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An Analysis of Cruise Supply Chain Management in
European Region: The Outsourcing Decision Making
of Food and Beverage Department

by

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Abstract

This thesis aims to analyze the complexity of the cruise supply chain and makes a statement on the issue of outsourcing not only the logistics part but also the onboard processes. In our research, we consider that the supply chain starts and ends in the cruise liner. We are taking account processes from placing the order and managing the procurement until the final onboard consumption. After analyzing with a conceptual model the main characteristics of the supply chain and basing on the classification of the cruise supplies, we distinguish the cruise supply chain in two chains, the food and beverage chain, and the engine and hotel stores chain. We point out that engine and hotel stores supply chain is coordinated centrally and directly from the cruise company while food and beverage is divided on the procurement, logistical and inboard activities. This is the room for outsourcing the whole processes in a third party provider. The main conclusion of this thesis is that for a small or medium sized cruise company that is not part of a large group and is operated globally, outsourcing could increase the quality and the efficiency of the services. Of course with an added value agreement with trust and collaboration. For a large group of companies, we believe that the optimal strategy should include investments in their owned facilities and network by introducing a core business company that is going to manage all the processes in each ship of the group. As the research is limited in the European region, a future research could take in account the yearly itineraries that are going to partly change the data. In addition, we believe that an economic analysis on a company that has already outsourced the department, could provide more accurate result for the economic benefits from such a strategy.

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1 Introduction

Supplying cruise liners becomes more and more challenging. Issues like large lot sizes, just in time deliveries, global sourcing, worldwide operations, limitations on ports of calling and more that we discuss further in this research, increase the complexity of the cruise supply chain management. The cruise liners are vessels, luxury hotels and entertainment parks at the same time. During a big loading in port of Piraeus, a cruise liner may receive frozen food and beverages from United States, hotel equipment from Germany, dry and frozen food from Netherlands, wines from Italy, fresh produce from Netherlands and local market, spare parts from Italy, Germany and United States, chemicals from local market, live lobsters from Canada, casino parts from Switzerland. All the above have to be delivered eight o'clock in the morning in the requested quality and quantity. Offering to passengers high quality services requires an efficient, robust and well-organized supply chain. At the same time, the cruise liner as a vessel requires an effective supply chain for all critical and urgent spare parts while the onboard storage capacity is limited. There is no room for a missing order and delays as in our example, ship is going to sail in Greek Islands and Turkey for a week, where the facilities for loading are not always available and approachable.

The continues growth of the world fleet, the entrance of new European cruise companies, the global economic crisis, the increasing oil price and the pressure from low costs alternative tourist sectors, forced cruise companies to reduce the prices and offer more attractive leisure packs. The increasing demands on high quality of many core business services, created the need for outsourcing some activities. For instance, some small departments like casino, spa and boutique. The number of employees, the landside facilities and the quantity of supplies that these departments require are very limited. The outsourcing decision-making on important onboard departments is a continuously discussion in cruise industry. Some companies have outsourced the food and beverage department including the onboard and landside operations. The room for such an outsourcing, the functions that include, and the role of the third party are some of the issues that we analyze in our research.

In our research, we consider that the supply chain starts and ends in the cruise liner. We are taking account processes from placing the order and managing the procurement until the final onboard consumption. During the analysis, author distinguishes the cruise supply chain in two sub supply chains, the food and beverage chain, and the engine and hotel stores chain.

As we mention in our literature review, cruise industry exists more than half a century. The procedure of supplying ships and passengers is not a recent challenge as well. Therefore, the research community has not involved in this interesting aspect of cruise supply chain management. There is a lot of literature in cruise industry for marketing policies, cruise company's management issues, information technology aspects, economic results in local economies and more, but as we will mention in our literature review only few in supply chain issues and non in the outsourcing of the whole department.

The thesis aims to analyze the complexity of the cruise supply chain and makes a statement on the issue of outsourcing not only the logistics part but also the onboard processes. The main research question for this thesis is: *What is the room for outsourcing the food and beverage department taking account the challenges in the cruise supply chain, the classification of the supplies and the distinction in two main logistics networks?* In order to answer this question we state few crucial sub questions that need to be answered: *Which are the main factors that determine the cruise supply chain management? Which are the participants that are involved in cruise logistics? Which are the main categories and groups that cruise supplies can be classified? Which are the main supply chain networks of the cruise supply chain and which are the main similarities and differences?*

This thesis reports on the findings from three stages: semi structured questionnaires with face-to-face interviews with managers and officers, author's onboard internship, and author's background. The main data collection from ships took part in the port of Piraeus in Greece with thirteen cruise liners from eleven different sized cruise companies responding to our research. In addition, during author's onboard internship interviews from over twenty officers and storekeepers from all the departments were collected. In addition, three supply chain managers from three different sized cruise companies took part in our research. Finally, we made some interviews with the largest logistics companies, regional ship chandlers, local ship chandlers in Piraeus, port agents and customs and port authorities.

The thesis is structured as follows. After the introductory chapter, in chapter two we make a literature review on the cruise industry and the European market, the cruise supply chain, the food supply chain management and finally the spare part supply chain management. Chapter three using a conceptual model, highlights the cruise supply chain, determine the main challenges for the supply chain strategy and analyze the factors that determine the selection of the port of loading. Chapter four presents the main categories and groups of supplies that a cruise liner requires in terms of the lead time, the time until the next replenishment, the criticality of the goods and the last mile transportation mode. Chapter five presents the two main logistics networks as these are distinguished from the classification, their main characteristics and the main differences. Chapter six focuses on the outsourcing decision making of both landside and onboard processes of food and beverage department, focusing on the main characteristics of the third party, the factors that determine the decision making, the relationship with the cruise company and the advantages and disadvantages of such a decision. Finally, chapter seven summarizes the main conclusions.

2 Literature Review

2.1 Introduction

In our second chapter, we make an introduction on the main fields that we are going to refer during our research. First we analyze the cruise industry in order to understand the transformation and the stable growth, we focus on the oligopolistic market and we define the regional markets. In the second part of the chapter we make a review on the existing literature on food and spare parts supply chain. We make this review in order to achieve important information and highlight the main differences between the two supply chains. The general conclusions are going to be used as a basis for the distinction of the cruise supply chain and the decision making on the outsourcing of the food and beverage department.

2.2 Cruise Industry

In this sub chapter, we define the cruise industry and we point out the main state of affairs. We go back to history when the cruise liners where a transportation mode, we come to the present growth, we highlight the cruise market and we finally classify the worldwide itineraries in three groups by focusing on the European region. For the purpose of this paper we define as a cruise industry all the companies that operate pure passenger vessels which offer onboard services and facilities during a pleasure sea voyage. In this general definition, we can include the cruise riverboats and local companies that offer more than one day cruises. Especially in European market, river cruising is very attractive for more and more tourists. The cruise industry does not include the luxury ferries that are used for transportation purpose. For instance in Baltic and Adriatic Seas, offer cabins and facilities ,but they are actually Ro-Ro vessels. We do not put any other restriction on that definition as with our research we cover a range from the strategy that a small river cruise company follows to the supply chain management that a large group of cruise companies follow.

2.2.1 Cruise Industry's growth

The cruise industry has dramatically changed during the last decades. In the early years, cruise ships were providing the only connection between North America and Europe. In the 1950s, these core passenger services were challenged by the introduction of the jet aircraft. In the 1970s, after the bankrupt of some major liners, the cruise industry was characterized by the transformation of North American passenger

liners in Caribbean cruising. According to Dickinson and Vladimir (2008), transatlantic and steamships companies operated the first cruise services, departing from the major United States ports. at an early stage, an integrative tourism pack was offered, combining luxury hotels, train infrastructure and ocean services.

Page (1987) trying to explain the rapid growth of the cruise industry, concluded that the cruise liner innovation, the creativity of people, and the successive marketing of companies, transformed the industry from a pure passenger liner to the pure tourism sector that we know today. The innovation in new shipbuilding transformed the cruise vessel from a floating hotel that reaches several destinations to a floating resort that is itself the destination. Ship was not any more the transportation mode that reaches worldwide unique destinations from big American ports. Companies started to schedule cruise itineraries including several ports of destinations and islands. According to Teye and Leclerc (1998), another factor that increases the demand for cruising was the reduction of aviation costs that permit the access in new itineraries without any surcharge in the price. This integration with aviation industry offers a variety from short cruises in nearby places to long voyages in new markets, located worldwide. All these factors contributed to a continuously growth for cruise industry.

Year	Passengers
1970	500,000
1980	1,400,000
1990	4,495,000
2000	9,768,000
2004	13,378,000
2011	16,300,000
2015*	24,924,000

Table 1: Total passengers per year, CLIA Cruise Market Overview, (2011)

Another factor that influences this growth is the continuous change in cruisers' profile. According to Cruise Market Watch (2012), the foreign passengers have been increased from 7.4% to 41% and it is estimated that they will be equal to Americans the next years. In addition, the average age of cruisers has been decreased during the last years. Cruise ships introducing new onboard activities, have become more attractive for families and youth passengers.

With an 8.5% annual growth in the last 20 years, cruise sector is one of the most dynamic sectors in both shipping and in tourism industries. Nowadays, with over of 1,000 itineraries, international crew members, passengers from several regions and a worldwide network of vendors, logistics forwarders, port agents, tour operators etc, cruise industry is one of the most globalized industries. According to Florida-Caribbean Cruise Association, the current cruise liner order book until 2014 includes nineteen ocean-going ships and seven European cruise riverboats (2012).

2.2.2 Major Cruise Companies

Cruise shipping is a highly concentrated industry. The last few years, the horizontal integration in the industry has been very significant. There are dozens of cruise companies but the 73% of them, are members of two giant groups. In 2012, according to figure 1, Carnival Group is the forerunner with 49.2%, and Royal Caribbean Group following with 23.8%. The rest 27% is consisted from two big European companies and dozens of small and very small companies of one to five ships. Nowadays, alliances have been reduced and a strong competition between groups is taking place.

Parent	Brand	Percentage
CCL	Carnival	21.1%
	Costa Cruises	7.2%
	Princess	6.4%
	AIDA	4.4%
	Holland America	3.7%
	P&O Cruises	1.9%
	P&O Cruises Australia	1.9%
	Ibero Cruises	1.3%
	Cunard	1.0%
	Seabourn	0.3%
	TOTAL	49.2%
RCL	Royal Caribbean	17.0%
	Celebrity	4.7%
	Pullmantur	1.6%
	CDF	0.3%
	Azamara	0.2%
	TOTAL	23.8%
All the Others	TOTAL	27.0

Table 2: Share of World Wide Passengers in 2012, Cruise Market Watch (2012)

The competition is focused on different cruise itineraries, ports of call, passenger's origin, size of vessels, onboard activities, all included packs, level of luxury and variety

in cabins. There are very important barriers for both entry and exit this market. High cost of building new luxury ships, global network of ships suppliers, agents and hub agents in each region and tour operators are some of the requirement for entering the market. Competition for new, small companies is very high as long as there are some large, historical companies, which control the market globally.

2.2.3 Major Cruise Markets

The cruise market can be divided in three group of markets. The first is the American market with the lowest growth rates in last decade. This is the most developed market as many private investments have taken place and there are steady sales values. The most popular destination is the Caribbean Sea where cruise companies use Miami as a homeport. The supply chain management of these itineraries is quite predictable and straight forward as companies the majority of the American companies have their distribution center in the port. Large companies have invested in specific islands by building their owned facilities. The majority of the cruise itineraries include seven days cruises with four or five ports of call. This is the most competitive market and companies operate their most attractive and large ships. Some other important itineraries are the Alaskan and the South American.

The second group of markets includes the Middle East itinerary, the Asian itinerary with India, Indonesian, Hong Kong and China, and the Australian that is combined with new Zealand. Cycle itineraries are not very usual in this group of markets as these are new markets and companies try to make them more and more attractive. The supply chain in these markets is extremely challenging as the loading ports are limited, the local markets for fresh products are not reliable, and the quality of the products is not the requested.

2.2.4 European Market

The European market is the third and fastest growing market worldwide (Figure 2). The reasons for include the increasing number of European cruisers, the foundation of new European companies like Pullmantur and Costa Cruises, the saturation of the Caribbean Sea and the ability of introducing new itineraries. The main markets in Europe are the Mediterranean with western and eastern itineraries and the North with Baltic, Norway and Germany-Benelux itineraries. An upcoming new market is the Black Sea that either is combined with Greece and Turkey, or is operated separately.

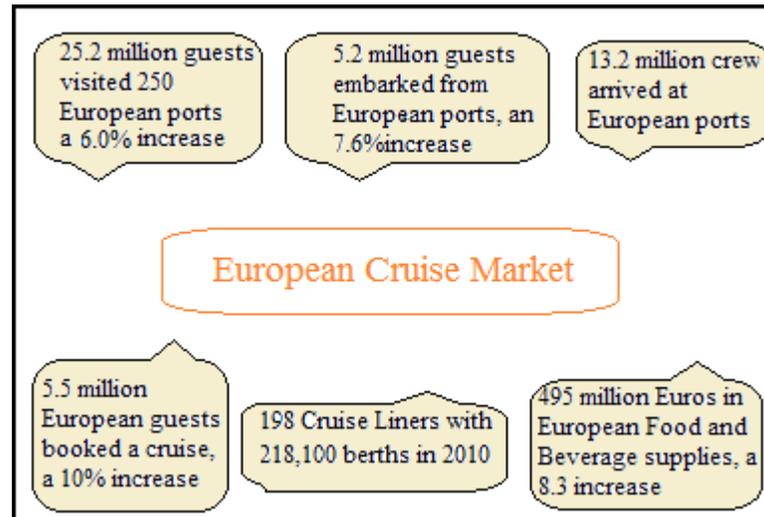


Figure 1: European Cruise Market in numbers, *European Cruise Council (2011)*

All the non European cruise companies use some ship chandlers or logistics providers in order to have their regional warehouse. The long duration of the cruise season that exceed the seven months in Mediterranean and the numbers of ships that are operated in the region, have been created a stable market. In our research we focus on European market as the vast majority of our data refers to the European loading ports.

2.3 Cruise Supply Chain management

The worldwide operations, the high number of involved members located in several regions, the mobility of the delivery point and the limitations in ports of loading are some of the characteristics that increase the complexity of the supply chain and require high quality of services and further coordination in order to satisfy the cruiser. Looking deeply in the existing literature review in cruise industry, we can find many papers focusing on managing cruise services, on safety and security, on itinerary planning, on social and environmental impacts, on human resources but very limited focusing on supply chain management. This is reasonable as the concept on cruise supply chain introduced after the global economic crisis in 2008, when the pressure for cost reduction was significant high. In this subchapter, we make a deep review on the existing literature that is relevant with the cruise supply chain management. The research papers that we mention below are the only ones that are related with the cruise logistics. We want to present how research society describes this supply chain and on which main issues is focused. Focusing on existing literature help us to make an introduction on this particular supply chain and target the research gap.

Vaggelas and Laggoudis (2010), introduced the concept of supply chain complexity in the cruise sector and focused on the way the different strategies effect the competition among cruise companies. They used three supply chain methodologies in order to

provide a framework of analysis that it has been used in other transportation industries. They did their research on a small cruise company that is operated in Mediterranean. Their data analysis showed that the company's strategy was rather customized because of the high flexibility. This is an element of the various leisure packages. In addition, they researched the internal and external flexibility in former and later case. As the company focuses on high quality leisure services in order to cover the cruiser's needs, it prevented high level of internal flexibility. Finally, they applied the Kraljic's matrix in order to present the processes and relationships with customers and suppliers that are required in order to achieve the desired flexibility. There are the critical items like coach services and tour agents that need long-term relationships with high risk and high profit impact. On the other hand, non-critical items like food beverage, fuel supplies and cabin stores, are linked to processes and suppliers of low risk and low profit impact.

Veronneau and Roy (2009), examine the complexity of the cruise supply chain in terms of the global sourcing. Initially, he mentions some characteristics of this unique supply chain and bolds the three main challenges. The first is to maintain a large global deployment by achieving the required service quality for the cruisers. The use of local agents, the good connection with local authorities, a long term planning and a centralized communication infrastructure are found to be the main key indicators of a deployment success. The second challenge is the ability to source high variety of supplies in large quantities. Specialists purchasing agents are important for reducing costs. After achieving the local presence and knowledge, he suggest of using an in-house control for greater returns. Finally, the third challenge is the short time window available for replenishment that requires coordination in planning the supply chain. The just in time procedure is required as the stock out is not acceptable and missed shipment increases the cost rapidly. At the end, author states that the human element is very crucial for an efficient global supply chain.

In another paper, Lakovou and Spaulding (2005), examine the multi-stage onboard inventory policies for food and beverage for a cruise ship. They study a cost minimization in three stages of the replenishments for F&B items. The zero stage where the final number of bookings and the consumption during the cruise are not known. The first stage where the number of passengers is known and some additional purchases from the home ports may be required. The second stage refers to some additional replenishment in the next itineraries. The last stage is the end of the trip, usually back to the home port. Lakovou and Spaulding, in order to determine the optimal decisions in all stages, use a *stochastic programming paradigm that utilizes a backward induction approach*. They suggest that as the market replenishments of stages 1 and 2 follow a stock policies, the optimal quantity at the ships orders, depends on the market scenarios that create extra costs at the zero decision making stage.

