



**ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ**  
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“The supply chain optimization and integration and their  
role in ports efficiency and function”

by

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## Abstract

This thesis primarily aims to examine the logical relationships among the integration strategies of seaport terminals along with the supply chain processes and strategies, and the antecedents and consequences of the integration strategies.

In this thesis integration strategy is termed Port Supply Chain Integration (PSCI) and the antecedents and the consequences of PSCI were identified and termed as Port Performance (PP).

The analysis of this thesis is developed in a four-way model, where each part covers a different dimension of the analysis regarding the influence of the supply chain optimization and integration regarding the efficiency and the function of ports.

In the first part we include a theoretical and classification and analysis regarding ports efficiency with information regarding ports policies, competition and performance of ports, governance strategies and ports role in the Supply Chain Optimization and Integration Strategy

Following this part, a theoretical and historical analysis takes place by analyzing 4 different strategic models regarding the function of ports. A Porters analysis model, the port selection criteria model, the resource-based theory and the Supply Chain Management Theory (SCMT) consist these four theoretical models and strategies based on which this thesis analysis is based.

Moreover, in the third chapter of this paper there is an extensive analysis regarding the Supply Chain Integration strategy and its role in the function of a port. To deep dive there is an extensive approach regarding the Supply Chain Management and Integration Ports Supply Chain Integration, a reference to the casual relationships and to the motives and circumstances of Ports.

The final part of this thesis consists the conclusion of the whole analysis. Conclusions are presented in a simple way so the reader and the researchers to be able to deep dive in the knowledge helpful for him and to be able to extract the data and information that he may need for a future analysis.

At this point I would like to mention that this thesis analysis remains a theoretical document and theoretical approach regarding the main strategies that currently exist when it comes to the efficient management of a Port. Of course, every port in the world may have special needs and customized strategies and measures should be adopted to cover these needs. This paper only provides a logical based analysis where the future researcher may stand, analyze and based on his needs extract future conclusions for his analysis.

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## Contents

1. Introduction
  - 1.1 Background Analysis
  - 1.2 Research Objectives and key questions
2. Classification Analysis of Ports, A Theoretical Analysis
  - 2.1 Introduction to the basic analysis issues
  - 2.2 Ports Policy
  - 2.3 Governance and Reform
  - 2.4 Competition and Ports Performance
  - 2.5 Ports and Supply Chain Management
  - 2.6 Port Planning and Development
  - 2.7 Terminal Operations
  - 2.8 Spatial analysis of Seaports
3. Disciplinary and Theoretical bases
  - 3.1 Disciplines involved in port research
  - 3.2 Theoretical Concepts
4. Literature Review
  - 4.1 Introduction to the Theoretical Models
  - 4.2 Transaction Cost Theory
  - 4.3 Porters Analysis Model
  - 4.4 Ports Selection Criteria
  - 4.5 Ports Performance
  - 4.6 Resource Based Theory
  - 4.7 Supply Chain Management Theory (SCMT)
  - 4.8 RBT and SCMT: Analyzing the key concepts
  - 4.9 Main Conclusions
5. Supply Chain Integration
  - 5.1 Supply Chain Management and Integration
  - 5.2 Nature of Port Supply Chain Integration (PSCI)
  - 5.3 Motives and Circumstances of PSCI
  - 5.4 Casual Relationships
  - 5.5 Components and Constructs
6. Conclusion
  - 6.1 Final findings
7. Appendix

## Chapter 1

### 1. Introduction

The chapter provides an overview of this research analysis and presents the summary of the key questions tried to be answered in this thesis. The main question however remains: Why are the problems relating to the Supply Chain Theory worth solving them? Therefore, in the first section we are trying to present the background of this research approach and the second part outlines and underlines the key research questions and objectives.

#### 1.1. Background Analysis

Under the global trend of manufacturing and consuming new products, the logistics and the transport industry around the world is facing new structural challenges in order to deal with this complicated situation and this high increasing demand for new products. In one side the production companies and the major OEMS realized the important need to manage their supply chain operations effectively and on the other side these stakeholders needed to identify a way to deal with the globalization that characterize the world's economy and the competition.

