



Department of Social Sciences
Master of Supply Chain Management

Postgraduate Dissertation

*“Maritime Supply Chain Management.
Impact of Procurement on Vessels operations.”*

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Athens, Greece, January 2023

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"Maritime Supply Chain Management. Impact of Procurement on
Vessels operations."

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Abstract

Maritime sector is a highly challenging environment with a lot of complexities and interconnections. Ship owning companies are competing internationally in an unstable environment, transferring cargo from the major producing to the major consumer countries and despite its high earning nature, maritime sector has sadly the lower innovation rates. Supply chains, on the other hand, have become more vast than ever, including countless nodes and tiers. Although maritime supply chain management pre-existed comparing to other sectors, it is only the recent years that literature has been dedicated to this specific domain.

A rough categorization of the supply chain management in the maritime industry is suggested in this dissertation, between two main sectors: the maritime industry operating as logistics provider transporting cargos and the shipbuilding industry.

This dissertation reflects on how Porter's value chain management analysis was a breakthrough contribution to management thinking at that time, incorporating supply chain and procurement activities. A brief elaboration is attempted on the level the supply chain management and procurement activities are creating value for the shipping company and affecting its race towards gaining competitive advantage. In addition, the seven stages of procurement are being explored and the interrelation of procurement function and vessels' operating activities is examined.

Vessels are living entities who have obligations against its owners and employers; cargo loading and discharging, bunkering activities, ballast water exchanges and garbage, sludges and cargo residues disposal are a few of the operating activities related to a vessel's employment. There lays one of the challenges procurement experts face in the shipping companies: perform supplies and deliveries without interfering to any of the above tasks.

This dissertation illustrates how web technology applications promote the visibility throughout the supply chain and are a major enabler of integration; same is applicable on

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the maritime sector as well. It also sheds light on the importance of ERP softwares and information systems on the procurement function of shipping companies and how they create a bridge between the vessel and the office.

Keywords

Supply chain management, Maritime sector, Procurement of vessels, Shipping operations.

Περίληψη

Ο τομέας της Ναυτιλίας είναι ένα περιβάλλον υψηλών προκλήσεων με πολλές πολυπλοκότητες και συσχετισμούς. Οι πλοιοκτήτριες εταιρείες ανταγωνίζονται διεθνώς σε ένα ασταθές περιβάλλον, μεταφέροντας φορτίο από τους μεγάλους παραγωγούς στις μεγάλες καταναλώτριες χώρες και παρά τα υψηλά ποσοστά κέρδους, ο ναυτιλιακός κλάδος έχει δυστυχώς τα χαμηλότερα ποσοστά καινοτομίας.

Στον αντίποδα, οι αλυσίδες εφοδιασμού έχουν γίνει πιο ευρείες από ποτέ, περιλαμβάνοντας πολυάριθμους παίκτες και βαθμίδες. Αν και η διαχείριση εφοδιαστικής αλυσίδας στον τομέα της ναυτιλίας προϋπήρχε σε σύγκριση με άλλους τομείς, αναφορές και έρευνες του συγκεκριμένου τομέα εμφανίζονται μόλις τα τελευταία χρόνια στη βιβλιογραφία.

Σε αυτή τη διπλωματική εργασία προτείνεται μια κατά προσέγγιση κατηγοριοποίηση της διαχείρισης της εφοδιαστικής αλυσίδας στη ναυτιλιακή βιομηχανία, μεταξύ δύο κύριων τομέων: της ναυτιλιακής βιομηχανίας που λειτουργεί ως υλικοτεχνικός πάροχος μεταφορών και της βιομηχανίας ναυπήγησης.

Αυτή η διπλωματική εργασία εξετάζει πώς η ανάλυση διαχείρισης της αλυσίδας αξίας του Porter ήταν μια σημαντική συμβολή στη αντίληψη της διοίκησης εκείνη την εποχή, ενσωματώνοντας δραστηριότητες αλυσίδας εφοδιασμού και προμηθειών. Επιχειρείται μια σύντομη ανάπτυξη του επίπεδου στο οποίο οι δραστηριότητες διαχείρισης της εφοδιαστικής αλυσίδας και προμηθειών δημιουργούν αξία για τη ναυτιλιακή εταιρεία και επηρεάζουν τον αγώνα της προς την απόκτηση πλεονεκτήματος έναντι των ανταγωνιστών της. Επιπλέον, διερευνώνται τα επτά στάδια της διαδικασίας προμηθειών και εξετάζεται η αλληλεπίδραση του τομέα προμηθειών και των λειτουργικών δραστηριοτήτων των πλοίων.

Τα πλοία είναι ζωντανές οντότητες που έχουν υποχρεώσεις έναντι των ιδιοκτητών και των εργοδοτών τους. Η φόρτωση και εκφόρτωση φορτίου, οι δραστηριότητες ανεφοδιασμού καυσίμων, οι εναλλαγές νερού έρματος, όπως και η απόθεση απορριμμάτων, λυματολάσπης και υπολειμμάτων φορτίου είναι μερικές από τις

λειτουργικές δραστηριότητες που σχετίζονται με την απασχόληση ενός πλοίου. Εκεί υπάρχει μία από τις βασικότερες προκλήσεις που οι ειδικοί στο τομέα προμηθειών του ναυτιλιακού κλάδου καλούνται να αντιμετωπίσουν: οι προμήθειες και παραδόσεις πρέπει να λαμβάνουν χώρα χωρίς να παρεμβαίνουν σε κανένα από τα παραπάνω καθήκοντα του καραβιού.

Αυτή η διπλωματική εργασία παρουσιάζει πώς οι εφαρμογές τεχνολογίας προωθούν την ορατότητα μέσα στην αλυσίδα εφοδιασμού και αποτελούν σημαντικό παράγοντα ολοκλήρωσης. Το ίδιο ισχύει και για τον ναυτιλιακό τομέα. Η εργασία ρίχνει επίσης φως στη σημασία της χρήσης του λογισμικού ERP και των συστημάτων πληροφοριών για το τμήμα προμηθειών των ναυτιλιακών εταιρειών και πώς δημιουργούν μια γέφυρα επικοινωνίας μεταξύ του πλοίου και του γραφείου.

Λέξεις – Κλειδιά

Διοίκηση εφοδιαστικής αλυσίδας, Ναυτιλιακός τομέας, Εφοδιασμός πλοίων, Δραστηριότητες των πλοίων.

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1. Introduction and Methodology

1.1 Introduction

Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products. Information flows upstream the chain, from the market place to the supplier, and the level of integration and sharing depends on the organizational culture. The ultimate goal of a company is to maximize customer value and gain the competitive advantage in the marketplace. By managing the supply chain, companies can cut excess costs and deliver products or services to the consumer faster and more efficiently. A supply chain manager is tasked with controlling and reducing costs, monitoring the smooth operation of the processes, while avoiding supply shortages and dealing with potential disruptions.

On the other hand, procurement is defined as a strategic process to streamline an organization's operations to ethically purchase quality goods and services from suppliers to realize business objectives of saving cost, reducing time, and improving profitability. The activity of formulating and delivering a procurement strategy is viewed as part of three- cycle processes. The business strategy cycle is the process of creating visions, goals and strategies for the organization, implementing them and learning from them. The strategic procurement cycle, represents the process of developing and delivering on the procurement strategy. And the procurement sub-processes represent the tactical and operational activities of sourcing, managing supplier relationships and processing the order cycle. All three of these cycles feed into each other, providing alignment across the organizational hierarchy.

In the context of theory, Michael Porter created a strategic management tool for analyzing a company's value chain. A value chain is composed by various subsystems that are used to create products or services and eventually gain profit; this includes the process from start to finish. Porter sought to define a company's competitive advantage noting that it stems from a company's processes, such as marketing and supporting activities. He breaks value chain analysis into five primary and four supporting activities. The primary activities

are inbound logistics, operations, outbound logistics, marketing and sales, and service. The goal of the five sets of activities is to create higher profit. The secondary activities are the procurement, human resources management, infrastructure, technological development. Every support activity plays an active role in each primary activity.

The maritime sector is defined as consisting of the shipping industry, ports, marine and maritime business services industries, each of which comprise a diverse array of activities. It is a global industry that has been developed in order to promote international trade through connecting sources of supply and demand for commodities such as raw materials, manufactured goods, and finished products, as well as transportation of passengers, cars and livestock, between ports and countries. The maritime industry is of huge importance in terms of natural resources and energy, trade and industry, sciences and leisure activities. The sustainability concerns have overrun this sector as well and call for innovative solutions and careful management systems to ensure implementation of international regulations and ways to address any socially related emerging problems in the near future.

It is obvious that technology has now transformed the shipping company into a perfectly equipped and well-organized business center, where specialized maritime executives have the ability to control, guide, and support every activity of the vessels and their crews. Web technology boosts the supply chain visibility by providing more real-time data from all links of the supply chain, resulting in greater collaborations among trading partners. Maritime supply managers need to understand the impact of technology and gain competency in making a business case for e-procurement. IT solutions improve supply chain agility, reduce cycle time, achieve higher efficiency, and make deliveries on board the vessel in a timely manner. The use of Internet has penetrated the whole procurement process forming the e-sourcing; it is of great assistance in all stages of the supplier selection process as well as in the construction of a comprehensive framework for the final selection.

Globalization, extreme competition, and great financial fluctuations in the prices of products and services, have resulted in enhancing the procurement management as one of the company's most important influencing factors. It is now recognizable that

the need to improve the operation of supplies exists. In the maritime space and especially in the field of catering and supply for vessels with both consumables and spare parts, supplies are one of the fundamental running costs. The difference in each company's approach derive from enhancing the business strategy. Nevertheless, key business priority is to reduce the expenses as much as possible to save resources.

1.2 Methodology- short description

In order to gain better insight into the maritime supply chain and the level the procurement discipline is influencing and interacting with vessels' activities, semi-structured interviews were conducted with seven employees of a shipping company.

Here, employee of the shipping company is defined as someone who works ashore or on board vessel; a member of the board of directors is included as well.

Interviews were personal; five of them were conducted face-to-face, in the meeting room of the shipping company and lasted approximately 20 minutes each. The remaining two were conducted online, through web meeting tool. Answers were recorded by note-taking, and six interviews were also audio recorded with consent. One interviewee preferred not to be recorded in audio.

The interviewees were promised of their confidentiality; their identities will remain anonymous throughout the dissertation and will not be revealed in the aggregated findings.

The interviews were transcribed and thematic analysis was conducted. This involved coding all the data before identifying and reviewing six key themes. Each theme was examined to gain an understanding of participants' perceptions and viewpoints.

1.3 Structure of the dissertation

This dissertation is structured as follows: in the first section, maritime supply chain is examined, a small literature review on its definitions and its part in the Porter value chain. The role of technology is also examined. A brief review of the maritime sector is also attempted, along with an analysis of the presence of supply chain management in the maritime field. In the third chapter, the relation of procurement and vessels' operations is explored: first, a detailed description of vessels' operation is attempted. Then, the procurement is viewed as part of the value chain and the seven stages of procurement are being elaborated. An analysis on the procurement of vessels follows, accompanied by the role of technology and closing with the interconnection of procurement and vessels activities. Next, the interviews are quoted and along with a brief discussion of findings. This dissertation is completed with the conclusions and the limitation of the research.

2. Maritime Supply Chain Management

2.1 Supply chain management (definitions etc)

Although based in traditional business operations such as logistics and simple raw materials procurement, supply chain management is a relatively new theoretical domain with dedicated literature only the recent years.

As well put by Lummus and Vokurka (1999), it was around the 1980s when companies started seeing tangible benefits of collaborative relationships within and beyond their own organization; that moment forward, interest in supply chain management has steadily increased. While Lummus and Vokurka (1999) explore the definitions of the supply chain related to its management, they conclude on the following definition:

"all the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities. Supply chain management coordinates and integrates all of these activities into a seamless process."

A very important point to be noted is that the entire process within the supply chain must be viewed as a system (Lummus and Vokurka, 1999). All components of the supply chain, meaning suppliers, warehouses, logistic parties etc should be evaluated so that the level of their capabilities can be determined. This way, we can conclude on the true value of the supply chain and trace more easily any inefficiencies across the supply chain.

A lot emphasis is given on the interconnection and information sharing of a supply chain in the (Lummus and Vokurka, 1999) review. Companies can be successful only when they have clear view of all nodes in the supply chain and willingness for as much extended cooperation as possible. Information about the market demand should be shared without reserve securing the competitive advantage of all parties of the chain.

On the other hand, Mentzer *et al.* (2001) defines "supply chain management as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole".

Mentzer *et al.*, (2001) develops the notion of Supply Chain Orientation being a prerequisite for organizations to form a successful supply chain, who will have its own identity and function like an independent firm. Supply chain members should focus on creating new sophisticated solutions to increase customer value and satisfaction in order to obtain the competitive advantage in the market. "This, ultimately, improves the profitability of the supply chain and its members" (Mentzer *et al.*, 2001).