In our review, we found a paper that explores the application of RFID and other relative technologies to the cruise supply chain management (Simon Veronneau J. , 2009). They found out that RFID can provide direct cost reductions in labor costs and further savings as a result of the real time visibility. They mention the issue of the long amortization period of the equipment that is required onboard. Nevertheless, the cost of each chip is too low and gives an immediate return of investment. Finally, authors

suggest that in order the use of this technology to be sufficient to the cruise logistics, it must be used from the whole network of suppliers and logistics providers.

The closest research paper to our topic is by Diakomihalis and Stefanidaki (2011) who present some factors that determine the outsourcing of the supply chain department. The processes that are included are the procurement and the transportation flows. Authors collect some questionnaires from two companies and use the Analytic Hierarchy Process to calculate the priorities ranking. They make their research on two cruise companies. The first is a small regional deluxe and the second a large mass company. Diakomihalis and Stefanidaki determine the main factors including the cruise product like itineraries, characteristics of cruise company like having or not a parent company, location of the activities like the distribution centers, the cruisers characteristics like demographics, the total costs of a cruise and the supply strategy. Then they put some sub-criteria for each factor and they make a pair wise comparison. Authors conclude that the cost is the top driver for both companies for outsourcing the supply chain management. Furthermore, the supply strategy is very important for a large mass cruise company while for a smaller one is not.

Completing the literature review on cruise logistics, we conclude that the existing literature is very limited. All the above authors make a brief description of only few characteristics and issues of this particular supply chain. In addition, the majority of the authors try to suggest an optimum solution in several tradeoffs and improve the efficiency of the supply chain that is a new competitive advantage for each cruise company. Finally, we can observe that the size of the company is a factor that is able to completely change the decision making for several issues. In our research we are going to distinguish the supply chain using the classification model and focus on the outsourcing of both landside and onboard operations.

2.4 Food Supply Chain Management

Cruise ships are operated like a large luxury hotels. The price that the customer pays in order to travel with a cruise ship includes at least two meals. For instance, in order for 1,200 passengers to be served, over ten dining venues are required. As the demographics of the passengers vary, different kinds of cuisines in different restaurants are provided to the cruisers. Considering that a typical cruise in Mediterranean lasts ten days, massive amount of food and beverage is required in order for the passengers to be satisfied. In chapter 3, we will analyze how companies manage to supply a cruise liner starting from the first stage until the final consumption from passengers.

Food supply chains have some particular characteristics that we can find in an extended literature. In cruise logistics, we can categories the food supplies in three categories. The dry, frozen and fresh products. Vorst is one of the researchers who focused on this particular supply chain. Vorst et al (2007) distinguishe the two main

types of food supply chain. First, supply chain for fresh agricultural products such as fresh vegetables, flowers, fruit, and second supply chain for processed food products such as portioned meats, snacks, desserts, canned food products. In both chains, actors understand that products with a good quality at origin are subject to quality decay as they travel through the supply chain.

In food and beverage supply chain in cruise ships, we consider two sources of uncertainty. The first is on the number of bookings and the second on items, that will be consumed onboard during the cruise. Soman, Donk and Gaalman (2004) investigate the combination of Make to Order (MTO) and Make to Stock (MTS) policies in food industry. Authors mention some specific characteristics of the food supply chain like the high capacity utilization and the fact that processes depends on both continuing set ups and short product life. After providing an hierarchy of decisions that take part in combining MTS and MTO productions, they conclude to three levels of decisions. The first level refers to decisions that determine which products are going to be produced to order and which to stock. At the second level the forecast of the demand and the available capacities in warehouses are balanced, based on previous feedbacks. The set of inventory levels, the selection of policies for order acceptance and the purchase of materials in advance, are decisions at this level. At the last level, the optimum orders are placed considering the time horizon of the process. The rescheduling is also part of this level, as a result of additional information that appear after the decision making.

As we will see in the conceptual model, one of the main characteristic of the cruise supply chain is the fact that cruise company's fleet is operated worldwide. The food cost, the transportation costs, the labor costs and the freezer or dry storage costs are very crucial for the cruise company. Evangelos et al (1998), focus on the optimization of these issues in the case of the US Navy ships. Authors introduced a management tool capable to develop strategies that optimize the logistical needs for the worldwide navy fleet. This model is based on different menu categories and different kind of products that are available to passengers. They note that the optimum solution is determined by the weight that each of food cost, labor hours and storage capacity have on the total cost. They provide the optimal menu that should be served onboard by savings from specific items or mix of goods. The "expensiveness" is not the only factor that determines the selection of the product.

In cruise industry, the final consumer is the cruiser who requires the food to be in good quality, fit for consumption and safe. At the same time cruisers demand product diversity and convenience. Keeping the food quality moving on the supply chain is very important for cruise ship as the cost of replacing a missed order is very high. Van der Vorst et al (2007), refers to the need of controlling and guarantying the food quality in the supply chain by using time- dependent quality information. The information refers to the quality of the product from the origin until the last node cross the supply chain. This information flows are going to improve the design and the operations of the food supply chain management. Authors support that quality is a dynamic issue for the operations management and introduce the Quality Controlled Logistics concept in order to predict the product quality and availability. Finally, authors believe that investments in the food chain design, are important both for improving logistics performance and for the

preserving the food quality, in order for right products to be delivered at the right place, at the agreed time, with the demanded quality.

2.5 Spare Parts Supply Chain Management

Another important group of cruise supplies are the spare parts. This category includes any product that is needed either in the engine room or on deck. There can be both consumable and non consumable items. The spare parts logistics require a responsive supply chain management as the criticality of these goods is very high. In the case of the cruise sector, short lead time is very difficult to be achieved as the company's fleet is operated worldwide. There is an extended literature on spare part logistics focus on inventory control, uncertainty of demand and efficient operations management.

Huiskonen (2001) focuses on the spare parts logistics, following a qualitative approach. He discusses the principals that determine the strategic decisions as well as the need for differentiating the decision-making based on spare parts classification and logistics system elements. The first main control characteristic of spare parts is the criticality of the item depending on the consequences of a failure. Second, the control of the criticality depending on both predictability of failure and availability of the item. Another characteristic is the process criticality depending on locally or centralized structure. Fourth, the specification of the spare part and the demand pattern depending on the volume of demand and predictability, and finally the attractiveness of stocking depending on the value of the item. He emphasizes the need of applying different strategies between different kinds of spare parts in terms of main characteristics and required logistics system. Finally, author suggests a further collaboration at the planning stages between the parties that involved in spare parts supply chain.

In addition, Dekker et al (1998) analyze spare parts that are both critical and non-critical for the production process. Authors built a model with an approximation of the service level for both types of products, and an approximation of handling the incoming order. They report twenty cases and they present the results of three different methods in order to hand a new order. For each of the method they calculate the service level and the length of the stock-out for both critical and non-critical demands. They conclude that guaranteeing a high service level for critical items was cost effective. That requires further stocking of critical items.

Cruise liners use new innovative, sustainable engines that are very expensive. These engines are used for several decades and are followed by many smaller but expensive parts that are vital for the function. In the case of a failure of these parts, either a repair or a replenishment of a new one is required in order for the ship to have a safe and on scheduled cruise. An optimum inventory strategy is required as the lead time of these spare parts has to be very low. At the same time, the cost of holding and ordering these parts do not allow an extreme stocking policy.

Teunter and Haneveld (1997). mention the above issues and suggest an optimal solution for the inventory cost of slow moving expensive spare parts. They divide the

ordering strategy into the initial procurement and procurement during the lifetime, taking account the purchase, holding and back-order costs. They suggest that purchasing all the spare parts at the time of the initial purchase, a better discount can be achieved. Based on some assumptions, authors built an optimization model that covers the entire lifetime of the product. They find a formula for the optimal initial provisioning and another one for the after purchasing strategy.

Gajpal et al (1994) point out the process is needed before reaching an optimal supply chain. First, authors category the spare parts using VED analysis. The criteria that he uses in order to evaluate the spare parts are the type of spare, the lead-time and the stock out implication. Authors present some alternative options for each criteria. Using the Analectic Hierarchical Model, they conclude on composite weights that provide the vital, essential and desirable classes. This paper illustrates the importance of the systematic forecasting demand for spare parts based on these factors.

Except from the consumable items that need replenishment, there are the some others that are repairable. For these items, there are two options that a vessel has. The first is to repair the item onboard from technicians and the second is to export the spare part to the repair store and return it fixed onboard after several days or hours. The expected shortage for repairing and shipping the item increases the cost rapidly. Dhakar et al (1997) define three types of replenishments in normal repair, emergency repair and extremely emergency orders, and they simulate all the possible complexities. Authors applying their methodology on a paper mill operation and conclude on the computational feasibility of the results. Finally, they mention that the spare parts with low demand rates increase the uncertainty of future failures.

2.6 Conclusions

In this chapter we introduce the main characteristics of the cruise industry and we analyze the current market. We observe that cruise industry was affected by several facts that create this strong, stable and profitable industry. American tourists are still the main trigger for this successful sector. Focusing on the cruise logistics literature, we find the research gap on a deeply and multi analysis of the cruise supply chain management. All authors refer to the complexity of this supply chain and suggest strategies for the optimization of the supply chain management. Analyzing the food and spare parts supply chain management, we can make some statements. The main challenges in food supply chain are the quality and the perishability of the products. On the other hand, spare parts supply chain tries to minimize the lead time by reducing the transportation time and increasing the availability of the product. Another issue for spare parts is the extremely high cost of both safety stock and missing order that require an optimum inventory control. Food supply chain management requires an efficient network while spare parts supply chain management requires a responsive network. All these issues are very important in order to make the supply chain management distinction in chapter 5.

3 Conceptual Model of Cruise Supply Chain

3.1 Introduction

In this chapter we answer our first two sub questions that refers to the main characteristics of the cruise supply chain and the main challenges that make this supply chain unique. In order to make the distinction of the supply chain, we need to focus on the involved members and the main challenges. The information and the data that we used in order to make some statements is based on author's personal working experience and on a long research in several involved members of the cruise logistics. Author has worked for five years in a logistics provider for cruise liners in the port of Piraeus. From several positions like customs broker and operations manager assistant, author is very well informed of the last stage of the supply chain and has a general view of the whole network. During his summer internship onboard a medium sized cruise liner, during the interviews from other over sixteen ships and during the research on more than ten European logistics providers, author gained a very well overview of characteristics, tradeoffs, strategies, issues and challenges in cruise supply chain. All the above are used in the next chapters in order to make statements, define factors and provide examples.

3.2 The main characteristics of Cruise Supply Chain Network

In this sub chapter, we describe the supply chain network that ship supplies use in cruise industry. We present the participants and the role that participants have in this network, as well as the information and physical flows between them. Then we mention the processes and the operations that are taking place in the industry giving examples from the day-to-day logistics.

3.2.1 Involved members

Every supply chain network has some major participants who determine the efficiency and the effectiveness of the network. As cruise industry has to deal with a global sourcing, several supply chains are used in order to optimize the efficiency of the network and satisfy the final customer.

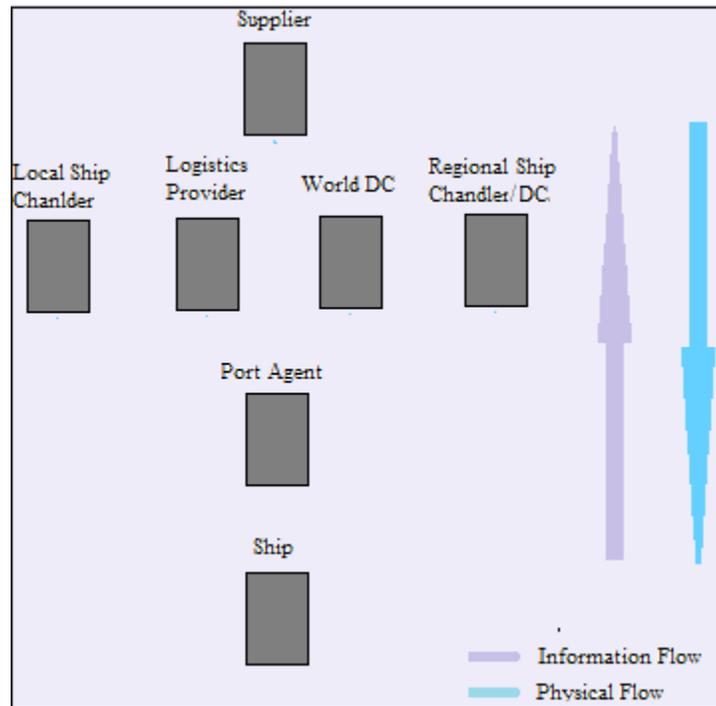


Figure 2: Involved member in Cruise Supply Chain, Author

3.2.1.1 Supplier

Suppliers are very crucial for the supply chain as they are the initial stage. They have to provide the demanded quantity in the required quality, at the right place, at the agreed time. Producers are responsible to provide homogeneous quality during the season by introducing a reliable mechanism that guaranties the stability of the final product.

A well-organized schedule for the future loadings and an optimal supply chain strategy are required, in order to minimize the uncertainty of demand and avoid the bullwhip effect. Suppliers make a classification analysis in all their products in term of the criticality and the uncertainty of demand. These policies optimize the inventory policy and minimize the storage, transportation, and shortage costs.

One of the most important factors for this step of the supply chain is the durable supply of first commodities. For instance, for producing a spare part, steel and smaller parts are required to be in stock. Another element especially for fresh and vegetables is the weather conditions and the seasonality of some products that affect the availability of products during a year. The lead time from the supplier is the most unpredictable factor especial for engine parts. For food and beverage products, suppliers are informed for the yearly consumption and adjust their production.

3.2.1.2 Ship Chandlers

Ship chandlers are the most important part of the food and beverage supply chain. We can divide ship chandlers in regional and local. In Europe, there are some ship chandlers with dry and frozen products and few others with fresh products. These companies supply by truck the whole region, with the largest and most reliable be located both in Netherlands and in Germany. Every cruise company uses a ship chandler as a regional distribution center for dry and frozen products.

The role of such a provider is double. As distribution centers, ship chandlers have a specific contract with cruise companies for consolidating, warehousing, and transporting the orders. They receive large or small lots from vendors and manufactures, they store them for few days, they build the orders on pallets, they load them either into trucks or into containers, and they forward them to the port of loading with a third party transportation company.

The second role of a regional ship chandler is the procurement. Each company has a procurement department that is able to make a global sourcing. In that case companies are operated like suppliers. In previous years, these companies covered the majority of the orders. However, some companies looking for further integration in their supply chains go directly to the ship chandler's suppliers. For instance, a large cruise corporation has achieved direct contract with the 20% of their suppliers, reducing the cost of procurement.

Every loading port has several local ship chandlers who are used from cruise companies for urgent shortages, missed loadings and small replenishments. The operations of these companies are the procurement, the consolidation and the delivery of the products. The availability in quantity and quality combining with the procurement cost, are the main issues for cruise company that avoid them.

3.2.1.3 Global Distribution Center

The vast majority of cruise companies and groups use a global distributions center in order to optimize the inventory strategy. The location of these facilities is close to the place that headquarters are located. Companies usually outsource to third parties the warehouse management. Even in the case of Miami that supplies a stable market in Caribbean, companies mainly do not invest in infrastructure.

Theses warehouse provide facilities either for frozen or for dry supplies. They store local branded special products with high demand like beverage in order to use them in the case of shortage in covering the order. In addition, they keep inventory for some specific products that are available only for instance in the American market and are delivered in small lots. The global distribution supplies both regional warehouses

located in ship chandlers and the cruise liners directly. The capacity of these warehouses determined by the size of the company, the location, and the cruise itineraries during the year.

3.2.1.4 Logistics Provider

In the case of engine parts and hotel stores, cruise company uses a logistics provider. The role of this third party company is to consolidate the goods from suppliers, keep them in its warehouse, and forward them to the port of loading. We can make two notes in these activities. The first has to do with the inbound and the second with outbound transportation. Cruise company by issuing the purchasing order, determines the if the supplier has the obligation to deliver the goods in the warehouse. In another case, logistics provider picks up the goods by charging the supplier.

For the outbound transportation, cruise company is the one who determines the transportation mode and the date of shipment. Actually, they agree on a seasonal schedule in order to maximize the consolidation. Cruise companies, use more than one regional provider in order to decrease the inbound transportation lead time and costs, increase the effectiveness and achieve alternatives. The location of each logistics provider is determined by the supplier's location.

3.2.1.5 Port Agent

The legal representative of each cruise liner in the local government destination is the port agent. Agent represents the company in port authorities and customs authorities and has a huge local network of partners like tour operators, waste handlers, customs brokers, hospitals, bunkers, tugs and more who are able to cover all the needs that may occur. In some turn around ports like Barcelona, large companies use a supply chain agent who is responsible for organizing and delivering the supplies in this particular area.

