible cost. There are cases where businesses are forced to reduce service quality due to the possibility of lowering costs, but this should be applied as a last resort. As mentioned above, the goal of Logistics Management is to minimize the cost and in particular the total cost. This is understandable if we think that if a business seeks to reduce costs to one of its functions, it can achieve cost increases in another and have negative effects (for example, if it reduces costs in one mode, automatically for meeting needs cost increases in another can be noticed, interlinked operation). Thus, when a company attempts to reduce total costs, a company must take into account all the elements and parameters in order to achieve the right result. Basic logistics cost categories that a business may incur are: 1. Stock keeping costs 2. Storage costs 3. Transport costs 4. Freight costs in the warehouse 5. Cost of fixed assets (buildings, vehicles, machinery). The objective of Logistics Management is to balance the attainment of minimum costs with the maximum level of quality customer service. This may require the creation of an additional service department in the business that is automatically translated into cost increases. With proper handling, the quality-cost ratio can be moderated, resulting in a satisfactory level of customer service on the one hand and low cost on the other. Therefore, it is necessary to check the quality and quantity of services offered to customers with as much cost reduction as possible (Panayides, 2013).

### [3.4 Strategy](#)

Choosing the right logistics strategy requires the same procedures as setting a good business strategy. It is supported by experts and entrepreneurs that the classical logistics strategy has three main objectives: 1. to reduce costs; 2. to reduce capital needs; 3. to improve services. Cost reduction is a strategy that is geared to minimizing variable costs associated with handling and

storage. The best strategy is formed after an assessment of the alternatives, such as choosing between different storage sites or between alternative means of transport. The main purpose is to minimize costs. Similarly, the maximization of revenues from various investment decisions is sought. Methods used to improve return on investment (e.g. investing in automatic equipment, selecting public warehouses instead of privately owned, direct shipment to customers to avoid storage) may lead to higher variable costs compared to other strategies that require a higher level of investment but ultimately ensure an increase in return on capital. In any case, the goal is to maximize profit, which is usually achieved by reducing spending and increasing revenue simultaneously. Improvement strategies for 'services' are based on the view that revenue depends on the level of logistics services provided. Although improved service levels entail an increase in costs, they are offset by increased revenue. However, there is also a modern perception, which considers that the modern logistics strategy is nothing more than a part of the general policy of the company to diversify its services. The modern company operates in a global environment and therefore has demands for so-called global logistics, i.e. offering services on a global basis. Demand is exposed to global trade risks and competition, while supply is forced into alliances and networking to provide services worldwide, keeping costs low on economies of scale and differentiate from competitors globally (Giannatos; Andrianopoulos, 2010)

### 3.5 Elements of the logistics system

The elements of the Logistics system and the process of sending the goods to customers are: 1) Markets 2) Stocks 3) Transport 4) Storage 5) Distribution.

**Markets:** are all those procedures required for the supply of raw materials or finished goods by third parties (suppliers). This category also includes packaging materials, consumables, fuel and various services. Markets are one of the most important elements of the Logistics system because they are directly related to production, so they play a major role in the operation of the business. So if you do not take them in account properly, the company will



constantly encounter problems in production, warehousing and storage (Binioris, 2014).

**Inventories:** The amount of resources the business must have in order to ensure its smooth operation. Good management is required when the orders are made, which products will be selected, and in what quantity they will be stocked.

**Transportation:** is the physical movement of materials or finished goods from the warehouse of suppliers to the warehouse of the business for sale. Transport probably contains the largest proportion of the total cost, so companies are constantly looking for more economical ways to move their products. The basic principle of transport is the factor of time. Goods must be taken at the agreed time and place on time, otherwise the whole supply chain system is left in the air.

**Storage:** has to do with the design, organization and operation of the warehouse. It includes the procedures for receiving, storing and delivering products to customers. Theoretically, it is the right place to store products in practice, but it is a key point in the supply chain since its management is an important factor in the final costing of the product. The warehouse contains: Space classification, select storage media, goods placement, stock monitoring, etc.

**Distribution:** is the carriage of the goods from the warehouse space of the company to the point where the customer wishes. The difference between distributions and transports is that distributions have as their object the movement of many products in small quantities to many customers, while the transports have to do with moving a few products in large quantities to one or a few customers (Sifniotis, 2009).

### 3.6 Aims

During the planning of a Logistics system it is necessary for the company to set targets to ensure its best possible operation. Such objectives can be: 1.

Customer service with the minimum stock height at all stages of the supply chain. Maintaining stocks at all stages of production (stocks in raw materials, packaging materials, etc.) is unbearable cost for the company. 2. Quality control. Not only quality control on the correct and safe handling of the products but the overall certainty that the customer will feel when executing the order (transport consistency, error reduction, handling of inappropriate products). expediting expired products will be the reason for the customer to lose confidence in the business and that may have an impact on sales. 3. Reduce deviations from the selected goals. The head of the Logistics system should be aware of the specificities of suppliers and customers, product demand forecasts, etc., so that the system can eliminate variations covering all possible scenarios (Giannatos; Andrianopoulos, 2010).

### 3.7 Reasons for increasing importance

Increasing interest in the logistics sector can be explained by the combination of many factors, which are:

1. The rise in oil prices in the 1970s has led to increased transport costs and increased interest in the transport system.

2. Developments in deregulation in the transport sector during the 1980s to date, both in Europe and in America, have greatly changed the 'rules of the game' and decisions on business transport policy are based on the anticipated benefits of these changes that create opportunities and choices that did not exist in the past.

3. The efficiency of productivity has reached its peak. Savings from the production process have become particularly difficult, while logistics remained an area that has not been examined. In addition, the prevailing perception of demand stimulation has changed to the greater importance that should be given to supply control. Cost control, productivity and quality control became areas of intense business interest.

4. There has been a fundamental change in the perception of stocks. While it was once natural for retailers to hold a substantial portion of the

stocks, this was later changed and suppliers had to have central storage and distribution points .better times and delivery services.

5. There has been a multiplication of production lines, according to the marketing philosophy in which everyone will receive what they want. For example, the variety of products in a supermarket has grown from a few thousands to over tens of thousands of products for major stores.

6. There has been considerable progress in the field of information technology and computer use. Over the years, problems related to logistics have become more complex, as there are far more alternatives to explore whether technology has brought more solutions to the transport sector, multiplying products which meant more stocks for management, protection of the environment has created the need for recycling and proper disposal of waste and increased consumer demands have led to an increase in the number of distribution centers. This growing complexity has been addressed with PC capabilities and the use of models.

7. Time is the new strategic weapon to gain a comparative advantage in the battle of competition. By reducing design, construction, sales and distribution time, businesses are better equipped to cope with competition. While initially great emphasis was placed on reducing production time, it later turned out that sales and distribution offer the greatest opportunities for time reduction.

8. The increase in the value of money and the reduced availability of new funds during past economic downturns have created incentives to reduce costs and stocks.

9. The large reduction in unit costs for the recording, transmission and processing of information as well as the development of telematics have resulted in greater investment in the information sector, which offset by the largest reductions in transport and storage costs.

10. There have been radical geographic changes in relation to the production and consumption centers and the internationalization of trade (Binioris, 2014).

### 3.8.The role of seaports as logistic centers for distribution of goods in urban areas

#### 3.8.1 Seaports as logistic centers

Logistics, as we saw above, affect many sectors. Having a look in maritime business, nowadays, seaports can function as logistic centers.

Firstly, seaports can be separated into three generations as far as their level of modernity and openness to development is concerned. This division is not the result of their size, activity area or management, but the features that characterize their activities.

	<b>I generation</b>	<b>II generation</b>	<b>III generation</b>
Limit dates	Until 1960;	After 1960	After 1980
Dominant factors	Labor and capital	Capital	Capital. Technology and know-how
Dominant tape of cargo	Dry bulk cargo, Other cargo nes,	Dry and liquid bulk cargo, Other cargo nes,	Dry and liquid bulk cargo, Large containers Ro-ro mobile
Main objective function	Transport	Transport, Industrial, Commercial	Transport, Logistics & distribution
The basic role of the port	Transport hub / note	Transport-industrial complex connected to commercial center	Distribution center / Logistics center / Logistics platform, Information center
Strategy	Conservative	Expansive	Market
Basic principle of the strategy	Seaport waiting for cargo	Port acquires areas, and stimulates the development of the port industry, thus obtains loads	Port co-creates supply chains
Range of service	Handling and storage services for the cargo. Simple administrative services, manipulation and control for cargo	Handling and storage services for the cargo. Processing and production of goods Complex administrative services, manipulation and control for cargo	Handling and storage services for the cargo. Distribution cargo Logistics services for cargo <u>Gathering and processing of information</u> Organization chain supply
VAL	Low	Higher	High
Operating principles the port environment (internal environment harbor)	Atomization Informal relationships with port users	There are no permanent links between deferent sectors port A close relationships with port users Ad hoc relationships with city	Unity of action sphere of operation Integration of organizational or capital sea port companies with its users Close relationship with the port city and region

#### **Seaports and Generations (UNCTAD TD/B/C.4/AC.7/14)**

**(Figure 3-1)**

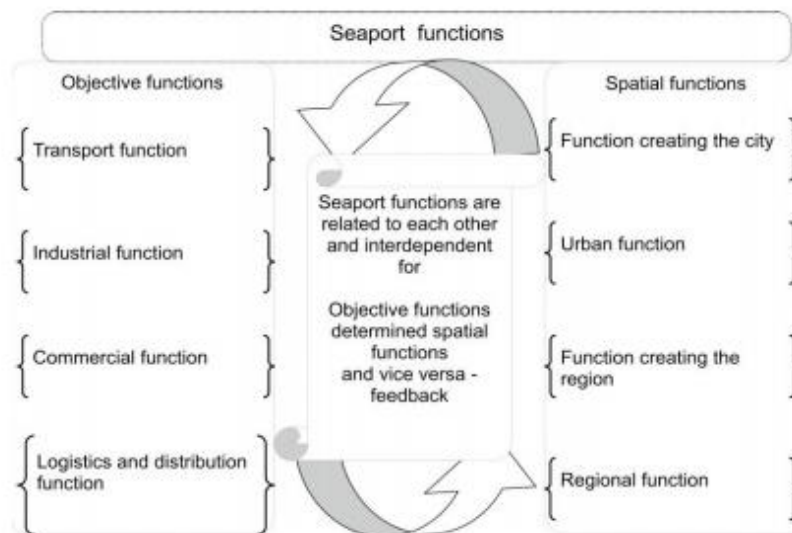
In the worldwide transport system there are functioning ports of various generations, and ports of Europe of the first or second generation keep on being a vital element in the local delivery systems. In any case, the most essential role

in the supply chain network is accomplished by the port of the third generation. Thus, ports are vital for the functioning of the world economy, and the effective competition amongst ports and their services plays an important role in the final price of many products. The third generation of seaports perform same tasks and give a range of activities same as the ones of integrated logistics centers. After year 1995 the improvement of the network delivery system has led, in accordance with numerous analysts, to the transformation of the leading ports to the fourth generation of ports, which is related to the adoption of the new tasks characteristic for centers or logistic platforms. Using accessible research material it is shown that the port of fourth generation is characterized by a set of elements, where: main cargo is containerized in large containers, port improvement strategy depends on the use of advanced automation and information technology; scope of activity means full integration in the Transport Forwarder & Logistics sector, intermodalizm and standardization of data; character of an organization and management model is centered around the globalization of port activities and orientation towards SCM (Supply Chain Management) and control of the environment; the port is characterized from the perspective of service processes and its variety of management tools, for example TQM (Total Quality Management), change management, HRM (Human Resources Management), process management and automation of service procedures; major factors are: innovation, technology, and information. This can be supplemented by ascertainment that the change of seaports from the third generation to the fourth generation-logistic centers- applies to the enrichment of objective functions of these ports : wholesale trade, passenger traffic and tourism. These are zones, which connect sea and land passenger streams, industrial multimodal and intermodal transport as well as port and urban functions, realizing at the same time the port's function and connecting it, for instance, with the trade, distribution, logistics and urban aspects, like: services, industrial and communications functions. The fourth generation of European seaports and integrated logistics centers have move towards to centers of information for supply chain networks and places for locating distribution centers. This allows the optimization of distribution and transport procedures in the sequential organization of deliveries to unique customers located in urban area. Such actions result in diminished congestion in urban

area by reducing transport and planning due dates and order deliveries to unique customers of the urban transport system (Chew; Lee; Loo; Tang, 2015).

### 3.8.2. Seaport functions as logistics centers and their range of services

The finance space of the third and fourth generation of seaports are acknowledged in their objective and spatial functions. Their improvement is a result of the interaction between external and internal environment of the seaport. Figure 3-2 shows port functions found in the ports of the third and fourth generation which are the key components of the supply chain of the network system (Ng K.Y., 2011).

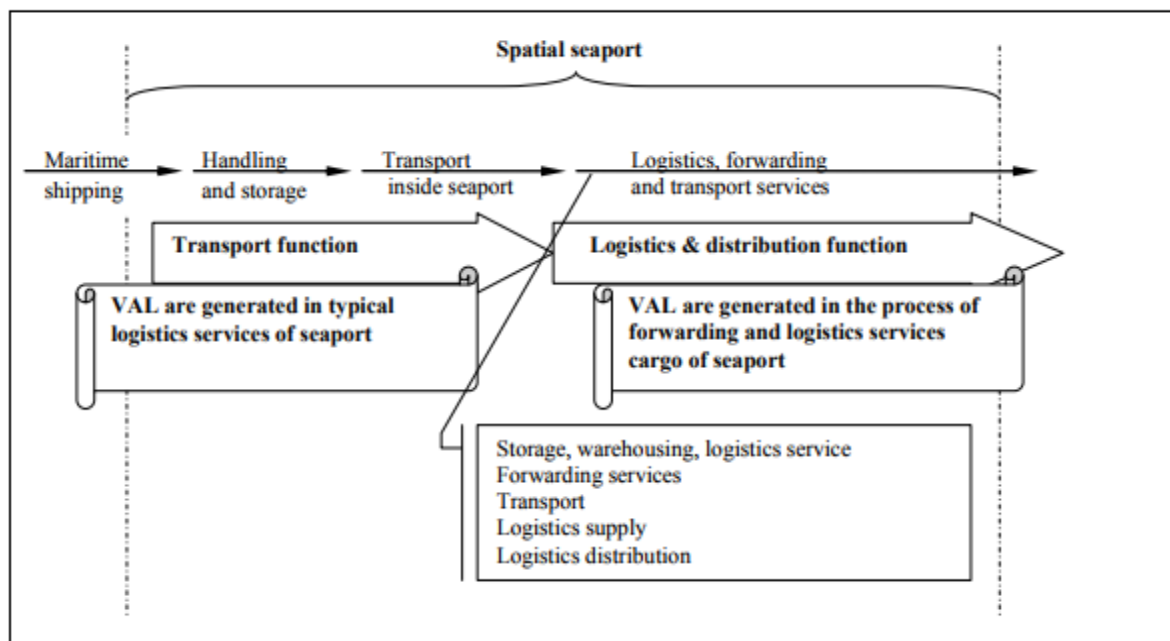


**Seaport Functions (Montwill, 2014)**

**(Figure 3-2)**

A change in the connection between a seaport and a city is the aftereffect of changes in the management of ports in the decade of 80s of the twentieth century and the new philosophy of their exercises. The biggest and most significant seaports started becoming ports of third generation, of which one of the characteristics of their operation is a closer relationship between the port city and region. Thus, this leads to the rebuilt of seaports and city links. History has made a 360° turn. Cities and seaports came back to the symbiosis, as in the medieval times of port-towns or port-cities of Italy. The most fabulous case in

Europe is the seaport of London, England, where the zones outside the city center along the spectacular docks of London have turned into a powerful district in which the city executes its residential, commercial and cultural functions, while the port has its logistics, commercials and distribution activities. Areas appealing from the land are attractive from the water also, turning into a center of tourism and passenger journeys by land and sea. The exact same part of the port makes a uniform spatial and functional zone, blurring the border between these two organisms. A new urban function to a group of spatial functions, which enables situations to be distinguished where a port city enforces territorial extension (function creating the city) from a circumstance where existing seaport areas and urban areas are revitalized and intensively used for the improvement of various functions created by the seaport and the port city was introduced.