It is still 2005, when Gibson, Mentzer and Cook (2005) pointed out the persistent lack of consensus on defining the supply chain management. With the *Council of Supply Chain Management Professionals (CSCMP)* quoting two alternative definitions for the discipline, it is evident that supply chain management was still under "maturation process". According to Gibson, Mentzer and Cook (2005) only the contribution of practitioners would be vital, playing an active role in registering all the aspects of supply chain management.

With a similar note and analysis on the *Council of Supply Chain Management Professionals (CSCMP)* definitions, Stock and Boyer (2009) identify the activities, benefits and constituents/components as main themes of the supply chain management definition, including various subthemes such as material and information flows, networks or relationships and benefits from creating efficiencies and customer satisfaction.

Stock and Boyer (2009) deliver the following definition, as encompassing: "The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final

customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction."

2.2 Supply chain management as part of the Porter Value Chain

Porter has introduced the concept of value chain in 1985 in his book *Competitive Advantage*. He has created a tool for analyzing organizations and their activities, a breakthrough contribution to management thinking at that time (Presutti and Mawhinney, 2009). Porter contemplated on the discrete activities an organization performs and their way of interaction.

Porter's value chain model lists nine value activities, divided into two categories:

- Primary activities: the inbound logistics, operations, outbound logistics, marketing, sales and services. This category includes tasks belonging to the ongoing production, product design and promotion, delivery, and servicing of the product (Mozota, 2010).
- Support activities: procurement, human resources management, infrastructure, technological development. This category includes tasks providing purchased inputs, technology and research and development applications, human resources management, corporate premises (Mozota, 2010).

According to Porter, an organization is a system composed of inputs, transformation processes, and outputs (Piboonrungrroj, Williams and Simatupang, 2017). Resources are being consumed and investment on infrastructure is required so that the organization runs its activities towards achieving customer's satisfaction.

Great emphasis is given on integrating the activities while focusing on increasing value for the customer (Al-Mudimigh, Zairi and Ahmed, 2004); seamlessness is a newly introduced attribute and whichever organization acquires it, reaches one step closer to the ultimate goal: creating customer value to the marketplace as a source of competitive advantage. It is evident that Porter's value chain model is strategizing the creation of value (Feller, Shunk and Callarman, 2006): value chains are focusing on the benefits that are provided

to end customers and the related, interdependent processes in order to generate value. The subsequent demand and funds flows should be effectively controlled to increase profits (Feller, Shunk and Callarman, 2006).

Besides, Porter considers an holistic value system that includes the interacting value chains of suppliers, distribution channel members, and customers (Presutti and Mawhinney, 2009). Yet again, he underlines the importance of interconnection built with strong linkages, both horizontally among a firm's internal activities, and vertically among suppliers, channel members, and customers (Presutti and Mawhinney, 2009).

On the other hand, supply chain management is a concept that although pre-existed in practice, it was not theoretically articulated. Having a closer look at Porter's primary and secondary activities, we can identify supply chain in the former and procurement in the latter part. The supply chain is an important component of the value chain but is not synonymous with it (Presutti and Mawhinney, 2009).

As technology evolved and information started circulating upstream and downstream the supply chains, there was more connection and interaction amongst them. As suggested by Porter in 1996, a more structural approach is required to solve the various issues (Piboonrungrroj, Williams and Simatupang, 2017). The evolving complexity should be controlled and mitigated in order to maintain effectiveness and eliminate waste that minimize customer satisfaction. For a successful supply chain, the value should be created and delivered at its fullest.

Supply chain and value creating activities should be synchronized (Feller, Shunk and Callarman, 2006); operating in a dynamically changing environment, where customer preferences and tastes are rapidly changing, integration of value flows within the supply chain is the key to success. Third generation supply chains need to circulate materials and products in the most economical and lean way possible. Information and knowledge as well, should flow upstream in an integrated manner and as swift as possible. Businesses can achieve the next level of performance by having a holistic perception of the business process and learning to integrate the concurrent flows of value and supply (Feller, Shunk and Callarman, 2006).

2.3 Role of technology in SCM

Without any doubt and as elaborated in supply chain management theory, customer satisfaction is the source of profit for supply chain stakeholders. Web technologies have proven to enhance collaboration among the business partners, thus reduce costs, leading to upgraded customer experience and retaining competitive advantage (Chou, Tan and Yen, 2004).

Starting from the '70s with the simple Management Requirement Planning (MRP), evolving to the Electronic Data Interchange (EDI) and terms like e-commerce, B2B, B2C in the 90s, supply chain management has now developed not only the e-commerce but also the c-commerce (the collaborative commerce) (Chou, Tan and Yen, 2004).

Web technology applications promote the visibility throughout the supply chain, as real-time data are being registered from all stakeholders of the chain and are available to be shared (Chou, Tan and Yen, 2004). Hence, greater collaboration levels are being achieved maximizing profits. Numerous tools and techniques contribute to this data sharing, as well as to most of the supply chain key processes: cost reduction, quality improvement, expedited product development and distribution. In addition, new emerging web technologies create opportunities for synergy (Chou, Tan and Yen, 2004) with new methods of simpler and streamlined coordination between business partners and customers.

Technology is a major enabler of integration: organizations as well as external partners or customers are interacting under a unified environment where market data is available for all. A more integrated supply chain is more likely to achieve better results for all stakeholders by responding efficiently to customer problems and needs (Tseng, Wu and Nguyen, 2011).

Web technologies as well as the Internet have altered the way companies do business opening an extra distribution channel. Internet can support the entire supply chain's operations providing real time access to stakeholders (Chou, Tan and Yen, 2004). Small to

mid-sized companies have also the opportunity to take advantage of supply chain management techniques with low-cost connectivity.

As (Tseng, Wu and Nguyen, 2011) states, "it was assumed that the diffusion of IT into the activities of the supply chain amplified its value-creating potential." Considering the way the flows are facilitated by the use of IT, both information and services, through various technological applications, it is safe to conclude that IT impacts many of the supply chain dimensions, ultimately raising the profits of the firm.

Information technology allows the organizations to handle the information easily; firms can acquire, share, use information in coordination, thus eliminating any information delays and distortions (Tseng, Wu and Nguyen, 2011). Transaction costs between the chain links are reduced through e-collaboration, meaning business-to-business interaction at strategic and operational level via the Internet (Yücesan, 2007). Consequently, Information technology makes the supply chain more robust and resilient without undermining its efficiency (Tseng, Wu and Nguyen, 2011).

Newly introduced technology such as Internet of Things (IoT) and related terminology have also penetrated the supply chain management; as an Internet ascendant, IoT converts objects to living units with the use of data and other smart technologies. These networks of physical objects are created to interact and simplify processes and people's lives through tasks automation (Agrifoglio *et al.*, 2017). IoT has also affected businesses' operational management of the value chains, highly driven by globalization and recent drift of customer expectations.

As more and more pressure is put on the supply chains, firms seeking the competitive advantage through technology, are generating an explosive demand for supply chain management applications to create a cohesive production and distribution network (Chou, Tan and Yen, 2004). However, this mass application installment leads to application integration issues: new IT strategies are drafted in an attempt to coordinate application users and control related interactions (Chou, Tan and Yen, 2004). New IT solutions are introduced with software products covering such integration needs.

Nevertheless, creating an adequate information infrastructure to interface the members of a supply chain can be challenging, requiring time and money investment (Yücesan, 2007). For an increased IT functionality, with broad network and platform not only for information sharing but also for collaboration and even granting access to inter-company applications, a considerable investment is required, having great impact on organization's budget planning (Yücesan, 2007).

2.4 Maritime sector

The maritime sector is a considerable player and a key asset in the world economy. It is a highly profitable industry, with a lot of interdependencies, and extremely affected by the global economy cycles. As shipping relies heavily on intermediaries (Clott, Hartman and Beidler, 2020), involved parties are exposed to systematic risks that are almost impossible to diversify away (Benito *et al.*, 2003). "The shipping industry is a capital-intensive and technology-intensive industry as well as a high-input and high-risk industry" (*Market Prospects: A Value Analysis of the Global Shipping Industry*, 2021). Consequently, maritime business can be a source of massive, insanely high profits, but in the same time, loss can be detrimental, if not devastating for an organization.

Vessels are a source of income for various sub-sectors. Numerous enterprises are involved in all aspects of ship's life: from shipbuilding to maintenance, till voyage fixing to port related activities. Starting from vessel procurement in the global market, design providers and consultants are generating technical studies of the construction of the vessel. Shipyards and shipbuilding firms are involved in the negotiations of contracts with the maritime firms for new building projects (Koilo, 2019). Shipbuilding industry is evolving to a strong supply chain as its scope of work entails intensive components and services sourcing.

Businesses supplying equipment and maritime service providers are a huge part of the maritime sector; supplying new equipment while in initial construction binds the owning company with specific brand of spare parts and maintenance providers. Taking into consideration the makers' overhauling recommendations, the equipment's life, as well as

the unexpected defects, these type of businesses have also a considerable share in the shipping market (Koilo, 2019).

If viewed from the vessel's employment side, the shipping industry is mainly divided into dry bulk transportation, oil transportation, and container transportation according to the difference of the goods (*Market Prospects: A Value Analysis of the Global Shipping Industry*, 2021). Similarly, vessels are divided into different types: bulkers, cargo/containers, tankers, Ro-ro/Ro-Pax (Prussi *et al.*, 2021). Apart from cargo transportation, there is always the recreational part of shipping, including yachts and cruise companies, as well as commercial fishery (*Maritime Sector*, 2023).

Ship owning companies are competing internationally in an unstable environment, transferring cargo from the major producing to the major consumer countries (*Market Prospects: A Value Analysis of the Global Shipping Industry*, 2021). With worldwide trading routes, firms are expanding their operations in Europe, Asia and North America (*Maritime Sector*, 2023). Major commercial ports and maritime centers attract countless vessels and gather the primary portion of the maritime operations. Following the tendencies of the global trade, there has been observed a shift of the center of gravity, advancing from Western Europe to North America, and then to East Asia (*Market Prospects: A Value Analysis of the Global Shipping Industry*, 2021). As far as Europe is concerned, Rotterdam is a hub port representing a considerable amount of maritime activities, supporting the European economy; respectively, New York and Los Angeles represent the same role for the North American region. However, as all eyes are on the Asia-Pacific trade, Singapore and Hong Kong have promoted the economy of the nearby regions as a result of their superior geographical position (*Market Prospects: A Value Analysis of the Global Shipping Industry*, 2021).

Maritime sector, similar to each and every business activity, could not remain untouched by the sustainability concerns being raised the past few years. As the majority of international trade is seaborne, vessels' supply in the market is multiplying rapidly; although passenger vessels constitute a notable economic segment of the maritime industry, it is the freight engaged vessels that are responsible for the largest part of emissions (Prussi *et al.*, 2021). Port activity is drawing a lot of attention in literature as

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well as by international regulatory bodies; harbor logistics services and their technical use is an issue that has to be revisited as it involves huge amounts of emissions into the air (Koilo, 2019).

Despite its high earning nature, maritime sector has sadly the lower innovation rates. Ship owning firms have been digitalized and introduced ICT infrastructure only recently, often with a lot of internal resistance (ENISA works towards strengthening cybersecurity in the Maritime Sector, 2023). Hindered by manual processes, documenting transactions is time consuming, expensive, and inefficient, leaving room for improvement possibly through blockchain technology (Clott, Hartman and Beidler, 2020). On the other hand, regulatory framework imposed by IMO, the International Maritime Organization, or other similar entities, are viewed with skepticism, dispersed fear and uncertainty (Acciaro and Sys, 2020). As international regulations are piling up in an attempt to protect and improve more and more aspects of shipping life, consultancy companies specializing in policy design are called to support shipping firms in complying with international regulations referring, for instance, to cyber security or to International Safety Management (ISM) Code. The commerciality of the vessel is the first priority of every shipping firm.

2.5 Supply chain management in maritime (detailed description)

Maritime industry is a set of activities operating in a highly dynamic environment. The level of changes is so high, that companies need to develop a significant amount of sensitivity, as well as to be able to respond swiftly to market changes in order to succeed with positive results (An-Shuen Nir, 2012). Combined with the scenery change of increasing environmental protection and social awareness, maritime sector is called to continuously raise the service standards (Liu, Zhang and Zhen, 2021).

A considerable part of the maritime industry is characterized by the transportation of cargo, meaning that it is acting as a logistics sector in the most profitable way: maritime transportation is highly- efficient at a very reasonable cost comparing to the rest modes of transport, making the sea freight the primary transportation mode in the global trade (Liu, Zhang and Zhen, 2021). The existing logistics services have been accommodated in the supply chain along with maritime, logistics and distribution process; by effectively

integrating all functional logistics activities, for instance transportation, storage and control through IT infrastructure, the goal is to provide reliable, value adding services, at low cost (An-Shuen Nir, 2012).