In both cases agents either they own or they outsource warehouse facilities located near the loading ports. They use these warehouses in order to store and consolidate small parcels from airfreight and road freight that arrive in the port prior the ship's arrival.

In addition, port agents are responsible for receiving the exports, arrange the customs clearance, and forward them according to the landing manifest. Finally, in some cases port agent is called to find local chandlers for any urgent replenishment or repair shops for spare parts. The main challenge for agents is to create a reliable network for different kind of services.

3.2.1.6 Cruise Liner

Cruise ship is the initial and the final point of the supply chain. It is the place that managers place the order to the company and receive the goods. Every morning the ship calls a different port of destination in a different country. As we mention in the next subchapter, the mobility of the delivery point is one of the main issues in the supply chain management. In some cases, in Indonesia for instance, the ship can be operated for over a week in small non-approachable islands.

There are some elements that onboard managers take in account in order to place the order. Some of them are the number of bookings for the next itineraries, the real consumption per day per person from previous 30, 60 and 90 days and the number of days until the next loading. In order to predict the onboard daily consumption, the weather and the location of each bar and restaurant is very important.

Another ship's characteristic that is very important for the supply chain strategy is the capacity is both because new vessels are basically designed for seven days cruises in Caribbean Sea and because naval architects try to maximize the number of guests cabins and increase the economies of scales. We have to take in account that storage room is required for restaurant and bar food and beverages, equipment, hotel stores, laundries, engine parts, concessionaires like spa and boutique and other more.

3.2.2 Processes and Operations

In this sub chapter we analyze the processes and operations that are involved in the cruise supply chain. As we can see in figure 4, the main processes are the placing of the order from the ship to the company, the procurement from suppliers, the storage of the goods, the consolidation of the whole order, the transportation to the loading ports, the loading and finally the onboard operations.

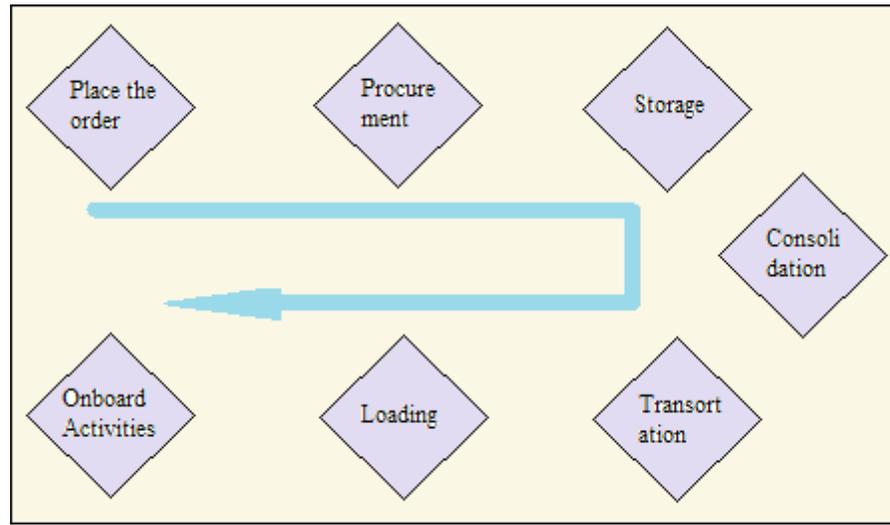


Figure 3: Main processes and operations in cruise supply chain, Author

3.2.2.1 Placing an order

There are some steps before the order will be placed in the supply chain department. First, as soon as the itinerary schedule approved from the cruise company, supply chain department creates a loading plan for the next one and a half year. Without mentioning quantities but just the name of the loading port, the days until the next loading, the type of products, the place of origin, the name of logistics provider and the required lead time.

Some months before the loading date, each department builds the order using the internal information technology system. The food and beverage department for instance uses thousands of codes for describing the whole products. The system needs some inputs in order to suggest the optimum order size for each code. Some of them are the number of passengers that will be onboard, the number of crew members that is stable, the average consumption of last seven, fourteen and more days, demographic characteristics of passengers, the type of itinerary and the days until the next loading of the product. From all the above there is an optimum lot size that increased by 20% safety stock.

3.2.2.2 Procurement

As soon as the cruise company receives the order, creates a purchasing order (PO). This paper includes several information not only for financial but for logistical aspects. Some of these are the terms and conditions, the payment policy, the code of the item, the description of the item, the ordered quantity, the date of the order, the place and the time of delivery and the transportation mode.

Procurement is a very crucial process as determines the quality and the availability of the product. A worldwide network of suppliers is required in order to balance the seasonality of some items. In addition, the cost of procurement is very important for the supply chain adding values and some companies in food and beverage products try to avoid ship chandlers and buy directly from suppliers.

3.2.2.3 Storage

The inventory control is one of most important processes in cruise supply chain. The availability of the products, the short lead time, the optimal warehouse management as well as the optimal replenishment strategy determine the supply chain management. As we mentioned before, cruise companies use at least one logistics provider in European region. Usually, cruise company uses a part of 3PL's warehouse in order to use it as a regional distribution center. They storage goods in order to both handle the uncertainty of demand and reduce the transportation costs.

The duration time of the storage is determined by the kind of the product, the yearly demand, and the permissibility. The selection of the goods that are transferred to regional warehouse has to do with some factors that we analyze in the next chapter. The nature of these products determines the warehouse facilities that are required. There should be frozen warehouse, dry warehouse, fragile warehouse and customs warehouse in order to handle the majority of the goods.

In addition, the warehouse has to use an information technology system that is visible to the cruise company. Every parcel that is getting into the warehouse takes a barcode or a RFID following by the most important information in order to achieve an efficient inventory control. Some of these information are customs situation, date of entering the warehouse, date of loading in trucks, expiration date, date of next loading end other more. Finally, the security measures for these facilities should be the best possible.

3.2.2.4 Consolidation

Consolidation is referred to all the procedures that are taking place between several members in order to reduce both the transportation and the storage costs. In cruise industry, we observe consolidation procedures in three stages. The first, is taking place in global distribution center where products from all over the world are stored and consolidated first in pallets and then in containers. During our research, we observed engine spare parts, safety items and consumable chemicals consolidated in the same truck.

The second stage is in regional distribution center where logistics provider, consolidates the whole order. One truck may transport cruise company's goods from the distribution center, products from global distribution center, products supplied from local vendors and manufactures. All these products have different barcodes and all together build a pallet. The new pallet is going to have a new barcode that will be visible both to the company and to the vessel.

On the third stage, there is a consolidation in the loading port. Port agent or supply chain agent, collects and stores all the small parcels that arrive in the area prior to the loading day. These items may be transported either by air or by small trucks or by containers. They separate the deliveries and put them in pallets. The day of arrival of the ship, a truck pick up the goods and deliver them. In some cases, these warehouses are used from companies as local distribution centers.

3.2.2.5 Transportation

Transportation appears in each step of the cruise supply chain and we can notice three modes of transportation. The first is the road transportation and refers to the day to day logistics between vendors, suppliers, manufactures and logistics providers/ship chandlers/distribution centers. In addition, the 95% of the goods in regional warehouses and in supplier's warehouses are transported to the cruise liner by truck. This process may concerns transportations from Barcelona to Rostock and from Rotterdam to Amsterdam, depending the location of the goods as well as the location of the vessel. Finally by truck are transported all the goods from container terminals and airports to the agent's warehouse and the cruise liner.

The second transportation mode is by container. There are two transportation flows with container in cruise logistics. The first is either from the global distribution or from the American market to regional distribution centers and the other one from global distribution center, direct to the cruise liner. There is a third flow in the case that there is a scheduled loading in some ports that are not approachable by land. For instance, if the port of loading is Limassol, all fresh, frozen and dry goods should be transported by container. This increases the leadtime to over two months for all the categories of products.

The last transportation mode is the airfreight. The majority of cruise companies try to avoid this mode, as the cost is extremely high. There are only some exceptions where the cruise company has her owned air fleet that operates the charter flights, like the Spanish company Pullmantur . In the costs, we have to include also the road transportation from the supplier to the origin airport and from destination airport to the vessel. In addition, air transportation has some limitations in dangerous goods like flammable hotel stores, in large and heavy goods like engine parts, and in goods with specific equipments like frozen food.

3.2.2.6 Loading

As soon as the vessel arrives early in the morning to the loading port, crew members open the supplies gangway. Forklift and stevedores are provided either from the agent as it happens in Germany or from Port Authorities as it happens in Greece. All trucks and containers pass through customs officers and port authorities. Then goods are clear for loading and the order that trucks are going to offload is determined by the location of the different storerooms. For instance, if frozen and wine storerooms are

located on the second deck, and fragile and dry storerooms on the first, the vessel loads first, fresh and frozen and then dry and wines.

During the delivery of the goods, hotel controller and provision master check all the products pallet by pallet in order to confirm that they receive everything is included in the invoices. In perishable fresh products, they check the expired days both for security reasons and for being sure that there will be available safety stock until the next loading. For instance, if a cheese has fourteen-day product life and next loading is after twenty days, vessel send a claim to the supplier and does not pay for it. If there is no safety stock from previous loadings, vessel informs cruise liners that are operated in the region or go in the local spot market.

3.2.2.7 Onboard Operations

The cruise supply chain does not end with the loading of the goods. Cruise liner is operated as a huge distribution center for several kinds of products. There are thousands of items and products located in dozens of small or big storages in more than one decks. All these products supply the vessel for several days or weeks.

Depending on the size and the degree of luxurious, every ship has more than fifteen bars and restaurants. For instance, a luxury cruise liner with 700 passengers and 480 crew members, has six restaurants and four bars for passengers, and two restaurants and one bar for crew members. Every morning, chefs and bar tenders place their order by using the information technology system. The system is classified per restaurant, per breakfast, lunch, dinner, per menu and per plate. Its plate has a cost based on the average consumption. Software, that counts dollars and not quantities, suggests to chefs the optimum value that has to order. There are value limitations in each item in order to avoid excess food capacity that will go to garbage. At the same evening, provision master consolidates the order and sends it to each department. This is also a way to control the costs as well as optimize the inventory control.

The same procedure is taking place for hotel store keeping department for consumable and non-consumable hotel items. In the case of supplies that have to do with engine, duty free shops, photographer, spa, goods are delivered at the port, directly to the managers. Inventory controller is not involved in these cases.

Another very important process in cruise logistics is the waste management. Every cruise ship the environmental officer who is responsible for the wastes. There are international rules like MARPOL that are applied by all cruise ships. They provide an environmental operational control index with all the categories of emissions, wastes, chemicals, waters and more. For waste and garbage vessels have strict rules with different points for plastic and paper, food waste and alumni. For instance, the food waste is discharged over twelve nautical miles from the land. For chemicals there are specific companies in each port that provide discharge services. In the case of the garbage, every two days, the ship discharges bags in specific large bins that are provided usually from the port agent.

3.3 Main Challenges for Cruise Supply Chain Management

As we mention in the literature review chapter, cruise supply chain combines food, spare parts, tourism, waste and more supply chain managements. Cruise sector requires the most complicated logistics both in shipping and in tourism industry. There are several factors that determine the supply chain management and make it so unique. In this sub-chapter we present these challenges and provide some real cases in order to understand these factors in practice.

3.3.1 Mobility of the delivery point

Cruise liners are operated in worldwide. Their itineraries are not stable like Ro-Ro vessels. Except from the fact that every six months vessels are repositioned in different regions, the several months that ship is operated in one region continuously change itineraries. This is happening in order to become more attractive for repeater passengers. Some exceptions are noticed in very demanded itineraries that offer limited ports of call like Baltic and France Riviera.

For instance, a two months schedule for a cruise liner may starts with a seven days cruise from Barcelona to Monte Carlo, continues with a ten days cruise to Venice, continuous with a ten days cruise to Piraeus, continues with a ten days cruise to Istanbul and ends with twelve days cruise in Black Sea. In this example, there are five homeports.

As we can notice, the turnaround ports are different in each itinerary. Large cruise liners with thousands of passengers, require replenishment each seven or ten days. Middle sized luxury vessels with less passengers, can handle over twenty days inventory. Cruise company has to load these vessel both from the global distribution centers and from regional and from several local markets. Supply chain managers and logistics providers should be aware of local issues with port authorities, customs offices, ships chandlers and get information that has to do with transportation, handling and loading costs.

3.3.2 Large Orders

Cruise liners are large luxury hotels that offer accommodation and facilities like bars, pools, restaurants, coffee corners, in order to provide to passengers breakfasts, lunches, dinners and all day services. In order for managers to control the consumption and forecast the required demand use menus for dinners, and buffet for breakfast and

lunches. Except from food and beverages, hotel equipment consumable and non consumable items like towels, cleaning liquids, paper, shampoo are required to maintain the luxury services.

A small sized cruise ship with 1,100 passengers and crew members, requires nine 40ft trucks and containers loading for 17 days consumption plus any extra order from local market, or urgent orders transported by air. The daily demand depends on the region that ship is operated, the days that vessels is sailing in open seas where the consumption increases, the number of passengers, the all inclusive price or not, the variety of menus, the demographics of passenger list and other more. We have to take in consideration that large cruise vessels are supplied with over fifteen trucks for only seven days consumption.

In order for a large group to supply thirty cruise liners worldwide at the same time, an efficient well organized supply chain network is required. The challenge is not only in logistical issues but in cost controlling. Vendors should be aware of the products that are going to sell for at least a year in advance. There are vendors and suppliers who are only involved in cruise supplies. For instance, a cruise company needs for her fleet quality local tomatoes from Santorini. A team of purchasing and supply chain managers visits local vendors and makes contracts for the next year.

3.3.3 Cruise Company's Characteristics

The characteristics of each company are the most crucial factors that determines the cruise supply chain. As characteristics we could mention the size of the company, the nationality of the company, the existence of parent company or not, the type of the pack that they offer, the level of the luxurious, the itinerary policy, the investments or the outsource strategy of the company and more.

The larger the company, more vessels are operated in more locations worldwide. This increases the complexity of the supply chain and a strategy is required in order to create an efficient network. In the case that company is very large, a supply chain department is introduced in order to achieve a further integration and reduce some costs. In addition, a company with few ships, usually outsource the supply chain management activities. There is also an effect on the selection of suppliers. For instance, an one ship company orders few big lots from regional suppliers for the main products and the rest day to day consumption is covered by local suppliers.

The nationality of the company is relative with the nationality of the passengers that are onboard. For instance, the Spanish low cost company Pullmantur Cruises accommodates over 90% of Spanish cruisers. Other similar examples are the German company AIDA, the Greek company LOUIS and the Italian COSTA. Usually, companies from different nationalities merged from one of the two large American groups. Parent companies, in order to achieve higher integration, reduce the costs and

increase the efficiency, create a supply chain management department that manages all companies' supplies.

The number of stars in the accommodation that each company offers also determines the supply chain management. A six star cruise liner offers unique brands, more fresh products, variety in wines, beverages that are more expensive, high quality hotel items, variety in boutiques and more facilities like spa. All these facilities and services require suppliers in a global range that are able to supply the vessels during the whole year.

Another factor is the pack that cruise companies offer to the customers. In the case of an all-inclusive pack with unlimited onboard consumption, more supplies are required in order to cover the increased demand. These luxury companies, offer itineraries that approach one port every day. They avoid sailing at sea during the day as the consumption increases the costs. On the other hand, mass four-star companies, avoid many ports of call, and prefer sailing days, when the consumption increases and passengers spend money.

Finally, a factor that determines the supply chain strategy is the investment policy of the cruise company. There are some companies that outsource their activities in either logistics providers or catering companies. Some other large historical companies with stable sales, invest in their owned logistics network in order to reduce the operational costs. Either they make a partnership with local suppliers or they build their regional distribution centers.

3.3.4 *Worldwide Operations*

Cruise companies depending on the fleet and the passengers that they target on, are operated in several markets. The initial market for cruise companies that nowadays is developed was Caribbean Sea. As a result, the first passengers were Americans who were using cruise liners for exploring new destinations and enjoying facilities onboard. These were four to seven days cruises and ships used the homeport for loading.

Later on, cruise companies in order to be attractive to tourists, introduced new ports of call and extend the itineraries. A ten days cruise requires a replacement for at least fresh products. In addition, cruise industry expanded in European region for both Americans and Europeans passengers. In general, cruise companies operate their vessels in Europe from May to October and in Caribbean the rest of the year. This means that during the summer they don't have a ship in Caribbean. In figure 5, we notice a 143 days cruise itinerary that the luxury, six star, company Regent Seven Seas offers from November to March.

is handled by taking in consideration previous consumptions and ordering 20 more than estimated.

The second type of uncertainty refers to missed deliveries, critical breakdowns, repairs, safety items, medicals and more. The issue is the mobility of the vessel and the fact that the majority of the ports of call are not approachable by direct flights. In order to handle this type of uncertainty, cruise companies keep inventory onboard for slow moving items and use several service points in third party warehouses.

3.3.6 Guest's Characteristics

The demographic characteristics of passengers are very important for creating an efficient supply chain management. This factor contains information about the age, the origin, the social stage of passengers that are crucial in order to predict the consumption. In some companies this is not such an issue.