As a major outcome, the need to adopt new Supply Chain Strategies that will offer time and processes optimization is nowadays necessary, followed of course by an optimization in the global sourcing and outsourcing logistics functions. These developing needs in the logistics industry made the major providers of logistics services to adopt new technologies and to integrate them in their systems, as well as to expand the reach of their operations in order to penetrate further the available and to increase their market share among their competitors. The old-fashioned fragmented logistics system is now replaced by a more agile system in which the new technological and operational challenges triggered the transport industry to move forward the new era (Heaver 2001).

In any case this thesis is focused in this effort to identify new processes and technologies capable enough to optimize the operations and timings and to support the ports to become more efficient in the future. Based on new market studies the key of success lies nowadays in the new technologies adopted in this direction. Blockchain strategies, analytics tools, real time data collection and monitoring are some of the key functions that in the case they are adopted by a port mechanism may be the solution to unlock future capabilities and increase their revenues.

In the context of the global maritime and ports industry shipping companies and major first trader providers (COSCO Shipping) have shown exceptional proactiveness either through mergers, acquisitions and strategic alliances in the field of processes optimization or in the vertical aspect of the analysis by providing integrated logistics services (Heaver 2001). What is important to mention is the fact that these changes adopted and implemented by shipping companies led to structural changes in the organization and function of the major ports around the globe (Slack et al 2002). This new situation within shipping companies which remain ports main customers made ports to adopt new strategies to transform their operations and to make them faster and more efficient (Robbinson 2002). As Robbinson mentioned two new strategies were emerged: First the development of global networks which can be achieved by horizontal integration within ports function and on the other side the integration related to supply chain optimization that is related to vertical integration.

Recent literature analysis showed enough evidence of distinctive trends towards the integration processes and strategies in the ports function into the logistics and supply chain processes (De Langen and Chouly 2009). Except for these new trends, also new technologies were adopted in this direction with main purpose to fasten and optimize the processes within the ports. Added to this point some recent researchers and based on new analytical studies attempted to expand the reach of the supply chain integration analysis to the other traditional research analysis (processes optimization, tools amelioration, transport and airports logistics) in the purpose to provide further evidence and information to support their theory (Bichou and Gray 2005). However and despite the fact that researches have come to the conclusion that the integration of ports into supply chains should be strategically adopted by ports authorities around the world in order to improve ports efficiency, the impact of this research effort in the performance of ports has rarely been analyzed and researched.

## 1.2. Research Objective and Key Questions

Against the first stage analysis presented above, this thesis is mainly a personal effort to approach and examine the causal relations involved in the integration strategy of ports along with the supply chains. Can theory and practice be being implemented at the same time? Can ports be the field of study for these new studies? In the end are ports the ideal field to examine new trends. All these questions were posed over the last years and all the studies around the field of supply chain were focused to provide answers to these key questions.

The analysis in this base is conducted in two-way model: Between the organization strategy of a port around the world and the organizational characteristics that facilitate this strategy and on the other hand between the integration strategy and the port performance as the main consequence of this strategy. This two-side model tends to be accepted by most of researchers as this provide a more spherical perspective to this field.

Based on the points mentioned above several research questions arise and my effort in this thesis is to try to approach them in the most academic and professional way possible. In some cases, the question maintains a matrix role as the key question remains the same: How can ports integration in supply chain strategies affects positively the function and the efficiency of a port? However, my effort to provide a enough answer to this key question led me to a series of questions that should be analyzed in order to deep dive in the main question:

Q1: What are the key activities of the integration strategy of ports in relation with the Supply Chain Strategy?

Q2: What are the organization characteristics and capabilities of global ports that are able enough to facilitate this process?

Q3: What is the impact of this integration strategy on the performance and the efficiency of the ports?

Q4: Can these characteristics be easily applied to the external and the internal environment of every port around the world?

## Chapter 2

### 2. Classification Analysis of Ports, a Theoretical Analysis

#### 2.1 Introduction to the basic analysis issues

Recent research analysis have showed that despite the fact that valuable insights could be obtained from existing research and analysis regarding the field of maritime economics and port management (Heaver 2006) these analysis and studies are not in the position to provide an analytical structured knowledge within this field.