Shipping companies being established many years ago and mostly by practitioners, face great difficulties in adapting to the rapidly changing business environment. A high percentage of companies' activities relies on human resources at a dangerously high level, not only in terms of management but also in terms of business process reorganization (Liu, Zhang and Zhen, 2021). In addition, professionals often lack an overall grasp of supply chain management (Liu, Zhang and Zhen, 2021), operating under low transparency as they are reluctant to conform to information sharing and many other supply chain principles. This scheme is limiting the traceability throughout the maritime supply chain, hence minimizing the quality of services.

Besides, this traditional and outdated nature of shipping companies is confining the advancement of the maritime sector comparing to others. Their centralized network is leading to complex processes, accompanied by loads of paperwork and physical documentation. Moreover, there is no homogeneity amongst each link in the maritime supply chain due to different level of practitioners (Liu, Zhang and Zhen, 2021) resulting to poor visibility throughout its operations. Consequently, reported KPIs can be inaccurate and untrustworthy, leading not only to incompetence in becoming resilient and forming risk management, but also to building bad reputation, harming company's commerciality and future profits (Hunaid, Bhurgri and Shaikh, 2022).

On the other hand, there is the shipbuilding industry, another extremely profitable part of the maritime sector. Shipbuilding companies have supply chains similar to manufacturing businesses, automotive or aviation: components should be sourced, equipment should be outsourced as well or fabricated in house, a vast supplier network should be managed effectively and with flexibility to endure possible disruptions. Especially the suppliers relationship management can be an asset for the shipbuilding supply chain that will provide the advantage against their competitors. Advanced information technology solutions are also being adopted so that information can be shared instantly to all nodes.

After the recent intensification of the globalization process (Mello and Strandhagen, 2011), shipbuilding companies were found on a dead-end: they would either keep handling new building projects in the traditional way or evolve and adopt agile supply chain procedures that would maximize profits. In the past, shipbuilding companies were responsible for performing most of the activities to produce a vessel (Mello and Strandhagen, 2011): services were completed by in-house workshops, even some equipment was produced internally. Nowadays, there is a huge part of equipment and services that is outsourced; shipbuilding companies have evaluated the relevant profits and decided to focus on the activities where they could remain competitive (Mello and Strandhagen, 2011). Consequently, shipbuilding created a global network of companies from different countries, urging the importance of integrating and coordinating for a successful outcome.

It is evident that, concerning either part of the maritime industry, maritime supply chains should turn to agile practices in order to safeguard their profits and build resilience. New alliances and services integration provide the competitive advantage; companies that implement an extended risk management policy with scrutiny and special committees can certainly maximize their profits (Liu *et al.*, 2017).

3. Procurement and Vessels operations

3.1 Vessels operations (detailed description)

With maritime sector being one of the most profitable industries, ships are a major source of income. Numerous businesses are involved in a vessel's operation contributing in its seaworthiness while taking advantage of its high income.

First of all, the commercial party of a shipping company pursues for the ship to be constantly employed by fixing voyages. Vessels can be employed as liners or as tramps (*Ship Operations and Management*, 2011), the terms corresponding to the nature of their trade within the market: a liner vessel has a pre-booked and scheduled voyage between designated areas. Its cargo can be composed either by a single or multiple shippers as well as of a single or multiple parcels. A tramp ship on the other side, is a vessel whose trading route is defined by the market; the ship has a changing schedule and makes sure to arrive on time at port for loading and/ or discharging.

When a voyage is nominated to a vessel, clear instructions are provided to the Captain of the vessel regarding cargo and its size, place/ port of loading and discharging, time-frame within which vessel should arrive at the location along with local port agents that act on owners behalf while vessel remains in the area (*Ship Operations and Management*, 2011). Port agents provide any necessary information for terminal restrictions that would affect vessel's operations as well as berthing and loading/ discharging prospects.

A ship can be compared to a living organism: it has needs that should be met in order to fulfill its purpose within the economy cycle of shipping. Bunkering, an expression that is still used from the days of steam ships using coal engine, can be as vital as the voyage fixing for the company profits (*Ship Operations and Management*, 2011). Bunkers comprise the fuel for the engine and other machinery on board ships, such as auxiliary diesel engines that provide electricity or the boiler that provides hot water to the vessels. These fuels can be of different grades and type and their supply can even define the voyage to be fixed: commercial parties are taking into consideration the bunkers

remaining on board and thoroughly calculate those to be required till arrival at next convenient bunkering port.

Aside from the bunkering, maritime operations span all routine procedures which a ship must undergo whilst at port to operate effectively, including anchoring and ballast water exchange (Dinwoodie *et al.*, 2012). All vessel's activities are monitored by regulations, conventions and guidelines to ensure proper completion without any disruptive effect, mostly on the environment (Dinwoodie *et al.*, 2012). Ballast water exchanges for example, is a much discussed topic the past few years with new regulations raised by related to the port areas countries. The lurking risk of upsetting delicate ecosystems by releasing invasive species through the ballast water to the wrong areas has been alerting the countries on taking countermeasures to avoid such incidents.

Along with the ballast water removal, a vessel should be taken care of similarly to a household: while at port, garbage, sludges and slops removal should be arranged regularly to ensure sanitary living conditions.

Another important element of the vessel's good operation is the human resources factor: vessel should be manned by competent seafarers, well trained and qualified. As technology moves forward, there are a lot of navigational tasks and equipment that are now digitized and highly automated (Mallam, Nazir and Sharma, 2020), leading the shipping companies closer to the "autonomous shipping" but in the same time putting a lot of pressure on the crew agencies for procuring highly specialized seafarers. Seafarers' welfare on board is protected by Maritime Labour Convention (MLC) ensuring proper living and working conditions while respecting the resting hours. Crew changes is another defining operation for the vessel that should be materialized in accordance to contracts and proper work timeframes.

Needless to mention that proper vessel operation is ensured via proactive and planned maintenance. Shipping company closely monitors the machinery operation through weekly reporting and follows up the repair of any machinery defect. Specialists inspections are arranged under this scope of work, as well as service attendances for machinery repair or overhauling.

As Vederhus *et al.*, (2018) states in the article "Perceptions of demanding work in maritime operations": "Maritime operations have a scope of work where you depend on synchronization of the task performance". While vessel is at port, there can be countless works and tasks arranged by all departments of the shipping company: from bunkers to provisions and stores supply, from garbage and sludge disposal to service attendances and inspections. It is usually the operation department of every shipping company that acts as a liaison between the office, the vessel and the port agent to make sure that all owners items will be completed during vessel's port call.

3.2 Procurement as part of the value chain

Porter has formed his ground breaking theory and included the procurement function in the supporting activities of the value chain. As he elaborated: "Procurement refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves." (Porter, 1998). These inputs differ depending on the genre of business and can be raw materials, suppliers and any consumable items; a company's assets also fall under this category, for example machinery, laboratory equipment, office equipment, even buildings.

It is well proven the last years that, companies that are implementing a value creating strategy are those that are using effectively all the resources at their disposal. Resources are either physical as mentioned previously, or can be human resources, technological infrastructure or even intangible, reputation for instance (Mena, van hoek and Christopher, 2018). In case the available resources are not enough, prudent organizations with the eyes set on sustainability in the long-run, seek to create complementary resources and alliances.

Procurement's greatest contribution to an organization is knowledge of the supply market and skills. Only a well updated procurement department with excellent market knowledge can make the most profitable contracts and purchases. Besides, a talented procurement specialist can be highly efficient in global sourcing, negotiating and managing suppliers relations (Mena, van hoek and Christopher, 2018).

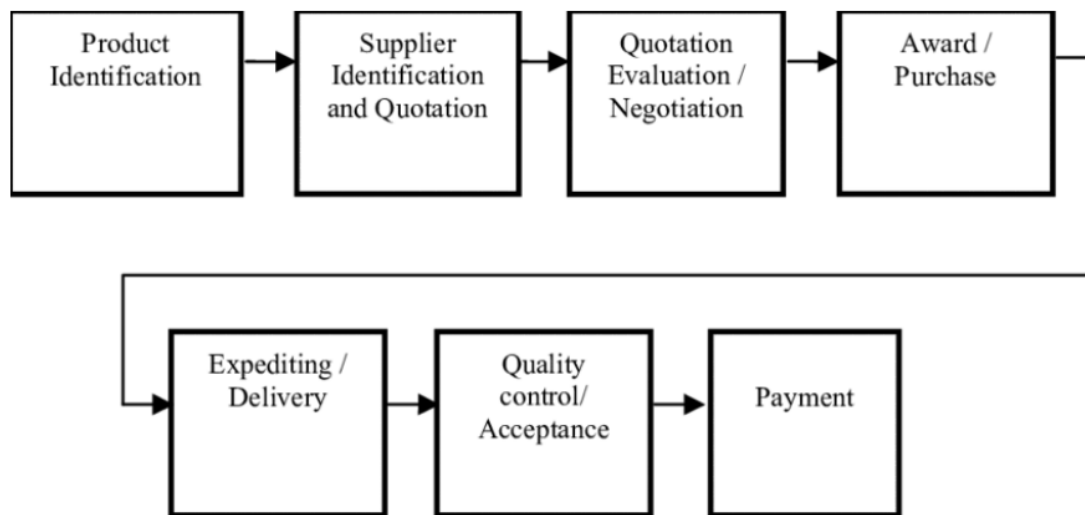
Similar to all activities aiming to create value, procurement uses specific procedures for dealing with vendors, qualification rules and information systems (Porter, 1998). Hence, procurement can be divided in sub-activities such as new suppliers' or any required input sourcing and related further monitoring of the supplier performance.

Nowadays that the market competition is based on the supply chains and not the companies themselves, organizations, that have acknowledged procurement's critical role and gave the necessary room to transform from clerical activity to a strategic function, seem to lead the race towards the acquiring the competitive advantage (Mena, van hoek and Christopher, 2018). It is the myopic focus on deals that can usually distract a company from allowing the procurement department to take a more strategic role within the organization (Mena, van hoek and Christopher, 2018); not to mention the organizational inertia, which combined with the high level of complexity for strategy and decision making, can confine the procurement activities and thereby their deriving benefits for the organization (Meehan and Bryde, 2011).

In addition, procurement discipline can be an efficient leverage against disruption: it is not only the natural disasters, eg the earthquake in Tohoku, Japan in 2011, that procurement professionals have to be prepared for and furnish the organizations with enough sources to mitigate their effects. As procurement practices have effects that run through the supply chains, beyond organizations, their decisions should encompass the environmental, economic and social elements of the triple bottom line (TBL) (Meehan and Bryde, 2011). Due to the complexity in translating the sustainability concept into the procurement strategies (Meehan and Bryde, 2011) and in view of the growing concern of the public eye on the environmental issues, economic and social dimensions tend to receive less attention. Nevertheless, these three elements are interconnected and need to be expressed throughout the procurement practices, supported by organizational culture and gifted procurement experts.

3.3 The 7 stages of procurement

The procurement processes are referred to as procurement cycle in literature and is often broken down to seven stages. Depending on the industry and the product or service involved there are some differentiations, but the core model remains the baseline for an effective procurement implementation.



The seven steps of a purchasing process (Costantino and Pietroforte, 2004).

It is of paramount importance to denote the existence of planning prior any procurement process: "it is an essential step for conducting successful procurement in an economic, efficient, transparent, and fair manner" (Khan, 2018). This preliminary step includes the identification of needs within the project and an estimation of costs. Organizations rely to a large extent on the budget analysis, constituting an effective tool for forecasting and needs prioritizing in terms of funds availability (*Ship Operations and Management*, 2011).

The first stage is the *Product Identification or Identification of needs*; the procurement entity identifies the goods, the inputs or the services required in order to achieve the project or goals set on the planning phase (*Ship Operations and Management*, 2011). Thorough check of existing resources, through inventories, or a sharp eye for missing functions within the companies is required for this stage to be completed.

The second stage is the *Supplier Identification and Quotation*: every well organized procurement entity has a list of suppliers who are cooperating under contract or at an opportunistic mode, per project. The buyer is going through a list of potential suppliers and contacts them (Costantino *et al.*, 2006). After receipt of the request for quotation, the suppliers are accepting and reverting to the buyer with respective quotation. In cases of manufacturing industry, they are conducting a feasibility study to decide whether participating in specific tender would be cost beneficial for them.

Moving forward, at the third stage the procurement department receives the *Quotation/ Evaluates/ Negotiates* with the supplier. The quotation is double-checked by the procurement operator who ensures that offered goods are not only suitable to the requirements but also in accordance to company's set policy and standards. In addition, negotiations are being made in terms of prices as well as lead time or any possible parameter that would contribute to maximize profit for either sides.

Having set all parameters for profitable agreement, it is time to *nominate a supplier with the purchase order*. The purchase order is a binding request from the buyer to the supplier that specifies the items to be supplied, the quantity and quality of those items, and the delivery date, in accordance to the quotation.