For instance, an American cruise company with luxury double occupancy suites has more on less standard type of customers. There are only some differentiates when there are groups onboard. This cruise company will never have many kids as the facilities are targeted on retired wealthy passengers. A European company, which is part of an American Group, may accommodate both European and American cruisers. The demand for products is extremely different in the two types, and if managers are not take it account may destroy the inventory. Cruise liner has to provide both Europeans and American brands.

Another characteristic that is very important for the supplies is the age of the passengers. For instance, a company, which targets on children like Disney Cruises, has to be supplied by extra fries potatoes, pizza, hotdogs, ketchup, sweets and more. A company that is attractive from middle age people should provide alternative ways of entertainment like extreme sports, tennis court, cinemas, clubs, pubs, gyms and more.

3.3.7 Safety and Security Aspects

As the final customer of all services and products is the passenger, safety is the most important issue. From the initial part of the supply chain until the consumption of the product, managers put some high standards in order to control the quality. During the loading, Food and beverage manager checks both the quality and the expiration of every product. They do the same in the storage rooms and they use first in first out strategy. Keep cleaning all areas, especially restaurants, and applying an efficient pest management are very important for a cruise liner.

After 09/11, cruise companies increased the security measures in order to make cruisers to feel secured. One of these measures was to check every pallet that is

loading to the ship. They take samples for each pallet, they analyze the results and they permit or not the loading. This procedure delays the loading activities.

In general, people who use cruise liners for their vacations, really care about the safety and security. There are mainly wealthy customers with high requirements who need to feel safe in order to enjoy their cruise.

3.3.8 Information Technology

Information technology has totally changed the supply chain management. In cruise industry, information technology is very important and complicated. Cruise companies use different information systems depending on the department. From our research we conclude that the majority of companies use the AMOS software for spare parts and the MXP software for hotel department. In some cases the food and beverage department has a customized software depending on the supply chain strategy and the relationship with ship chandlers.

Depending on the supply chain strategy and the degree of visibility to third parties, Companies use the information system as the connection point with the vessels and headquarters. In a second level, cruise liners use another system with only few information, in order to make public offers for orders in spot markets. Finally, the data base of each ship is visible to the whole fleet, in order to increase the internal shipments.

3.4 Factors that determine the loading port

Cruise companies make a schedule for the next two or more years. There are several managers who are involved in this procedure but not from supply chain department. As soon as the itineraries will be finalized, supply chain and procurement department planning the loading schedule for the whole year. Creating an efficient schedule, previous experiences are very important. There are several factors that determine the selection of the loading port. These factors are not the same with the factors that determine the homeport. Loading supplies and passengers demand different kind of services and facilities.



Figure 5. A typical cruise itinerary in Baltic Sea, with Copenhagen and Stockholm as ports of embarkation and disembarkation respectively, Oceania Cruises (2012)

During our research and internship, we observe that some cruise companies use more than one port of loading in every cruise itinerary. As we can see in Figure 5, a cruise liner selects the port of Warnemunde in Germany as a port of loading for food beverages and equipment, the port of Stockholm for spare parts and chemicals, the port of Copenhagen for fish and the port of Saint Petersburg for fuel. The most important factors that determine the port of loading for each type of goods are the total cost of loading, the reliability of the port, the accessibility of the area, the port infrastructure, and customs offices.

3.4.1 Total Costs

The total cost of loading is calculated by summarizing the transportation cost, the cost of storage, the handling cost, and the customs costs. The logistical cost is determined by the transportation cost of the final mode of transportation until arrives to the port. For instance, using Rhodes as a loading port and Barcelona as European distribution center, the transportation costs are the ferry from Barcelona to Italy, ferry from Italy to Patra, from there to Piraeus by road and then ferry to Rhodes. All these fuel and freight costs have to be multiplied by the number of trucks that are needed to transport the order. Another transportation cost is the cost from the local airport to the port. In the case of the container, the transportation cost includes the freight, the inland transportation, as well as the handling costs.

The handling costs include the cost of using forklifts, workers, and special cranes. In some ports like port of Piraeus, these activities are provided from the Port Authorities and are usually very expensive with workers in powerful unions. In some other cities like Rostock, these activities are provided from the port agents by hiring the services from private companies.

The customs costs are relative with the customs procedures. There are some governments that have simplify the customs clearance in order to become more attractive for cruise companies to use their ports for loading. For instance, in Amsterdam, customs documents need just a stamp of the ship and the items are clear. In Istanbul, customs offices require the supplies to be in the custom area one day prior to the loading.

3.4.2 Reliability

Reliability is very important element for achieving an efficient supply chain management. In the case that one participant of the logistics network is not reliable, then the loading schedule has to be changed. In that case, the final destination of all goods should be relocated, the cost would be increased rapidly, and there would be a miss of demand. Reliability in ports is relative with the stability in offering the same quality of port services, strikes, and good relationship with port agents, local suppliers, inspectors, bunkers, waste companies, customs brokers, and all local providers.

The stability on port services may concerns stable quality in services as well as on costs. When cruise companies make the loading schedule, they based on some costs that have to do with port authorities and different kinds of local providers. Before they confirm the schedule, they contact these participants and make an agreement on stable prices for specific services. The same is happening with the local suppliers. For instance, if food and beverage manager has agree on a specific price and the day of loading local ship chandler increases the price because the market price has changed, then either ship has to cancel the order and buy from other chandlers in other port or has to pay more.

Another very important issue that supply chain managers have to deal with is the strikes. This is a threat that Euro zone crisis makes it more and more crucial. There are several types of strikes, which are able to affect the loading procedure. For instance, there was a truck drivers strike in Italy and all the containers could not transported from the terminals to the ships. Another example is in France that there was a strike on container terminals for several days. In Greece there was a stevedores strike because of the privatization, and there were no workers and lifts to load the goods. Some other strikes could be in customs authorities, port authorities, truck companies, and other sectors that powerful unions exist.

3.4.3 Accessibility

Accessibility is the first factor that managers have to take in consideration. The main elements are the vessels' accessibility, the trucks accessibility, and the existence of container terminals and airports in the area.

The port accessibility refers to the ability of the cruise liner to berth in a position that loading is physically possible. For instance, Santorini is one of the busiest destinations in Europe. Though, this is an anchored destination and cruise terminal is not accessible by trucks. The port should be also accessible by trucks. Unloading a truck requires space for putting down pallets and for lift's maneuvers. Another example is the port of Kefallinia where the cruise berth is as wide as a bus and no loading operations may be served.

Finally, port of loading has to be near logistical points like container terminals and airports. Managers try to minimize the cost of the final transportation, as this is not included in the value of each item. Port agent charges for these costs. Using Monte Carlo for loading port, you have an transportation cost from Genoa for the containers and from Milan for the airfreight. Nice airport attracts small airplanes that are not able to carry on heavy items during touristic periods.

3.4.4 Hinterland

Another important factor that determines the selection of the loading port is the economic activities in the hinterland. In order for cruise companies to supply locally, the demanded quantity and quality must be available. In addition, the country has either to produce the products or to be able to import them with low cost from neighbor countries.

For instance, in a Baltic itinerary cruise companies choose Rostock as a loading port. Germany has a very efficient transportation network from several container ports, has a central airport in Berlin, has a road network free of tolls, and is close to Netherlands that is a country with the largest ship chandlers and logistics providers in Europe. In addition, in West Germany there are three ship chandlers who supply all the German cruise companies and more others.

Another example is in repairing or ordering new spare parts. Cruise liner would prefer to unload an engine part that needs repair to Kusadasi for instance. They would choose Piraeus where the shipping and shipbuilding sectors are historical developed. They know that they can found more variety of alternatives. There are only some exceptions when there is an urgent item. In that case, they transporting it by airplane.

3.4.5 Customs Regulations

All the goods that are loaded in cruise liners need to be followed by customs documents. The customs procedures differ from country to country no matter if there are both in the European Union. Each product that is entered the borders is charged by VAT and duties depending the type and the usage. Ships are third countries as they sail in international seas and usually they do not pay any taxes or duties during the loading.

Some countries are trying to charge the additional items that are not part of the ship. These kinds of items may be the casino stores, the duty free shops, the beverages, the laptops and more. For instance, in Spain they announced that they are going to tax all food and beverages that are loaded from Spain ports and consumed onboard. Both Italy and Spain just started to tax the duty free items when these are loaded in their ports. In Greece, they tax every movement of casino stores from the distribution warehouse to each vessel.

In addition, in some cases port authorities demand extra documentation for items that are not from Europe. They do it in order to maximize the security for these goods but all these procedures increase the costs of loading. In Germany for instance only a stamp of the ship is required in order to release the document, while in Greece are required eight signatures. Along with customs authorities there are some other public services like veterinary control for containers that may block the goods. All the above are crucial elements that if managers will not take them in consideration, the costs and the dangers for missing loadings will be increased rapidly.

3.5 Conclusion

In this chapter, we mentioned the main characteristics of the cruise supply chain. In the first sub chapter we described the supply chain network by analyzing the involved members. We observed that cruise companies use one regional ship chandler as European distribution center for sending provisions from the global warehouse and from local suppliers. The degree of ship chandler's procurement is determined by cruise company's the purchasing policy. We mentioned that in the case of engine and hotel stores, cruise companies use more than one logistics provider in order to minimize the lead time of critical items and reduce the transportation costs. In the same sub chapter we described the main processes of cruise supply chain with placing the order and consolidation playing the most important role. Placing the order requires much information from all the onboard departments that have to deal with the uncertainty of demand and the limited storage capacity. In the second sub chapter we pointed out the main factors that determine the cruise supply chain management. There are all very important with worldwide operations and mobility of the delivery point being the most crucial. The relocation of the cruise liner during the year increases the complexity of the logistics flows and increases the lead-time. Another issue is guest's

characteristics that are not always the same and are able to create uncertainty of the demand. We have to mention that the information technology systems are very important as provides to the users crucial information for optimizing the supply chain. We observe that each department uses different system depending on the products characteristics. in the last sub chapter, we pointed out the factors that determine the selection of port of loading. The selection of port is very important in order to make a yearly schedule for the supplies. The selection is going to determine the transportation lead times, the time until the next replenishment, the place of consolidation and the selection of the suppliers.

4 Classification of Cruise Supplies

4.1 Introduction

In this chapter, we focus on our third research question that refers to the classification of the cruise supplies that required onboard. The classification is taking place in terms of the lead time, the average days until the next loading, the criticality and the last mile transportation mode. This classification gives us the ability to distinguish the cruise supplies in two main categories based on the criteria of the classification. We use these two large categories in the next two chapters where we make the comparison between two main supply chain networks. Based on the data that we provide in this chapter, we are able to better understand the structure of the onboard organization and logistics networks and find the room for either further coordination or outsourcing. As the factors that determine the data are many, in the first subchapter we make some assumptions. The initial categorization of the supplies is based on the main management departments. These departments place the order and receive the goods. In the third sub chapter, we define the criteria of the classification applied in cruise industry by providing some examples from the day-to-day cruise logistics. In the fourth sub chapter, we present the classification of the cruise supplies based on the main departments and we make some comments in terms of the lead time, in terms of average days until next loading and the last mode of transportation. Then we focus on the degree of coordination between different groups of products by analyzing the four stages of consolidation. Finally, we refer to the policies that cruise companies apply in order to increase the coordination in the supply chain.

4.2 Data Analysis

The data that we use for the classification of cruise supplies was collected from several sources. In Appendix A, we attach the questionnaire that we use in eighteen interviews with onboard officers and managers, the list of the vessels that we visit and the positions of each interviewer. We asked them to give us the accurate data, completing a table. The lead time, the criticality, the last miles transportation were in most of the cases similar. There were only some differentiates in small companies which are supplied mainly from local markets. In the case of the time between the loadings, we observed many fluctuations in food and beverages supplies, because of the different inventory capacities. One vessel with five thousands guests and crewmembers needs a weekly replenishment, while a medium sized ship can handle more than twenty-five days inventory. In addition, officers provided us the general structure of the onboard departments. The main departments are the bridge, the hotel and the engine

departments. In many cases, the food and beverage department has a separate manager but it is still under the hotel department. In some other cases, the food and beverage department is a separately department.

The second source for our data is the deeply analysis of purchasing orders, invoices and yearly schedules that we managed to get during our research in logistics providers and during the internship. Only few onboard officers were willing to provide us the yearly schedules of loadings. In Appendix E, we present the form of such a schedule and the data that we can achieve. As we can see in Appendix D, during the internship we had open interviews with twenty two officers who were willing to provide us all the information that we were needed. Exploring the purchasing orders and commercials invoices, we are able to get crucial data like the date of the order, the production lead time, the place of consolidation and the last mode of transportation. Combining these sources we are able to get the information that we need in order to make the classification. Finally, during the internship, author contacted with headquarters and few suppliers in order to make more clear some flows and confirm the data.

4.3 Assumptions

In order for our classification to be more accurate, we make some assumptions for the data that we use. First, we keep the food and beverage department separately. As we mention in the previous subchapter, some companies keep it separately and some others under the hotel department. This assumption is helpful for the next two chapters as well.

We have to mention that all the above data concerns the European region. The results of this research would be different in the case of Caribbean market where the majority of supplies are delivered by truck. In the case of the Asia and Australia market, companies use containers and airfreight in order to supply their vessels from both European and American centers.

Furthermore, we assume that the headquarters of the companies that we examine are in United States. We make this assumption because three American Groups control the 80% of the cruise companies. All these companies use global outsourced or not distribution centers in Miami. In the case of a Spanish company, the vast majority of the supplies would be from Spain and the transportation mode would be only trucks.

In addition, the lead time for non consumable engine, electrical and technical items that we present in our classification, is the minimum required in order for the goods to be delivered on time. These days are the required days in order to inform and collect the products from the suppliers. This lead time may vary from product to product. For instance, the lead time of a specific heavy spare part may be over seven months.

Finally, from our research, we conclude that the main concessionaires were boutiques, spa, art department, and casino. In some large companies with more activities, we

found more outsource companies in the field of entertainment, sports, photographs and more.

4.4 The Main Categories of Cruise Supplies

Cruise supplies have thousands of different codes. For instance, only food and beverage department uses 1,500 product codes while engine department over 800. The groups of supplies that a cruise liner requires are similar for all the companies. The main categories are similar as well with only some exceptions. We classify the cruise supplies in five categories based on the departments that place the orders. Each department is responsible to approve the orders from the sub offices, places the order and receives the goods onboard. These five categories are the food and beverage, the hotel stores, the engine parts, the bridge items and the concessionaire' products. All these categories are classified in several groups depending on the type of supplies, the lead time, the transportation mode, the replenishments and the criticality. In this sub chapter, we define all the groups of cruise supplies.

4.4.1 Food and Beverage

Food and beverage department is responsible not only for the consumables like food, soft drinks, wines and others. The department manages all the equipment and consumable goods that are required in order for the bar, restaurants, galleys and room bars, to get operated properly. Finally, we create a specific group of products that refers to the urgent orders as the information and logistics flow for these products defer from the other groups.

Fresh, dairy, and fish: This group of products is the most important in the food and beverage category. All three types of goods are perishable. The product life is short and cruise liners need to load them more recently than the other foods and beverages. The main products are fresh vegetables, yogurts, fresh milk, special cheeses, fruits, fresh fishes, and live lobsters. The supply chain of these products has to be short in order for the expired date to cover the next loading. Usually companies have a regional ship chandler who covers the most important European cruise ports in maximum four days.

Dry and frozen foods and beverages: In this category, we find the majority of the products that guests consume during a cruise. Onboard managers divide them in four subcategories in terms of the storage characteristics. First are the frozen goods like meat, chicken, and fish, then the dry stores like pasta and rice, third the beverages like coca colas, whiskey and water, and finally wines that are very expensive. All the above products are shipped either from the European warehouse or from the global warehouse. The warehouse of origin depends on the product availability, the inventory

level in both centers, the location of the supplier, the brand, the port of loading and more.

Consumable goods: These goods are the additional provisions that are needed in order for all involved departments to be operated properly and efficient. Each bar, restaurant and galley requires some categories of goods except from the products that they serve. These categories are paper for several usages, plastic like garbage bags and chemicals like cleaning liquids. In addition, this group includes all the products that onboard management offices require. These goods have usually standard supplier.

Urgent Orders: All the above loadings have been scheduled months before the loading day. The lead time in most of the cases is from two weeks to over two months. In the cases of either an overconsumption or a miss of loading or an expiration of a product, cruise liners send a note directly to local ship chandlers. Manly these are fruits and vegetables. These chandlers have direct access to producers and vendors in order to minimize the lead time.

Equipment: This sub category includes all the equipment that all bars and restaurants need in order to be operated properly. The most important are all the electrical equipment like washing machines, the service equipment like dishes, the facility's equipment like furniture and mores. Cruise liners receive these types of products usually every two loadings. The department that places the order for this equipment is the food and beverage.