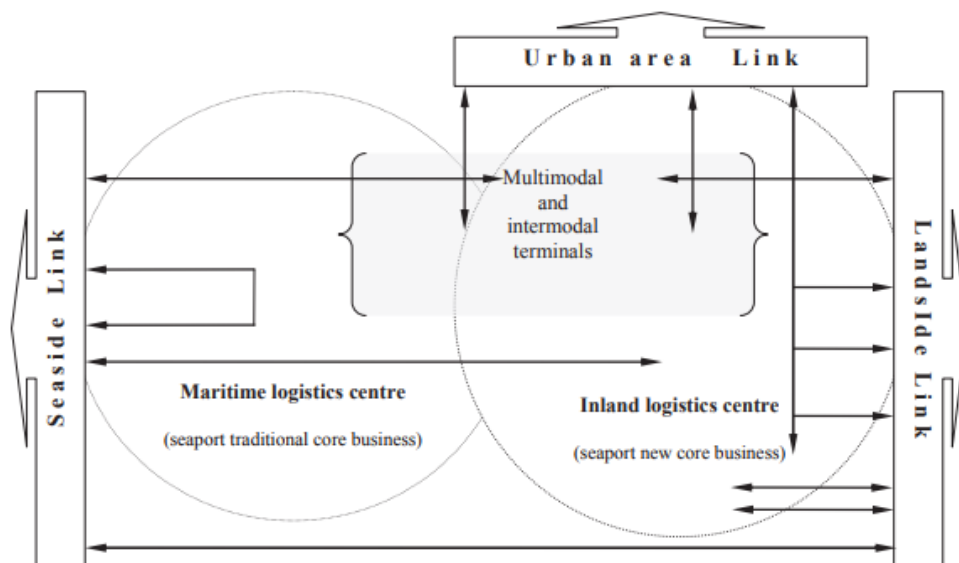
**Cargo Handling (Montwill, 2014)**

**(Figure 3-3)**

The above figure of cargo handling in the seaport of developed logistics and distribution function shown in Figure 3-3 shows two main areas that make up the logistics system of the seaport. Typical services in the area of transport function include:

- storage and warehousing,
- cargo handling and transfer operation,
- break / bulk and consolidation,
- cargo storage and manipulations, and
- customs and phytosanitary clearance.

These elements could constitute a decent benchmark for ports claiming to operate as maritime logistics centers. Ports might, likewise, be seen as inland logistics centers, when they act as nodal interfaces intersecting the various segments of the inland transport system, for example road/road, road/rail, rail/rail, and even rail/road and air combinations (UNCTAD, 2014). Figure 3-4 introduces a diagram of the seaport functioning as a logistics center, where it is possible to characterize the functional space of maritime logistics centers as well as the functional space of inland logistics centers.



**Seaport functioning as logistic center (UNCTAD, 2014)**

**(Figure 3-4)**

The logistics, forwarding and transport services for freight (products) in the seaport functioning as maritime and inland logistics centers are much wider and can incorporate (Fechner, 2009):



- receiving and keeping storage of goods planned for production,
- consolidation of supply deliveries for production purposes,
- completion of assembly kits,
- delivery of goods to manufacturing organizations, including sequential delivery to assembly lines,
- keeping inventory,
- picking and palletizing,
- consolidation and deconsolidation,
- finishing, including foiling, ticketing, minor repairs,
- cross-docking,
- inventory management by logistics operators / forwarders, and
- forwarding services, and
- transportation, which includes the transportation of cargo in the form of small parcels.

The mentioned above possible logistics, forwarding and transport services provided in the seaport do not have any difference from similar characteristics of integrated logistics centers. In case it is considered that the ports of the third and fourth generation are particular logistics centers or even logistics platforms, they regularly shall have unified range of services provided both in typical integrated logistics centers, as well as seaports of the above generations (Montwill, 2014).

## CHAPTER 4: DISTRIBUTION CENTERS

### 4.1. Definition and role

**Distribution center** is a facility or a group of facilities that carries out consolidation, warehousing, packaging, decomposition and other functions which are linked with handling freight. Their primary purpose is to offer value-added services to freight, which is stored there for relatively short periods of time (days or weeks). Products stored in a distribution center have commonly been sold and are in transit to their destination. Besides, they can perform light manufacturing activities, for example assembly and labeling. A distribution center tends to focus on the demand that customers want (Higginson, 2015).



**E-commerce Distribution Center (Wikipedia  
Distribution Center)**

**(Figure 4-1)**

Distribution centers are the establishment of a supply network, as they enable a single location to stock a vast number of goods. A few organizations operate both retail distribution and direct-to-customer out of a solitary facility, sharing space, equipment, labor resources, and inventory as applicable.

A typical retail distribution network operates with centers set up all through a commercial market, with each center serving various stores in a certain area. Large distribution centers for companies such as Wal-Mart serve

approximately 50–125 stores. Suppliers provide truckloads of products to the products that they need when there is a demand.

Since a large retailer might sell huge numbers of products from many vendors, it would be inconceivably inefficient to ship every product directly distribution center, which stores the product until required by the retail location and provide the requested quantity (Wikipedia Distribution Center).

DCs have two main purposes. First, in most instances it is much more cost effective for a company (like Wal-Mart) to have items store in a place where they can be readily shipped to meet the consumer demand. Among many other benefits of having a DC is it allows a company to take advantage of discounts by purchasing items in bulk, storing, and shipping them when the demand calls. Second, companies of this type handle such a large number of SKUs that coordination between the vendors and all individual stores can be difficult. The DC is instrumental in supplying the stores with the from each vendor to each store. Numerous retailers own and run their own distribution networks. On the other hand, smaller retailers may outsource this function to dedicated logistics companies, that coordinate the distribution of goods for a number of organizations. A distribution center can be co-located at a logistics center (Remmer, 2005)

#### 4.2 Differences between warehouses and distribution centers

Logistics distribution centers have evolved from traditional warehouses. The principle difference between distribution centers and warehouses is the fact that a warehouse is designed to store products for longer periods of time.

A warehouse is a facility that intends to store products for longer periods of time. Products stored in a warehouse have most of the times not yet been sold and are held in stock. A warehouse is driven by the supply of makers and wholesalers.

Distribution centers are facilities with main purpose of logistic coordination. There are various activities within a center, with the main assignment of constant adjusting to new market demands through continuous

automation and computerization. Moreover, in manipulative activities (unloading, loading, load transfer), there is an improvement on all levels, in trade, delivery and transport functions in logistic systems. New methods of production are concomitant with new methods of distribution. Their primary purpose is to provide value-added services to freight, which is kept in store for relatively short periods of time (days or weeks). Distribution Centers are regularly in proximity to significant transport routes or terminals. The scope and importance of logistics distribution systems is ceaselessly amplifying. The continuous increase of the contents and number of logistic activities conditions the increase of the relative share of logistic costs in overall costs structure. Consequently, as far as globalization is concerned, the challenge of finding the way to reduce to minimum logistic costs is put before financial science even more ardently. In particular, the main factor of global efficiency is an outline of a sufficient spatial configuration, and building efficient business infrastructure and network of outside connections required for the implementation of business strategies. Internationalization of business has led to centralization of distribution, and distribution centers are a market case of such centralization. Obviously, we are talking about large regional centers. The key difference between the contemporary and conventional approach to distribution management in supply chains is reflected precisely in the approach of distribution (Warehouse Fulfillment, 2017).

There are 5 main differences presented below:

1. **The purpose:** Warehouse is used to store possible maximum amount of materials for long periods, while on the other hand distribution center stores only the required quantity of the right good in the right place at the right time.
2. **Value-added services:** Warehouse doesn't offer value-added services just dedicated for keeping in store pallets, but a distribution center offers other operations such order fulfillment, cross-docking, mixing products, co-packing, packaging, etc.

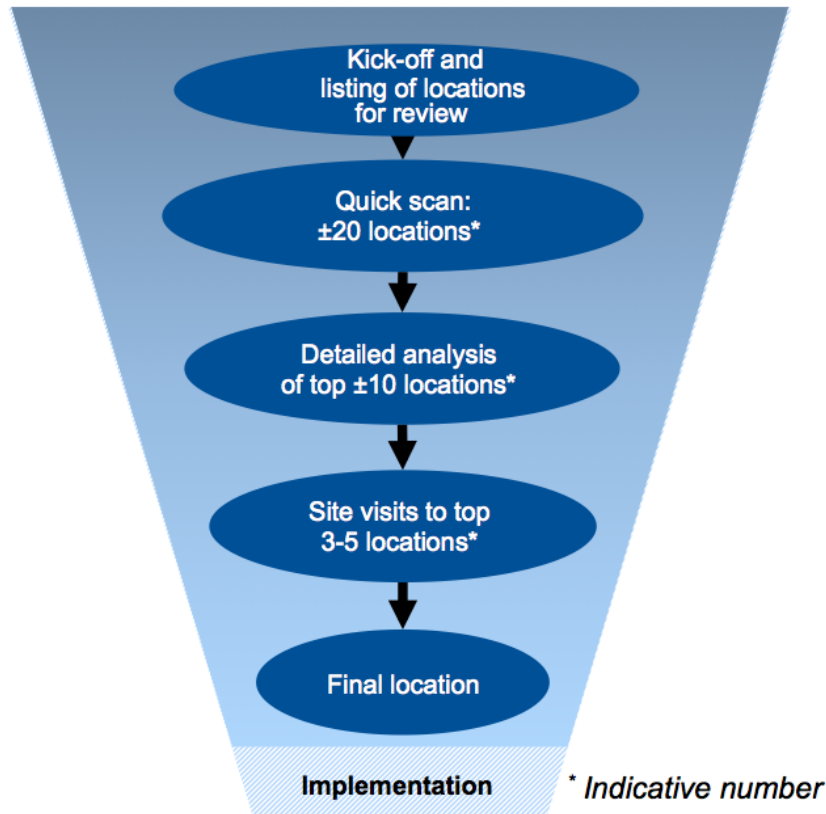
3. **Processes velocity:** A distribution center stores goods for relatively shorter periods compared to a warehouse. So, the flow speed through the distribution center is much greater than the flow speed through a warehouse.

4. **Customer focus:** A distribution center is customer-centric and is the connection between a supplier and its customers. While the role of a warehouse is to store products effectively, the role of distribution centers is to efficiently meet customer requirements.

5. **Complexity:** The operations at a distribution center are more complex than that at a warehouse. Therefore, the distribution centers are equipped with latest technology for warehouse management, order processing, transportation management etc.( Abonnasr, 2017).

#### 4.3 The location decision of a DC

Companies can have a variety of reasons for starting the location selection process for a new distribution center: cost reduction, expansion of capacity to facilitate business growth, the entry of new markets, tapping into new labor pools, rationalization after a merger or acquisition, coping with geopolitical developments. The realization of a new warehouse comes with significant investments (or leases). The investments are done for a long period of time and therefore the impact of the new location should also contribute positively for a prolonged period of time. In other words: in case of a wrong location decision the negative implications will also have a negative impact for a prolonged time period (e.g. higher costs, issues in finding the right labor, customs issues, delivery issues).



### Choosing a Location for Distribution Center (BCI Global)

(Figure 4-2)

In general, we see that location selection is done based on three types of factors

- *Costs* - All relevant factors that can be translated into money such as land, real estate, labor, logistics costs, taxes, etc.
- *Quality of the business environment* - Factors that cannot be translated directly into currencies but that still have a direct effect on the performance of the new operation. Think of availability and flexibility of labor, accessibility (by various transport modalities), supplier availability, customs regulations
- *Risk* - All external business disruption risk factors that a company itself cannot influence but that still may have a substantial impact on the future operations such as inflation risk, currency exchange rate risk, transparency risk, natural disaster risk, etc.

Traditionally, in the location selection for a new warehouse geographical positioning, accessibility and the availability of land or existing buildings are critical. But the availability of labor is becoming a key factor as well. In almost all logistics hotspots in Europe, but also in other parts of the world, labor shortages emerge, with rising labor costs as well. Therefore, it has become very important to assess the labor market in detail, not only looking at today's situation but also making forecasts of the labor potential towards the future.

Investment incentives and tax reduction measures are attractive in certain countries/States/regions in Europe, Asia, the US and Mexico. Especially for warehouses with a large number of workers the total financial packages can be (very) interesting for the investing company. (Remmer, 2005)

#### 4.4 Running and operational costs of a DC

Warehousing is nothing more than the administration of space and time. The space management portion, storage, has a cost for every month, because there is a month to month cost for warehouse space. The time management component incorporates work associated in handling materials as they move in and out of the warehouse. If you are purchasing or offering warehouse services, or simply providing warehousing services for your own company, you have to isolate and analyze the costs of warehousing. All companies with distribution centers incur the similar elements of cost, but they compile them in a different way (Cutler, 2013).

Some warehousing costs have a tendency to be overlooked or misallocated, because the analyst does not perceive where they belong. In every costing system, allocation of overhead costs is a matter of one's judgment, and no particular formula will be correct for every user.