Recently studies are focusing mainly in operations research when it comes to ports functions and terminal operations (Stahlbock and Vos 2008). Ports efficiency is another issue that researchers deal with some years later when they decided to focus on the impact that ports efficiency has within the whole supply chain industry. However, it is widely acceptable that even nowadays, is really tough to identify what efficiency means when it comes to port functions and more difficult to provide ideal solutions in order to achieve this efficiency.

Many scientific papers were published between 2008 and 2010 regarding the analysis of the efficiency of ports and the correlation between ports efficiency and the overall ports performance. Is true that until that time there was no need for such a deep analysis on this issue as the port's efficiency was not considered a major factor that may influence either positively or negatively the overall performance of a port. However, since 2008 when more than 84 papers were published scientists recognized the need to deep dive to the efficiency of ports analysis and to extract accurate data regarding the impact that this analysis may have on the overall performance of the ports. Key figures of this analysis were the port of Piraeus with Cosco Shipping and the port in Marseille with MSC Global. These two companies put an effort to optimize their processes within these two ports – hubs and adopted new integrated structures to achieve the expected efficiency they wanted. As a result, since 2008 the researchers started to connect the meaning of efficiency of ports with the meaning of the performance of a port. And that time a new question raised. Can a port, wherever in the globe be of high performance if efficiency is not a characteristic of that port? In the end we tend to accept that efficiency and performance are two meanings that are strongly related between each other.

#### 2.2 Port Policy

It is generally accepted that Van Hooydonk in 2002 was the first researcher that tried interpreted in the most effective way the port policy. According to Van Hooydonk as port policy we mean any “decision that could influence the future development of port activities”. In any case all these activities are undertaken at a government or state level and have a general impact on the whole functionality of a port.

In a wholistic research view almost 9% of the total researches are focused on this issue and mainly to the issue of how a port policy has changed and how this change has impacted the development of the industry within a country. Ports are key economic figures for an economy and

as Van Hooydonk mentioned “Countries that have the privileged to have ports, can sustain better their economies”. What is crucial to mention is the fact that during the years some governments have influenced the general attitude towards the port’s development and the overall investments in ports development framework.

Supra – National port policy is usually referred to the policy applied by European Union or in some special cases by the member states of the Union itself. In our case, when the port’s efficiency is concerned these policies refer to a various system of policies including state aid, market access, environmental regulations and safety initiatives (Psaraftis 2005, and Bergantino 2002). The point of attention regarding these policies remain on the impact that these policies have on member states or aspects of ports functions. In the end of the day, as Pallis mentioned, “port’s efficiency and function is directly related with specific policies apart from specific technologies”. Even in the field of European Union, the institution itself recognized the need of paying special attention to the policies around the maritime and port function, and has created a whole plan of policies that will lead the member states to adopt a common policy and strategy regarding their ports and maritime industry.

In our case the number of studies on policies and regulations regarding the port’s function and port’s safety was not as great someone would expect. The main issue is the fact that these analyses remained so superficial and never deep dive in the route cause that may cause inefficiency. They mentioned the issue and the impact that these policies have on port’s efficiency, but scientists did not take the extra step to analyze and deep dive to the root cause of this inefficiency. “We know the problem for ten years now, but we do not have a satisfactory solution to this problem. Lack in port’s efficiency is the fact, but the question remains on how we will deal with this problem” (Bergantino 2002). In the end according to Bergantino, the issue remains as we still do not have a satisfactory answer to the key question. Are efficiency and performance two meanings that are interconnected? And if yes, how we can ameliorate the efficiency in order to increase the performance within a port?

Instead of having a satisfactory number of studies relating to the port’s policy and function, most analysts were focused on managerial analyses relating to policies on how to manage the management of the safety and security regarding port operations under new legal environments. In any case, “Even though the ports policies framework is structured by European Union as a whole, it remains responsibility of each member state to ensure the efficient operation of its port’s functions” (Maria Damanaki, European Commissionaire for Maritime and Shipping Sector)

EU directives on port reception facilities led researchers to evaluate availability and adequacy of reception facilities in EU ports and compliance with the regulations. The impact of new legislation for coastal management in Canada and the US on port administration and their effectiveness were also researched. Decadal trends are not clear in this category, as the number of papers is small considering the number of research topics. However, a few aspects are observed: (1) national policy has been consistently researched since 1990; (2) regulations pertaining to competition and market barriers were well researched in the 2000s; (3) environmental policy studies drew researchers’ interests due to newly introduced initiatives at national and supranational levels in the late 1990s. As we observe the when it comes to the national policies regarding ports function, the level of progress within the member states is low. Except for Greece, Spain, Italy and Portugal , countries with traditional maritime and sea history, the rest European Countries have performed really small steps towards the direction to ameliorate their port’s



policies. As this tend to be not a focus for these countries no significant progress was observed by these countries as a result by European Union as an Institution.