4.4.2 Hotel Stores

Uniforms: All the personnel need several types of uniforms depending on the position that are operated. There are also over two different types of uniforms per crewmember. No matter of the department that are finally delivered, the storage room usually controlled by the main laundry that is in charge of hotel controller. Uniforms are not consumable items but the replenishment is frequent. There are some companies that are mainly operate in the cruise industry. The loadings are a combination of manufacture uniforms for engine, hotel uniforms, restaurants uniforms and navy uniforms.

Chemicals: Cruise liners need some categories of chemicals mainly for cleaning activities. The per day consumption of these products is more or less the same in each itinerary and the replenishment is frequent. Cruise companies usually use one producer for chemicals. Depending the port of loading these products either shipped by truck directly from company's warehouse or via logistics provider. We divide the chemicals in those that are for laundries and are ordered from food and beverage department, and those that are for the hotel and are ordered from hotel controller.

Hotel Stores: In this subcategory, we classify the items that the hotel requires. Taking in consideration the fact that cruise liners may be six stars hotels, the consumable products and the equipment that is needed, require the maximum quality and

availability. These stores are consolidated in company's logistics provider in United States and are shipped globally.

4.4.3 Engine Parts

This category of products is logistical the most interesting. The suppliers are located globally and the criticality of these items is high. Cruise companies trying to minimize the lead time and use more than one logistics providers who are located in the most important spare parts markets. The transportation mode depends on the location of the part and the criticality. In the case that a spare part needs immediate loading, an airfreight is chosen wherever the ship is located.

Technical parts for hotel: This subcategory includes all the technical spare parts and equipment that is needed for the hotel. These may be the air-condition system, the fire system and more. The suppliers are usually related with the manufacturers of the systems who deliver the items to the logistics providers. These goods follow the same supply chain with the engine and electrical parts but are separated onboard.

Engine and Electrical parts: The most important, most expensive, most critical, most slow moving items are classified in this group of items. There can be small spare parts of 500 grams to big wooden boxes of three tones. In addition, the lead time of these items may be from few days to years. Engine and electrical items are most expensive goods onboard. The varieties of the goods make the supply chain of this group challenging. This is the reason why cruise companies use more than one logistics providers who have a global network. These providers are closely to the largest supply of the industry.

Chemicals: This group of products has nothing to do with the chemicals that we mention above. It refers to the chemicals that are need in the engine, electrical and technical departments in order for the equipment and services working properly. These consumables goods have frequent and predictable replenishments and are loaded either directly from the local sub-warehouse or via the same logistics providers with above parts.

Fuel and oil: This is an autonomous group of products that are needed in order for the cruise liner to be operated. The main product is the fuel that is supplied by feeder ships in the main ports. In some cases, tanker trucks are used in order to supply small vessels with low consumption and limited storage capacity. Ships need two types of oil for their efficient operation. The first type needs frequent replenishments and the second one has a reorder level. Cruise companies use traders in order to achieve the best price in stock market. The price of the oil determines the quantity of each loading and the time until next loading.

4.4.4 Bridge

This category refers to all the supplies that have to do with the functions of the cruise liner as a vessel. Each of the three officers above the captain has one field of responsibility. The first is the safety management that deals with security and safety issues, the second is the environmental management that deals mainly with waste management, and finally deck management that deals with maintenances of all external part of the vessel.

Environmental goods: Environmental goods are all items and consumables that are need in waste and pest management. The replenishment of the environmental items goods is not frequent and managers keep their owned safety inventory. As the items are not for the guests, company may not always use stable suppliers and they are changing with the reposition of the ship. The consumable products like plastic bags are consolidated with other departments' orders.

Deck and Security stores: Safety of guests, ship and crew is the first priority of every cruise company. Especially after MS Costa Concordia's sinking that had a negative impact on the industry, companies focused more on safety issues. The problem of safety items and spare parts is the long lead time as the suppliers are stable and few in the market. In the case of the deck stores, the majority of the products are consumables. Officer keeps its inventory and has a reorder point. Usually the suppliers are determined by the region that ship is operated.

4.4.5 Concessionaires

Cruise companies use to outsource some activities that need core business and a specific supply network in order to offer quality services to guests. In addition, these are activates that depend on the individual consumption and the cost of these services is not included in the cruise packs. Usually these activities are the casinos, boutiques, spa, specific sports activities, art galleries and more. Cruise company take a percentage of these activities, either as percentage of the profits like in casino or like a standard price per person per day like in boutiques. In addition they pay for the accommodation of the personnel.

Casino: Logistical, casino is the less important department of a cruise liner. The needs of a casino are the machine slots that are standard, some spare parts for the equipment and some marks. The only consumables are on the office. The casino companies operate casinos in both landside and onboard. They have one global or in some case two regional offices where manage the supplies.

Spa: The spa shops load mainly consumable goods. The cruise company provides the equipment and spa company supplies the store with all the goods that required. The replenishment are frequent but the quantities are small. Door to door logistics providers supply the vessels globally, usually by air.

Boutiques: There are some large corporations that operate the duty free boutiques in both shipping and airline industry. They have their own warehouses in Europe and supply the vessels monthly. They use an information technology system, in order to control the inventories and place centrally the orders. The order is placed from the company and they have a schedule for the whole year. In some cases, in busy markets with local products like Eastern Mediterranean, companies have an area agent. The agent supplies vessels with local goods and use a warehouse as a local distribution center.

Art: This sub category refers to a department that exhibits and sells paintings to guests. Either there are original or authorized copies, these items are extremely expensive, a fast and secure supply chain is required. These companies use a global distribution center and the replenishments depend on the sails. Art products are transferred in special secured boxes by airfreight.

4.5 Criteria of Classification

We make the classification of the supplies in terms of lead time, days until next loading, criticality and last mode of transportation, in order to be able in the next chapter to make the distinction of the cruise supply chain. We select these specific criteria in order to find the room for coordination between different groups of products and departments. In order to make this coordination and consolidation, we need to know this information for every group of supplies.

4.5.1 Lead Time

As lead time we can define the number of days, months, years between the place of the order and the loading of the products. The lead time depends on two factors. The first is the availability of the product in the producer, manufacturer, suppliers or vendors. If the product is in the stock like potatoes, the lead time may be only few days. If the product is not available like a specific engine part that needs replenishment, the lead time for manufacturing the item, may be months. The second factor is the lead time in the logistics flow. This time depends on the number of involved members, the transportation modes that are used and most importantly the location of the port of loading. For instance, if the distribution center is in Netherlands, the transportation time to Amsterdam is two hours, and to Dubai one month.

Lead time is the most important element of the cruise supply chain. It is used for managers to draw an efficient yearly schedule of loadings. In some cases, this procedure is straightforward like in food and beverage planning, and in others very difficult like in engine spare parts planning. Cruise companies try to maximize the storerooms in their ships in order to increase the safety inventory stock. The safety

inventory is used in order to satisfy the exceed demand and covers the missed or wrong loadings. Cruise liners and mainly departments such as safety, environmental and engine, have classified their product in terms of the criticality. The most critical items have to be onboard.

4.5.2 Days until the Next Loading

This criterion is very important as determines the quantity of each order. The numbers of days until the next loading are determined by the maximum onboard inventory capacity, the perishability of the products, the itinerary and the location of the port of loading. The data that we use in table e refer to the average number of days until the next loading based on the assumptions that we make in previous subchapter. We do not take in account the repositions of the vessels to other regions. For instance if Piraeus is last European port of call before ship sails to Middle East, the loading will be the maximum can be. Cruise companies take in consideration that factor and add logistical important ports in their Middle East, Asia and Australian itineraries. The inventory capacity of each vessels depends on the consumption per day for all passenger and the number of store rooms for each category of products. In addition, the type of product is very important factor as for instance fresh products with short life need less than ten days replenishments.

4.5.3 Criticality of the Product

The criticality of the product refers to the degree of the importance of each group of products. We classify the cruise supplies in two classes. The first, includes all the goods that are required in order for the ship to operated with safe at the scheduled time framework. This class, named H(hight), refers to the engine spare parts, safety equipment, and environmental goods. In addition, we add in this class both some consumable goods with specific characteristics like short product life and some urgent orders. The second class M(medium) includes all the other supplies. We didn't use the third class L(low) because the final customer is the cruiser. Guests have high standards in quality and availability of the services. In a cruise liner the answer "I am sorry Miss but we don't have It." does not appear. All the consumable goods and the required equipment are critical.

4.5.4 Last Mile Transportation Mode

This criterion refers to the last mode of transportation that cruise companies and logistics providers use. There are three different options: by air, by truck and by container. The first main factor that determines the selection of the mode of last mile transportation is the location of the place of origin. This can be either global or regional

distribution center, or regional ship chandler, or logistics provider, or manufacturer, or supplier. The second main factor is the location of the port of loading, the available local infrastructures, and the authorities. For instance, if the port of loading is Dubai, all items should be transferred either by container or by airfreight.

Another factor is the criticality of the product. The criterion of the criticality influence the selection of the mode but only with combination with the above factors. The urgent orders from long distances are transported mainly by airfreight while goods with low uncertainty of demand are transported by container. There are some exceptions like a Spanish cruise company that has her own air fleet. In that case, the whole engine parts are consolidated in Spain and are transported by airfreight. We need to mention that actually the final mode of transportation of all goods is the truck. Container is offloaded in container terminal and from there is transferred by truck to the cruise terminal and airfreight by air to the city airport and from there by truck to agent's warehouse for consolidation and from there by truck to the cruise terminal. In our classification we use as delivery point the port city.

4.6 Results and Analysis

4.6.1 Results

Category	Group of items	Lead time	Average until loading	days next	Criticality	Last mode of transportation
Food and Beverage	Fresh, Dairy, Fish	15	10		H	Truck
	Dry and Frozen foods and Beverages from EDC	70	19		M	Truck
	Dry and Frozen foods and Beverages US Brands	70	19		M	Container
	Consumable goods	70	19		M	Truck and Container
	Urgent Orders - Local Ship Chandlers	3	Rarely		H	Truck
	Equipment	60	45		M	Truck
	Chemicals for laundries	14	12		M	Truck
Hotel	Uniforms	60	30		M	Container
	Chemicals	14	12		H	Truck
	Hotel Stores and Equipment	60	45		M	Container
Engine	Engine and Electrical Parts from American Suppliers	80	45		M	Container
	Last minute Orders /Urgent Orders/ Small Lot Size	10	30		H	Airfreight
	Technical for Hotel	80	45		M	Container
	From European Suppliers	10	30		H	Truck
	Chemicals	19	30		M	Truck
	Fuel and oil	Spot Market	15-20		H	Feeder Ships
Bridge	Safety	90	60		H	Airfreight
	Environmental	14	60		H	Truck
	Deck	45	30		M	Truck
Concessions	Casino	7	60		M	Airfreight
	Spa	30	60		M	Airfreight
	Boutique	25	28		M	Truck
	Art	7	30		M	Airfreight

Table 3: Classification of Cruise Supplies, Author

Observing the table 3, we can make some statements about the classification of the cruise supplies. The figures for every group of supplies are accurate for every product that is part of this group. We have to mention that the days in our classification are calendar days.

The leadtime of each group of products is usually directly connected with the last mile transportation. In order for an American product to be delivered in a European port, need over two months for collection, consolidation, documentation, clearance, transportation, clearance again and shipping to the cruise liner. In the case of the road transportation, the lead time varies as depends on the strategy that cruise company follows.

According to our assumption, company uses European and Global distribution centers for food and beverages, the order is requested two months in advance in order to split the order. Still, in shipments by truck, last minute orders are possible as the truck needs only few days for the transportation. This is the main difference between truck and container. If we did not have this assumption, the lead time for road transportation would be fifteen days, like the fresh produce. In the case that the port of loading is an island, the ferry transportation from the hinterland increases the lead time rapidly.

Another observation is on products that are transported by airfreight. These products are either urgent that require the minimum lead time, or last minute order that did not involved in the container and truck shipments, or expensive its, or small lot sized orders. In all the above cases, the time for transportation is maximum three days and the lead time depends on the availability of the product. For instance, the group of safety items have 90 days leadtime. Even if companies use the airfreight, the leadtime for the production is the 60% more than two months. The oligopolistic market on the equipment is one of the main reasons. The reason for the In general, airfreight is the fastest mode of transportation for all groups of products but the most expensive. This is the reason why it is preferred as a transportation mode in expensive items like concessionaires, safety items and spare parts.

Focusing on the average days until the next loading, we can classify the groups of products in four categorize. The first are the consumable goods including all food and beverages, chemicals, paper and plastics need frequent replenishment. The consumption of these products is daily and stable and all the replenishments are scheduled more than a year before the loading. The next category contains goods with monthly loading. In this category we find some spare parts with small lead time, some consumables that need monthly replenishment and some concessions. The third level of goods is mainly refers to the engine, electrical and technical items, and the hotel equipment. These two group of products usually use the same logistics providers and are consolidated by sharing containers and trucks. In the last category we observe some concessionaires with small lot sizes, the safety equipment and the environmental items.

Concerning the classification in terms of the criticality of each group of supplies we can make two comments. The first is that that the criticality of the product is strongly related with the lead time and lightly connected with transportation mode. Usually the critical

items are shipped from regional or local supplier in order to minimize the lead time. In addition, the scheduled shipment is usually by truck. We have to underline one more time that in the case of an urgent order, the products become critical and usually are shipped by airfreight.

4.6.2 Consolidations between Different Groups

Focusing on the transportation mode in comparison with the replenishment, we conclude that four stages of consolidations appear in the cruise logistics. The first is in the *suppliers*. Suppliers receive the order from the cruise company, collect all the items from manufacturers or producers, and build the order. The Purchase Order (PO) that supplier receives from the company include instruction for the place of delivery. This place is either the logistics provider or the port agent. In the case of food and beverage supplies this place is the distribution center/ship chandler of the company.

Logistics providers and *ship chandlers* or *distribution centers* are the second stage of consolidation. This is the place where all the orders are stored waiting for the day of loading in trucks and containers. The shipments are scheduled such as the warehouse to be empty for next orders. Containers, trucks and airfreights have as consignee the port agent.

In the case that the shipments arrive prior the day of loading in the customs authorities either in ports or in airports, *agent* provide logistics service to the companies. This is the third stage of consolidation. Agents use a local logistics provider in order to clear the goods from customs authorities, collect, consolidate, and deliver the goods to the cruise liner. In some cases, these providers have direct contracts with regional logistics providers in order to achieve further coordination. In that case, local providers receive products in big lots by trucks or containers and forward them in small parcels, in several ships.

The fourth stage is *between logistics providers*. During our research there were some cases where two competitive companies shared the transportation costs from the hinterland to the loading port. For instance, if the port of loading is in Istanbul and the goods are consolidated both in Italy and in Germany, the German truck is going to pick up the goods from Italy as well. In addition, we noticed some collaborations between logistics providers with equipment and spare parts, and regional ship chandlers with food and beverages. For instance, in the case that are both located in Netherland s and they transfer less than full truck. Finally, in some cases in Piraeus, one truck or container contained supplies for more than one vessel. This is taking place in busy cruise ports with many shipments.

Analyzing the proofs of deliveries, focusing on the packing lists and combing data from information technology systems, we observed that in the three final stages, companies try to consolidate goods from different group of products. Looking at lead time data in

comparison with the last mile transportation we notice that spare engine part and hotel equipment are usually shipped in the same container from American logistics providers. In addition we observe that some kind of products that are ordered from several departments are shipped together. For instance, companies usually use one company for supplying chemicals for all departments.

4.6.3 Degree of coordination in the Cruise Supply Chain

In this sub chapter we focus on the strategies that cruise companies already apply in order to increase the coordination in supply chain network and increase the efficiency. During our interviews with supply chain managers from three different sized companies and managers on several logistics companies, we conclude that the degree of coordination is already high in the vast majority of the companies.

The most important element of the cruise logistics is the acquisitions between cruise companies. As we mention in chapter one, there are two large American groups of companies that control the 73% of the industry. Each of these groups have a supply chain department that controls the loadings from all the companies. The department consolidates all the PO's and make a schedule for all vessels and companies.

We need to mention that cruise companies use several partners in the European region. In the field of engine parts, companies use more than one logistics provider. They do this in order to decrease the lot sizes and the lead time. For instance, a cruise company uses an Italian provider for Italian suppliers and a German provider for North European suppliers. In addition, Cruise companies make contracts with American suppliers that have local warehouses in each large port. This policy reduces the lead time for these products in two weeks from two months. The order goes to the headquarters that forward the it to the local warehouses. In that case, headquarters keep the inventory and arrange the replenishments from the global distribution center.

Another important factor that increases the coordination in cruise industry is the position of the supply chain coordinator. He gets all the information for each order that needs to be loaded. He has a network and separates the orders. Then he informs the ships of the expected loadings and gets the feedback from the loading. The coordinator arranges the transportation flows of engine, hotel and food supplies. this position is very important and usually are employees who have strong background in the field.

A critical factor that determines the degree of coordination is the information systems that companies use. The information sharing between the headquarters with the vessel, the logistics providers, the ship chandlers and the suppliers is really very important. They optimize the information flows, they control the inventories, they check the availabilities, they control the shipments by tracking, get the detailed information for each stage of the supply chain and spread information for the demand. It is very important all involved members to use the same reference numbers that followed by several information.