The time interval between the purchase order until the final delivery of the product or service is covered by the lead time. This waiting should also be pre-agreed and followed. Upon delivery, the received order should be checked and verified to be in accordance with the placed order. Goods are accompanied by packing list/ delivery note that facilitates this verification process.

Quality control and acceptance of the delivered order is closely connected to the previous step. Any non conformities should be reported back to the supplier the soonest so that debit notes and corrective actions can be done.

Payment is authorized and sent to the accounting department and is the final stage to close the procurement cycle. Remuneration of the supplier is remitted only on condition that his

supply has passed the quality check (Costantino *et al.*, 2006); in a different case, legal enforcement can be applicable.

3.4 Procurement of vessels

Procurement in the maritime business can be a highly complex task: the volume of commodities included is vast, both in terms of quantity and of type. Besides there are a lot of parameters to take into consideration and many parties involved for the supply of a vessel. Overall, the ultimate objective is to maximize value creation while minimizing operating costs (Lau and Yip, 2017).

First off, a simple and basic supplies categorization would be as follows:

- Provisions, bonded and slopchest stores
- Deck, engine, cabin, stationery stores
- Spare parts
- Lubricants and paints

Although provisions and stores, seem to be of minor cost comparing to the overall profits of a vessel, these items cumulatively are costly and represent a significant portion of vessel operating expenses (Kendall, 1986). Over the recent years, shipping companies have invested significant amount of time and money in an attempt to gain close control over both their procurement and expenditure.

A basic and most common outline of the procurement procedure would be as follows:

-vessel crew identifies a need of materials on board. Same can be a shortage in stock, a machinery defect or a proactive request in avoidance of future machine failure or a class inspection observation.

-following Master's approval, a requisition is issued in company's ERP system, taking into consideration the existing stock ob. A captain is the highest ranking on board a vessel and the connecting link between the vessel and the office.

-requisition is received office side and reviewed by the procurement operator. The requisition is proof read; all information should be available so that same is clear for the supplier to quote.

-the bidding process is starts: suppliers' list is reviewed by the procurement operator and at least three offers should be obtained.

-evaluation stage: Vessel's needs should be verified. In addition, aside from the price, procurement operators should take into consideration quality and service of the suppliers.

-order is placed to the supplier who is expected to deliver on time, without any delays that would cause problems in vessel's employment duties.

-vessel crew is confirming the delivery of goods ob and evaluates the supplier for future records. Invoices are issued by the supplier and payment is issued in accordance to delivery notes signed and stamped by Master.

One of the most complicated tasks from the above described procedure is the evaluation and order nomination. First of all, companies establish standards of quality and quantity of goods placed on board vessels. Hence, all material should be supplied in accordance with company policy, at the best available prices (Kendall, 1986). Besides, there are also international organizations and regulations, Maritime Labor Convention (*MLC*) and Safety of Life at Sea (*SOLAS*) for instance, protecting seafarer's life at sea and ensuring high standards of living and working conditions (Lau and Yip, 2017); such directives often create new needs that company has to satisfy through material procurement.

Moreover, procurement operators are guided by vessel's orders history and inventories. Any unexplained deviations become the subject of investigations and should be adjusted to conform to actual experience (Kendall, 1986). Prudent management dictates that office

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side staff, marine and engineer superintendents contribute from their experience and make amendments to vessel's crew requests accordingly (Kendall, 1986).

On the other hand, provisions are an intricate part of vessel's procuring. It is their sensitive nature, especially the fresh and perishable provisions, that demands special transportation and delivery conditions to maintain the quality. Adding to the latter, reliability, responsiveness and assurance are the main aspects of concern in relation to the supply chain (Lau and Yip, 2017). Crew nationality, is a determinant factor as well (*Ship Operations and Management*, 2011); vessels are manned by diverse nationalities, with different eating habits that should be respected and served as much as trading areas permit.

What is more, a procurement officer has to study the layout of the vessel he/ she operates. Supplies are affected by the structural features of the ship which should always be considered when planning to supply stock for long period ahead. Master should be consulted in order to ensure proper accommodation prior the supply of stores (Kendall, 1986).

Another challenging sub-category of vessels' procurement is the supply of spare parts. This section calls for intensive record keeping and preventive actions, since insufficiency or unavailability of spare parts can lead to long machine downtimes or disruptions (Kian, Bektaş and Ouelhadj, 2019). Storing extra spare parts ashore can incur significant costs from warehousing or their degradation (Kian, Bektaş and Ouelhadj, 2019), which leaves this option out of the question. Intense maintenance control by engineer superintendents, combined with procurement operator's experience logistics alternative, are of vital importance for a shipping company.

3.5 The role of technology in vessels' procurement

Due to the rapid changes in economic conditions of global market, organizations are compelled to implement new technologies in order to remain competitive. Companies that do not adopt new technological tools in their core business run the risk of losing customers and failing to overcome any disruptions in their supply chain. Maritime industry is no exception; operating in a highly competitive market as it is its inherit nature, shipping

companies introduce technology following the main drivers of the ongoing pressure to reduce overhead costs, efficiency and safety in their operations (Agrifoglio *et al.*, 2017).

Shipping industry constitutes a vast supply chain comprised by numerous nodes: customers, partners, port agents, shippers, port operators, suppliers and service agents, scattered around the world, can all be part of the maritime supply chain. Information sharing and high speed transmission of data is the key to a resilient supply chain. Having that in mind, organizations focus on e-commerce and e-business to gain the competitive advantage (Agrifoglio *et al.*, 2017).

The procurement part of the shipping industry can be intriguing and highly complex: emphasis is placed on time- and quality- based competition (Chou, Tan and Yen, 2004). With such fluid delivery conditions, as vessels are always changing ports and usually have unstable schedules, closer coordination with suppliers and distributors is desirable (Chou, Tan and Yen, 2004). New economic relationships are being built based on computer networks and human knowledge. Suppliers and shipping businesses are connected through the intranet and extranet that exist within and across firms supply chain management applications (Chou, Tan and Yen, 2004). The ultimate goal is to gain solid control of related expenses, reduce paperwork and shorten product cycles. The last two have plagued the maritime industry for ages and information technology has been inserted as a leverage to minimize their effect.

With the development of ERP technology and information systems, special module has been created in the inter-company information system related to the supply chain activities in which the procurement departments of shipping companies operate (Biccario, Annese and De Venuto, 2014). The procurement section of shipping companies ERPs includes product catalogues with all stores supplied on board vessels under International Marine Purchasing Association (IMPA) codification. Unique code is assigned to every product which is common internationally and helps communicating the needs of the vessel. Hence, in the functionality dimension, ERP systems offer the opportunity for unparalleled transparency among the stakeholders and high levels of simultaneous information sharing (Yücesan, 2007).

Record keeping is another crucial attribute of the ERP software; procurement scrutinizes vessel's requests based on historicity and inventory data (Agrifoglio *et al.*, 2017). Information technology offers useful tools to overview the remaining stock on board a vessel and avoid shortages. Besides, special features designed to comply with recent regulations for minimum spares on board as indicated by Tanker Management and Self-Assessment (TMSA) program for instance, ensures not only vessel's safe and smooth operation but also its commerciality.

3.6 Procurement and vessels operations

Vessel's employment is one- if not the only- major factor affecting the procurement activities. Except for the cargo operations and bunkering, all other activities are performed as side ones and should not interrupt or delay vessel's employment duties by any means; in different case, binding contracts are broken and claims with financial and legal implications will occur.

To begin with, the type of vessel affects the general procurement planning; there is a huge difference in operating a liner vessel from a tramp in terms of procurement of supplies. In liner service, same voyages are repeated continuously and port schedules are being followed quite rigidly (Kendall, 1986); with this kind of schedule, inventories, rates of consumption as well as minimum experience, are merely the tools required for preliminary planning and procuring the vessels. To the contrary, last minute voyage fix policy, requires high professional competence from the procurement side: even though all above mentioned tools are similarly available, long stock supply planning becomes almost impossible. Alternative solutions, such as placing preliminary orders to suppliers in major ports with a pre-agreed cancelation fee in case needed can be an option.

When vessels do not have steady employment, it means that the route and ports of call change and can be anywhere in the world (Kendall, 1986). Effective supplier relationship management with long-term contracts can be life and time saving. In addition, operational delays might affect initial planning (Kendall, 1986); for instance, while stock would suffice until second calling port, which is more convenient in terms of costs and supply conditions, a delay in the first calling port due to terminal unavailability or bad weather

not permitting berthing, forces the shipping company to supply fresh provisions at the first port so as to replenish the stock on board. It is crucial to design flexible, responsive and supply chains by removing unnecessary activities, implementing different sourcing strategies and increasing coordination of operations (Lau and Yip, 2017).

Nonetheless, there are cases where procurement of special stores and spares is set as prerequisite so that the chartering department can fix a specific voyage for the vessel (Kendall, 1986). For instance, chemical tankers are required to have a kit of antidotes on board in case of a mishandling by crew or accident can occur physical injury. In case same are not available on board, vessel's commerciality is harmed and owning company can lose significant amount of money. Another case is that the company should have the vessel well prepared to conform to the requirements of calling ports: for example, in order for a ship to pass the panama canal, special mooring arrangement is required with specific diameter and material of mooring ropes. Procurement should be attend to such matters; shipping companies often set minimum stores and spares remaining on board policy in an attempt to minimize incidents of unpreparedness that would be detrimental for the company and possibly its reputation.

On the other hand, procurement of materials for maintenance purposes can constitute one of the most easy going tasks a procurement officer has to execute. No matter the voyage fixed for a vessel, when maintenance related orders are placed well in advance, its highly probable that the procurement operator has time to consolidate cargos in a central dispatching location as well as select the most economic mode of transportation. Shipping companies that assume a preventive policy, consequently aim to minimize operating costs by optimizing order quantities (Kian, Bektaş and Ouelhadj, 2019).

4. Interviews and discussion

4.1 Introduction

There are two main categories of sampling: probability and non-probability sampling. Probability sampling involves a random (and therefore representative) selection of participants from a population, whereas non-probability sampling entails selecting participants in a non-randomized (and therefore non-representative) manner.

The sampling strategy chosen for this interview section could be characterized as probabilistic; a random but representative selection of participants from the shipping environment was chosen. As the intention is to have an insight of the maritime supply chain and the impact procurement activities have on vessels' operations, it seems appropriate that the interviewees represent the various aspects of the shipping industry. Executives performing procurement activities were interviewed, but not only them; various experienced professionals in the maritime field, with direct, as well as indirect involvement with procurement operations were chosen to be interviewed. The goal is that every perspective adds to the full picture of the procurement of the vessel and assists in understanding more how complicated and challenging the procurement activities in the maritime sector can be.

The questions are directly related to the structure and themes of the dissertation. After attempting a theoretical analysis of the maritime supply chain and the interconnection of procurement with vessels' engagement in employment operations, it is deemed necessary to explore the practical perspective of the matter by interviewing practitioners of the shipping industry. Questions were based on the main themes of regulations compliance and alignment with company policy, procurement importance on the vessels' smooth operation, technology, supply chain disruption, vulnerability of the value chain and the company's efforts to gain the competitive advantage in the market.

General Data Protection Regulation (GDPR) was respected and implemented as it should. Interviewees remain anonymous, declaring only their job title, so that their relation and

perspective to the procurement of vessels can be evident. Consent was obtained, no further personal data was acquired.

4.2 Interviews

4.2.1 Question 1

Please describe the operation of your department regarding your vessels' operation and its compliance with regulations and the company's goals.

Procurement Manager

The procurement department is one of the oldest departments in shipping companies. As long as the ships are on the move, supplies are required. It has never happened that a ship started full of provisions and supplies and completed its voyage without even a small stock replenishment. At least in the modern years!

Our Department's primary concern is to provide the ship's crew with everything they need on board. The range of these supplies we are dealing with is of course enormous: we talk about fresh provisions to engine and deck tools, like hammers, pliers or nails, and from printer cartridges or carpet cleaning chemical to engine spare parts, like turbocharger rotors or main engine liners.

Nowadays, the international institutions are more influential than ever; new regulations are constantly being issued with the aim of protecting various aspects of human life, social life, the environment, working conditions, and many others.

It is very common for our department to be the first barrier to ensure the integrity of the company in terms of regulation compliance. Due to the broad nature of our job we have to deal with many regulations and take into account a lot of relevant parameters.

Besides, our company renews correspondingly and continuously the prerequisites for high level of business; we receive weekly newsletters and guidelines that guarantee to keep us on track and right on the edge of our seat!

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On the other hand, we make sure that our suppliers follow international standards, are certified as defined by the International Maritime Organization and agree with our guidelines for best quality of supplies on board our vessels. We scrutinize our suppliers, take evaluations from the crew on board right after every supply and try to track our activities backwards so as to re-evaluate our trail and improve our services.

Procurement Operator

Procurement is the department of the company that materializes the requests of crew on board as well as of the office executives. We make sure everything required for vessel's smooth operation is delivered on board efficiently and on a timely manner.