### 2.3 Governance and Reforms

Prior of analyzing what means “governance and reforms «regarding the function of a port we need to identify the meaning of these terms. Governance refers to all the policies adopted by a country that impacts either directly or indirectly the port’s functions and port’s efficiency. The term reforms simply refer to these decisions that tend to have a positive impact on port’s function. Is not always easy to identify the slice difference of these terms, as by a “de facto” statement of all countries all the policies adopted tend to have a positive impact regarding the function of their ports that are located under their authority. However, whether a policy has a negative or positive impact within the operational function of a port this needs to be proven by the market itself or by estimated customer preferences when it comes to the use of a specific port.

Reforms in port management continue to take place in various ways depending about a country or region, to varying degrees. Studies in this category are concerned mainly with the port governance system and governance reform and include labor reform. This category accounted for 10% of port research in this analysis. The topic of the most interest was port governance reform. Most of studies pertaining to this topic described the experience or necessity of port reform in a port, a country or regions. It was in the more recent past (2000s) when researchers characterized port reform trends worldwide and undertook empirical studies to assess the consequences of port reform.

As a final step of this analysis regarding to port policies and to how these policies influence the function of any port around the world, we need to mention at this point that this category covers such a wide range of port management topic that it accounted for around 20% of the papers reviewed. Studies in this category generally discuss managerial and strategic issues at the level of port authorities. Port strategy drew researchers’ attention throughout the past three decades. And that happened because it was also difficult to identify the role of the authority itself. What was the main responsibilities of these authorities? Which are the limits of its controls? This includes research regarding strategies of port authorities under changing environments (Heaver 2001), analysis of the role of port authority within context of the port community and cluster and strategic and long-term planning for development of a port or port in a country.

Developing the capabilities of human resources is an area which has not been well researched in port research, and the reason that the number of studies in this topic is relatively high is because studies on industrial relationships management were included. Until the era of Gary, human factor was only a factor that contributes to the total function and performance of the port. Was not clear however that this factor is key for the success as 85% of the total tasks within a port were performed by people this time. Gary was the first to mention that the appropriate selection of job force, the good training and education and the high retention rate of this force, are some key figures that can increase the total performance of a port. However, few researchers have paid some attention to port training and human resources development. Emerging managerial issues include environmental management, safety and security management and information and knowledge management. The former is primarily about how port authorities can or should effectively deal with the challenges and pressures imposed by regulations or institutional changes (Bichou 2004; Stojanovic et al. 2006) and developing measures to reduce terrorist risks and

accidents. The latter concerns how ports adapt advanced information technology and how such technology and management can improve port operations.

## 2.4 Competition and Ports Performance

This category accounted for almost as large a proportion of studies as the Management and Strategies' category (20%). Port competition studies begin with conceptualizing and characterizing seaport competition (Verhoeff 1981) and can be advanced with new concepts of seaport competition such as co-opetition, cross regional competition and intra-port competition. What this actually means is that the competition between two or more players within the same region or field of services, will lead them to ameliorate the level of the services provided in order to gain a better place among their competitors and increase their market share within this market. However, the number of these studies are limited. A substantial number of papers are devoted to analyzing the current situation and development of port competition of a region or country in the 2000s (Comtois and Dong 2007; Yap et al. 2006). Advanced methods, analytical tools and new measures helped researchers analyze and assess the complex nature of competition dynamics and relationships among competing ports. The conclusion is one and only one. The better services you can provide, in the most competitive prices then you are eligible to increase your market position. That was the key concept of Cosco Shipping when they chose Piraeus Port to transform it to its hub when it comes to European transport services. Piraeus offered except for its ideal position in the Mediterranean Sea, an ideal choice due to the low work force cost, and the long-term relationship between Greece and China. The choice of the port was of significant importance for both parties as COSCO Shipping managed to position itself within the European Market by transforming the Port of Piraeus in its European hub and at the same time the port itself was upgraded as new technologies and infrastructures were adopted.