Finally, frequent replenishments especially for products with uncertainty of demand increase the coordination. Frequent replenishments means small lot sizes and reduced lead times. Creating a schedule with many loadings with different transportation modes, companies organize the shipments better and get able to satisfy last minute orders. In addition, with more replenishments companies avoid the bullwhip effect.

4.7 Conclusion

In this chapter we made a classification of the main supplies that a cruise liner needs. Depending on the departments that manage and place the orders, we concluded in twenty-two different groups of products. Using data for the leadtimes, days until the next loading, criticality and last mode of transportation, we classify the groups of supplies and we make analyze the results. We observe that the criticality of the good and the production leadtime, affect the last mode of transportation. We also conclude that all the products from the American warehouses are transported by container except from some urgent that are transported by airfreight. In addition, we noticed that some goods like chemicals are in more than one category. In that case, the orders are placed from different departments, but are consolidated for the loading. The degree of consolidation between different group of supplies is very high in cruise logistics as companies try to minimize the last mile transportation costs. Finally, we observe that hotel stores and engine parts use the same days until the next loading as they follow the same transportation flow while products from food and beverage department need a frequent replenishment. The degree of coordination in the case of spare parts and hotel items is very high while in the case of food and beverages , ship chandlers have an upgraded role. In the next chapter, we focus more on that distinction between these flows and we will find the room for outsourcing activities.

5 Distinction of Cruise Supply Chain in Two Networks

5.1 Introduction

In the previous chapter, we made a classification of the most important goods that a cruise liner needs in order to provide the best services to its guests. From the lead times and the transportation modes, we concluded that different transportation flows are followed for each group of products. In this chapter we make a distinction between food and beverage logistics and all engine and hotel sores and equipment. In our literature review, we mentioned the main characteristics of both food supply chain management and spare parts supply chain management. We saw that food supply chain requires efficient, well organized network with several quality controls.

On the other hand, spare parts and critical items require an effective network with minimum participants, difficulties in scheduling, large lead times in the manufacturer's stage and faster response in logistical stage. In this chapter, we try to analyze the main information and transportation flows that involved in the cruise supply chains. During our research in more than thirty loadings, we faced some extremely rarely flows that we do not include in the next sub chapter. These were few direct flows, chemicals for instance, from the manufacturer to the ship without taking account the port agent.

5.2 Food and Beverage Supply Chain

In this sub chapter, we describe the possible logistical paths that a food and beverage product can follow before this arrives at loading port. After collecting information during our research from different sized cruise companies, we conclude that there are four types of distribution networks. The first type is shipping the goods from world distribution center, the second from Regional distribution center, the third from local market, and the fourth from other cruise liners (Figure). The majority of companies, depending on their supply chain strategy, use a combination of these alternatives in order to optimize their logistics network.

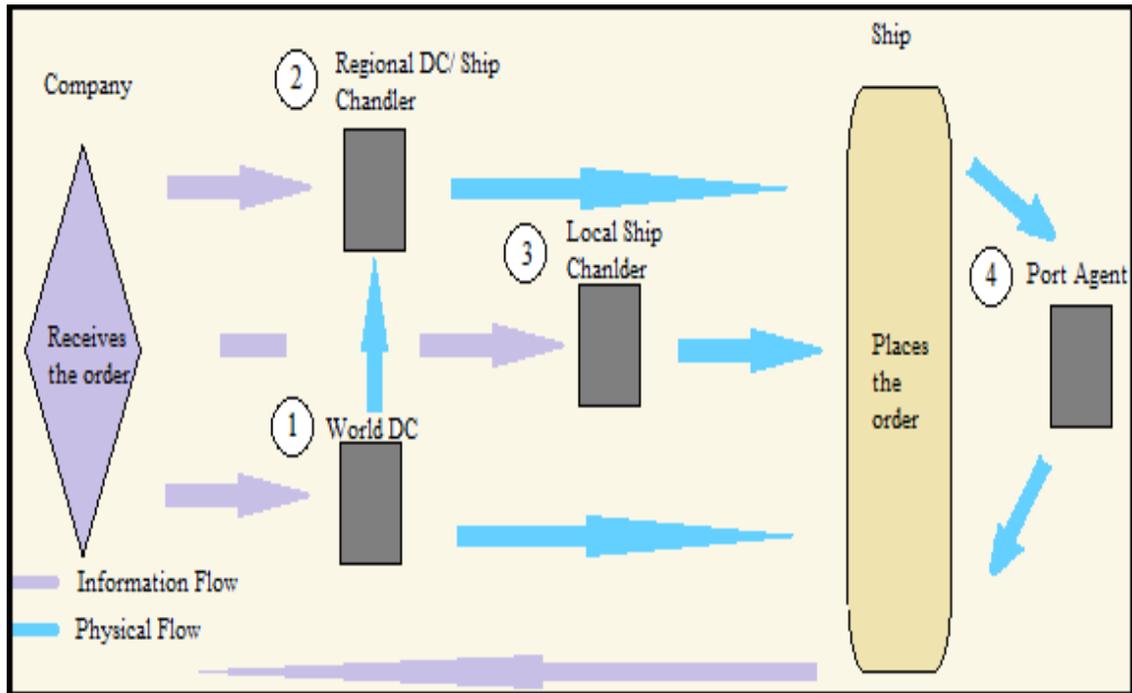


Figure 6: Spare parts and hotel stores supply chain, Author

5.2.1 Shipping from Global Distribution Center

The majority of the cruise companies use a distribution in order to store non-perishable dry and frozen products. The location of the warehouse depends on the location of the headquarters. For instance, a Miami based cruise company has her warehouse in Florida and a German cruise company in Bremen. In these warehouses, companies store products in large quantities in order to increase the availability of the products, minimize the inbound and outbound transportation costs, and achieve the maximum consolidation..

At the initial stage, food and beverage manager approves the orders from every onboard department and forwards the whole order to the supply chain or procurement department of the company. As soon as the department receives the order, they divided it in three parts. The first goes to the global distribution center, the second in regional ship chandlers and the third to local ship chandlers. In some large companies, part of the order goes directly to the vendors who are responsible to deliver the goods either directly to the ship chandlers. The factor that determine the split of the order are the availability of the product, the procurement cost, the inventory level of warehouses, the type of the products and the perishability

All suppliers are responsible to deliver the goods to the warehouse, according to a yearly schedule that they have agreed. After consolidating the order, goods are built in

pallets and are loaded into frozen and dry containers. In world distribution center, the main supplies are from local market with brands that American passengers demand. In addition, the health and customs control are more convenient and certified in United States (Figure cons). These containers are shipped directly to the closest container terminal to the port of loading. For instance, in the case that Rostock is the port of loading, the container is shipped to Bremen or Hamburg and from there by truck to the ship. The container has to be at least one day prior to the ship's arrival, as the customs procedures usually need two working days. In addition, global distribution centers replenish the regional warehouses. For instance, a small group of cruise companies transfers over 40 dry and frozen containers from Global to European distribution center in order to optimize the inventory and minimize the last mile transportation time.

5.2.2 Shipping from European Ship Chandler

As we mentioned above, cruise companies use the facilities of one regional ship chandler as a regional warehouse. Still these companies have a procurement department that satisfies the vast majority of the order. They receive the order from the department and they check the availability of the products both in their storage and to the company's inventory. If they have shortage, they order from their suppliers who have the obligation to deliver the goods in their warehouse. In addition, they consolidate other orders from local producers who have direct contract with cruise company (Figure 6).

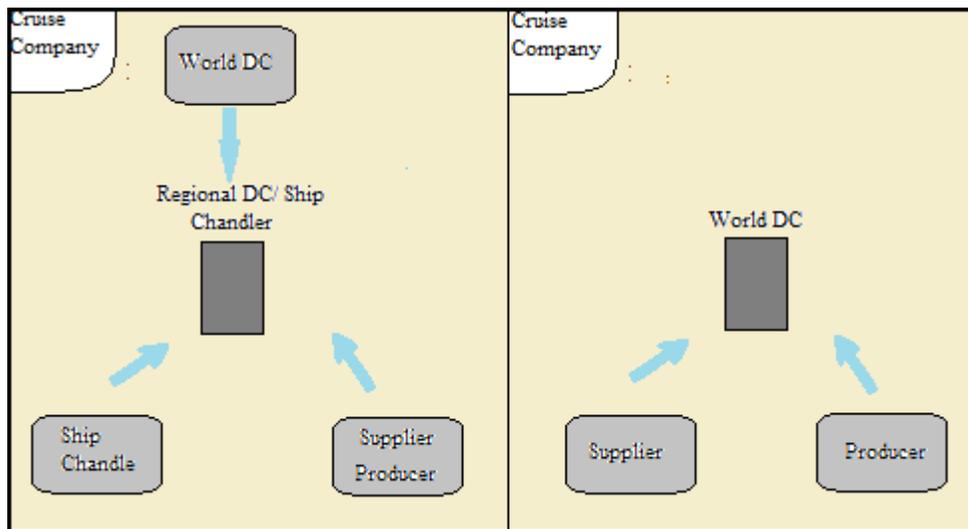


Figure 7: Consolidation in Company's Warehouses (Author)

Regional warehouses receive the containers from world distribution centers and storage them in the respective storage areas. In addition, they receive goods from both local markets and from worldwide. Cruise companies have to offer the same products in same quality during the whole year and use producers from worldwide. After

consolidating and packing the whole order they transport them by trucks to the final destinations. In the case that the connection by truck is not possible, like in Lemesol in Cyprus, they transport them by container. Regional warehouses are use also for reverse logistics of spare parts, documents and other kinds of exports. We have to mention that usually companies use a separate ship chandler for fresh products. The perishability of the fruits and beverages requires a core business chandler. The same with fresh fish products.

5.2.3 Shipped from local Ship Chandler

Logistical, loading from local market is like shipping from regional ship chandlers in a smaller scale. Local ship chandlers receive the order only two three days in advance, go to their vendors, buy in spot market and sell to the ship. Either the transportation is taking place directly from local vendors and manufacturers, or ship chandlers storage in their owned facilities the products for only few days, consolidate the orders and transfer them at the loading day. Some companies avoid local suppliers, others go to spot market only for value for money products, and others buy only locally..

5.2.4 Shipped from other Cruise Liner

This is a relative new type of loading in cruise logistics. Cruise companies have increased their fleet rapidly the last decade and operate more than one ships in the same region. In addition, as we mention in previous chapters, many cruise companies merged from large groups and used one main supply chain management for all. For instance, one group of seven ships may operate three ships in Baltic at the same season. The required leadtime for an urgent order, the high costs of local supplies and the high transportation costs are the main reasons for this strategy. In some cases, as managers in the industry know each other there are transfers between different competitive companies.

In this procedure, except from the two vessels some other third parties may get involved. In the case that ships are at the same day in the same port, the transfer needs only a truck. In the case that the shipper ship will be in the port after a period, port agent is involved for customs clearance as well as a logistics provider for storing the goods. In the case that the ship is operated in other location, regional distribution centers and ship chandlers are involved by applying reverse logistics. For urgent order and lack of specific goods, managers first ask other ships if there is availability, and then go to local suppliers.

5.3 Engine and Hotel Stores Supply Chain

In this subsector, we point out the different information and physical flows for engine parts and hotel stores. In the previous chapter we noticed that cruise companies

consolidate in common logistics providers products from different groups and categories. The main flows that we observe are the shipment from the logistics provider to the ship, the direct shipment from the supplier to the ship via the port agent and the shipment from other cruise liner (Figure 8). Finally, we have to mention the reverse logistics that is very usual in engine spare parts (Figure 9).

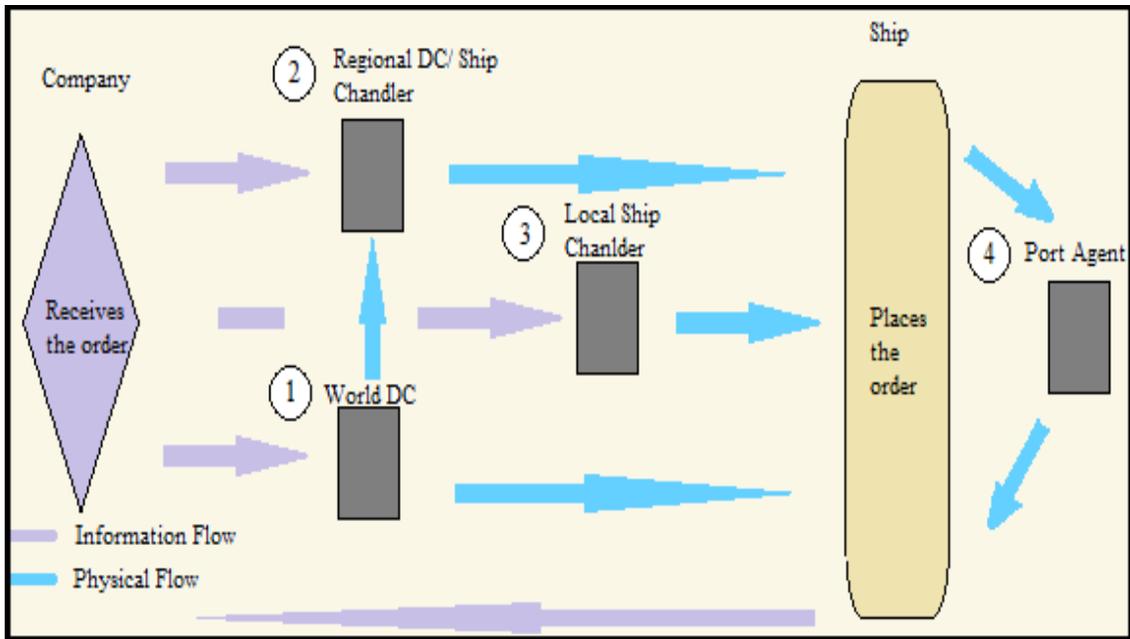


Figure 8: Spare Parts and Hotel Stores Supply Chain Network (Author)

5.3.1 Shipping from Logistics Providers

At the initial stage, chief engineer and hotel controller approve the orders that they receive from several departments like engine room, technical department, housekeeping department. They forward the order to the cruise company's headquarters that creates the purchasing orders (PO) and sends them globally to the suppliers. Purchasing order gives directions to the suppliers including the delivery point, the latest date of delivery and some time the transportation mode. Suppliers deliver the goods to the closest logistics provider. Cruise companies use more than one provider in each region. They do this in order to decrease the transportation lead time and costs.

Logistics providers have agreed on a specific yearly schedule with cruise companies. In these schedule, there are usually monthly shipments by truck or container, and some air shipments for critical, last minutes products with shorter lead time. The location of the port of course is very important factor for the transportation mode.

At this point, we would like to separate the final transportation flow. In the case of an air shipment, the goods are collected from the port agent, are consolidated with other deliveries and are loaded up on arrival. For instance, a shipment with only 100 kilos from Rotterdam to Piraeus and with no room for consolidation should be transferred by airfreight. Similar flows have the goods that are transported by small trucks and arrive in port prior to the loading day. The second flow refers to the direct shipment from logistics provider's warehouse directly to the ship by using container for American products and trucks for European products.

5.3.2 Shipping Directly from Supplier via the Port Agent

The second alternative transportation flow is a direct shipment from the supplier to the cruise liner. Some global suppliers have local representatives in strategically European ports. For instance, the most popular chemical provider in cruise industry, has local warehouses in Piraeus, in Civitavecchia, in Barcelona and other ports. In that case the supplier delivers directly the cruise ship. They consolidate their order in their warehouse and they deliver the goods to the vessel. In the case that the goods are transported by air or by truck but arrive in port prior to the ship's arrival, the port agent consolidates them in his warehouse.

5.3.3 Shipping from other Cruise Liner

The procedure is similar with the one on food and beverage supply chain. This transportation flow is not very usual in the engine parts as each ship has different systems. There are some exceptions in large companies with some classes of sister vessels. On the other hand, hotel stores are similar between the ships of the company. A quick tour in the hotel storeroom was enough to understand that the intra transfers are frequent. Another important difference is that hotel and engine items are dry cargo and do not request specific warehouse. This fact reduces the costs of transfers and makes them easier.

5.3.4 Reverse Logistics

During our research, we did not observe any reverse logistics in food and beverage department. The main reasons are both that in every loading there are no many new products and that the value per item is extremely low in comparison with the costs of

reverse transportation. In the case of the engine and hotel items, the value and the criticality of each part may be very high. In general, we can classify the cases of reverse logistics in two categories.