The warehouse costs are allocated in five categories:

- 1. Handling.** All costs related with moving goods out or in of the

warehouse should be admeasured in the handling cost center. The largest element is the labor of the people used to handle the good that goes through the distribution center. It includes receiving the good, put-away, order selection, and loading in any means of transport (Speh,2009). There are different ways to calculate the cost of labor-intensive functions of a DC. Some of them include the development of “use rates” charging the cost to a particular workstation, or machine as a fraction of the total cost of the product. Others include the development of a staffing table to completely detail the skill level of the operation to be cost, labor rates, any needed supervision, and overhead personnel requirements. The calculation of labor rates can be broken down into complex calculations of “fringe costs” involving social security tax, workers’ compensation tax, and unemployment compensation. Also included within the calculation can be a “for nothing” cost which is the overtime labor premium which comes in the forms of overtime pay. This is generally considered an additional 50% of regular pay and/or a shift differential.

Simplified calculations of the labor-intensive warehousing operations consider the cost of an individual operation and what that particular operation costs the company. All of the operation costs that contribute to the total cost of the method are accounted for. Each cost is captured and reflected for that operation.

Receiving is the first of the labor-intensive warehousing operations. This activity includes removing the SKUs from the transportation vehicle and placing them in staging lanes to wait for the next phase, which is detail checking. The calculation of receiving cost can include the machine use rates and the standard calculation of labor needed to perform this function; however, machine use rates are not used in the calculations of this research.

The next phase is detail checking. This activity includes the task of checking and verifying the packaging of each carton of each SKU that has been received. This operation is often the bottleneck of the receiving process because this function is the most labor intensive. The calculation of this function involves the standard labor calculations involved with the labor hours paid to completely detail a particular shipment. There are no other use rate calculations involved



Put away and eventually retrieval follow the completion of detail checking. The put away function and the retrieval function are the more complex functions of the receiving process. Factors of these two functions involve distances to and from the average storage location, vehicle fuel consumption, and average amount of time needed to pull or retrieve SKUs (Remmer,2005)

**2. Storage/Holding Cost.** Storage expenses are costs related with “goods at rest.” These costs would be incurred regardless of whether any good was ever moved. Since storage costs are related to the cost of occupying a facility, and these costs are normally accumulated every month, storage is expressed as a month to month cost. If a whole building is dedicated to an operation, storage costs are the overall occupancy cost for that facility.(Speh,2009).

Also Holding cost is often expressed as a percentage of the overall investment in inventory. Inventory being held can be considered a liability. The cost of holding inventory is a function of the potential profit of a SKU against its cost to the company and a time period percentage interest rate that further adds cost while the product sits idle.

DC holding costs are generally calculated by the cubic space that SKUs on a pallet occupy, equipment costs to determine an occupancy factor, and the interest cost of the dollars locked up in the inventory being stored. Simplified calculations of holding costs include the calculation of the capital cost of the product, the weekly interest rate, and demand of the SKU in question.

In a standard economic lot sizing problem, warehousing costs are considered part of the inventory holding costs and are typically assumed to be proportional to the amount of inventory held. The total warehousing cost is comprised of material handling costs, general warehouse activity costs, and overhead costs (Remmer,2005).

**3. Operations administration.** These expenses are incurred to help the operation of the distribution center. Shutting down the facility would eliminate these costs. Costs are also included for line supervision, supplies, insurance, taxes, clerical effort, and information technology,

**4. General administrative expenses.** Costs not incurred for a particular distribution center are included in this category. General management, general office, and non-operating staff expenses are examples. Allocation of such expenses to each warehouse is a judgment call (Speh, 2009).

**5. Transportation Cost.** As they pertain to warehousing handling costs for a DC are not very different from those pertaining to Direct Shipping costs. DC costs of transporting SKUs attribute the cost of transportation to those particular SKUs being hauled. In effect, the cost to transport those SKUs is calculated by the number of units being hauled and the volume of space they occupy as a percentage of the total transportation cost. After SKUs are loaded onto a truck they leave for their particular destination(s). Vehicle routing paths may become important as the best path to take may have to be found if routes are not already predetermined or if the truck visits more than one store. In most instances, DC shipping routes have already been determined and costs have already been calculated.

Some companies have their own fleet of trucks which they use to service their retail stores. Other companies sub-contract out to independent shippers. In the case where the company owns their own fleet of trucks, the costs are labor calculated to the destination, unloading, and a return trip, fuel consumed by the truck, and the cost of the truck. In the case of the latter, a fee for the run is paid which is all inclusive. (Remmer,2005)

#### 4.5. Advantages and disadvantages of a Distribution Center

First of all, if we are considering a distribution center, we must look at the significant advantages and disadvantages of this model. Although many organizations are utilizing this strategy, is it necessarily appropriate for every company?

As each supply chain model and organization is unique, these factors can help those who take the final decisions better to analyze what areas of the supply chain they are looking to improve. After these considerations are better

seen, a company can progress to a more informed strategy for their supply chain development moving forward (Nurgul; Tuzkayaa, 2012).

The more important advantages for building a distribution center are firstly, the reduction in inventory. Once we understand the most significant function for the distribution center, we may see this as quite obvious. The reality on the other hand, is that reduced inventory is specifically related to a reduction in procurement, manufacturing or transportation lead time. As the distribution centers usually increase the speed of material flow, lead times are inherently reduced in one of these three areas. With a big reduction in lead time, lower inventory levels can be maintained as goods can be produced and delivered more readily. This ensures that demand is fulfilled without carrying a large amount of inventory. In this case, a company can lessen their inventory holding costs and more important the cash that is invested in inventory. Subsequently, this is one of the essential reasons that more companies are moving to distribution center model. But there are also other reasons that this model is suggested (Speh, 2009).

Increased material volume movement is another plus. As inventory capacity is restricted by physical space, warehouse capacity, transportation capacity, and retail holding capacity, the volume of goods that can be moved is limited. With the model of a distribution center, a company removes the capacity constraints of a warehouse and enables the productivity of material movement to increase. As demand grows, more goods can move through the distribution center on to the client instead of focusing on moving inventory to the client and producing to maintain buffer inventory. Transportation management in light of the distribution center operations also takes into account increased volume movement.

As distribution centers are made for movement of materials, improvements in transportation logistics are a third advantage. When a good arrives at a distribution center it is instantly prepared to be shipped. With these improvements to the system, total transportation costs can be reduced in light of increased capacity utilization, better delivery routing, more frequent delivery schedules, and more structured policies for pick-up and delivery. As companies

look to lower these costs further, coordination is critical. Another cost saving is bringing down overhead costs. Warehouses come with some overhead costs, primarily related to material handling. As goods must be moved either inside the warehouse or to the shipping area, these procedures utilize valuable resources. Distribution centers, on the other hand, use a lower number of overhead because the system internally is created for material flow processes. In a model that is very simple, a product enters one side, goes through the distribution center, and comes out on the other side. In light of the reduction of procedures in inventory documenting, stock handling, shipment preparation, loading and unloading etc. the process costs of operation can be much more reduced. (Vargo, 2012).

One last advantage that can be seen with distribution centers is increased flexibility. This can be identified with flexibility in transportation routing, controlling material flows not to proceed orders that are cancelled, or using postponement at the distribution center to improve process flow. These are only a few cases. Material handling processes are additionally much more flexible in a distribution system. In the event that an expedited product is required, it can be routed into the distribution system more effectively. On the off chance repairs are needed, a few companies do after-sales service at their distribution center to fix or provide spare parts. The distribution center gives these companies the flexibility to manage outflows and inflows of not only finished goods going to a customer, as well as material procedures that are integrated into the system.

After taking into account all the advantages, it is a must, also, to look at the disadvantages of a distribution center model.

The first and most noticeable is that distribution centers require an alternate process management approach than warehousing, so people must adjust. As materials are relatively easy to manage when kept as on-hand stock, a distribution center creates a whole new set of complexities, since material is no longer controlled in the same way. Material is simply moving through the distribution center, and as orders now go directly to the maker, not the distribution center, now and again this system will seem difficult to control. In

view of the product type and demand levels, keeping up control of the system could be very critical to a company. One reason here is the danger of stock-out. When the cost of stock-out is very high for a product or company, a distribution center may not be the optimal solution. With stock on-hand a company can simply send the product to a customer to fulfill demand. In a distribution center model the order is received and production must begin, based on the lead time. In this case, if the lead time is greater than it is needed to, the company may not be able to fulfill the order when the customer wants it. Regardless of how efficient the distribution process is, the costs to the customer and the maker for not having the good will be high.

In the meantime, stock accuracy can be hard to manage with a distribution center since limited or no time stock is kept on hand. With a distribution center, once more lead times turn out to be fundamentally important to maintain adequate stock and more significantly manage material process flows throughout the downstream supply chain to guarantee that goods can be made-to-order. This implies that coordinating lead times between contributors to ensure demand is met or stock is prepared at intermediate locations. At the point when a company is used to managing stock, this change in process can create potential stock inaccuracies throughout the supply chain as a make-to-order systems requires alternate stocking levels than a make-to stock model (Montwill, 2014).

Besides, a significant disadvantage for the companies is that when items enter a DC warehousing costs begin to accrue. These costs are associated with handling and storing items. There are several functions and costs associated with general warehousing activities, such as Labor (receiving, detail checking, shipping, etc) Holding/Storage (cost of holding current product not being sold). (Remmer, 2005)

Managing transportation systems is yet another potential disadvantage for a distribution network. With powerful 3PL providers, who are in part devoted to the distribution center, fewer risks can occur. By working firmly together, routing and scheduling can be managed more effectively. By and large, in any case, the coordination needed to manage transportation in a new system is

altogether different from the standard warehousing model. Transportation companies must have good knowledge in advance of picking-up times, which depends on customer orders and manufacturing and transportation lead time. On the opposite end, delivery times are important to ensure high service levels. In a distribution system, scheduling and planning are far more essential to guarantee a smooth material flow process.

Last but not least, we must consider the capital investment for a distribution center. First of all, we must look at the structural investment, yet in addition the internal operating systems managing material flows. Inside a distribution center there are usually a number of material processes occurring, for example, sorting out, picking, order assembly and shipment documentation processing. Each of these systems is accompanied with an additional cost, and depending on how advanced the distribution center is, the expenses can be extremely high. This factor should be weighed, for sure, against the added value of the advantages listed before. Important: this will differ for each company and supply chain (Kong; Allan, 2014).

#### 4.6 Role of a distribution center in supply chain

At the present segment we will have a closer look at the different roles that a Distribution Center may take on in a supply chain. In particular, we analyze the issues and literature identified with the distribution center that might act as a make-bulk / break-bulk consolidation center, a cross-dock operation, a transshipment facility, as an assembly facility, a product fulfillment center, or a returned goods depot. The definitions of these roles are misleadingly clear. In fact, a distribution center often performs several of these at the same time, as will be seen below.

##### 4.6.1 The DC as a make-bulk / break-bulk consolidation center

Making bulk and breaking bulk are traditional functions of a distribution center. In a break-bulk facility, big incoming loads are disaggregated, regularly for product mixing and to make consolidated outbound shipments. A make-

bulk facility, or consolidation center, uses small quantities of several products in fewer, with larger assortments. A program of freight consolidation includes determining those products to be dispatched together; which customer requests-orders will be joined together; and when consolidated orders will be released. Besides, who will play out these activities, which particular consolidation techniques will be utilized, and will these activities be done at a DC or elsewhere? The major advantage of this role is better utilization of retail space, rather than reduced inventory. We can list a few activities that a consolidation center should not perform:

**1. Kitting.** To do as such, consolidation center employees would require updated, until last day, information about picking lists, bills-of-material, and engineering change notices. Kitting should be exercised in the factory; the consolidation center should only cope with individual items.

**2. Quality assurance of incoming products.** This would require consolidation center workers to be trained in the attributes of parts and the customer's quality assurance techniques and requirements.

**3. Sorting of empty crates and other shipping materials.** This activity makes work that in another situation wouldn't need to be done. It is more practical and economical to organize the pickup of empties by item.

A typical example of the use of Distribution Centers as consolidation centers for the inbound-to-factory line development can be found in the automobile manufacturing supply chain. In this function, the consolidation center is a facility located near to a production plant, that gets large shipments of components and parts from many makers, splits them down into smaller quantities that the plant requires, disposes of the maker's shipping materials, puts the parts in the plant's reusable containers, and transfers them either to plant receiving or straight forwardly to the point of utilization. In this way, the consolidation center acts like a supplier to the maker, making deliveries of components frequently and relieving the factory from having to accept big, less regular deliveries of improperly packaged items. This requires the consolidation center to hold substantial stock, while facility management must be able to influence suppliers to improve deliveries and decrease costs. Consolidation

centers in the automobile industry often are operated by several companies, in which the maker might or might not own equity. A consolidation center can recruit warehouse employees for 50% or even 30% of a car assembler's wages. It cannot do all the material handling for the making plant, but what it does, it can make a gain while saving money for the plant" (Vargo, 2012).

#### 4.6.2 The distribution centre as cross-dock (CD)

Another function of a Distribution Center, i.e. the cross-docking of a product throughout a distribution center, is perceived as one of the basic distribution strategies. Cross docking refers to a procedure where the product is received at a facility, periodically combined with product going to the similar destination, then shipped in the first opportunity, without going into long-term storage.. The often quoted time limit is 48 hours for a cross docked product to stay in the facility (coming as a result in an annual stock turnover greater than 100), but limits of time ranging from 1 to 3 days appear in many sources. Besides, some sorting and product consolidation might occur before shipping. There is a key difference between the use of a CD and conventional warehousing. Client orders can be filled from goods that are stored at the warehouse, where on the other hand with cross-docking, client orders are filled from some other facility (for example a manufacturing plant) and simply pass through the distribution center or CD. Cross-docking is a type of transshipment, with the two differing in terms of objectives. The previous strategy is customer-focused, and tries to move a product through a facility as fast as possible. Transshipment is a carrier process that has as an aim to improve truck utilization, usually by better matching the measure of the load to that of the vehicle. Transshipment is not new (all things considered, LTL transportation or less-than-truckload is dominated by transshipment operations), while it is only in the last twenty years that utilization of a CD has received widespread attention. Cross-docking produces many advantages, including:

- Elimination of activities related with the storage of products, like incoming inspection, putting them away, storage, picking-location replenishment, and picking orders. Getting rid of with the latter is especially



beneficial: Order picking is the most labor-intensive, time wasting, costly, and error-prone of all activities in a common warehouse.

- Quicker product flow and improved customer service. Having eliminated storage, goods move directly from receiving to shipping (or at worst case scenario sit in a staging area for short time period).
- Reduced product handling. The outcomes are decreased probability of product harm, less wear on material handling equipment, and lessened labor.
- Cuts in stock. Cross-docking avoids the holding of stock at many locations.
- Lower costs due to elimination of the above-mentioned activities; smaller stock; fewer investment in racking, using floor as storage space, or other equipment; and support of consolidation of products for the same destination.