Port selection is a traditional topic analyzing shipping liners or shippers' port choice behavior, generally using interview or survey (Murphy 1985). This topic showed an observable advance with the introduction of a variety of methodologies in the 2000s, such as Analytical Hierarchy Process (AHP), Factor Analysis (FA) and Multinomial Logit Model. A topic relatively well researched throughout the 1980s and 1990s is port performance. Studies on this topic primarily aim to discuss what and how to measure port performance (Talley 1994), evaluation of existing measures and the proposal of new measures and (Gray 2004). This topic evolved in the 2000s in two distinctive ways. One was to conduct relative comparison studies in terms of technical efficiency using a group of analytical methods called the frontier approach such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). Both these two methods were aiming to identify in a quantitatively way what port performance is and the most importance which are the key elements that we can use in order to measure this performance. The other is to assess the competitiveness of a port or ports in a country. This topic includes: competitive status and positions, assessing the competitiveness of ports in terms of cost, geographical advantage (Caillol 1981), service quality (Ugboma et al. 2007) and accessibility etc. Studies in this category can only have taken advantage of advanced approaches and research methodologies, which took place mostly in the 000s.

## 2.5 Ports and Supply Chain Management

The papers in this category were separately classified even though the proportion in all the papers was the lowest (=5.2%) among 8 categories. The reason for this is that they have different view' on seaports from those of traditional studies which see seaports as a node between sea and land transport. The difficulty in that case was the fact that it was extremely difficult to provide an easy and overall understanding of the term "view". Which were the key elements of that view? Are these elements the same both for seaport and land transport? Can we base our theory and scientific questions for the two types of transport at the same time? They argue that seaports should be viewed as parts of supply chains (Gray 2004) and as an extended system which can interact with other members in the supply chain. In this context, several papers investigate the integration strategies and practices of seaports along supply chains and their impact on performance.

It is worth commenting that the recently increasing trend in studies in this area is related to the increasing interest in various strategies along with the supply chains strategies and the activities of container terminals rather than the port. Further, a group of studies about inland logistics connected to port logistics has gained increasing as seaports increasingly rely on intermodal solutions through rail corridors and inland ports to cope with volume growth and the imperatives of global supply chains. The question in that case tended to be more simple in the beginning but ended to be a serious problem for scientists. Are port logistics related to the overall efficiency of a port? And if yes what we can do to improve the port logistics as a key element to increase port efficiency? To that question scientists provided several answers but most of them are related to one factor. The introduction of new technologies within our ports like blockchain strategies or processes optimization and RPA machine learnings tools to improve the digest of all information are crucial if we want to fasten our processes and improve the overall performance of a port.

## 2.6 Ports Planning and Development

This category includes studies about the planning and development of port infrastructure and decision making related to them. However until the recent years it was really tough to provide an ideal definition when it comes to these infrastructures and more importantly to persuade the scientific world that the possible optimization of these infrastructures can increase the whole efficiency of the port. Thus, topics in this category include demand and supply analysis of infrastructure, financing and risk management, project appraisal analysis and the economic impacts of seaports. These accounted for 15% of all the papers. A considerable number of studies were undertaken in the 1980s when port expansion and reconstruction was spurred by the acceleration of international trade and technological change in maritime transport in many countries, to reduce congestion in ports or to adapt to the technological changes.

When it comes to demand analyses, basically forecasting studies of cargo throughput and growth, is certain that scientists cannot extract accurate data. Some studies addressed this topic using an explanatory approach. However, most applied statistical methods such as error correction, and mathematical modelling such as linear programming, mixed integer modelling and simulation. Supply analysis is primarily concerned with determining the optimum terminal size and capacity. It was widely acceptable that despite the possible bottlenecks that the structure of a port may have, the size of the port contributes to its general performance. That was proven mainly by the deep dive analysis of significant ports around the world like Rotterdam, Huston, Singapore etc. However what has not still being done is the interconnection of this analysis and the information that we extract from these analysis with RPAs systems which can analyze on real time all these

data and provide us useful insights that we can use to improve our efficiency when it comes to port's function. Economic impact analysis is also a topic which has been considered as important in providing state and local budgeting agencies with a rationale for, and useful information in, the determination of capital and operating budgets for port facilities. There was also a continuing debate into the validity and efficacy of normally applied methodology such as input-output analysis. However, researchers have consistently addressed this topic due to a possible imbalance problem between local and global benefits in globalizing environments, applying various approaches to various situations.