Adding to the core business, we have the control over the stock on board but also on the logistics part; we monitor and control the entire procurement circle, starting from the requisition of the vessel until the closing of a case with the invoice and the payment of the vendor.

In view of the high risky nature of the vessel, being a floating business community, usually comprised by different nationality crew, with different background, we emphasize on control over our job: we closely follow up material remaining on board and provisions inventories and we scrutinize the stores categorized as "safety items". This is also a good example showing our dedication in complying with the international regulations.

Safety items are stores related to crew's safety on board and there is a specific list of items with their specifications dictated by The International Convention for the Safety of Life at Sea (SOLAS). Such items are for instance, hand flares, line throwing apparatus and man over board lifebuoy. In case any of these safety items is missing or expiring, same is replaced immediately or better yet, we make sure this never happens! Aside of the matter of safety of human lives, it is always vessel's commerciality at stake: missing a safety item is a reason for detention of the vessel at port.

Our company is adamant on maintaining the good vessel's operation; the goal is that vessel's remain commercial and high on the list of charterers for possible employment.

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Considering this and referring to the safety items we are discussing, our company is offering us the necessary tools to follow up the status of this specific category as well as the budget in order to never deviate from this policy.

Procurement Software Designer

Well, my department is certainly not one of the oldest in the maritime business, I would rather say the youngest! Shipping has started using web technologies and softwares only the last few years. Actually, it is a paradox how a sector so profitable and with such a heavy workload, neither was using technology nor was certainly innovative in the field.

As a software designer, I create software solutions tailor made for maritime businesses. We are working on the procurement faculty in specific. We study closely with the procurement executives, we follow their business routine and hear their needs. We acquire any specific details about their day-to-day interaction with vessels, vendors, other departments and we have learnt a lot about the procurement cycle.

The e-cloud based platforms we are building are double-faced: there is the office side and there is the vessel side. Office side, we have the procurement operators as already mentioned with all the challenges they are facing. Vessel side, is also a large volume of work: aside from the requisitions that crew has to send to the procurement, there are numerous reports, maintenance jobs, pending tasks or undesirable events that crew has to report through the software on a regular basis.

From our experience in the business, maritime sector is a regulations driven one. International organizations, conventions, state rules, each and everyone is issuing new guidelines concerning vessels and all influence shipping companies respectively.

We conduct meetings with the company's executives and get updated on new requirements so that we either renew the existing features or create new, that would facilitate the business routine both for vessel's crew and for the office.

In addition, company has a strict policy of high standards in vessel's operation. In order to comply with this and keep up the pace of the international changes, we make sure that software and the web technologies we are using are well maintained, secure and user

friendly. Especially, cyber security is a new subject of discussion; we are studying a lot on this and comply to company's requirements for safeguarding its integrity and quality of business.

Managerial Executive

Shipping companies are businesses that have to manage a lot of risk and change. Consider the world how it is today and how it was ten years ago; it is not only evolution of technologies and the normal progress on every sector, but also the economic changes and the unexpected disruptions that have to be surmounted.

We have been through a lot of changes: it is true that shipping companies are pioneers in business infrastructure and many other fields. For years, vessels were the only concern of the company and the internal organization was usually neglected; but not anymore.

Our main concern remains to operate our vessels with strength and quality. This to happen, we need to build strong foundation and coordinate in harmony. The past years we have made a lot of changes in our organization chart; we have set new boundaries and opened new opportunities in the same time. We have invested a lot in training our employees ashore to master the usage of the tools we have provided in order to outperform themselves. We step on the experience of the old way of management and bring a new way of thinking to the shipping business.

One of our priorities is to be up to date, follow up the advancement of the regulatory bodies and comply in the best possible way. We need our vessels to be competitive in the market and seaworthy. Therefore, we furnish our ships with competent crew and especially well trained high ranks. Besides, vetting checks are fixed regularly by external bodies to ensure that no point is missed.

Service/product provider (vendor)

We have been providing provisions and stores on board vessels for over a decade now. We are operating in the Piraeus port but we also have cooperators and branches globally in other major ports like Rotterdam, Singapore and Istanbul.

The difficulty in our job lies on the vast nature of the supplies; when a vessel calls at a port as commercial as Piraeus, where conditions are favorable for delivering supplies and replenishing stock, the orders we receive are enormous volume, requiring concentration and swift actions from our side to deliver all requirements and on a timely manner.

Aside from the shipping company's pressure, we need to manage our suppliers network. In order to keep control of the costs as well as consumption, we keep our inventory levels to the necessary minimum. We stock only consumable items that are very common and used on board vessels without any differentiation. Therefore, we need to cooperate with suppliers for big part of our business.

Another major aspect of our job is that we have to face the port authorities and the Customs pressure. We work very closely with these institutions; as we operate right at port, where the vessel is having her cargo operations, we are being exhausted by the paperwork which seems to be never-ending.

An important prerogative that the shipping companies are placing in order to work with us is to be fully certified and work under international maritime regulations spectrum. Apart from the ISO qualification, that verifies that we are a well-established proper business with infrastructure and processes, we follow up the international regulations updates and make sure to operate accordingly.

Besides, there is also the International Marine Purchasing Association (IMPA) whom we trust to protect our interests and have helped us bridge the communication with the vessel and the shipping companies. It has provided us with a common reference code for every material that needs to be supplied on board, setting also the specifications and quality standards.

Crew on- board

Seafarer's life has certainly been improved the past years but still remains hard. I might not be one of the oldest on board our vessel but have certainly done a considerable part of traveling. My current position on board is a chief officer: I report to the Master, the Captain of the vessel directly, and have a lot of responsibilities. From vessel's navigation and bridge operation duties to loading/ unloading cargo parameters study, till paperwork for the office and port agents.

The vessel is our good lady, as it is customary to call the vessels in the maritime business. Office is flooding us with guidelines both based on new international directions as well as on internal deliberation. From my side, I do my best to assure compliance by reviewing the essays we receive and materialize any guideline applicable.

I would dare to say that a crucial aspect of my job is to maintain high safety levels on board. I have in my duties to discuss with the crew and organize the safety meetings. During these meetings we discuss near-misses and new guidelines sent from the office to comply with international regulations. The vessel is fully equipped with gear that ensures our safety only on condition that we know how to properly use it. Drills therefore is an important part of our everyday life; they are exhausting, but absolutely necessary!

The shipping company certainly wishes that the vessel is always employed and well operated. They also respect the international regulations protecting the seafarers' life at sea, therefore we have no reason not to be consistent to our job and try to maintain high levels of quality.

Operations department representative

The operations department in a shipping company has the overview of the vessel's movement at sea. It was once staffed exclusively by ship's captains and ranking crew, who stopped voyages at sea and were looking for a permanent office position. Nowadays, this is not a prerequisite any more.

From our side, we closely monitor the vessel and ensure its unhindered operation: we prepare paperwork where required, we follow up its loading and unloading operations, we

fix the bunker intake in cooperation with the Master on board and we make sure to frequently free vessel from sludges, cargo residues and domestic garbage.

An important task of my job is the coordination: on the one hand, we need to coordinate all departments at port. When calling a major port, all companies departments make arrangements for numerous services to be completed on board so that the ship remains seaworthy till the end of its voyage. It is under my duties to coordinate these tasks, in terms of when to take place during the vessel's operations. It is vital that the company's arranged services do not interfere by any means with vessel's employment duties. Nor delays in loading or departure from a port can be forgiven.

Our company has a policy of high quality standards in order to maintain vessel's commerciality. In accordance to current regulatory framework, the company encourage us to take initiatives and be effective in our work. On the other hand, we ought to assist crew on board with their day to day reporting obligations so that the charterers are happy and seek to work with our company and employ our vessels.

4.2.2 Question 2

In your opinion, which factors are considered the most important in terms of vessels procurement?

Procurement Manager

To my point of view, it is very important to develop defense mechanisms and promote agile practices in our job. Maritime sector is a very erratic environment to do business; the calling ports are changing repeatedly, and in our company's case, voyages are not fixed till the very last minute. Even we have a schedule on hand, it is highly likely that the included ports are not convenient supply-wise.

It is crucial to be responsive in this business; we have a lot of examples where we are called to perform major supplies on the last minute. For example, a vessel's voyage is

fixed USA am time and the schedule is as follows: Houston, Usa, then Altamira, Mexico and Campana, Argentina. Voyage laycan starts the next day.

It doesn't require much of experience to know that our chance for supplies is Houston; it is a major port of the US gulf, with lower prices comparing to the rest mentioned in Mexico and Argentina. Therefore, we have to place orders to our suppliers in Houston and arrange supplies delivery in half a day. And of course we are talking about a stock replenishment to last at least till Campana call.

I can confidently say that such endeavors are possible today in favor of our experience and our dedication to work. The procurement operators are following up closely their assigned vessels, know their movement at all times and act fast whenever needed.

Procurement Operator

I strongly believe that effective procurement implementation requires a skillful operator with experience and understanding of the surrounding environment. By all means, being equipped with the correct tools, such as ICT applications, supplier sources and logistics solutions is crucial. Nevertheless, it takes the combination of all these in order to perform this job successfully.

Firstly, you certainly need to know the vessel you have been assigned with: apart from its general arrangement and physical characteristics, you should understand the people on board and their needs. The human factor is important and can set the pace of your whole work.

Furthermore, there are a lot parameters that should be taken into consideration when designing a supplies, delivery prior performing it. Budget constraints is a major one; especially when we are after the third quarter of the year, expenses start pressing if not within the limits. It is a critical guide as to whether to invest on stock on board a vessel or monitor the condition of existing material and postpone the supply till beginning of next year.

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Another big part of our job involves logistics, which can be quite challenging in the maritime environment. In our company, vessels do not have steady port rotation schedule and voyages. This of course makes our job even more complicated. A successful logistics handling budget-wise, dictates to consolidate cargos in main locations globally and dispatch with the most economic way. Sea freight is out of the question as mode of transportation due to slow transit time. On the other hand, when a convenient calling port is becoming available to us only one or half day prior vessel's arrival, it is obvious that our main concern is to check if we can reach the destination in such short notice- consolidation is out of the table.

Procurement Software Designer

I think that the most important factor in the maritime procurement is the information availability. From our meetings with procurement executives, I have noticed the need for data collection and information to be available at all times.

Procurement requires extensive data collection and registration. We are taking specific requests for storage issues and groupage of all these collected data. From email messages to invoices and virtual folders, everything seems to be relevant. This information is retrieved occasionally and procurement operators are adamant about keeping these records on cloud, no matter how old they are.

This information data base serves as history; it is connected mainly to ports and voyages, showing vessel's activity as well as company's actions. It has a double-purpose: the usage in the short-run is that it serves as supporting evidence when the payment phase of the procurement cycle comes. Invoice amounts are verified basis initial quotations or email discussions that took place while vessel was at port. A second purpose is that this information is useful in the long-run as a future reference; every time a vessel calls this specific port, the company draws from its own experience and chooses to be prepared in terms of how to assist vessel with its employment as much as possible.

Managerial Executive

I am convinced that in order to succeed to every endeavour, you need to have everything under control. Same thing with the procurement in the maritime business: we emphasize on control of resources and traceability.

Budget is a defining factor that cannot be neglected. Every beginning of a new calendar year, we study the data of the previous one; we evaluate our progress and make statistic analysis. Taking into consideration not only the economic environment changes as well as the competition in the market, we conclude to a budget for the operating expenses of the vessel.

We expect our procurement executives to be actively involved in the formation of the yearly budget, since they should be able to trace the expenses and justify them. It is important to understand the reason why a vessel has exceeded the budget within the year and trace the lost profit.

When talking about procurement, it is natural to demand control over the stock/ inventory of an entity. In our case in specific, this is not entirely applicable: we are a shipping company with mixed type vessels fleet, which means that we cannot place bulk orders of main air compressors for instance, and keep them in stock for whichever vessel needs them. We do not operate warehouses under our organization; we use outsourcing stock points instead. The issue that we need to deal with is off-landed equipment from the vessels and how to handle it in the most profitable way. Our procurement is still working on this project; for the time being, we collect data on the equipment available and the related costs for its storage and maintenance. It's a work in progress.

Service/product provider (vendor)

After all these years in the business, I have concluded that the most important factor in the vessels procurement is time management. Dealing with vessels supply is a very particular

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field: schedules are being altered on the last minute, which can be either an opportunity or a disaster!

Our clients, the shipping companies, are very demanding ones; driven by vessel's needs, we all serve one purpose: to maintain the vessel in absolutely good working condition. Our part is to supply within required time frame, which is not an easy task. There are many parties involved that need to coordinate, making the task even more complicated.

From our side, we have evolved mechanisms to mitigate these complexities. When we get an order to supply a vessel, the operation is screened by our operations team. Same is laying out the data of where, when, possible terminal restrictions at port and discusses same with client. The team is also contacting vessel's port agent on its own channels so as to establish direct communication and obtain first handed information. We get well informed and investigate all parameters that could obstruct us from delivering supplies on board on time.