There are a few disadvantages to cross-docking. The major one is the extremely complex planning and coordination needed to make it work properly. Due to this difficulty, many retailers have been able to achieve nothing close to true cross docking. A major impediment is that most makers are not equipped to proficiently create store-order quantities. As well, because cross-docks do not hold stock, some managers feel uneasy that client requirements must be fulfilled from more distant facilities, as opposed to from local warehouses that carry stock. Generally, the best potential for effective cross-docking is for those SKUs where a feeling of urgency exists. We can take as examples time-sensitive components, fast-selling products, and sale and promotional items. Special requests and goods that are backlogged also should be cross-docked: These regularly arrive at the CD pre-packaged and marked for delivery to the consignee, and it is not necessary to be combined with extra items to complete the customer's order. Cross-docking can give more control over delivery plans and schedules. The use of a CD is thus well appropriate to the Just-In-Time manufacturing environment, and furthermore to the make-to-order environment. Some other conditions under which cross-docking should be considered are shown in Modern Materials Handling. These include SKUs that come at the warehouse already with a label or priced; receipt of large quantities of individual items; goods whose destination is known when received; and

products for clients who are prepared to receive them instantly. The most significant prerequisite for successful cross-docking is a system to guarantee the efficient exchange of products between supply chain entities. Emphasis should be given to the planning and coordination of shipments outbound and inbound at a given node. This requires a timely and precise flow of information between supply chain individuals. Such an information system should support electronic data interchange (EDI), advanced shipment notifications (ASN), and automatic identification (auto ID) technologies, for example bar codes and radio-frequency tags. Furthermore, proper knowledge of inbound goods and their destinations allows the CD to route the good to the proper outbound vehicle, to plan inbound loads to match outbound requirements on a weekly, daily or even hourly basis, and to better adjust the use of receiving resources (dock doors, handling equipment, staging space, personnel, and material) and, if it is important, shift time-consuming receipts to off-peak hours. Other requirements of cross-docking incorporate:

- Suppliers who can consistently provide the correct amount of the right goods, at the precise time when it is required.
- Capital to sustain a cost justified. Cross Dock system and personnel who recognize the significance of moving, not storing, products.
- Adequate space for organizing appropriate docks and material handling equipment.
- Inbound shipments which are consisted of pallets or cases that contain a set of SKUs or a single SKU going to the same destination, so as to reduce to the minimum sorting.

In addition to information requirements, the physical design of the CD must be taken into account. The perfect cross-dock should be rectangular, long and close, with loading docks on each side to smooth the product flow and inhibit product storage. Despite the fact that the facility should be as small as possible to diminish travel distances among vehicles, the cross-dock staging area must be large enough to permit the direct flow of products between receiving and shipping. Also, there must be a sufficient number of doors to avoid backlogs and postponements for carriers. A typical warehouse can

encourage direct-flow operations by having both receiving and shipping docks on the same side of the building.

#### 4.6.3 The DC as a transshipment facility

Alongside breaking bulk and making bulk, a common function of a distribution center is transshipment. This refers to the process of how to take a product or shipment out of one means of transport and loading it onto another. Transshipment might or might not include consolidation or de-consolidation. In the event that no products are added or removed during the transshipment, the procedure is sometimes referred to as transloading.

Transshipment occurs when there is justifiable reason to change transportation modes or vehicle type. Transshipment centers decouple the line haul transportation and regional delivery operations, enabling us to use bigger trucks for line haul than for delivery; they increase also the number of delivery stops that could be made without violating route length limitations. Transshipment can be used, as well, at the final delivery stage to handle time-of-day constraints at clients, or weight restrictions on truck-delivery routes. Means of transport operating out of a transshipment center are dedicated to particular links of the supply chain; they would thus be ideally sized and configured for the services and routes they handle. On the other hand, transshipment does imply bigger cost: Less-direct truck routes are utilized, transshipment facilities are required, and terminal operations increment transit time and potential for damage.

It has been noted that frequent JIT deliveries have negative impacts such as noise, air pollution, etc. In Europe, transshipment centers have thus been suggested as an approach to lessen environmental problems created by truck traffic in urban areas. It was observed, however, that centers like that have had issues related to relatively high operating costs, insufficient product volumes, and the feeling of loss of control by shippers of the goods. Since the major disadvantage of transshipment facilities is inadequate throughput, suggestions for transshipment centers often require carriers to consolidate products for

delivery or collection in city centers (or imposing penalties for not doing so). A lot of carriers, however, have requested exemption from consolidation, asserting that their products are highly perishable, might contaminate other goods, or need intense levels of security.

Another point of view is that transshipment centers is the key to a concept called city logistics. During the 1990s, carriers in several cities agreed to divide loads (and revenue) so as to increase efficiency and avoid duplication of travel. These schemes included, sometimes with financial assistance of local authorities, the settlement of a transshipment center to handle collections and deliveries for the urban zone concerned. Moreover it was given as an idea a city logistics program, in which five carriers transship freight to a sixth. The last delivers to retailers in the city center. This arrangement enhanced the vehicle load factors by more than 50%. It was discovered, however, that environmental benefits were partly offset by increases in overall operating costs.

Another facility location/allocation model perceives that a company will use distribution centers with differing capacities. This integer linear programming model implicitly treats all DCs as transshipment centers.

Various researchers have examined the use of transshipments in the management of stock and its re-allocation. Such models normally employ the term, “transshipment,” differently in contrast to the transportation sense adopted in this section. On the other hand, transshipment is defined as a tactic in multi-location stock control, whereby goods can be transferred laterally between stocking-points, as demand requires. Thus, contrary to the definition of Distribution Center, it is assumed that facilities do hold inventory.

#### [4.6.4 The distribution centre as an assembly facility](#)

Having examined the inventory-transportation interfaces of a Distribution Center, we will proceed now considering linkages closer to manufacturing. It is known that delaying item-differentiation, labeling, and packaging until later stages of the supply chain can enhance product allocation. The example of Hewlett Packard’s European distribution center is a fine

example of using a Distribution Center for minor product assembly. Prior to moving assembly activities to this facility, HP's printer (for example Desk Jet) was manufactured in Vancouver, Washington, and dispatched by water to the European DC. The last facility suffered from inaccurate forecasts, serious stock problems, and poor customer service. HP designed from the beginning the mentioned printer so that a single generic model (allowing easy customization) could be possible to be produced in Vancouver, then assembled-to-order in one of possible six ways at the European distribution center. It was presented a mathematical illustration of the resulting savings in stock cost. This relies on the diminished standard deviation of demand, hence lower safety stock in total, due to generic redesign.

So important are the human issues related to HP's decision, assembly responsibilities were at first resisted by Distribution Center employees, who identified their role to be in distribution, not manufacturing. Also, the Distribution Centers were hesitant to give up some inventory, in light of expectations of high levels customer service.

A noteworthy advantage of using a distribution center for final assembly activities is "product localization"; which is, the ability to configure a good in a given market zone to better reflect the requirements and characteristics of that market. Switching to a strategy of performing final assembly at a Distribution Center will also have an effect on the relative value of an SKU at different phases in the supply chain. Some financial benefits may result. For instance, labor often costs much less at the distribution centers than at factories. If products must travel and cross international borders before reaching the Distribution Center for final assembly, tariff duties might be lower on the unfinished product than on a finished good.

#### 4.6.5 The DC as product-fulfillment center

Another option is facilities with stronger connection to the end-customer. The term fulfillment center has been used to describe a Distribution Center or warehouse whose most important function is to respond to product

requests from the final consumer, by shipping those products directly there. Commonly, customers will have submitted those orders through an electronic medium such as the World Wide Web.

Product fulfillment centers differ from traditional warehouses and Distribution Centers in ways such as:

- Because the fulfillment-center operator deals directly with clients, customer-service requirements demand greater significance.
- The size of a typical request-order handled by a product fulfillment center is smaller, yet the number of orders is larger.
- Most or all requests are received electronically.
- Fulfillment centers normally must receive customer payments, often by credit card; a few number also create customer invoices and handle banking for their customers.
- A lot of time is wasted in dealing with returns from customers.
- Computerized information systems and task automation are very critical, and the transportation function (particularly residential delivery) is more complex.

Since the role of product-fulfillment center interacts with several others that Distribution Center might play, there is considerable potential here for further research.

#### 4.6.6 The distribution center as depot for returned goods

Another role that a Distribution Center can play in supply chain is in the handling of returned items.

Many of the distribution-center functions (including consolidation and light assembly) come together in dealing with good returns. The reverse distribution channel normally is more complex than the forward flow. The main target in many reverse distribution systems is to reduce to the minimum costs, while getting quickly the returned product back into the forward distribution channel. In the meantime, a noteworthy management concern in reverse distribution is to avoid the inadvertent confusing of SKUs in the return channel

with those one in the forward direction. As a result, companies such as Sears Roebuck, Hudson's Bay, Target and K-Mart have given out their reverse distribution channel to third parties who operate Distribution Centers dedicated to materials returned.

The handling of the returned goods is very labor intensive. All returned goods must be inspected. At that point they must be separated into those that are possible to be repaired or repackaged at the returned-goods depot, while the others which need to go back to the maker, and those that will be dispatched elsewhere (for example donated to charity or sold in a secondary market); finally, some will be destroyed or recycled for scrap. Then again, an organization with a private fleet, and which decides to manage its own reverse distribution channel, can enhance vehicle and driver utilization if returned goods are transported on inbound trips back from other facilities.

#### 4.6.7 The DC in miscellaneous other roles

A distribution center often performs more than one function at the same time. We have referred to break bulk and light assembly; transshipment and consolidation; and returned-goods processing at outbound consolidation facilities. In conjunction with material flows, a Distribution Center might also act as a depot for trucks or drivers, where the fleet is domiciled or maintained, or where drivers change vehicles to avoid violating personnel schedules or legal or workforce constraints.

A distribution center also can provide customer support. Designing, providing and scheduling services like installation and repair require operational decisions quite different in relation to those faced by Distribution Centers dealing only in goods movement. Similarly, particular SKUs (for example repair parts or hazardous items) should be held centrally or in specialized areas. Some distribution centers will thus be assigned these functions.

Last but not least, a Distribution Center can provide space for retail sales to final customers, i.e. can play the role of a factory-outlet store. As well as

providing a way to discard of excess, discontinued, returned or slightly soiled items, makers and distributors can retain control over their goods while earning the higher revenues associated with retailing (Higginson, 2015).

#### 4.7 Distribution Centers in Maritime Business

We have to see how Distributions Centers operate in Maritime Business. In the beginning, we have to refer to the fact that almost none shipping company cannot hold inventory on its own premises, as there is limited space for stock of the spare parts. Thus the cost would be very big to hold such inventory, and due to the fact that the ships travel all around the world it would be very expensive to dispatch all the time spare parts from the premises of the shipping company.

And to solve this problem the solution is to cooperate with Distribution Centers. The number of the Distribution Centers that a shipping company uses depends on the number of the ships the company operates, the type of the ships, and the trading areas the ships are operating.

The Distribution Centers provide some services to the shipping companies so as to achieve cooperation and hold the inventory of their spare parts for their vessels.

The services that a Distribution Center provides are:

- They contact with the suppliers-makers so as to arrange the delivery of the spare parts at their premises, either getting them from a courier company or collecting with their own vehicles if the Distribution Center and the maker are in the same region (such as Busan, Korea)
- Also if the spare parts needed to go through customs then they handle the customs brokerage (import, export) and prepare all the relevant documents
- They declare to the shipping company that the spare part has arrived, with a stock report that contains the Purchase Order number, the



dimensions and the weight of the package. Also some Distribution Centers provide online access to the inventory so as to have all time access to that.

- After that, they are aware of any delivery instructions to be given from the shipping company, so as to arrange to send it to the port of the destination that the vessel has stopped. Before sending them, they inform the shipping company for the expenses, such as handling, air freight, customs, etc. and when they get the confirmation they begin the procedures.

- The last step is to contact with the agents so as to deliver the spare parts to the vessel, or sometimes if the vessel has arrived in a port near the Distribution Center, sometimes they deliver directly to the vessel (depending if it will stay at the port or if the spares are too heavy)

Distribution Centers may provide more services, depending on the cooperation that might have with the shipping company, such as free collection from makers in the same region, free handling of the inventory, etc. (Golden Cargo, 2017).

## CHAPTER 5: ANALYSIS FROM QUESTIONNAIRE

### 5.1 Methodology

The questionnaire has 15 questions (the first 2 questions were to ensure that the questionnaire was filled in from the department I asked for), from which the most are closed-ended queries so as to have certain answers and results, while some others had to be filled in by giving the corresponding number to answer the question.

The total respondents that answered the questionnaire were  $n=20$  and the total fleet the 20 shipping companies operate is 350 ships. The results of this quantitative research will be displayed in the next chapter.