## 2.7 Terminal Operations

This approach seeks optimal solutions in terminal operations and appears to be a separate field from port management and policy studies. It is indispensable in coping with increasing container transportation and achieving higher efficiency in seaports. Its importance is also shown by the 11% proportion of total papers for this category, even though several optimization studies were classified in other categories such as demand and supply analysis and port selection.

With the increasing interest in optimized terminal operations, a variety of review studies and methodological discussions have been provided in recent times. Research topics were identified according to the processes of terminal operation; thus, they are not as detailed as the review studies are. The sea-side operation subset is concerned with ship planning processes and loading/unloading processes such as berth allocation, stow age planning, quay crane scheduling, and queueing problems. However as easy it seems to describe the supply chain logistics performance within the land transportation and ports, the same process tends to become extremely difficult when it comes to sea – side operations and supply chains. Indeed is extremely difficult to analyze this optimization for a vessel onboard as each vessel is unique, has different needs and mainly different people to manage and handle it.

The yard operation subset includes storage space design, yard cranes and carriers transport. Land-side operations deal with rail and truck operations and modal split optimization. A group of studies adopted an integrative approach which views port operations as terminal operations, based on the awareness that improved terminal performance cannot necessarily be obtained by solving isolated problems but by an integration of various operations connected to each other. In this category, seaside operations and yard operation studies has shown an increasing trend in the 2000s.

## 2.8 Spatial Analysis of Seaports

While this category accounted for 11% for the past three decades, higher proportion was shown in 1980s and 1990s. Spatial analysis of port system of a country or a region or the world, in some cases, is a main topic in this category. This concerns current spatial situation of a port system and the causes of the change. Several theoretical modellings led this group of studies. They were followed by several empirical studies applying the theories to countries or regions. Thus, empirical studies or basically practical experience cannot be the subject of a scientific analysis and modelling. We cannot base a scientific question based on our experience as the expected outcome would never be a results based result but only empirical and theoretical assumptions that may or may not lead us to a concrete outcome.

Studies on the reason for spatial changes in port systems include containerization, technological change, and trade patterns. Port-city relationship studies developed the theoretical models of Hayuth (1982) and Hoyle (1989) and formulated spatial relationships between port and city. These models were applied to various port cities and advanced by some researchers. Some studies viewed port-city relationship, incorporating sustainability concepts and the role of the actors of the port community in the relationship. In the recent years two are the most characteristic port cities that these theories applied. Firstly Singapore, a city – state that its port refers to almost 45% of its economic activity and in another phase Rotterdam, where the existence of a port of such importance led the development of a city around it. Trade patterns however are not easy to predict. Singapore and Rotterdam were not transformed to these important ports and supply chain hubs because of their size only but also because of their important and strategic geographical position.

### 3. Disciplinary and Theoretical Bases

#### Introduction

Discipline bases of port research were investigated to identify the disciplinary characteristics of port research and academic territory covered by port research. In addition, theories, theoretical models and concepts which have been applied to port research was examined to show how port research has theoretically interacted with other relevant disciplines. Review studies and literature concerning theory development and academic disciplines in other research fields such as logistics and SCM, transport economics and economic geography (e.g. Krugman 1998; 1999) were also referred to.

#### 3.1 Disciplines Involved in Ports Research

The term ‘discipline’ was used by Burgess et al. (2006) as ‘a body of practice that is well supported by occupational groupings that identify with or defend a territory of activity’. In addition, Fabian (2000) distinguished ‘discipline’ and ‘paradigm’ by discussing that ‘a discipline is the common focus of a set of researchers who might perform research in varied paradigms and/or theoretical perspectives.

Seaports are regarded as either economic units providing a service or nodes between various transportation modes, or a place where cargoes pass through, or a part of logistics and supply chain. Therefore, problems in seaports can be viewed and addressed from various perspectives, and researchers who have different disciplinary backgrounds can be involved in port research. This section, thus, categorizes the literature into disciplines which appear to form the basis for the papers. In this categorization, the disciplinary backgrounds of the authors of the papers tell much and could not be disregarded.