The first category refers to the wrong deliveries. In that case, ship informs the headquarters for the wrong loading and company makes a claim to supplier. If supplier confirms his mistake, they arrange the loading of the correct item and the offloading of the wrong delivery. Usually supplier checks the itineraries of the vessel and kindly requests to offload the item in the closest to its warehouse port of call. The second category refers to the spare parts that need repair. These items return to the ship either in the same day if the repair shop is in the port of call or after several days or months in another loading port,

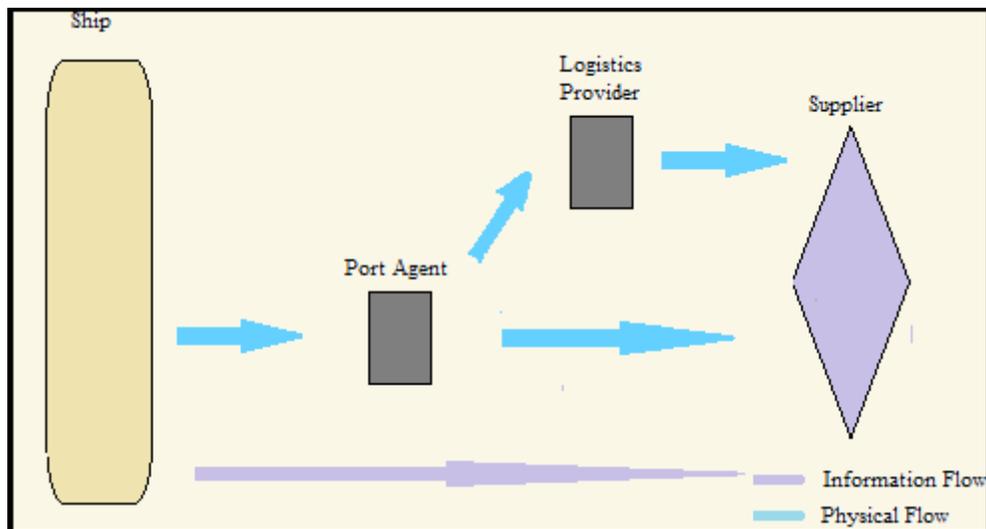


Figure 9: Reverse Logistics in Engine Parts and Hotel Stores Supply Chain Network, Author

Cruise liner creates a landing manifest that includes all the information for both customs authorities and port agent. Port agent arranges the customs clearance of the goods and stores them until the forwarder pick them up. The transportation flow depends on the receiver and the company's instructions in the landing manifest. Either the logistics provider receives the goods from the port agent and forwards them to the supplier, or the agent forward the goods directly to the supplier either by air or by truck. We have to mention that the cost of reverse logistics in cruise sector can be extremely high depending the location of both cruise liner and supplier. This is a reason why each item is characterized by its code, its discretion, and its photos.

5.4 Conclusion

Characteristics	Engine parts and hotel stores Supply Chain	Food and Beverages Supply Chain
Sourcing	Directly from the Supplier	From Ship Chandler, not from Producer
Consolidation	Company determines the Consolidation Point. More than one in the European Region	Agreements Between Ship Chandlers. Usually one for each type of goods
Transportation	Multiple modes of transportation. Combinations	Trucks and Containers directly to the vessel
Leadtimes	Fluctuated, depending on the item	Stable without uncertainty
Criticality	High, especially in urgent orders	Limited. Only in the case of missing orders
Reverse logistics	Many missing orders, repairs and tests	Limited, only between ships
Scheduling	Exists and depends on the orders.	Stable. Very well organized Supply Chain

Table 4. The main Differences between the two Supply Chain networks. Author

Table 4 illustrates the main differences between the food and beverage supply chain and the engine and hotel stores supply chain. Both supply chains use a third party in order to consolidate their goods and outsource the outbound transportation. In addition, they both use regional and global warehouses depending on the place of origin of the goods. We conclude that the food and beverage supply chain is well organized with yearly schedules, stable network, few critical items, and similar products without many fluctuations on the consumption. On the other hand, spare parts and hotels stores use many different suppliers from worldwide, many regional logistics providers, high transportation costs by airfreight, expensive items, reverse logistics, high critical goods, long lead time and many urgent orders that destroy the schedule.

The nature and the characteristics of the products in two supply chains are the main reasons for the distinction. Consumable products like food, drinks, chemicals that have more or less stable and predictable consumption, can manage and schedule the supply chain from the producer to the final consumer. On the other hand, products like engine spare parts and hotel stores are high valued critical goods, with high inventory cost. As a result the lead time for these items is very long and the ability of making a yearly schedule is limited.

The optimal way of organizing the cruise supply chain is distinguishing of the cruise supply chain in two networks. The integration in engine and hotel stores is very high and cruise company continuously optimize the supply chain management. For food and beverages, the distinction of procurement and logistical process, creates a room for either further integration to the cruise company or completely outsourcing to third parties providers. In chapter 6 we focus on that trade off. The optimization of the cruise supply chain management

6 Outsourcing decision making of Food and Beverage Department

6.1 Introduction

In the previous chapters, we answered our research sub questions analyzing the cruise supply chain, making the classification of the supplies and distinguishing the supply chain in two networks. In this chapter we use all the above conclusions in order to analyze and make suggestions on the main research question regarding the outsourcing of the onboard and landside processes. The information that we use in order to make the analysis and answer our research question, collected from interviews with food and beverage managers in outsourced departments and manager directors from cruise companies that outsource the department. We got the opinion both from third party provider and from cruise company. Unfortunately, cruise companies could not provide us the contract but they were willing to describe it without values and costs. In addition, during the internship, author focused on daily aspects that are relative with the outsourcing. After collecting the information, author builds the optimal profile of the third party that is going to provide the onboard and landside services. This is not a real company but the profile of each third party that would be able to manage the department. Then, we analyze the factors that determine the outsourcing decision making, the relationship between the provider and the cruise company and finally the advantages and disadvantages from such a decision. The structure of the advantages and disadvantages are results mainly from our research but also from the analysis that Chopra and Meindl make (2007), applied to our issue.

6.2 Structure and Characteristics of such a Third Party

Outsourcing refers to the processes that are provided by third party companies. In cruise industry, outsourcing the supply chain processes is very usual. Cruise companies use a regional ship chandler for all the provisions who operates as logistics provider as well. In our case, we examine the functions of a company which provide supply chain and onboard operations. It is actually like a large concessionaire that we mention in chapter three that arrange the orders, the logistics and the onboard processes. In this subchapter we mention the main characteristics and the structure of such a provider and we divide in two groups of services. The mainland services and the onboard services.

6.2.1 Landside Services

The structure of the company in the landside operations is similar with the structure of a ship chandler. In the most of the cases ship chandlers take the control of the outsourcing department. There are some differences both in the network and in the logistics processes. The main difference is that this company is responsible to provide the same services globally. Companies that do not outsource the whole department,

use different regional chandlers and providers for supplying their vessels. The main departments of head office are the human resources department, the operations, logistics, the purchasing, and the risk management department.

In the Human resources department, company uses some crew agents worldwide in order to send them to the vessels. Staff in the logistics centers is hired directly from the department. This department is one of the main differences with other chandlers. Managing and organizing crewmembers is a very difficult process. The policy of these companies is a rotation program between different cruise liners. Crewmember stays for six months in one vessels, then two months off and then six months in another vessel.

The logistics department is responsible for the transportation and storage network of the company. As the majority of the companies have American guests, American market becomes the first source. In order to reduce the transportation costs per product, the outsourced ship chandler uses a global distribution center that consolidates all the American products. Then, as we mention in chapter two the products are shipped either directly to the cruise liner or to regional distribution center. In the case that cruise company is European, the outsourced ship chandler is in Europe as well. Usually companies outsource the transportation of the products by using low cost companies from Eastern Europe. For the containers, they have an agreement with a specific container carrier in order to avoid third parties. They use some standard logistics providers that consolidates specific group of products. For instance one company uses one logistics provider in Germany who consolidates the department's equipment.

Purchasing department is the most important department as controls the procurement process. Along with the operations and logistics department they create a globally network of suppliers that are classified in two categories. The first contains suppliers, vendors and producers who are responsible to deliver the products to the distribution centers. These are mainly produces from the same region that are consolidated in containers and trucks. The second category contains a network of local or regional ship chandlers. These chandlers mainly provide fresh products to the company with a direct delivery in the port of loading. We have to mention that cruise company has not any contact with these chandler. Their payments are included in the main contract between the outsourcing company and the cruise company.

6.2.2 Onboard Department

Cruise liners that has outsourced food and beverage department, have two large categories of products and services onboard. The first category refers to the supplies and services that are provided from the cruise company. These are the engine department, the hotel department except from uniforms and all departments that has to do with the cruise liner as a vessel. The second category refers to the supplies that the outsourcing company provides. These are all food, beverages, cleaning and chemicals,

uniforms and equipment for the all bars and restaurants. In general, we could device the onboard department in three stages.

The first is the administration office that manages and organizes the whole onboard operation. This is also the office that is in continues contact with the head offices. They approve or not the orders, they send them to the office and they control everything that deals with money. They are responsible to make a physical inventory control, to make frequent reports for non-usable and slow moving products, to confirm orders from different officers and chefs, to organize the crew and more. In addition, the onboard department is the contact with the cruise liner. Food and beverage manager at the end of the gives a report to the general managers, informs him for all the expected loadings, for several onboard operational issues and more. The crew members that are paid from the provider have a separate staff manager who arrange all the aspects that deal with We have to mention that the initial heavy onboard equipment is provided by the cruise company and remains onboard at the end of the contract.

The second stage is the warehouse department that involves with day to day operations and loadings. During the loadings, officers check each pallet separately in order to confirm the quality and the quantity of the products. Receiving the pallets they distribute the boxes in the relative storage room, they inform the information technology system and give a loading report to the administration office. The day to day operations include the physical inventory control and the preparation and delivery of the onboard orders from the onboard departments.

The third stage includes all the facilities and crewmembers that food and beverage department manages. All the bars, restaurants, galleys and laundries with all the officers and crewmembers are part of this stage. The % of the crewmembers are managed, paid and controlled by the food and beverage department. Companies usually use crew agents in specific countries like Philippines, India, Italy, Greece, Indonesia, United States and more. All these departments, keep their inventory, report to the management, place the daily orders to the second stage, receive the products from the warehouse and organize and trainee their personnel.

6.3 *Factors that determine the outsourcing*

The decision making of each cruise company based on some factors. These factors are relative with the characteristics each cruise company, the total supply chain costs, the performance of the onboard department, the degree of coordination and the efficiency of the supply chain department prior to the outsourcing. The company in order to outsource or not all the activities of the food and beverage department should analyze all these factors.

6.3.1 Cruise company's Characteristics

As we mention in chapter two, the characteristics of the cruise company are very important for determining the supply chain strategy. In the case of outsourcing decision making these factors are the most important as well. First characteristics are the size of the company and the existence of parent company. In the case of a small company with two cruise liners, creating in landside an operational network and onboard an efficient, quality department is very costly. During our research we notice that large companies that are operated worldwide do not outsource their food and beverage department. The quantities are such as they can gain good prices from several regional and local ship chandlers. The medium sized companies either they outsource the department or they make a contract with a large ship chandler who is involved in landside operations.

Another important factor is the existence of a parent company. In that case, the supply chain department controls all the landside operations for the whole group. At the same time, as each member of the group provide different level of services, the onboard vcruise company was using a core business company for the department, and stopped this policy as soon as she joined a large American group.

The regions that each cruise company is operated also determine the outsourcing decision making. A cruise liner that every three months changes region, needs different port of loadings and requires more local products. Such a company is not able to use different ship chandlers and logistics providers in every region. This policy with substitutes, creates problems in the onboard inventory and consumption.

6.3.2 Total Supply Chain Costs

Companies evaluate the operational costs and try to find ways of reducing them. In addition, they try to save the resources and invest in processes that are more competitive. The operational costs in food and beverages department include the costs of purchasing, transporting, storing, loading, managing, supplying the onboard departments, keeping inboard inventory, optimizing the chain, investing in new infrastructure and equipment, paying all the staff, and others. All the above costs should be evaluated. The cost of ownership and the quality of the services are going to determine the outsourcing or not of the department.

6.3.3 Performance of the department

The performance of the department before the outsourcing is very crucial as well. The quality and the availability of the product are going to increase the satisfaction of the

final customer who is the passenger. As we mention in chapter two, the variety of the products in the required quantity and quality, makes the cruise company more attractive, improving the marketing. In addition, company should evaluate the onboard activities. The storage of the food and beverages, the internal distribution to the several bars and restaurants, the inventory control, and the crew efficiency are some of these activities. Finally, there should be an evaluation on the logistics performance like the just in time deliveries, the responsibility of the partners in the network, the degree of flexibility for urgent shipments and the ability of offering services globally.

6.3.4 Degree of centralization in sourcing

The degree of centralization in sourcing is an important factor that determines the decision making. The degree of centralization is a part of the supply chain strategy. Centralization is dealing with the relationship between the cruise company and the suppliers. In the case of a decentralized sourcing, companies use one regional ship chandler who manages the whole vessel's order. This ship chandler has a global network of producers and vendors and provides full landside services to the cruise companies. Ship chandlers adapt their information systems in order to be used from the company's system.

On the other hand, a more centralized sourcing contains direct contracts between company and producers and vendors. For large yearly quantities, company's managers visit local and regional suppliers or even and producers, achieve a better price, avoid the chandlers' commission and control the sourcing. In that case, ship chandlers are used both as procurement department and as logistics providers who consolidate products from the other suppliers. From our research we conclude that some large companies try to increase the percentage of local and direct sourcing but some others do not. The largest companies with well-organized supply chain departments try to go directly to the producer. Applying this strategy, both because they achieve lower prices from the producers as they agree on a yearly quantity, and because the control the quantity from the initial stage.

The companies that try to centralize the sourcing process could difficultly choose the outsourcing of the food and beverage department. They try to keep the management centrally and they would not like to give the operations of the most important onboard department to another company. In the case of a more decentralized company, outsourcing the department would be one more step to further management decentralization. The degree of centralization in each company determines the decision making and the success of this strategy.

6.4 Relationship with Cruise Company

The relationship between the third party and the cruise company are very crucial for a successful and efficient collaboration. The most important factor of success is the contract where all the specific details are signed from the involved parties. In addition the daily contact between the two members is important and this is taken place onboard. Finally, we mention the role of the information technology systems in the successful and trustful relationship.

6.4.1 Contract

The contract that both participants sign refers to the role that each company have both in landside and onboard. Cruise company and provider agree on a specific price per person per day. This price is build from the consumption per person, per day, for each product and equipment. It is everything is included. The procurement cost, the cost of storage, the consolidation costs and the transportation costs. The only costs that are not included are the costs of loading, the customs expenses, and the costs of agency that are paid directly from the cruise company.

Depending on the company's itineraries, the price change according to the season. For instance, during the summer, the majority of the cruise liners are in Europe while during the winter are operated mainly in Caribbean, in Latin America, in Asia and in Australia. The providers that has an American and European efficient network, charge more when the port of loading is far away from the this center as the costs are multiplied. For instance, the bottle of water from a European supplier costs 0.21 cents and from Dubai costs 0.30. In addition, the fresh local products do not have the same quality.

In the contract, two members agree on a specific availability, safety inventory, quality and variety of the whole products and equipment. Each product has its specific characteristics that the company requires. The provider is responsible to deliver the goods worldwide either by container or by truck or by air. The decision making and the costs do not care the cruise company. In the case of missing order or a shortage of a product, provider may charter the whole airplane to deliver the agreed goods. Cruise company does not involve also in the selection of the ship chandlers and the suppliers that provider has. Company only needs the certificates of quality and specific firms that depend on the guests.

In comparison with a typical ship chandler, a provider of an outsourcing department, covers the whole operations in a prearranged all included price. In the case of a regional provider who is operated both as a ship chandler and as logistics provider, cruise company pays a price per box that includes all the logistical costs. In the case that provider has a procurement departments, then has a separately invoice for purchase costs and logistical costs.

6.4.2 Onboard Relationships

Onboard, as we mention in the previous subchapter, the contact person of food and beverage managers to the cruise company is the general manager. The onboard relationships can be divided in two categories. The first includes the daily report of food and beverages manager to the general manager of the ship. This report refers to missing orders, expected loadings, shortages of products, urgent orders and more. General manager have to be informed about all problems that may occur in the department and affect the quality of the services.

The second category of relationships includes all the processes that general manager do in order to check the quality of the services that outsourcing company provides. During the loading, either by his own or by sending the chef, controls the quality of the fresh products and the brands that are loaded onboard. General manager makes frequent checks in galleys and restaurants in order to confirm that the level of services is the one that they agreed. In general, the collaboration onboard between the two parties is very good.

6.4.3 Degree of IT visibility

Another important issue on the relationship between provider and cruise company is the information technology system. As we mention in previous chapter, information technology system provides live information for inventory, values, orders, suppliers, loadings, shortages, consumptions, historical data and more. It works also as the communication system between vessels and headquarters. The main factor that determines the degree of the visibility from cruise company is the relationship between the members.

For instance, the shareholder of an American cruise group is the shareholder of a ship chandler who is the provider of the outsourcing onboard services. As at the end of the day the day the company have the same main shareholder, the cruise company has fully access to the information technology system. In another case, a Swiss cruise company that outsources her food and beverages departments to an Italian ship chandler. The information system is not visible to the cruise company. They use similar system in order for the orders to be delivered automatically and for the report to be visible, but there is no information sharing for values, inventory and other important information.