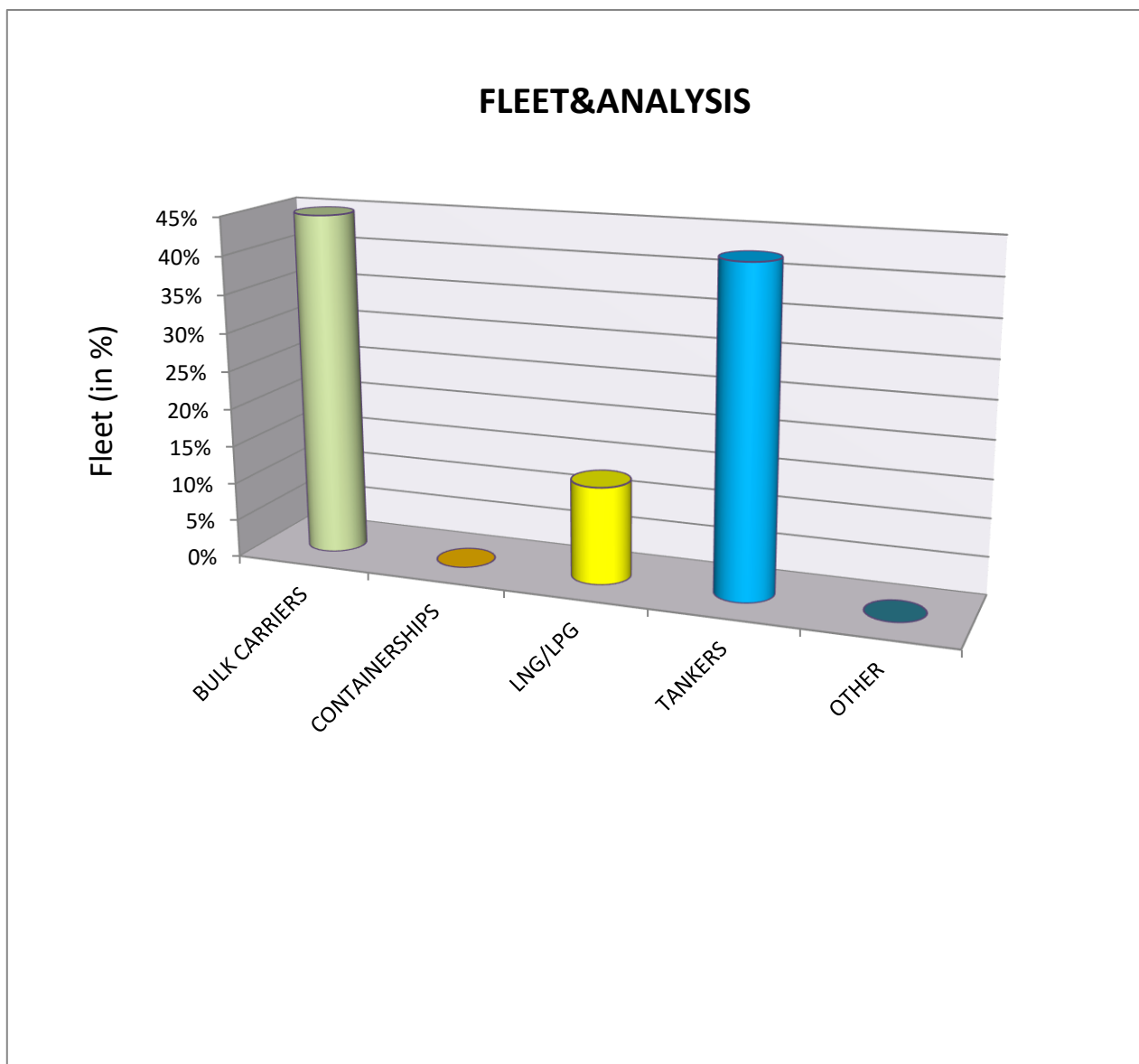
### 5.2 Research Objectives

As we have mentioned before, Distribution Centers are an essential part of Maritime Business, but is this part that brings up the cost of the operation of the shipping company, or with Distribution Centers and the storage of the spare parts the shipping companies saves much money, and invest on other fields of the business? So I came up with this questionnaire which was given to the purchasing/supply department of shipping companies, anonymously (even if I asked for name just to ensure that someone from supply/purchasing department would fill it in), to answer that and extract some useful results to examine (Langkos, 2014).

## 5.3 Results of the Research

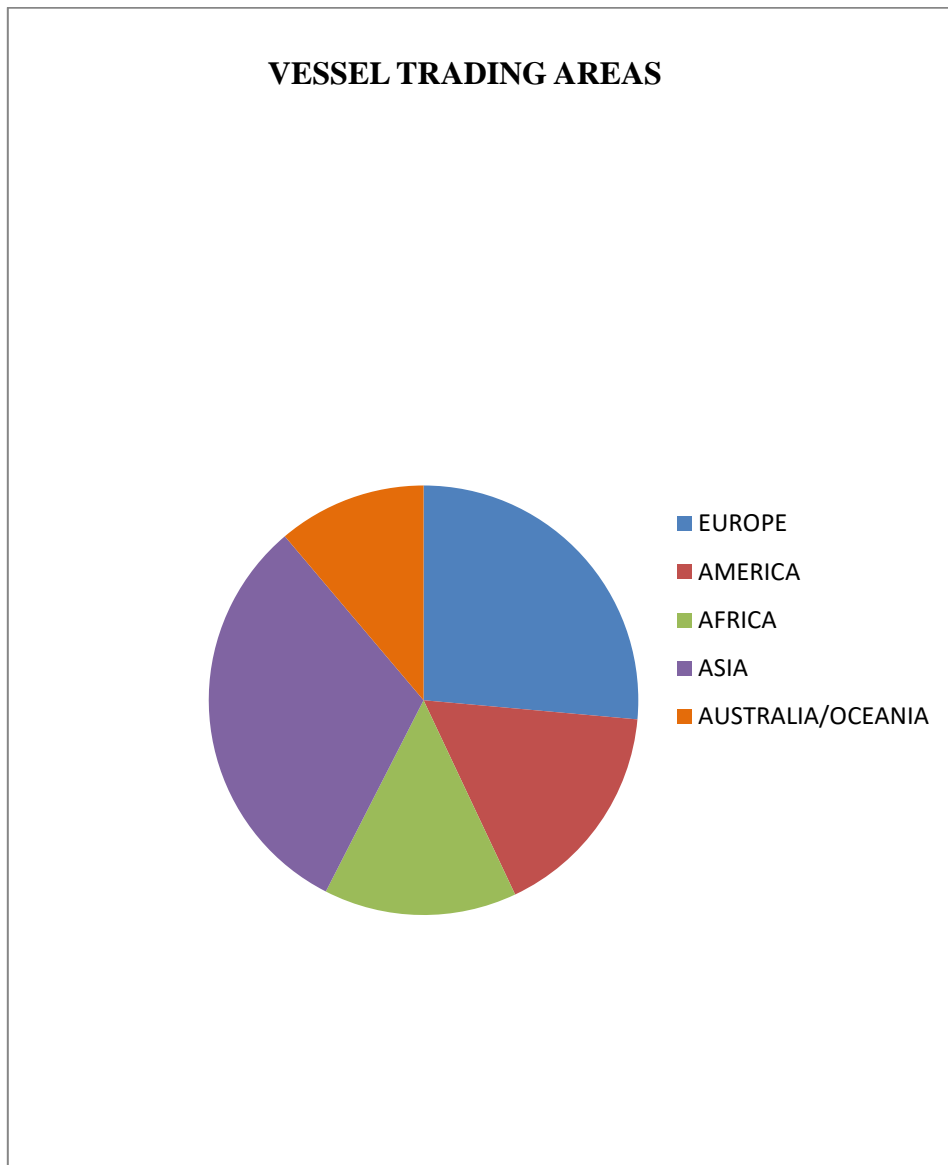
### **Question 1:** Fleet Analysis

This is a semi-closed type question, because the respondents had to fill in the corresponding number of the fleet the company they work for is operating. So the results we have are that the fleet that we examined consists of 45% bulk carriers, 42% tankers and 13% LNG/LPG. We did not get any answer for containerships or another type of vessel.



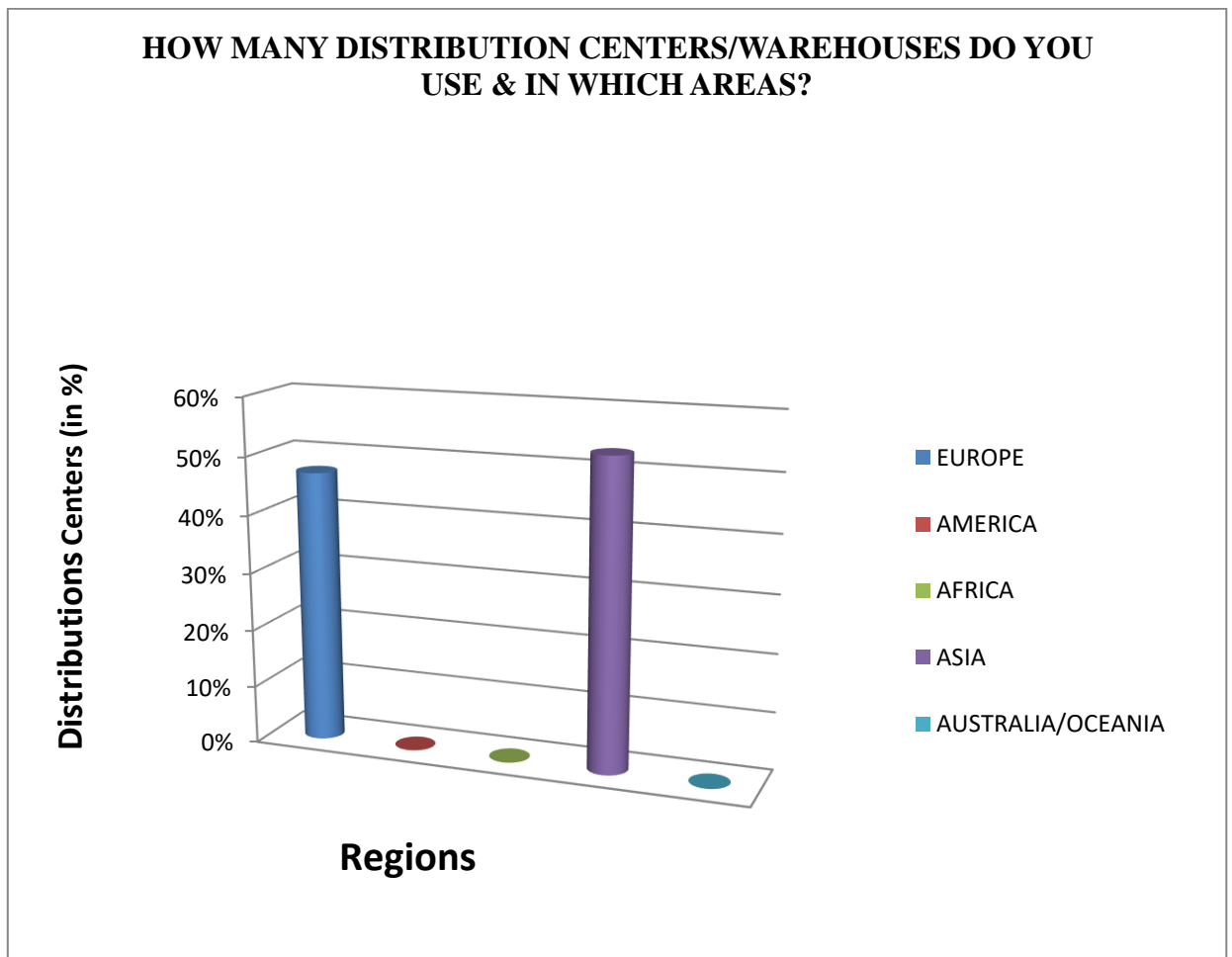
## Question 2: Vessel Trading Areas

This is a closed type question, with the possibility of multiple choice answers. The question focuses on examining where the fleet we examine trades. The 31% operates in Asia, the 26% in Europe, the 17% in America, the 15% in Africa, and the 11% in Australia/Oceania. So we see that the main roads of trading are between Europe and Asia.



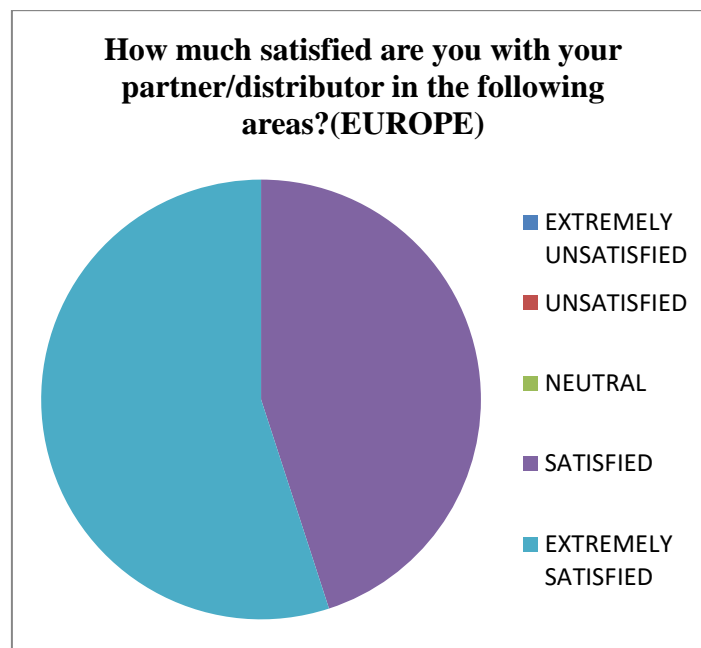
**Question 3:** How many Distribution Centers/Warehouses do you use and in which areas?

This is a semi-closed type question, because the respondents had to fill in the corresponding number of the Distribution Centers they use, and in which area they are. So, the results we got were that the 53% of the Distribution Centers the shipping companies are cooperating are in Asia (43 in total), and the 47% in Europe (38 in total). We did not get any answers for America, Africa or Australia/Oceania. So that supports the previous question that the main roads are between Europe-Asia, and another significant factor for having Distribution Centers at only these 2 regions is that the makers of the spare parts for the vessels are mainly found at these 2 regions.

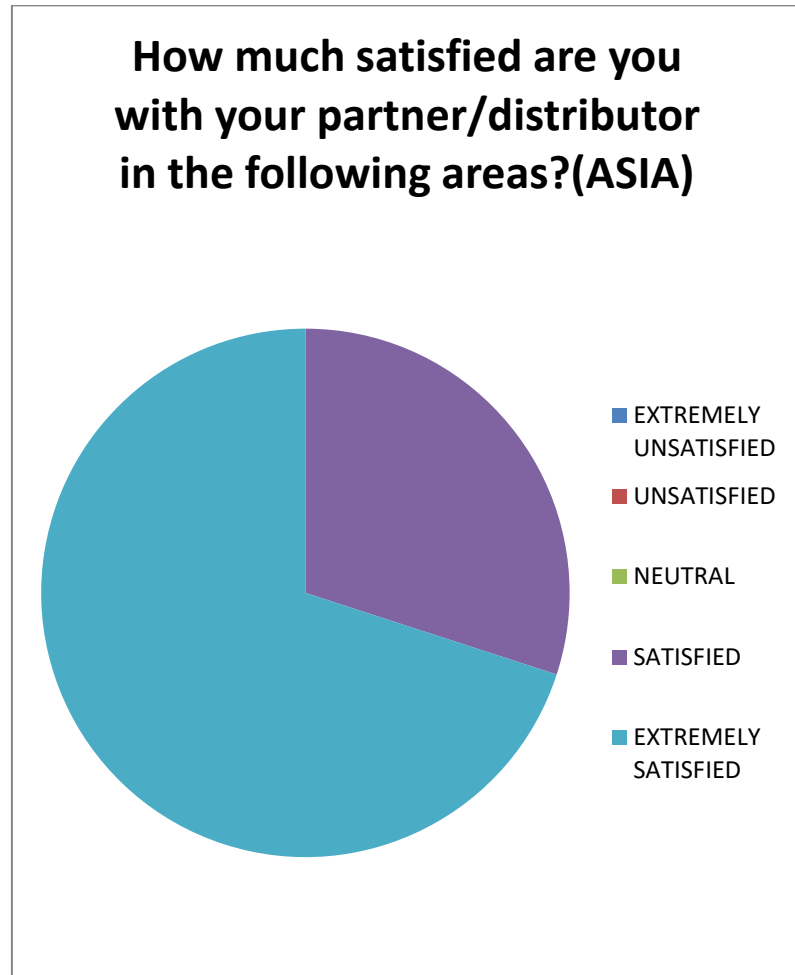


**Question 4:** How much satisfied are you with your partner/distributor in the following areas?

This is a closed type question, and the respondents had to fill in one answer for the satisfaction of their cooperation with their distributors in these 2 areas (Europe and Asia). So starting with Europe we see that 55% are extremely satisfied with their distributor, and 45% are satisfied, letting space for improvement. We did not get any answer for Neutral reaction, or Unsatisfied and Extremely Unsatisfied.