However, theoretical models, analytical approaches and concepts used in the papers were the factor which most clearly influenced the approach taken. When disciplinary characteristics were not discernible from the paper’s author’s view, those papers were defined as ‘Not specific’ (17.7%). Three disciplines have primarily dominated port research: economics, geography, and operation research (31.5%, 15.7% and 16.3% respectively). Various disciplines or research fields relating to management studies also contributed considerably to port research. However, the main question in this section remains unanswered until today. Are economics, geography and operations research the only disciplines that contribute to this ports efficiency? Unfortunately for

the scientists this is not a yes or no question as significant elements have not been identified yet in that direction. What is clear until now is the fact that these three disciplines are the most important towards that direction and can provide a wholistic and generic overview of that issue. Of course other elements exist as well and can contribute in combination with the disciplines mentioned above to this answer and to provide us more insights regarding this scientific question.

It is clearly observed that disciplines involved in port research became more diverse in the 2000s than the 1980s and the 1990s. This trend is distinctive in the 'Management' category. In the 1980s, 'Management'-based studies showed little appearance, and, in the 1990s, studies concerned with industrial relations in the port industry was relatively extensive. In the 2000s, strategic management, marketing and logistics-based research began to be conducted and the number of these studies increased.

### 3.2 Theoretical Concepts

Theory building and knowledge creation in a research field or discipline is a core part for its development. Researchers suggested several ways to develop theories and create knowledge. It is suggested that researchers have 'borrowed\*' and 'imported' existing theories from other disciplines and will or should continue to do so due to the various benefits from these practices (Amundson 1998; Stock 1997). Some researchers, however, argue that new innovative theories should be developed rather than 'borrowing' existing ones. And that happen under the opinion that if existing theories could provide a satisfactory answer to the current existing scientific questions then no need of new theories would have occurred.

According to Arlbjon and Halldorsson (2002), theories can have different levels of abstraction. Grand theory is concerned with 'lines of thoughts and interpretations representing a science such as classical economics and philosophy of science. This study focused on middle-range theories reflecting connections between a set of concepts or 'small-scale theories reflecting connections between a small number of concepts. This analysis aimed to show which theories from which disciplines were applied in port research, and to identify theories and models which are specific to port research.

The papers in which the theories, theoretical models and concepts were identified accounted for only 26% of all the papers. Even this number may have been exaggerated because some types of papers were counted only because they have applied analysis techniques which were developed based on theories. For example, disaggregate choice model using the multinomial logit model or multinomial probity model applies the utility function used in micro-economics. Papers applying disaggregate choice model thus, were counted for utility theory. Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) formulates production function or cost function in the analysis, so papers using DEA or SFA were counted for production theory.

It was also observed that there were few theoretical models which have been applied dominantly or consistently. The disciplines which the theories and models were borrowed from were like those observed in the discipline bases categorization. Theories and models from economics were applied the most. The number of theories and models used in geography was not as great, but they showed consistency in application.

They were introduced in port research in the 1980s and continued to be applied to empirical studies and to be extended to further stages of existing models. These models were directly related with the key elements of these theories and were aiming to provide more insights that can

be used and applied by the theories mentioned above. There was an outstanding trend of increasing the involvement of concepts and models to the management disciplines in the 2000s. Although these concepts and models were applied in only a few papers respectively, the variety they show may entail further application in port research. The models or concepts which have been developed for port research specifically were also examined but only a few were identified. An obvious example was the port administration model (Baird 1995), sometimes named the port function matrix. Others were theoretical models developed based on geography.