6.5 Benefits from Outsourcing

6.5.1 All included Price

Stable costs are the vital factor that determines the cost efficiency, profitability, growth and cash management of a company. In the case of outsourcing the whole department, cruise companies have stable cost for the largest part of onboard costs. As the price in contract is per person, company has the ability of offering more attractive price to guests. In this sector usually companies prefer to pay more some services than face last minutes changes in foresting costs. It is very important in this industry as the passengers book their vacation several months in advance. As the prices of fresh and consumables products changes in the local markets, providers face loses from the agreed price. Another example is with the transportation costs that vary from port of loading to port of loading and the criticality of the product. Cruise companies avoid these fluctuations in costs and are not involved in the uncertainty in every stage. The stable prices are usually the most important factor that determines the decision making for outsourcing.

6.5.2 Economies of Scale

As we mention in the previous chapter, the price is fixed and is not connected with the cost of procurement. Providers try to minimize the cost of procurement in order to increase the profit. Cruise company could never achieve lower prices as the quantities that chandler buys are for the whole year for several companies. The economies of scale are not only in the procurement process but also in inbound and outbound transportation. Cruise companies receive with one shipment food and beverages, the equipment that is required, the consumables, uniforms and more. Using similar transportation flows allows provider to consolidate the orders.

Using owned regional and global distribution centers providers are able to keep inventory for high demanded and urgent goods, either frozen or dry. This ability reduce the lead time and decrease the procurement cost by ordering big lots. In addition, as they control the onboard inventory, depending on the ship's capacity, they use safety inventory onboard and they avoid urgent expensive shipments. In addition, they control the bullwhip effect as using the same information technology system they have direct view of the real consumption. As a result, they are able to control the inventory level in all warehouses and adjust the orders from the suppliers.

6.5.3 Better Quality from core business companies

Outsourcing the department, except from reducing the costs increases the quality of the services. Specialization provides both better services in logistics and onboard. The providers of the outsourcing processes are usually companies that provide all inclusive

services to luxury hotels. They have the experience on the onboard services with only difference the crew that sometimes is difficult to be found. They know all the secrets of this core business and have a network of suppliers who are experts on the hotel supplies. In addition, as we see in our literature review, the food supply chain management requires an efficient supply chain with many quality controls. A special network of transportation companies, customs brokers and local suppliers who knows the core business is required.

6.5.4 Avoid of investments in Infra and network

Outsourcing the provisions and the onboard department reduces the cost of the investments in this field. The investments include the cost on infrastructure of warehouses in strategic locations, the cost of creating a supply chain management department with regional directors, purchasing departments, logistics coordinator that would be responsible for the procurement, the logistics and the loadings of the products. Even if the cruise company did not use its owned infrastructure, they had to hire space from a regional ship chandler in order to have their regional distribution center. In addition additional investments would be required in the information technology system both for internal communication and the adjustment with ship chandlers. All these amount of savings should be invested in other fields where cruise company is more competitive.

6.6 Disadvantages from Outsourcing

6.6.1 Loosing Coordination between Different Departments

Cruise companies that do not have outsourced their activities, are able to coordinate loadings from different departments. For instance, in the case that company needed half container of spare parts, could consolidate it with the dry food and beverage container. Outsourcing the department does not allow the company to decrease the transportation and inventory costs of other departments. In the case of an outsourcing strategy, companies try to achieve the maximum degree of coordination between the rest departments of engine, hotel and deck. As the issues is very cost effective, cruise companies make specific contracts with providers who hire slots from their container for other items.

6.6.2 *Reduced Supplier Contact*

Another issue is the fact that cruise companies do not have any contact with suppliers. They do not even select the suppliers. They agree on some standards and they do not suggest suppliers. The only physical contact between company and provisions is during the loading. Of course cruise company may suggest some firms especially for luxury products. For solving this issue, companies may mention some brands in their contract with the provider.

6.6.3 *Information Sharing of Important Data*

Provider requires all the information of consumption, number and profile of managers, itineraries, menus, onboard storage capacity, salaries, structure of the company, supply chain, management and marketing strategies and more. All the above information, create the profile of a cruise company and provide the competitive advantages that has. Providers usually operate for more than one cruise company and depending on the personal relationships some information may be transferred to competitors.

As we mention in the previous subchapter, information technology system is very important for a successful and efficient outsourcing. The degree of visibility to the provider is also important. The quantity and the quality of the information sharing from the system has to be underlined in the contract. In the common system should be only the information that required for the services. The relationship and the trust between two members is very crucial in order for misunderstandings to be avoided.

6.6.4 *Strong dependence from Provider*

Another issue is the importance of the control that provider has after sourcing. He controls the largest part of onboard activities in terms of number of crewmembers and variable costs. In some cases, cruise companies outsource to the same company other sub departments like housekeeping. Cruise companies lose their contact with the market for several groups of products. In the case that the collaboration appears problems for any possible reason, cruise company is difficult to keep the functions in-house.

6.7 *Conclusion*

Analyzing several issues regarding the outsourcing of the food and beverages department, we come out with some conclusions that are very crucial for answering the main research question. The third party company need an efficient, well organized network on the landside and a productive mix of crewmembers and services onboard. The quality of services and the total cost of the services are the two main factors that are going to convince the cruise company to outsource the department. On the other hand the contract and the relationship between two members are the two elements that create a stable and efficient collaboration. Analyzing the advantages and disadvantages that cruise company achieves from the outsourcing, we conclude that in small to medium sized cruise companies that requires good quality without investing in core business services, there is a room for outsourcing the food and beverages department. For large companies, we suggest a further coordination in the procurement and logistical processes that is going to be achieved from further investments and direct contracts with producers globally.

7 Summary and Conclusions

The present thesis aims at analyzing the supply chain management in the cruise industry and examining the outsourcing strategy in the case of the food and beverage department. The thesis is deviated from the so far limited literature and makes a classification of the products, distinguishes the cruise supply chain in two networks and analyzes how all the above effect the decision making of outsourcing both the onboard and logistical processes of food and beverages.

In the literature review chapter, we introduced the main characteristics of the cruise industry and we analyzed the current market. We observed that cruise industry was affected by several facts that create this strong, stable and profitable industry. Focusing on the cruise logistics literature, we find the research gap on a deeply and multi analysis of the cruise supply chain management. All authors refer to the complexity of this supply chain and suggest strategies for the optimization of the supply chain management. The main challenges in food supply chain are the quality and the perishability of the products. On the other hand, spare parts supply chain tries to minimize the lead time by reducing the transportation time and increasing the availability of the product. Food supply chain management requires an efficient network while spare parts supply chain management requires a responsive network.

For understanding and finding the main characteristics of the cruise supply chain, we made a conceptual model of cruise supply chain. Analyzing the involved members and the processes that are taking place, we concluded that is the cruise supply chain is a very complex network with worldwide sourcing and worldwide delivery points. This is the reason why cruise companies create consolidation points close to the main cruise markets. Focusing on the challenges that cruise supply chain has, we pointed out that the complexity of this particular supply chain is very high. The factors that determine the company's strategy vary and are not stable. Another crucial issue for the supply chain management is the selection of the port of loading. This is very important as determines the type of the supplies that will be loaded, the quantity and the yearly schedule.

From our classification, we conclude that all the supplies from the American market are transported by container and from European by truck except from some urgent orders in both cases that are transported by airfreight. In addition, we notice that some goods are classified in more than one category. In that case, the orders are placed from different departments, but are consolidated in one shipment. Finally, we observe that hotel stores and engine parts use the same days until the next loading as they follow the same transportation flow while products from food and beverage department need a frequent replenishment.

In order for us to describe more accurate the information and physical flows, based on the conceptual and classification models we distinguish the cruise supply chain supply chain networks. The first one is the food and beverage supply chain and the second the engine and hotel stores supply chain. Both supply chains use a regional and global third party in order to consolidate their goods and outsource the outbound transportation. The main difference is that in engine and hotel stores supply chain, cruise company orders directly from the vendor and controls the whole logistical path from the logistics coordinator, while in food and beverage supply chain, cruise

company pays the ship chandlers and not the producers, with large companies controlling the logistical path of the goods.

In addition, we clue that the food and beverage supply chain is a well organized, efficient supply chain with yearly schedules, stable lead times, stable network and few critical items. On the other hand, spare parts and hotels stores use many different suppliers from worldwide, more than one regional logistics providers, high transportation costs as usually use airfreight, expensive items, reverse logistics, high critical goods, long lead time and many urgent orders that change the schedule. The integration in engine and hotel stores is very high and cruise company try to achieve the maximum consolidation and optimize the supply chain management. For food and beverages, the distinction of procurement with logistical process and the core business onboard activities, creates a room for either further integration to the cruise company or completely outsourcing to third parties providers.

Exactly this room is that we analyze by describing the structure of such a third party both on the landside and onboard, the factors that determine the decision-making and the relationship with the cruise company both in a central level and on day to day operations. We conclude that are two completely different departments with different structures and operations. The onboard department is dealing with day to day supply of bars and restaurants, onboard inventory and placing orders while the landside is dealing with procurement and logistics planning. In addition, the most important factors that determine the outsourcing are relative with both the company's characteristics with most important the size of the company, and the prior of outsourcing performance of the department with most important the quality of services versus the total costs.

Summarizing our conclusions from each chapter, we are able to answer our main research question. The outsourcing of all the processes of food and beverages to a third party core business provider can be very beneficial for some cruise companies with specific characteristics and under some circumstances. For a small or medium sized cruise company that is not part of a large group and is operated globally, outsourcing could increase the quality and the efficiency of the services. The room for improvements and optimization from the outsourcing process is sufficient. The most important factor that determines the success of the outsourcing is the relationship between the involved members. The agreement and the day to day following of the contract are going to build a strong relationship that will achieve the added value processes. In another case, as it happened in a large cruise company that had a fully outsourced food and beverage department, the agreement is not going to increase the costs and create an inefficient supply chain.

For a large group of companies, we believe that the optimal strategy should include investments in their owned facilities and network by introducing a core business company that is going to manage all the processes in each ship of the group.. The quantity of the goods that required in a year and the degree of coordination and centralization in these companies do not allow a sufficient space for outsourcing. In addition, from our research we observe that the two largest cruise groups are not willing to invest in infrastructure. They try to maximize the centralization by making direct contracts with producers and suppliers, avoiding ship chandlers and by

organizing the consolidation. Maybe in the future they are going to separate the onboard department and create a core business company.

As the research is limited in the European region, a future research could take in account the yearly itineraries that are going to partly change the data. In addition, we believe that an economic analysis on a company that has already outsourced the department, could provide more accurate result for the economic benefits from such a strategy.

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Appendices

A) Interview with cruise ships

1. Interviewer profile
 - Position:
 - Company's profile:
 - Company' Supply Chain strategy:
 - Vessel:
2. Which are the main supply chains that involved in cruise logistics? (F&B, Technical, Hotel.)
3. Can you please describe the information flow of your department? Which is the procedure until you receive the goods?
4. Which is your onboard inventory strategy? Is it common for each type of products?
5. Do you have standard vendors that supplying your vessel?
6. Are you using a logistics provider in Europe that consolidates your orders?
7. I would like to provide me some data in order to make a classification of cruise supplies.

	Lead time Estimation (in days)	Criticality (I, II, III)	Uncertainty (Yes, No)	Perishability (Yes, No)	Last mode of transportation
Technical					
Hotel stores					
Spare parts					
Frozen Food					
Fresh Food					
Beverage					
Others					

8. How would you characterize the decision-making authority (onboard or centrally made) for various functions in the cruise supply chain?

	Most decisions made onboard	Most decisions made centrally
Long term Capacity Planning (investments plan for capacity)		
Internal improvements(functions that support supply chain Strategy)		
Transportation Planning (Transportation assets and		

parameters with carriers)		
Inventory planning (onboard)		
Shipment handling (functions that manages the day to day logistics, selection of port)		
Order management (functions that manages the lot size, the type of goods)		
Sourcing (Functions that manages the suppliers/vendors, purchasing and procurement processes)		
Others		

9. Which are the factors that determine the decision making of supplying locally or centrally?

Cruise Liners that were responded:

MS Crystal Serenity in Piraeus (Hotel Store keeper)

MS Regatta in Piraeus (Engine Store keeper)

MS Pacific Princess in Piraeus (Food and Beverage Manager, Hotel Store keeper)

MS Seaborne Odyssey in Piraeus (Provision Master, Technical Storekeeper)

MS Wind Spirit in Piraeus (Hotel Controller)

MS Mein Schief I in Piraeus (Provision Master)

MS Splendor of the Seas in Piraeus (Inventory Manager)

MS La'bell ade L' Adreatic in Piraeus (Hotel manager)

MS Aegean Odyssey in Piraeus (Food and Beverage Manager)

MS Seven Seas Mariner in Piraeus (Food and Beverage Manager, Hotel Controller, Engine Store keeper)

MS Eurodaam in Piraeus (Engine Store keeper)

MS Nautica in St Petersburg (Food and beverage Manager, Hotel Controller)

AIDA Blue in Rostock (Hotel Controller)

B) Interview with Third Parties

1. Interviewer profile:
 - Position in the company:

- Location of the company:
 - Position of company in the cruise supply chain:
2. Can you please describe the role of your company in the cruise supply chain?
 3. Which are the information and physical flows in your company?
 4. In case of a further integration in supply chain , which are the main competitive advantages of your company? Do you see any opportunity for a new role in the supply chain?
 5. Which are the limitations of your company in the case of a further centralization/ or localization?
 6. Do you use an IT system that is feasible to the cruise company?
 7. Do you use your owned transportation network?

Companies that were responded:

Greece: Port Agents: Inchcape Shipping, Donomis Ltd

Logistics providers: Trias Ltd, MareMarine Ltd, Cool, Vanos Supplies

Netherlands: Blue Water, B&S Global, Meeder,

Germany: Shoemaker

Italy: Prianno Marchelli (by telephone, I will visit them the following weeks)

C) Cruise Company's Supply Chain Department Questionnaire

Questionnaire Number 3

Name:

Position:

Company:

Place:

1. Can you please describe the information flows? Who makes the order? The SC department for each ship or each ship informs the department in US? Do they inform you directly or from central Department in Miami?
2. Which are the most important factors that determine the CSCM?(moving point, safety, size of company, global market)
3. Which are the criteria's that you split the whole order? Do you have one 3PL for each type of goods?(spare parts-Blue Water, F&B Global, fresh-Meeder)
4. Do you choose the port of supplying the goods? Is it always the home port or are there some other factors that determine the port for supplying.
5. Can you please define the main Supply Chains that involved in the CSC? (spares, food, equipment, hotel) Are you responsible for all of them?
6. Are you the only regional SC department or there are others in Asia for instance?
7. What is your inventory strategy determining the limitations in onboard capacity and lack of owned warehousing. Do you prefer smaller and frequent lot size or do you prefer big lot size with some replenishment s
8. On what information do you based in order to place an order? When do you forward the orders to the logistics providers? After knowing the final number of passengers?If there are last minute bookings? How you handled out uncertainty ?

9. Which are usually the problems that are faced as a department and you need a responsive supply chain? (Lack of supplies, engine failures, last minute passengers)
10. Do you have any contact with vendors are do you only use companies like Global who find the suppliers?
11. As I can understand there are four types of supply chains. Direct transported by US DC by container, EDC by truck (3PL), by truck from the local trade market, by airplane from all over the world). Has the decision only to do with the type of the product (frozen, fresh)?
12. Spare parts usually required a responsive SC as there are critical products. Do you follow a different strategy for cruise spare parts?
13. Europe is a growing market and your fleet continuously increasing. Why do you outsource the logistics part of the CSCM? Why don't you use your owned DC in order to achieve a better control of costs, vendors, network, transportation management, quality and safety? Why don't you make a further SC integration? Is the Central DC in Miami owned?
14. There are some ports that your company has already or is planning to invest in cruise terminals. Do you see any changes in your strategy if for instance are going to invest in Piraeus?
15. What is your opinion about Piraeus? From my working experience I have noticed that only some Celebrity and, Azamara ships use port of Piraeus for supplying. Are there any opportunities for Piraeus to become a supply center for your ships in the future?

Companies that were responded

- European Supply Chain Director, Royal Caribbean Cruises Ltd, in Rotterdam
- Director of Operations, the Apollo Group, Onboard during my internship
- Operations manager, The Aegean Experience, in Piraeus

D) Onboard Interviews

Master, General Manager, Food and Beverage Manager, Chief Engineer, First Officer, Second Officer, Safety Manager, Environmental Manager, Hotel Controller, Assistant Food and beverage manager, Assistant Hotel Controller, Engine Inventory Controller, Hotel Inventory Controller, Housekeeping Manager, Casino Manager, Boutique Manager, Spa Manager, Art Director.

E) Yearly Schedule Structure

	Name of Vessel						
NUMBER OF DAYS UNTIL NEXT LOADING	DATE	DAY	A/D	PORT	COUNTRY	ARR.	DEP.

continuous..

Comments	Type of loading	Equipment requirement Containers+Trucks+Local	Order Due Date for F&B Orders	Hotel Orders	Order Due Date for Hotel Orders