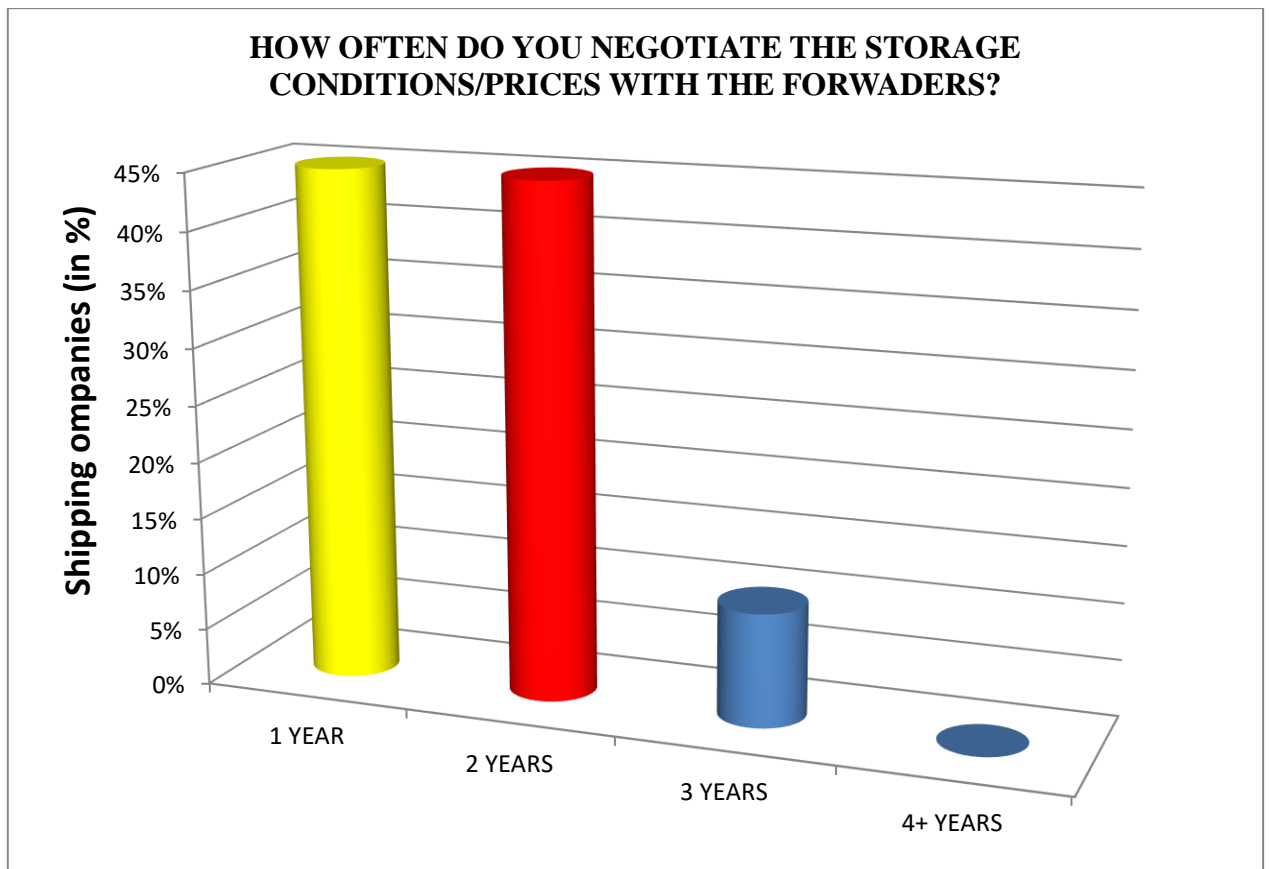


On the other hand, in Asia the 70% are Extremely Satisfied, and the 30% are satisfied, showing us that in Asia are having a better cooperation than in Europe. Here also, we did not have any answers for the other 3 options.



**Question 5:** How often do you negotiate the storage conditions/prices with the forwarders?

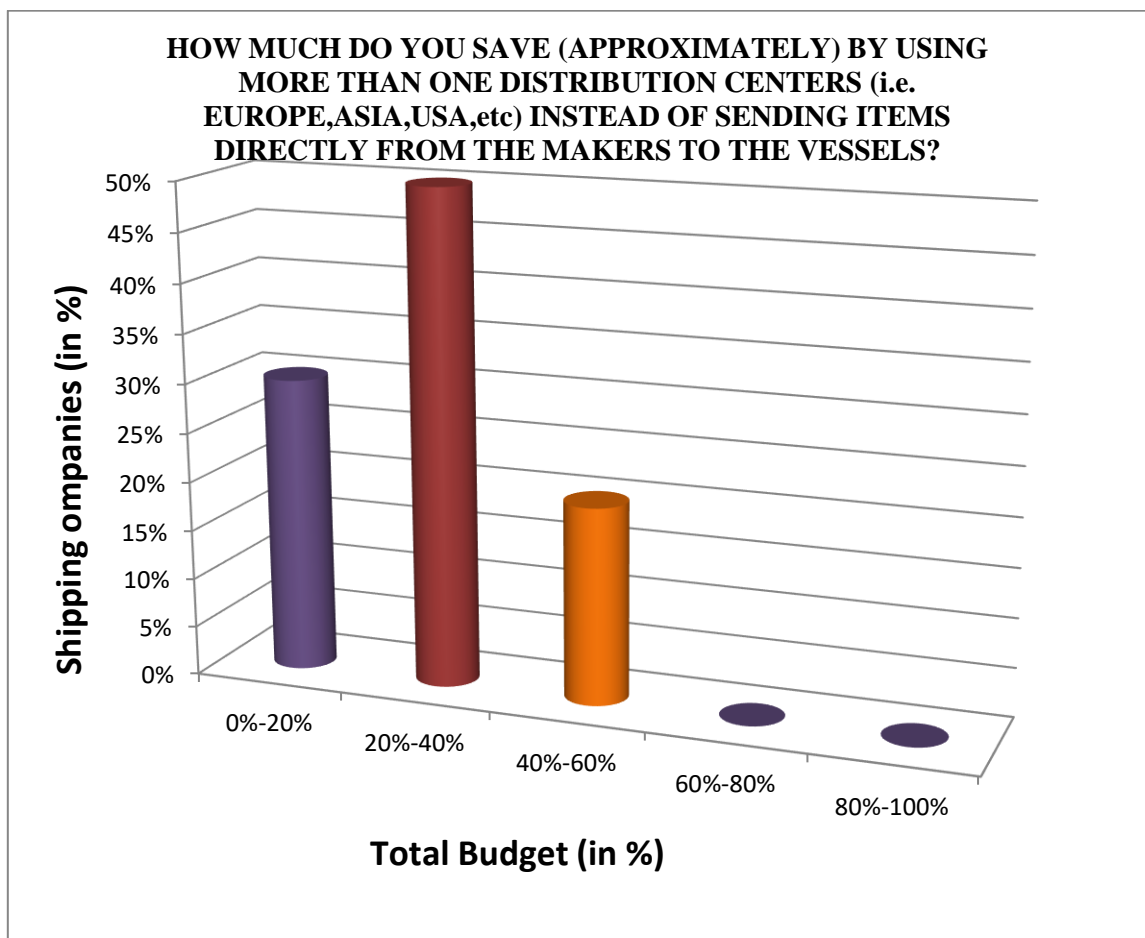
This is a closed type question, and its aim is to clarify how often the shipping companies negotiate the prices and the storage conditions a Distribution Center offers. As we see the 45% chooses to negotiate every year, another 45% in 2 years, and the rest 10% in 3 years. We understand from that question that negotiating the prices and trying to lower them is very significant for the shipping companies.





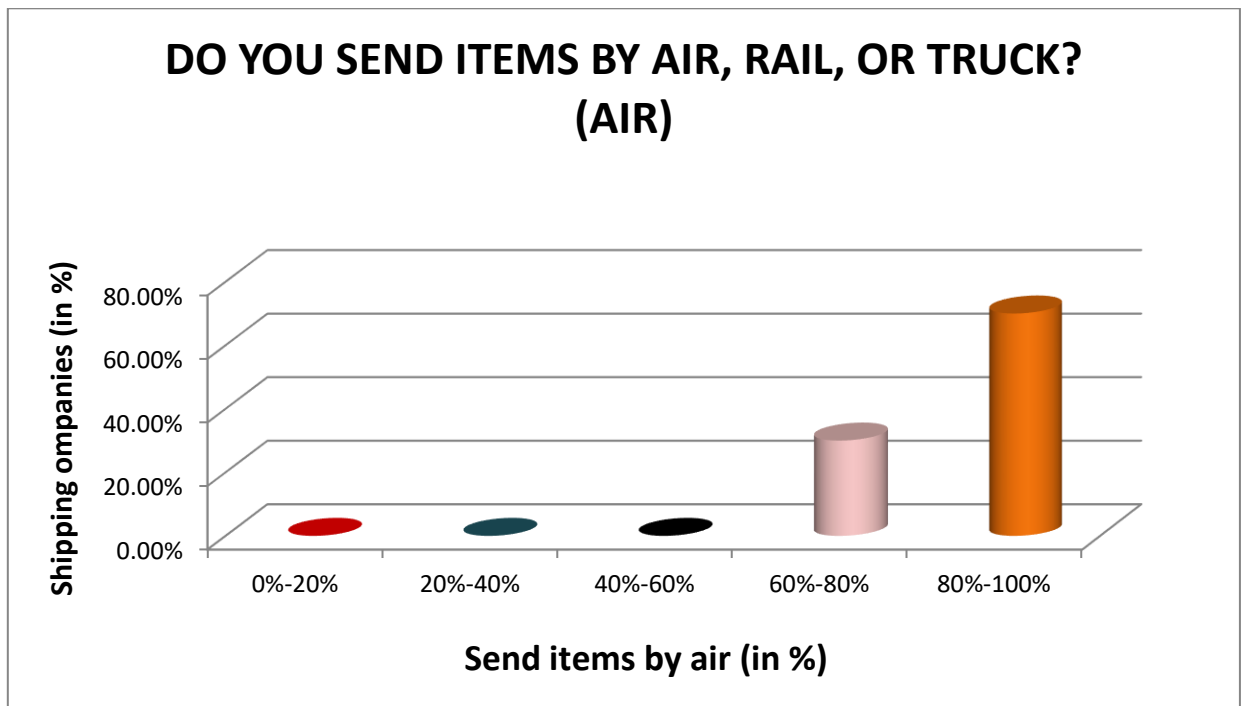
**Question 6:** How much do you save (approximately) by using more than one Distribution Centers (i.e. Europe, Asia,, USA, etc.) instead of sending items directly from the makers to the vessels?

This is also a closed type question, and its aim is to examine how much money the shipping companies save from having cooperation with a Distribution Center and collecting all the spare parts for their vessels, and not waiting the vessel to pass by the region of the maker and send it then with courier company. This is very significant because they can collect many spare parts from different makers for different vessels, and when the vessel arrives near the Distribution Center can deliver them. So the 30% of the respondents answered that they save 0%-20%, the 50% answered 20%-40%, and the rest 30% answered 40%-60%. We did not have any answers for the options 60%-80% and 80%-100%. So we see that the vast majority of the respondents save enough money for their companies by using Distribution Centers.