On the other hand, time should be managed in terms of our first and second tier suppliers as well. Since we keep inventory levels to the minimum possible, we need to ensure that we will be furnished with the required material right on time, not a minute later, if we wish to keep our clients happy and keep receiving their orders. This entails intensive supplier relationship management and special handling.

Crew on –board

From my experience in this shipping company, the location is a pivotal factor for the success of the supplies. We are calling a lot of ports around the year within our voyages. Each port has its own specifications, terminal restrictions, berthing style etc. We have noticed that in major commercial ports, procurement is more flexible and has many more resources to perform the supplies.

When there is an urgency for supply at a non-convenient port, like Augusta in Sicily for example where there are high criminal rates, or even worse cases, there are not many

channels that procurement can work with. The only source of information is the port agent, who we all address for husbandry matters. The procurement department is turning to the port agent for fresh provisions supply for example, and asks for a cost analysis for the delivery on board. We, on the other side, the seafarers on board, are waiting the minimum quantities on board as the ratio between cost and quality is not satisfactory for our company to supply.

In major commercial ports, procurement department has established long standing cooperations with shipchandlers that assists them in being more swift and responsive. We are used to wait supplies from specific shipchandlers who are familiar with our companies peculiarities and, most importantly, are tuned with our mentality on board.

Operations department representative

I consider the factor of good-timing and coordination to be of utmost importance for the procurement of a vessel. It is probably due to the point I am standing but I do believe that efficient operations call for coordinated movement.

Having cleared out all social and economic circumstances of the place of delivery or having studied the port that vessel is calling, the timing of the supplies delivery on board is crucial. Of course, a major issue is budget availability: I believe that procurement department is issuing budget reports the same way my department does. However, a mishap in delivery can be the cause of even greater expenses and budget expenditure!

4.2.3 Question 3

Please describe the importance of the role of technology in the field of vessel procurement.

Procurement Manager

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Vessel's procurement was not performed the same way twenty years ago; we used to receive vessel's requests for fresh provisions over the phone and only the absolutely necessary information through telex messages.

Thank God, web technology has advanced a lot since then and new applications have been introduced to shipping as well. Now, technology is an integral part of our job and we count on it almost way more than we should!

I believe that in the maritime field, the most important technological contribution is the communication. Crew on board is able to communicate with ashore no matter the time or the location across the globe. Besides, we are talking about twenty leaving souls on board; it is hard not to be able to have a connection with your family no matter what.

In terms of procurement, easier communication has helped us be more agile and make better request analysis. We receive tons of requisitions from the vessels everyday; some are well justified but most of them are not. It is of great assistance to reach out to the crew on board and discuss the request. We get valuable feedback on the material remaining on board, its condition and the level of usage or immediate replacement. This way, we have a clear picture of the vessel needs, verify them, which helps us handle more efficiently the budget that we have on hand.

The old-fashioned "listen to the crew on board and give the Master or Chief Engineer what he needs" is now investigated not only by executives with experience; we discuss together with the crew on board to identify the real needs of supply.

Procurement Operator

Technology is an indivisible part of our business. Web applications and softwares have made our life at work easier, without any doubt. If you consider the amount of time we are spending on the email application or the ERP software, you can actually conclude that our job cannot be done without web technology anymore.

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Technology is for us the arsenal containing the necessary gear for supplying the vessels. Apart from the easier communication with vessel, which is a life-savior and has made the procurement department independent from other departments, technology has facilitated us with the record keeping. Inventory data are inserted in the company's ERP software and synchronized with the office. This way, we have real time an estimation of the stock remaining on board.

Besides, we take this for granted nowadays, but it is a great advancement that needs to be mentioned: technology has minimized the data of our job and has relieved us from the extended use of paper. When I first came to work for this shipping company, we were printing out email messages and order sheets to create folders for every request and order we submitted. A lot of working hours were wasted in vain, not to mention the high paper consumption.

Technology promotes efficiency at work and liberates us from the old-fashioned part of the shipping industry. There are still ways to go, if you consider that we could be asked to provide a budget analysis in excel, but at least a lot of progress has been made already.

Procurement Software Designer

To my point of view, I cannot see any way different the procurement of vessels could take place; when this happened in the past, there were enormous problems accounting wise, as there were no digitalized records to support the incoming invoices.

We have been working with procurement executives for many years now in order to customize the ERP software. The complete procurement cycle is embedded in the software: requisitions are sent by the vessel, the procurement operator processes them and sends request for quotation to the suppliers. Evaluation of the tenders can also be done electronically through the platform, which of course offers additional tools and capabilities for easier processing.

Every interaction the procurement has internally in the company with other departments can be mainly accomplished through the ERP software. As part of the procurement process, there is the invoicing; accounting receives invoices from vendors and matches them with the orders procurement department has created in the ERP. For any clarification needed, we have created special dialogue boxes so that accounting can reach out to procurement easily and in no time. Not to mention that every activity is recorded and remains in the related invoice as a future reference.

We are a technology based business and from what I have gathered, the procurement faculty is equally based on web applications. We have a large volume of data in the software concerning the procurement department that causes us trouble to keep it always synched with the vessel side, as well as to keep the volume minimized as much as possible.

Managerial Executive

Maritime industry has been plagued for years by the absence of technology and is still bearing a lot of bad habits resulting from this situation. Persistence on paper documentation, extensive use of stationery supplies, are two of the outdated work habits we wish to eradicate from our organization. Clean desk policy is one of the latest clauses included in new ISO certification that we intend to successfully adopt.

To the extent procurement department is concerned, technology usage has accelerated the procedures. The operator is now directly connected to the vessel; crew on board identifies a need, issues a requisition through the ERP software and within minutes same is available to the office. Technology has succeeded what was inconceivable a few decades back.

We keep high standards of service for our vessels. As we are also involved in the ship management business, we have to confront other shipowners as clients, so we are very diligent in our vessels' operation.

Web applications are a huge enabler and have liberated both vessel and office side. Productivity has been sped up; nowadays a procurement operator can handle effectively

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the duties of more than three vessels in the same time. On the other hand, we insist on user friendly tools and software solutions that are easy to handle. One of our priority is that every activity is computerized and recorded; ERP softwares offer the opportunity to keep track of the procurement activity and have a history for future as well as budget reference.

Service/product provider (vendor)

Technology has improved our business a lot over the years, this is true. First off, we have gained the benefits of a computerized warehouse and inventory right in front of us. Not only do we see how much we sell but also we record the preferences of our clients; our sales and full job is now recorded creating a data base to which we turn to every time we need.

Technology has provided us with the market knowledge we needed, which of course was in front of us all along. At the end of the year, we retrieve the data we have collected and make statistics that helps us decide which stores should be stocked and which should be outsourced. In addition, we make forecasts about the upcoming year, which make our budget control easier. This way, we also try to make room for investments that will make us stand out from our competition.

The past few years, new web applications are reaching out to us for cooperation. New emerging technologies seek for tighter communication with the shipping companies and trying to establish new communication channels. This kind of web softwares are interconnected: a new request for quotation issued from the shipping company is coming to us through the application and we can submit our offer under the same way back to the client.

We have not gave in yet to such a software; it sounds better than it actually is. To be honest, it is not the software itself that is not user-friendly or complicated; it is the plethora of them that is difficult to be dealt with. There are numerous shipping companies adopting this policy, using different softwares; if we adopt all these softwares in our day to day

business, we will then need to find a way to solve the application integration issues that will arise. This is something that we are still considering.

Crew on –board

The supplies delivery on board is vital for the vessel's operation. Our communication with the procurement department has been facilitated a lot through technology. We can now order the required material and provide supporting documents; for instance, it was recently the case of a cargo reducer required to complete the cargo operations we have been fixed at next port. This cargo regulator needs have specific dimensions, with special coupling in order to be fitted to the shore hoses and the vessel side. Therefore, in our request to the office, we registered the details of the regulator in full and provided photos and drawings with dimensions.

Nowadays, we are able to send to the office big volume of data instantly, which has minimized supply errors. Sending pages from the engine manual can assist the vendor to identify and trace any given spare part. Our requests are becoming type specific, which leaves little room for wrong deliveries.

ERP software is a major tool for the vessel. Recently, there have been efforts to reduce the paperwork that burdens us by being replaced by additional features in the software. We have to admit that in many cases it is difficult to learn new steps in the ERP system- we are not used to differentiate from our routine. However, when the time comes to submit the end of month reports to each and every department of the company and same can be retrieved with only one press of a button, well this takes a lot of work load from our back!

Operations department representative

I believe technology is the A to Z for the procurement department, as it is to all activities nowadays. My department is connected on line 24/7 and cannot imagine my job without instant messaging or ERP software!

As far as procurement is concerned, I consider that web applications have helped them minimize bureaucracy and be more efficient to their job. When you get rid of excessive paperwork and processes, you can focus on the core business and perform at a higher level.

The use of internet networks and web applications has bridged the communication between the operations and the procurement department. A simple feature that we use is that procurement department is uploading the arrangements that they have made for a specific port of call. They name their suppliers, the activities that will take place and the volume of cargo to be delivered on board. Our task is to inform the appointed port agent with the company's items and coordinate the execution the best way possible. Hence, this is feasible with a single button press: we download the list of arrangements registered for the specific port and send it via email to the agent.

In the old days, we used to get the arrangements via telephone and keep personal records for every calling port. This is not the case anymore. It is a great relief to get rid of the outdated practices of the maritime business and move forward to a new era in the field.

4.2.4 Question 4

What plans or measures do you take to address risks that may arise from shortages or other supply chain disruptions, regarding vessel's procurement?

Procurement Manager

Unfortunately, shortages of stock do occur on board despite our clear instructions to crew to send actual inventory reports to the office. Wrong measurement units or a wrong

reported digit can create misconception about the remaining stock on board, letting us believe that stock is sufficient while it is not. This mainly refers to provisions, which is probably one of the most critical category of supplies we do.

For the event of a disruption in the supply chain, I believe that our strong suppliers network has helped us a lot tackle the obstacles. We have built partnerships with major suppliers for years; in some specific categories with high risk, like the medicines, we are using contracts.

Every vessel should be equipped with a specific list of medicines and at a defined quantity so that crew on board is covered at all times. Special certificate is being issued that declares that a pharmacist has checked the stock on board and guaranties its validity. Since this is a category with high sensitivity, we cannot risk to leave our crew without medical cover while on board.

In order to be on the safe side and secure from any disruptions in the supply, we have a contract with a well known pharmaceutical company which we re-negotiate every year. This way we are confident that stock on board our vessels is according to International Maritime Organization. In addition to that, we have implemented an internal policy with which we renew the paracetamol and the basic antibiotics when a vessel calls a major port; we have included that policy in our agreement with the pharmaceutical company and make sure it is followed up accordingly. It has become one of the major clauses in this matter and can be a deal breaker in case not materialized.

Procurement Operator

I put a lot of emphasis on planning in my work and I consider it to be the shield against shortages and disruptions. Certainly, I trust the company to have safeguarded itself with contracts and alliances on some major stores categories; however, we re-visit this list as frequently enough as the international regulations and guidelines are being updated.

In the years I am working in this shipping company, we have experienced the effects of international disruptions, with the most recent being that of the Ukrainian war crisis. The most common impact from this disruption is in the logistics part of our job, the difficulties in cargo transportation.

When it comes to spare parts, same are sourced from multiple locations around the globe, depending on their maker. We have a very intensive part of consolidation in order to group out consignments, dispatch and deliver them on board. With the warfare in Ukraine, air transportation got difficult: russian cargo aircrafts, which are the most spacious, were banned from the international cargo aviation companies. This minimized the available space for cargo to be transported via air, causing huge delays at the airports. Not to mentioned that airfreight rates scaled up within a night.

The situation I am describing is now a new status to which we had to adapt. The mitigation meter we used is to dispatch consignments pre-maturely to central locations, so that we can have the cargo more easily accessible. For instance, a vessel is drifting in the Mexico gulf waiting for voyage orders; I make sure to consolidate the spares orders and dispatch them to Houston until further notice. Houston is a major commercial port where vessels are calling for loading/ unloading operations or for bunkering. Either way, vessel's spare parts are now in a shooting distance, closer than the initial hub in Japan or Singapore.

Procurement Software Designer

Again, I believe that the information circulation has a priceless effect against supply chain disruptions. A procurement operator that is well informed on the risks, is able to confront them and develop defensive mechanisms.

From our side as web software designers, we usually include special add-ons to the ERP softwares ; these add-ons are interactive dashboards showing the global map. Scrolling over an area and a port in specific, a pop up of current information shows up mentioning data like location, port status, information on port state control inspections etc. These data

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are being provided both by current events as well as by the vessels calling these specific ports. It is a database of collected experience that helps the shipping companies learn from their past.