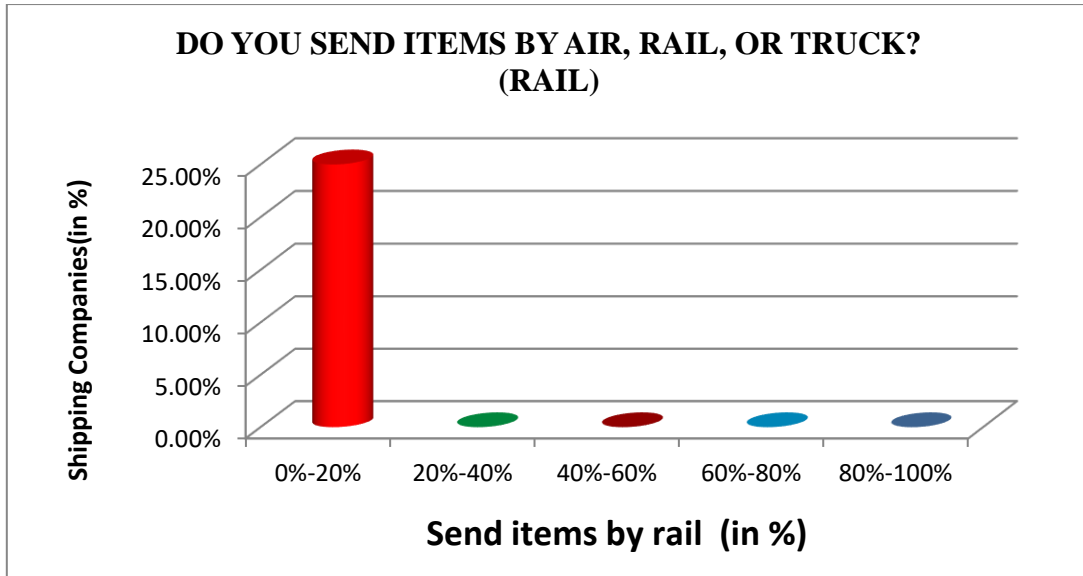


**Question 7:** Do you send items by Air, Rail or Truck?

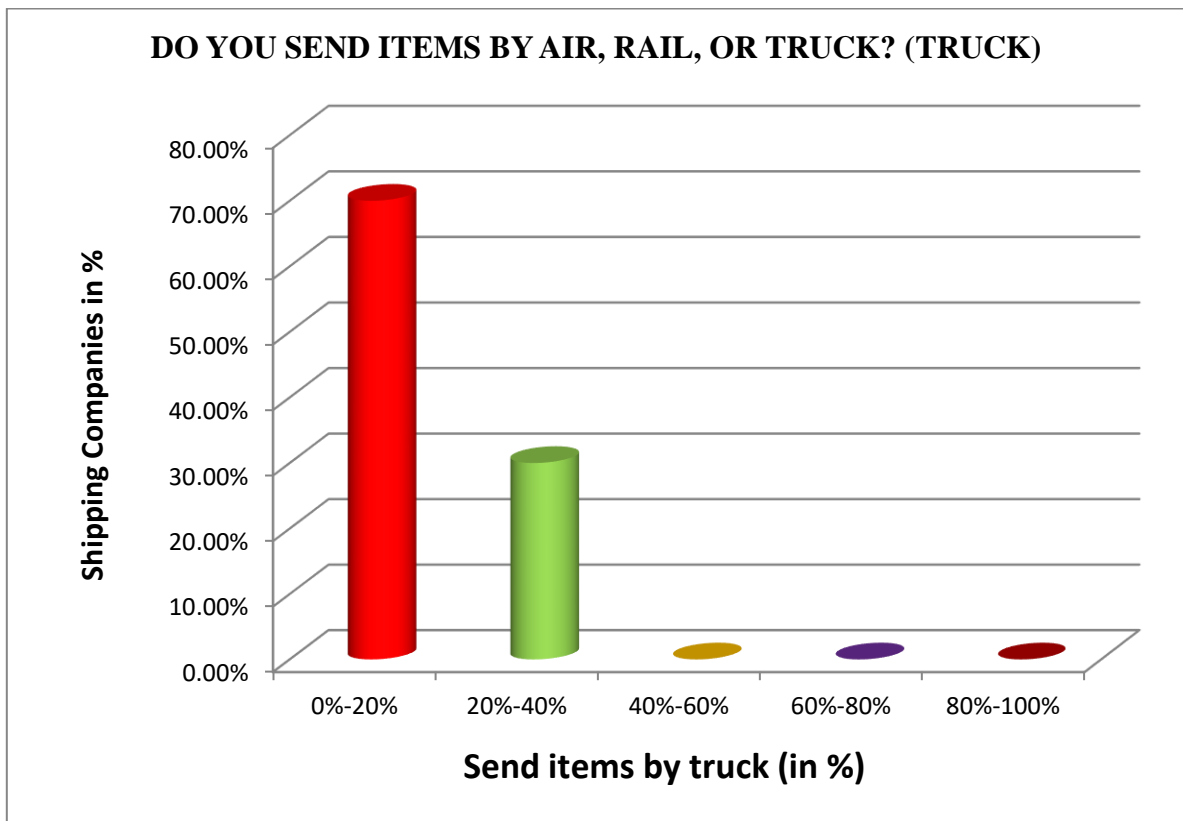
This is also a closed type question, and the respondents had to answer how they send items from their premises, or from vessels to their premises, etc. Firstly, starting with air, we see that the vast majority (70%) is using air freight 80%-100%, and the rest (30%) using air freight 60%-80%



Sending items by rail : only the 25% of the respondents is using this option and in a small percentage of 0%-20% (some said that they use this option under 10%)

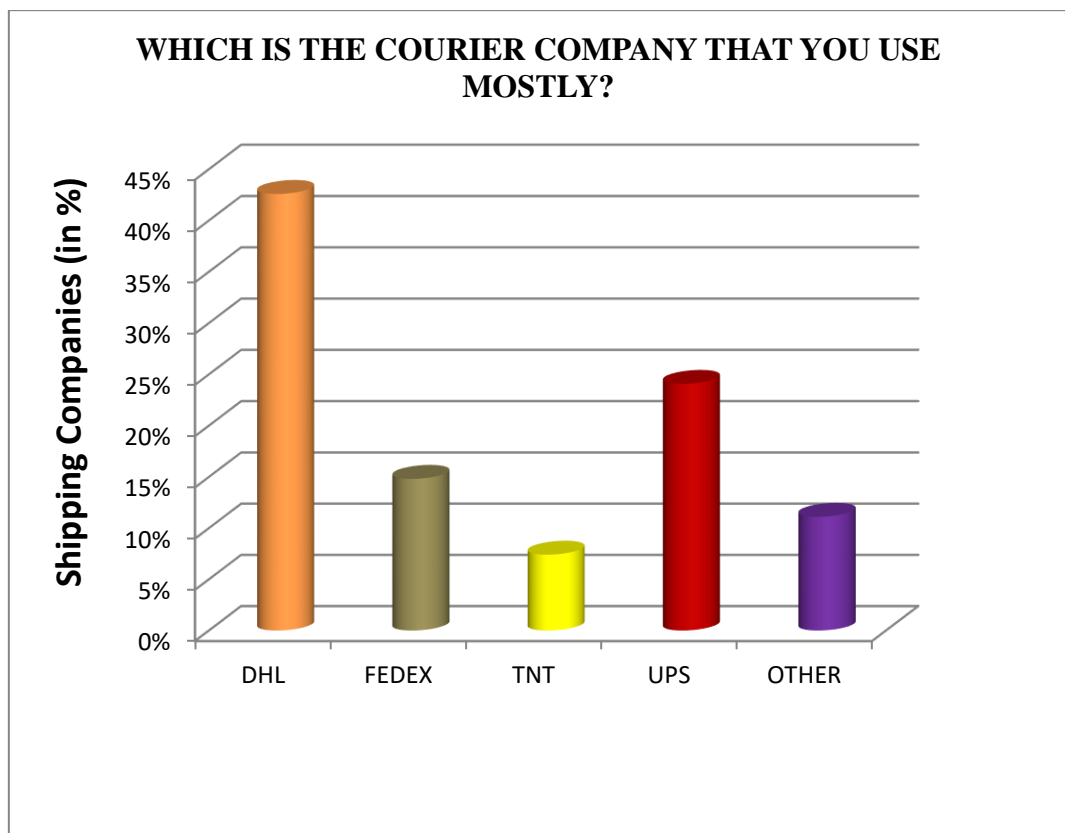


Lastly, the option of the truck the most companies (70%) send items in a small percentage (0%-20%), and the rest ones (30%) uses truck for 20%-40%,



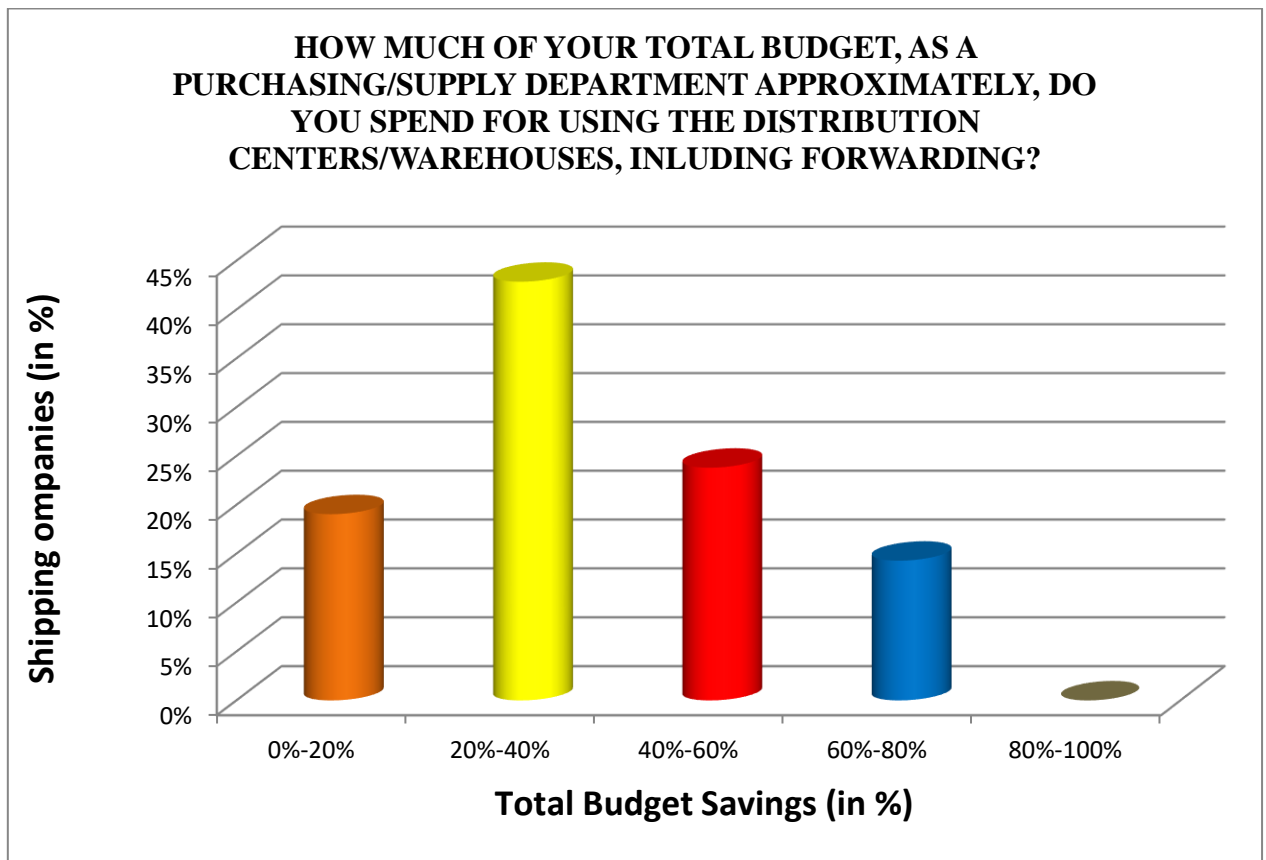
**Question 8:** Which is the courier company that you use mostly?

This is also a closed type question, and focuses the cooperation the shipping companies have with certain courier companies. If you have a good cooperation with a courier company, may affect also to get discounts for your cooperators, such as the Distribution Centers. We see that 43% prefers DHL, 24% UPS, 15% FEDEX, 7% TNT, and 11% other courier company. The main reason for using DHL is the reliability and the speed of delivering to every address.



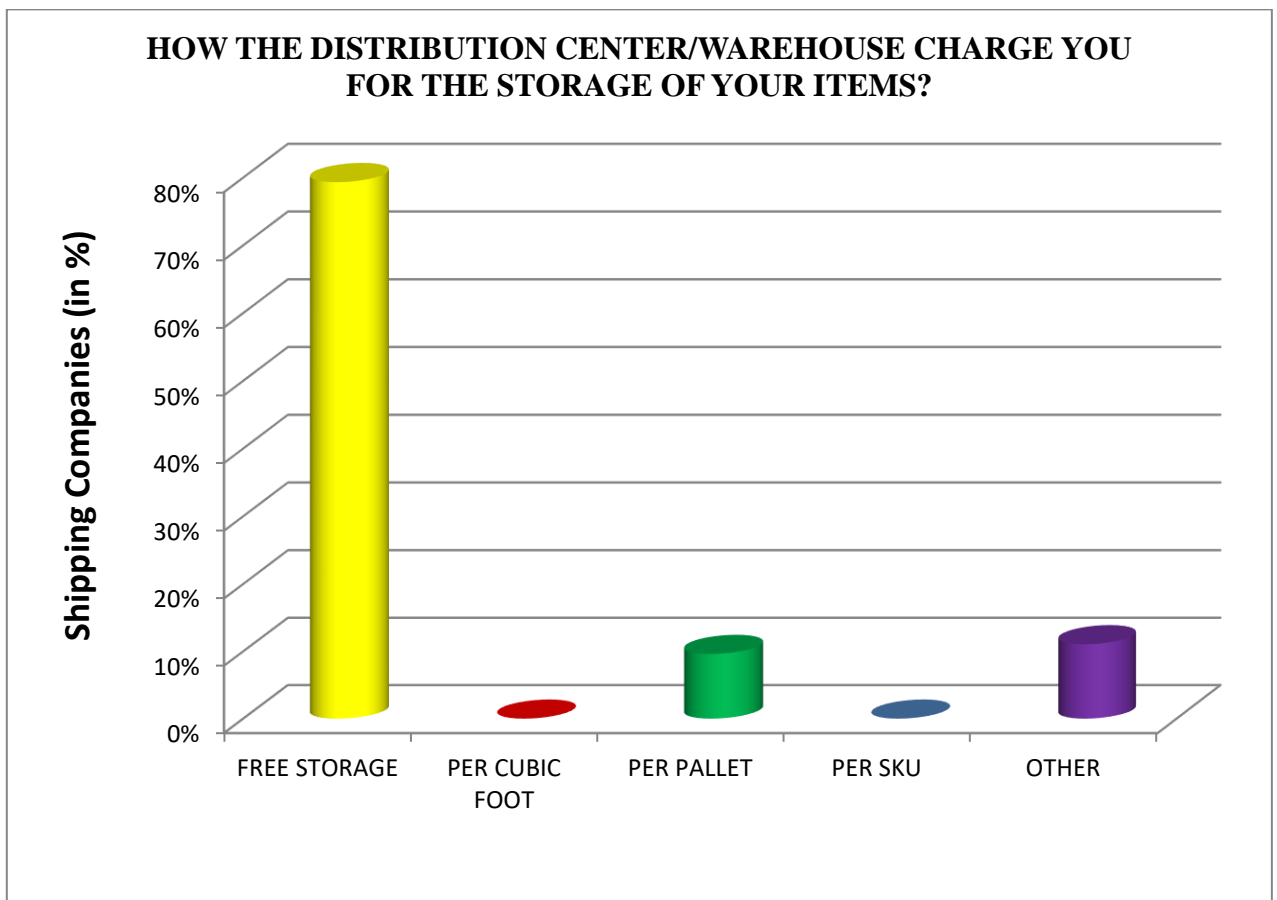
**Question 9:** How much of your total budget, as a purchasing/supply department, approximately, do you spend for using Distribution Centers/Warehouses, including forwarding?

This is a closed type question, and focuses on examining how much of the total budget of purchasing/supply department is spent for cooperating with Distribution Centers. As we have mentioned before, as a mandatory aspect of maritime business, Distribution Centers are a predominant cost for shipping companies. And the results showed that also, because the 43% of the respondents answered that they are spending 20%-40%, the 24% spends 40%-60% of the total budget, the 19% spends 0%-20% and the rest 14% spends 60%-80%. There was no answer for 80%-100%. So we see that at least 1/3 of the total budget of the department goes to the cooperation with the Distribution Centers.



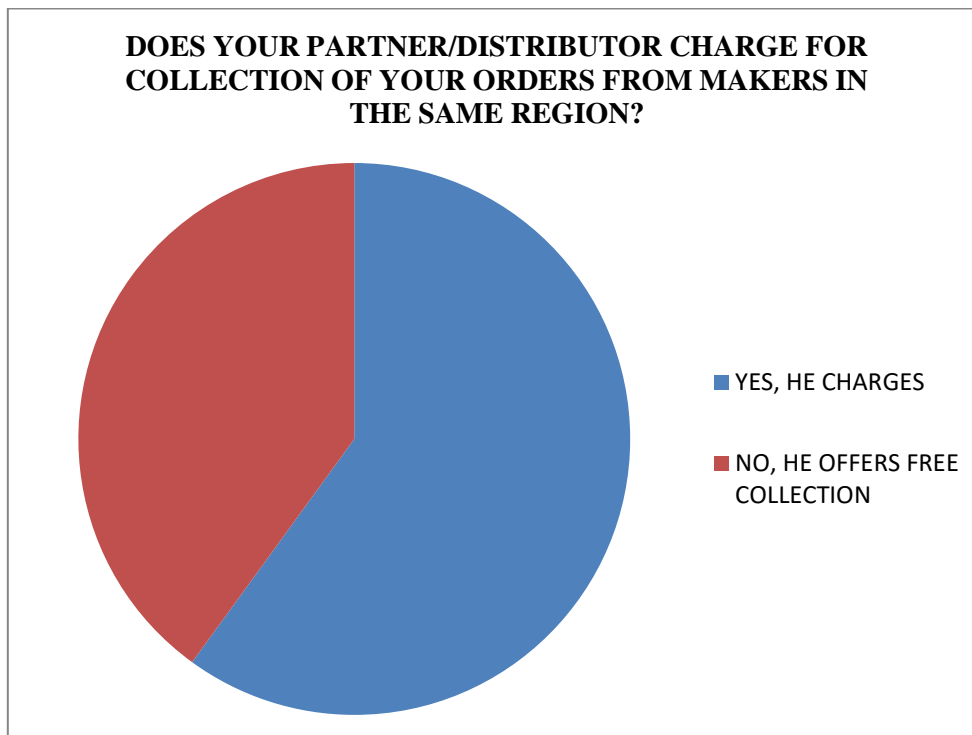
**Question 10:** How much does the Distribution Center/Warehouse charge you for the storage of your items?

Also this is a closed type question, and the question was about the charging that Distribution Center imposes on shipping companies. As we see the vast majority (79%) offers free storage, so that means the shipping company saves enough money for storing its spare parts at the Distribution Center. Only 10% charges per pallet, and the other 11% has other methods of charging, such as the space they occupy in the ground of the Distribution Center for heavy spare parts.



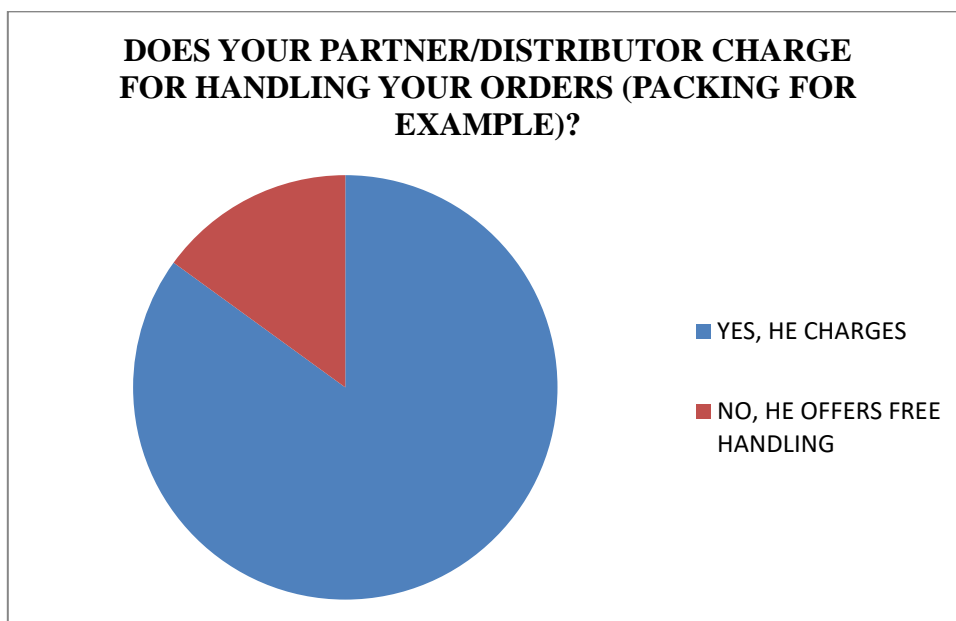
**Question 11:** Does your partner/distributor charge for collection of your orders from makers in the same region?

This is a closed type question with 2 options. Some Distribution Centers are located near ports and near to makers of spare parts, so they can collect easily the purchase orders from their own premises, without using courier companies. Some other makers, on the other hand, are far away from them so they charge for collecting these spare parts. From the results we collected, we saw that the 60% of the Distribution Centers charges for collecting them, and 40% offers free collection. But it was noted that free collection is offered in some places in Asia mostly (Singapore, South Korea) because the distances from the makers are not great, and less in Europe (Rotterdam, Hamburg) where some makers may be from other countries (Denmark, Sweden, etc.). So, by offering free collection, some Distribution Centers provide a plus for decreasing the expenses of the shipping company.



**Question 12:** Does your partner/distributor charge for handling your orders (packing for example)?

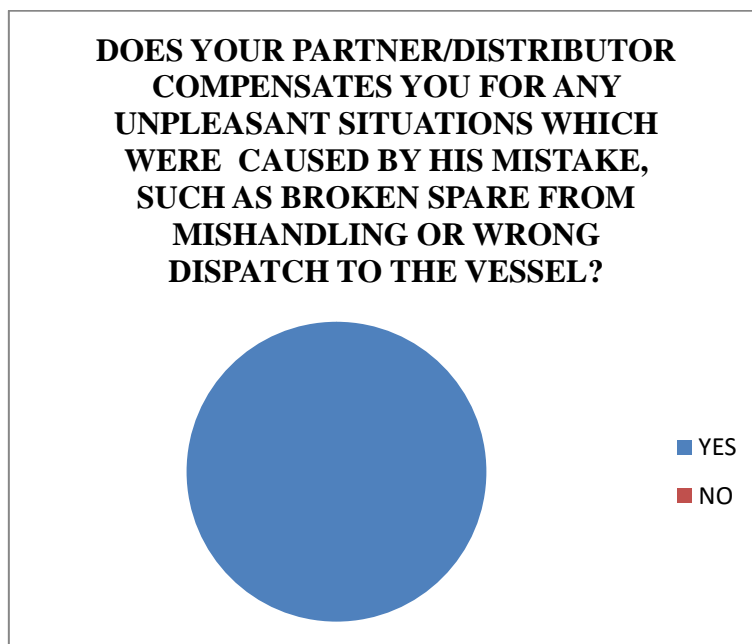
This is also a closed type question with 2 options. When Distribution Centers receive or prepare orders for sending them to the vessel, they must handle the imports or the exports, such as packing, operating costs etc. So the results showed us that almost every Distribution Center (85%) charges for handling orders and a small percentage (15%) does not. But it was mentioned that handling a Distribution Center is much cheaper than handling the shipping company itself.





**Question 13:** Does your partner/distributor compensate you for any unpleasant situations which were caused by their mistake, such as broken spare from mishandling or wrong dispatch to the vessel?

This is also the final closed type question with 2 options. Because mistakes are made, not in a very large scale but they do happen, the question focuses on the actions the Distribution Center does to make up for their partners. As we saw from the results, all the Distribution Centers compensate or fix their own mistakes on their own, without intervention from the shipping companies. So we see that in case of a mistake from distributors, no expense has to be made by shipping companies.



## Questionnaire Conclusion

To conclude with , we see most companies trading areas are between Europe, Asia and America. Given that fact, we see that shipping Companies use Distribution Centers in only 2 areas (Europe and Asia). This is because most of the makers locate in these areas, and vessels will trade sometime in these area, so they can arrange delivery on board, and they are very satisfied with the services Distribution Centers offer. But, because storing spare parts is very expensive, the negotiation for new contracts are necessary as we see every 2 years, or even every year.

Air freight, and DHL coming first as courier company. is the most common to dispatch spare parts from one place to another, with truck coming second if there is time and the distance is not far.

Most shipping companies, especially those with having at their fleet tankers, spend for using Distribution Centers (including forwarding) 20%-40%, because most DCs offer free storage for spare parts, free collection for makers in nearby areas, and charge for handling orders (input and output).

Finally, we see that most shipping companies save enough money of their total budget (20%-40%) by using DCs, and they can allocate this money to other sectors, to grow their company etc.

## Conclusion

To sum up , we examined the supply chain management and the logistics system. But the main focus was to examine how Distribution Centers work in supply chain management, how they evolved from traditional warehouses, and mainly how they work for maritime business and as an essential part for storing spare parts for shipping companies.

What we concluded from the questionnaire is that cooperating with Distribution Centers, not only they have a place to gather spare parts for their vessels, either because they want to have some spare in case of need or because these spare parts are important and waiting the vessel to be near so the distributor to deliver them, but it is a cost-saving practice for shipping companies (and for purchasing/supply department) to reduce cost. By offering free storage for spare parts, or compensation for any mistakes of distributors, or even by offering free collection for makers in the same region is something that shipping companies gain from Distribution Centers.

Lastly, as we saw from the results ,the shipping companies spend only a 20%-40% of their total budget for Distribution Centers (including forwarding), and they save by using them another more 20%-40% than using any other way of storage or sending directly the spare parts. So Distribution Centers are a very essential part in Maritime business, but also ,they are a way for shipping companies to save money , and as a result to continue using them for their work flow.

## Appendix

### Questionnaire

#### QUESTIONNAIRE FOR MASTER THESIS

My name is Pavlos Iliadis, and I am a Post-Graduate student at University of Piraeus, in Maritime Department. Below you will find a questionnaire, from which data will be extracted for my Master Thesis "**Distribution Centers: An expensive solution or a cost-saving practice?**". Your participation will remain anonymous, and the data will not be published anywhere.

COMPANY NAME & POSITION

NAME & SURNAME

FLEET & ANALYSIS (FILL IN THE BLANKS WITH THE CORRESPONDING NUMBER)

Bulk Carriers	<input type="text"/>
Containerships	<input type="text"/>
LNG/LPG	<input type="text"/>
Tankers	<input type="text"/>
Other	<input type="text"/>

VESSEL TRADING AREAS (FILL IN THE BLANKS WITH A ✓)

Europe	<input type="text"/>
America	<input type="text"/>
Africa	<input type="text"/>
Asia	<input type="text"/>
Australia/Oceania	<input type="text"/>

HOW MANY DISTRIBUTION CENTERS/WAREHOUSES DO YOU USE & IN WHICH AREAS? (FILL IN THE BLANKS WITH THE CORRESPONDING NUMBER)

Europe	<input type="text"/>
Asia	<input type="text"/>
Africa	<input type="text"/>
America	<input type="text"/>
Australia/Oceania	<input type="text"/>

HOW SATISFIED ARE YOU WITH YOUR PARTNERS/DISTRIBUTORS IN THE FOLLOWING AREAS (FILL IN THE BLANKS WITH A ✓)

	Extremely Unsatisfied	Unsatisfied	Neutral	Satisfied	Extremely Satisfied
Europe	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Asia	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Africa	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
America	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Australia/Oceania	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

HOW OFTEN DO YOU NEGOTIATE THE STORAGE CONDITIONS/PRICES WITH THE FORWARDERS?(FILL IN THE BLANKS WITH A ✓)

1 Year	<input type="text"/>
2 Years	<input type="text"/>
3 Years	<input type="text"/>
4+ Years	<input type="text"/>

HOW MUCH DO YOU SAVE (APPROXIMATELY) BY USING MORE THAN ONE DISTRIBUTION CENTERS (i.e. EUROPE, ASIA,USA, etc) INSTEAD OF SENDING ITEMS DIRECTLY FROM THE MAKERS TO THE VESSELS ?(FILL IN THE BLANKS WITH A ✓)

0%-20%	<input type="text"/>
20%-40%	<input type="text"/>
40%-60%	<input type="text"/>
60%-80%	<input type="text"/>
80%-100%	<input type="text"/>

DO YOU SEND ITEMS BY AIR, RAIL OR TRUCK? (FILL IN THE BLANKS WITH A ✓)

	0%-20%	20%-40%	40%-60%	60%-80%	80%-100%
Air	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Rail	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Truck	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

WHICH IS THE COURIER COMPANY THAT YOU USE MOSTLY? (FILL IN THE BLANKS WITH A ✓)

DHL	<input type="text"/>
FEDEX	<input type="text"/>
TNT	<input type="text"/>
UPS	<input type="text"/>
Other	<input type="text"/>

HOW MUCH OF YOUR TOTAL BUDGET, AS A PURCHASING/SUPPLY DEPARTMENT APPROXIMATELY, DO YOU SPEND FOR USING THE DISTRIBUTION CENTERS/WAREHOUSES, INCLUDING FORWARDING (FILL IN THE BLANKS WITH A ✓)

0%-20%	<input type="text"/>
20%-40%	<input type="text"/>
40%-60%	<input type="text"/>
60%-80%	<input type="text"/>
80%-100%	<input type="text"/>

HOW MUCH THE DISTRIBUTION CENTER/WAREHOUSE CHARGE YOU FOR THE STORAGE OF YOUR ITEMS (FILL IN THE BLANKS WITH A ✓)

Free Storage	<input type="text"/>
Per Cubic Foot	<input type="text"/>
Per Pallet	<input type="text"/>
Per SKU	<input type="text"/>
Other	<input type="text"/>



DOES YOUR PARTNER/DISTRIBUTOR CHARGE YOU FOR COLLECTION OF YOUR ORDERS FROM MAKERS IN THE SAME REGION? (FILL IN THE BLANKS WITH A ✓)

Yes, he charges	<input type="text"/>
No, he offers free collection	<input type="text"/>

DOES YOUR PARTNER/DISTRIBUTOR CHARGE YOU FOR HANDLING YOUR ORDERS (PACKING FOR EXAMPLE)? (FILL IN THE BLANKS WITH A ✓)

Yes, he charges	<input type="text"/>
No, he offers free handling	<input type="text"/>

DOES YOUR PARTNER/DISTRIBUTOR COMPENSATES YOU FOR ANY UNPLEASANT SITUATIONS WHICH WERE CAUSED BY THEIR MISTAKE, SUCH AS BROKEN SPARE FROM MISHANDLING OR WRONG DISPATCH TO THE VESSEL? (FILL IN THE BLANKS WITH A ✓)

Yes	<input type="text"/>
No	<input type="text"/>

Thank you, in advance, for your contribution

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