Another feature of vital importance in this respect of mitigating risks is the spare parts inventories. Especially, the critical spares on board feature, constitutes a list set by the shipping company with the minimum spares that should be available on board at all times. The list contains exact type and quantity of these spare parts and connects directly with a potential risk; for example, the main engine not properly igniting to move the vessel or a machinery being broken down that could cause detention of the vessel by the port authorities. From our side, we make sure the alerts are working properly; every time the crew on board is using a spare part from the list, an alert pop-up shows to the procurement operator and the technical department of the shipping company, warning them for a possible shortage so as to take immediate action.

Managerial Executive

Risk management is a subject we have spend a lot of thought and time on; following the international maritime guidelines we perform risk assessments on a quarterly basis. We have embedded risk management to our company's department plan and have invested on putting together a special team with exactly this task.

Risk assessment is being used as a guiding tool by our company, through which we contemplate on a possible defect, asses the severity of the risk we might be put through, thus creating intercompany policy for every item.

A good example concerning procurement would be the mooring ropes; ropes used for mooring operations are of specific material and diameter and should always be certified. These ropes are also being worn out by the usage at ports or even just by the conditions at sea. After assessing the risk of leaving the ropes to be totally worn out without replacing them, we ended up setting the limit to nine hundred hours of operation before replacing them with new units.

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It was only recently when we were informed about shortage of 8" mooring ropes in an international level; this can be source of great inconvenience for our company, as severity of missing proper mooring ropes is set quite high on our risk assessment. It is highly likely that a vessel could be left unemployed if the correct set of ropes is not available on board. For this reason, we have agreed with the purchasing department on ordering one set of mooring ropes as a safety stock. We do not usually go for stock keeping due to high related charges, however, the risk and the economic implications of not having a set when needed could be much higher.

Service/product provider (vendor)

I think that for us transparency is the key for a steady and strong supply chain. We have gained a lot visibility throughout our value chain over the last years; we have learnt from our mistakes and, nowadays, we share market knowledge with our partners. This information sharing has become reciprocal creating the grounds for fruitful cooperations.

Supply chain disruptions are occurring more and more frequently, so we end up implementing on a constant basis, the measures destined for a potential emergency. One of the more significant is the establishment of diversified suppliers.

Following a risk assessment we have performed, we made a list of stores consumables that constitute a considerable part of our sales. These items are products that are included in almost every supply we perform and, in case not available, not only are our clients disappointed but can also create a bad reputation for our company. Therefore, we have set a minimum stock of these items; every time the quantity drops, an alert pops up in our ERP system urging us to replenish the soonest.

In addition as mentioned already, we have established diversified sourcing; it is true that this technique has saved our business numerous times. It is quite edgy, as it requires intensive supplier relationship management and close follow up on the volume of orders placed in every direction, but it really pays out in times of disruption. By setting primary

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and secondary suppliers, we strengthen our supply chain and become resilient against political or economic events creating disruptions.

Crew on –board

As far as provisions and stores are concerned, I believe the only thing we can do is to be proactive and follow up the stock on board closely. The possibility of stock shortage is high, especially for the provisions, which is a crucial matter for our survival. Chief cooks are usually Philippino in this company and despite the trainings and the tests they are being submitted to, they are not always competent. The tricky point is to handle the provisions stock efficiently: take advantage of the variety the company is providing and come up with ideas and meals to use as much as possible.

From my side, in order to ensure that our crew will not go hungry and that the office will be alerted promptly, I agree with Master to assign an officer to verify the inventory along with chief cook. This way, quantities are verified by twice and provisions inventory uploaded in company's ERP every end of month is as accurate as possible, allowing the procurement operator to have a clear picture of the stock on board. We have also set a limit internally to notify the office on possible shortages at least four days prior.

Any other deck or engine spare part is a different story and is really up to the office on how they will handle the supply. We often ask for spare units to remain on board but due to budget constraints, our requests are usually postponed.

Our main duty is to notify the office on time, advise on possible shortages or on status of existing equipment on board. It is mainly the office side that handles the procurement part.

Operations department representative

Honestly, we do not have much part on this matter. Our involvement with procurement department has to do mainly while vessel is at port; we get the arrangements and coordinate their delivery on board. We do not even contact their suppliers- it is not in our

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duties that they show up, we only relay the port agents information and expect that everybody will be on time!

In this respect, I could say that our contribution would be to provide voyage information to the procurement department as promptly as possible. Having the necessary information on vessel's itinerary, I assume that planning of the supplies is feasible.

4.2.5 Question 5

Of the 7 stages of the procurement process, which is considered to be the most vulnerable factor to unforeseen situations, in relation to the smooth operation of a vessel.

Procurement Manager

The most vulnerable stage to the external environment would certainly be the delivery stage. Especially nowadays with the new status of high prices and long delays resulting from the socioeconomic turmoil we are experiencing, the delivery phase has changed the way we do business.

It is not far away in time when we could dispatch a consignment from Japan to Houston with two to three days transit time. Now we need about four to five; not to mention the period when we could not even dispatch Japanese cargos to the EU. With the Russian FIR shut down, these were merely a sample of the problems we encountered.

Delivery of spare parts is a delicate procedure, since it is a service that is one hundred percent outsourced and based on external parties. The first implications we experience in our job shortly after every global economic disruption, is in the delivery part of vessels' supplies.

Another example would be the container vessel that stuck in the Suez canal; we still experience the consequences of this one, only a second global crisis came to overshadow it. Back at that time, the airlines were overbooked and cargoes were delivered till airports to remain unloaded. We encountered major difficulties in delivering on board and faced many times situations where vessels were in desperate need of spare parts.

Procurement Operator

The most unpredictable phase of the procurement cycle would be the delivery stage. But it is not only the consignment dispatch, which of course is becoming more and more challenging every day. A major issue is the last mile delivery, the transportation from the warehouse till on board the vessel.

Consignments arrangement has become another challenging task of our every day routine. To be more accurate, the difficulty lays on the fact that you cannot plan a consignment in short notice and that the overall cost has become exorbitant.

The true challenge is the last mile delivery: I have read a lot of articles on how colossal companies like Amazon are trying to find a cheaper solution on how to deliver the product till end user's doorstep! Well, in our case, it is the vessel that is difficult to reach, both money- and means- wise. We have experienced cases where our vessels are calling major commercial ports, like Houston, but the charges required by the agents to hire a cargo boat and load the pallets with goods on board are so high that following a short cost analysis, it is preferable to perform the supplies at next convenient, probably not so commercial, port.

The delivery on board is an important parameter that we consider when we are planning stock replenishment. Based on experience, we can be prepared on an estimated cost of launch boat hire, crane for pallet loading, fuel surcharge and waiting time. Nevertheless, this remains a highly variable part both in terms of charges and of external conditions, that we should investigate every time prior proceeding with our supplies.

Procurement Software Designer

Since the element of "unforeseen" is added in the question I would have to say that the delivery stage is the most vulnerable, as I think it can be less controlled by the procurement operator.

Judging from the procurement cycle we create and follow in the ERP software, there are not much to do in the delivery phase; there are only click buttons to register the delivery when it is confirmed by the Master on board the vessel and there are also the forwarding orders placed to forwarding agents against the service they provide. No any alert or other special reminder feature, meaning that it is an activity beyond the computerized control.

And this seems to be about right: a shipping company does not own commercial aircrafts or vessels dedicated to the supplies transportation. They are exposed to third parties service, highly sensitive to social changes or natural disasters.

If we were talking about the most vulnerable stage regardless the imponderables of the external environment, I would say that a quite sensitive stage that requires thorough handling is the first one, the product identification stage.

A very common situation we discuss with the procurement operators is the availability of information and data on the ERP software. It is the first problem they encounter: to verify what is required by vessel. Although there is the IMPA coding for stores, the shipping companies find it difficult to create a common data base between office and vessel with all the engine spare parts. This seems to be an event to neglect, however, in case a digit is wrong in the part number of an engine part, then this could mean wrong supply. Depending on the case, such a discrepancy could be of minor or of major importance for the vessel.

Managerial Executive

Whichever service is outsourced, it can be considered a source of instability for us. The part of the procurement cycle from the order placement until the delivery on board vessel is full of points that could cause instability to the supply of a vessel, even our whole organization. We are trying to mitigate this kind of risks and counterbalance the instabilities in an attempt to be proactive and avoid any disastrous effects.

In this respect, I would like to stress the importance of the quality control in the procurement cycle; to my personal view, this is a crucial part for the sustainability of our processes. In the shipping business and the vessels' procurement, the quality control that we can implement relies on two parts: on the one hand, vessel crew on board is responsible for reporting not only safe receipt of the supplied material but also their quality. Procurement operator should ask explicit details about the quality of the goods and their suitability in every case. This information adds up to the clear picture we are trying to form regarding vessel's stock and operation.

On the other hand, the procurement operator registers an evaluation of the supplier, their customer experience and supplier's overall performance. Suppliers are being graded and these information remains in companies records for future reference. This way we gain control over our partnerships and the quality of goods we are supplying on board our vessels. The benefits we opt to in the long run, surpass the short term administrative cost.

Service/product provider (vendor)

Outsourcing goods can be a tricky point for us: we are promising our clients high level of service which we prefer to control and maintain to the fullest. Our wide network of second tier suppliers requires extra effort to manage and special measures of quality screening.

Apart from the quality that needs to be controlled, one of our major concerns is to mitigate the risk of a disruption in our suppliers network; a disaster in a supplier's warehouse or a wrong entry in the stock records can be the cause of us missing the deadline set by the customer. The past years we have gravitated a lot towards outsourcing in view of the economic benefits involved of keeping low inventory stocks; to this respect, we have also

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invested a great deal on supplier relationship management, in order to ensure inter-coverage of our stock on popular stores and further safeguard the integrity of our business.

Another part that we are trying to control is the pricing of our goods. Unfortunately, the past few years this has become very difficult as the socio-economic global scenery has left us all almost helpless.

Crew on –board

To my opinion the supplier selection is a critical part of the procurement process. There are many examples where suppliers act single-handedly, without or against clear instructions provided from the procurement department of the shipping company. This usually causes mess-ups, wrong or miss-supplies.

Therefore, the suppliers list should be screened and well updated. Supplier selection should be created based on trust and successful results. When a supplier fails to deliver the orders on board complete, this can result from simple prolonged pending lists to be executed, to important safety items missing from the upcoming voyage. A correct supply, complete and with the minimum discrepancies possible, assist on vessel's smooth operation.

Another very delicate stage of the procurement process of a vessel is the delivery stage. Imagine a full loaded truck to be held on the port terminal gate due to Customs documents complications and not let to proceed to discharge the cargo; although it might be a few kilometers away, it is still unapproachable. Port authorities can be a very unpredictable factor for the delivery of supplies on board: there are many prerequisites and a lot of particularities that suppliers are invited to face and overcome. Customs procedures are constantly being changed making the delivery process more and more complicating.

Operations department representative

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I would say that the most vulnerable stage is the delivery stage. We are involved greatly in this one and we have seen many times the complications in this phase.

There are a lot of parameters that could ruin a well-planned delivery on board the vessel. Starting from the only one that we cannot affect: the weather. In our job, we always mention in the end of our phrases or email messages: "all going well, weather permitting" (agw wp). This means that any arrangement we make, is valid only on condition that weather is favorable. We might have the vessel drifting on the outer anchorage of a port and the supplies left waiting at the dock for the rain to stop or the wind to calm down. There are specific guidelines on the weather conditions that are followed and launch boat companies do not deviate from them in order to ensure the operators' safety.

Another factor that we always check when a port of call is fixed is the terminal restrictions. The ports have separate terminals with different status. There are cases where delivery of provisions or supplies are not permitted due to position of berthing, for example, in order not to interfere with the cargo operations. Or, another case are the exorbitant terminal fees applicable over the delivery of supplies on board the vessels; there is no particular explanation for this one but can certainly be a determining factor for concluding on which activities will be performed during a port call.

4.2.6 Question 6

What do you think is the role of procurement, as an operation, in the maritime value chain and in company's strategy, in order to gain competitive advantage (apart from the obvious cost control).

Procurement Manager

We have worked hard enough to place the procurement department in the place it deserves in this shipping company. You know, this has not been the case in the past; twenty years

ago the procurement department would operate exclusively under the operations department and executing the job under the instructions received by the marine and engineer superintendents. The department had clearly administrative duties with no room for initiative whatsoever.

Our hard work has paid off in this company and we are included for many years now in the directors board. The company is viewing the procurement department as part of its strategic tools and I guarantee we have proven our value creation potential.

We actively contribute to the formation of policies as far as stores and supplies are concerned. We study the relevant regulations and follow up on the updates of products through our supplier's network. For instance, we have drafted the internal policy on the wire ropes used on board the vessel: after thorough research on the regulations and guidelines issued by International Maritime Organization (IMO) and the International Convention for the Safety of Life at Sea (SOLAS), we have cross-referenced it with the average time of usage of every type of wire rope. Consequently, we generated a manual including all types of wires, quantity required to remain on board as spares and their periodicity of replacement. This piece of work is specifically for our fleet and is constantly updated.

Thus, we are keeping the quality levels high while maximizing revenue opportunities for the company.

Procurement Operator

I am lucky enough to work at a company where procurement department is viewed as a separate entity adding up value to the organization. There are still a lot of shipping companies where procurement is clearly an administrative department; the requisition lists for the engine stores are evaluated by the technical superintendents and department and the deck and safety stores are screened by the Hygiene Safety Quality Environmental (HSQE) department. In our case, we are a hundred percent independent, cooperating with other departments in the context required for the optimal service of the vessels' requirements.

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The work here can be very pressing and challenging, however much more creative and nothing compared to a simple clerk's duties. The company acknowledges our contribution to the organization's growth offering us innovative technological tools that have automated the purchasing process, freeing us from the confining paper and print outs. This way, the business data we generate are all recorded and available for the management to include in their business planning.

These e-solutions, as already discussed, have provided us the necessary time to evolve our expertise and facilitated us to respond to the changing dynamics of the shipping industry. From our side, we have taken advantage of the flexibility given by technological tools and contributed greatly to building company's ERP and database. We have taken up various projects, with the latest being the critical spare parts catalogue: we have made company's generic list of critical spares ship specific. We have found the part numbers and the drawings corresponding to every machinery of every vessel and registered them in the company's software. This was a huge piece of work and certainly not typical of the procurement department's duties. We have a lot more to offer to the organization and is proven by any new project out of our usual scope of work we accomplish successfully.

Procurement Software Designer

I still believe that it is all about expenses control but in a more indirect way. A skillful procurement department adds value to the organization by being independent, well organized and having majored on the purchasing field. There is a huge difference in our meetings when we are discussing with a competent and active procurement expert instead of a procurement department operating under the shade of other departments.

A skillful procurement operator knows what he/ she wants from the business tools; they know their scope of work and how to express their needs. They come up with ideas and we are discussing new features of the existing ERP. This liberates the management team of a shipping company, leaving room to deal with other major issues. The way a shipping

company chooses to make the most of this non-attachment to the procurement is where the competitive advantage lies.

Managerial Executive

Without any doubt, we choose the best executives to staff our company, all contributing to our organizations growth and promoting our competitiveness. We view the procurement as a very active department; we share mutual passion about technological innovations and we have experienced together the reduction of purchasing cycle times by more than 30%. This has saved us not only from high money expenditures but also from a possible bigger disaster.

We trust that our procurement department uses the utmost from the tools we have provided them and we are always open to new suggestions that will facilitate their business routine and performance. We have seen in quite a few instances, the effectiveness of their expertise. A recent example would be the rescue boat case we had with a vessel of our fleet in Houston: under the threat of a possible vessel detention, there was a desperate need for rescue boat replacement. Unfortunately, same was not available in the region; our procurement sourced the rescue boat from the EU and shipped and delivered it on board the vessel within one day. This is a remarkable task if you take into consideration the external adverse factors.

Let us not forget that we are also a ship management company: we are in the market selling our services for technical vessels' management. We are extremely concerned in providing the best service to our clients and build our reputation of in managing vessels with quality and efficiently.

Service/product provider (vendor)

Procurement department is the function of a business entity that can leverage and contribute to a company's success. You can see the difference in the companies that have

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included the procurement department in the decision making processes; owning the control of the purchasing processes adds value to the business cycle while ends the so called "maverick buying". We opt for business relationships based on our merit, mutual cooperation and understanding. Business relationships exclusively based on social and money interests can only perpetuate existing weaknesses.

An active procurement executive adds value to an organization by his/ hers experience and the alternatives he/ she can offer in difficult situations. It is easy to follow up a designated path and stay in your confined administrative duties. The leading shipping companies nowadays outperform their competitors by utilizing the maximum of their departments' potential.

Crew on –board

Procurement department is certainly not in the front line of shipping companies but can make the difference and raise its quality levels. As seafarers, we take into account the procurement services a shipping company has to offer prior choosing its vessels to sail- it ensures the quality of life on board during our contract. My point is that an efficient procurement department adds value to a shipping company's reputation, making it more appealing to seafarers, charterers, brokers or other shipowners.

Reputation is major deal in any business and can lift or burry a company. In the shipping business, every incident is recorded; Q88 for example, is a globally accepted tool that all stakeholders use to source information on the vessel. Off-hire days is a significant factor when choosing to cooperate with a shipping company and procurement can be responsible for many of them. Therefore, a competent procurement department is committed to its work and adds value to the shipping company by keeping its activities swift and out of the way of vessels operations. Positive outcome of a vessel's performance provides the advantage to the shipping company against its competitors with constantly well-employed vessels.

Operations department representative

I think we all work towards improving the performance of the company and keeping a high level of quality in services. Procurement department in specific, has the privilege- or the disadvantage, you can choose the perspective you wish!- to affect many aspects of the vessels' operations and shipping company's interests.

As the procurement has the control over delivering on board safety items for example, it is directly related to vessel's commerciality; only one of them not to be supplied or to be expired and vessel's departure can be denied or receive a class observation that will be listed in its records for life. The stakes are really high and a company's reputation can be harmed from some supplies that seem to be a piece of cake.

In addition, procurement is handling spare parts supply on board which can be challenging in the event of machinery break down. Repairs can take some days but without required spare parts some problems cannot be rectified. We are operating in a very competitive market, where even hours of staying out of business can be harmful for a company's well being.

Another important contribution of the procurement department is the sourcing of stores related to the chartering party's requirements. It is possible to lose a voyage fixture in case suitable mooring ropes or cargo hoses are not available on board the vessel. A procurement department with a well organized sourcing network can truly save the day.

4.3 Discussion of findings

After reviewing the interview text, it is evident that supply chain management existed in the maritime field long time before the theoretics of the discipline started creating the theoretical base and procurement does have a considerable impact on vessels operations.

There were a lot of times within the discussion that the interviewees were expressing themselves with examples: for instance, when asked the way potential risks and shortages are being dealt with, the procurement manager replied with an example, item specific. Or when the procurement operator is asked for the department's operation and its compliance with the regulations and company's goals, again, their point of view was presented with an example, very precise and to the point of the question.

This reveals well- informed experts who have majored the discipline through hard work and practice. It is very impressive how the literature and general conclusions of a lot researches unfold before our eyes: maritime industry is full with practitioners of the supply chain management, who are performing procurement activities sometimes without even realizing it. The interviewees knew what was asked of them and responded using minimum terms borrowed from the supply chain and procurement sector theory; however, this is not diminishing the value of their responses- quite the contrary actually.

Another impressive trait of the shipping business appears to be the use of technology; further to most of the interviewees responses, techology is a new addition to the company's operation , without much differentiation from a default web application. As elaborated in the theoretical part, it seems to be re-affirmed here: despite the enormous profits which are incomparable to other sectors, maritime firms have low rate of innovation, while modernization and technological update seem to be applied in the slowest pace possible.

It is relevant to point out here the concerns expressed by the interviewees related to the techology advancement of the company: the crew member communicates a difficulty in following up the ERP features but concludes on its favorable implications to their professional routine. Or the procurement operator mentions the difficulties they are facing

by the denial of other executives to conform to technological procedures. Moreover, the service/ product provider points out the plethora of new web applications that intend to bridge the communication of the supplier with the client; this comments reveal the existence of integration application issues and missing infrastructure for such venture. Hence, we can presume that web technologies are not embedded in the maritime operations and there is still room for improvement.

In addition, after reviewing the responses of the rest interviewees, other than those of the procurement manager and operator, the impact of procurement in the vessels' employment activities reveals itself. We notice for instance that the operations department administrator has no engagement in procurement practices other than assisting in the coordination of the deliveries on board the vessels; yet, numerous instances are described where procurement department practices are involved in the voyage fixture or affecting the vessel's employment opportunities. The procurement department seems to have much more power and influence than they realize.

Many of the interviewees report the status of the procurement department the past years: performing almost purely administrative duties, under the command of other departments and maritime experts within the shipping company. This is exactly the opposite of the impact procurement seems to have on the shipping sector. Concluding on the involvement of procurement in vessels' activities almost by every interviewee, it can only be described as shocking the fact that procurement experts have chosen to operate in the shadow of other staff the past years.

It is also surprising that this policy of procurement negligence for the strategic table of the shipping companies seems to still be present in many shipping companies. It is assumed that the emergence of the procurement department in the strategic level within a company could be a matter of managerial decision, based on the personal view of the managing directors on business management.

Nevertheless, it is deduced by the interviewees' answers when asked about the procurement contribution in gaining the competitive advantage in the market that procurement department is greatly involved in attributing value to the company. It seems

that procurement department is very active in this specific shipping company, a fact which is highlighted by multiple interviewees that is not common in the shipping sector. Besides, both operations executive and the supplier are pointing out procurement's engagement in many aspects of the vessels' activities, affecting its commerciality and impacting indirectly the integrity of the company. Once again, it is suggested that managerial executives have not yet found the way to utilize the maximum of their departments' potential.

5. Conclusions, limitations and suggestions for future research

5.1 Conclusions

It is true that supply chain management is a fairly new discipline in theoretical basis, however very old in reality. A lot of definitions and analysis has been attempted, all deriving context by the practitioners of the discipline.

Porter presented his value chain analysis theory in 1985, giving a new perspective to management thinking. He introduced a useful tool for every business to organize its activities in order to gain better understanding. Every organization's goal is to built their way towards acquiring the competitive advantage in the market.

Technology plays a primary role in the supply chain management; organizations that have adopted web technology applications achieve smoother information sharing, promoting visibility throughout the supply chain. Information technology facilitates integration among the supply chain stakeholders and have opened an additional distribution channel. Nevertheless, as more and more new software solutions are introduced to the companies, application integration issues are being raised, seeking considerable budget investment from the part of the organization.

Maritime sector is a highly profitably industry of the global economy. It is characterized by its high dependence on intermediaries, therefore its big exposure to risks. The logistics side covers a huge part of the shipping industry, moving cargos from raw material sources to major consumer countries. However, sustainability concerns have altered the shipping business in many ways: international regulations are pressing to control various aspects of the life on board and of maritime activities.

Supply chain management in the maritime field has a lot of practical implications, but, once again, lacks in theory. Purchasing executives often lack an overall grasp of supply chain management, holding the supply chains back from information sharing and from implementing many other supply chain principles that lead to profit maximization.

Besides, a major source of complications for the maritime supply chain as well as for its procurement is the vessels operations themselves. Vessels have different type of employment which can include steady schedules or market driven routes, fixed on the spot. There are a lot of operating activities a vessel should perform in order to maintain its seaworthiness and commerciality, all of which should be unhindered by any other related supporting activity.

Procurement constitutes a very significant set of activities for every organization and have proven to be much more than secondary activities in the value chain. Companies that are implementing a value creating strategy are those that are using all the resources at their disposal effectively through procurement practices. The seven stages of procurement should be reviewed and followed with respect.

In the maritime business, procurement can certainly be a highly complex task; considering the dynamic environment and the way the vessels are operating, procurement requires agile practices, flexible suppliers network management and competent executives. Procurement operators should depend on a rigorous inventory control and supply history monitoring for most of the supply categories, such as provisions, stores consumables, engine spare parts.

Technology is once again a determinant factor in vessels procurement. The use of Internet has penetrated the whole procurement process forming the e-sourcing, a groundbreaking function for the maritime business. Information sharing and high speed transmission of data is the key to a resilient supply chain.

Lastly, every shipping company's goal is to maintain its vessel's seaworthiness and commerciality. Management of the maritime supply chain, as well as vessels' procurement are activities of vital importance, nonetheless, can only be characterized as side activities comparing to the vessels' employment obligations.

5.2 Limitations of the research and Suggestions for future research

The findings of this dissertation have to be seen in light of some limitations. The primary limitation to the generalization of these results is the huge literature gap on the procurement part of the maritime sector. In general, procurement is a discipline that is still reviewed by the researchers. Literature is confined and the sector is still evolving theoretically. As far as procurement in the shipping industry is concerned, the studies are quite limited; the existing studies are mostly research papers based on a sample either of only one shipping company or on the maritime sector of a single country. We used the procurement theory as a fundamental theoretical framework, as well as reviewed the status of the vessels operation to trace the procurement implications in an attempt to evaluate its importance. The results clearly indicate that advanced technology, comprehensive procurement procedures, qualified personnel ashore and extensive distribution networks for supplies delivery on board are core elements of the vessels' supply chain.

This study also has a managerial implication: the role of the ship procurement department should include the strategic position of shipping companies in forthcoming years. The involvement of procurement department in every core vessel activity influencing in an indirect way the shipping company's revenues is starting to be apparent.

Another limitation of this study is that the interviewees are all coming from the shipping business and only one shipping company; therefore, they can be subject to biases and confounding that may have influenced our model estimates. Although we carried out only a small scale of study with seven survey respondents, their insights provide a useful reference for the shipping companies to evaluate their supply chains to help improve procurement services for seafarers.

The concept of procurement influencing vessels operations is extremely important for the maritime supply chain performance indicators and should be highlighted in future research.

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