One is the Hayuth model (Hayuth 1981) which can be regarded as a generic model used in transport geography. However according to his work, it is reasonable to understand that this model was developed to conceptualize the stages of spatial development in seaports and sea trading logistics in general. A similar model was also developed by Rimmer (1967) but it was not frequently used. Port-city relationships suggested by Hayuth (1982) and Hoyle (1989) were also examples of theoretical models developed specifically for seaports. However, none of them could provide

## 4. Literature Review

### 4.1 Introduction to the Theoretical Models

Presenting an overview of the trends of theories about ports governance and competence, this chapter shows the motivation for the thesis, and why it is needed, and its significance in the context of existing theories. The theories provided until now were able to present an overall of the context regarding the supply chain strategies regarding ports performance as well the key optimization structures towards this direction. However, they were not at all able to analyze the key elements that may help scientists. The main purpose of literature review is to analyze in depth the study, distinguish the research from other work and present a clear definition of key terms and definitions. Through the years many different theories were presented to the scientific world. All of them tried to explain how efficiency may influence the whole function of a vessel. All these theories were based on a structural based model and their main purpose was to scientifically explain that efficiency and effective function when it comes to ports function are two terms similar with the same expected outcome. To this end, a comprehensive collection of literature has been reviewed including journals, books, seminal papers, and internet sources.

To accomplish the above aim, this section aims to provide a wholistic overview to the basic and the most used theories, that were manipulated by scientists during the last two decades. The Transaction Cost Theory (TCT), Porter's Competitive Strategy Framework, Port Selection Theory, and theory on Port Performance as traditional theories. Then, this chapter addresses Resource Based Theory (RBT), and Supply Chain Management Theory (SCMT) as new views. We need to underline at this point that the last two theories (Resource Based Theory (RBT), and Supply Chain Management Theory (SCMT) ) are recently used but their application in several cases within the supply chain and logistics industry is of significant importance and provided really important insights for the scientists. A comprehensive view of SCMT and RBT as an alternative to explain ports' performance or competitive advantage is demonstrated, especially when it comes to the mean of efficiency and ports and more concretely in the efficiency as a key element to contribute to the port's performance.

What we need to mention in this point is the fact that all these theories are focusing only in theoretical perspective of a port function. Functionality many times may differ from the theory as

within the port's operations we find many times unfair parameters that influence the final cost. Functionality tends to be a very blurry meaning nowadays as we are not able to approach consistently the true meaning of this term. Actually, we cannot even define what functionality really means let alone to identify the key characteristic in order to analyze it. Function, efficiency and optimization are terms that characterized the function of the ports, and all these theories are focused on explaining these terms. However, the characterization many times is difficult to be identified and to be analyzed and all these methods have as an output this effort.

To reach the new perspective on ports competitive advantages, traditional views on firms' governance and competence, i.e. Transactional Cost Theory (TCT) and Porter's Competitive Strategy Framework will be reviewed. Then, port selection and port performance theories also will be covered. RBT and SCMT will be presented with a wholistic analysis to form a new perspective on ports' competitive advantages. Based on this discussion, new perspective on ports' competitive advantage will be provided mainly based on SCMT and RBT. To identify key concepts, similar but detailed framework for the current research will be after the discussions on literature review on four major theories.

Regarding views on firms' governance, there are two main theoretical analyses of a firm, i.e. contractual (Transactional Cost Theory or Analysis) and competence perspectives (Porter's Competitive Strategy Framework, Resource Based Theory) finds a firm in contractual theory as a reactive entity, not a proactive entity in competence perspectives encompassing learning, innovation, and the pursuit of sustained competitive advantage center stage. His study gives a broad picture on theoretical progress of theories on firms from contractual to competence perspectives. These perspectives were difficult to be covered by one theory and only, and for this reason in this section, pros and cons about those two perspectives will be reviewed. Additionally, there is an increasing awareness on a keen interest on Supply Chain Management Theory in the field of logistics and port industry.

Considering the above general trends of theories on firms (or ports), literature review will be implemented in the sequence of general theories, applied theories in the field of logistics (or ports), limitations, and implications to the thesis for each theory in relation to presentation of individual theory in each section. Consequently, the research gaps and the reason the author chooses combined views with RBT and SCMT based on competence perspective are described. 15 Special interests are devoted to the applied theories to the logistics or ports industry rather than general theories. Based on literature review on basic theories, the theoretical model of this research using variables including ports' (PAs' and Port focused Supply Chains') SCM strategies, ports' resources, performance (supply chain performance) and ports' competitive advantages will be constructed in chapter four (Research Model and Hypothesis) with the conceptual model and hypotheses.

What we need to clarify prior to the deep dive analysis of all the major theories, is the fact that in the field of supply chain logistics and ports there is not "one solution, fits all". Every case is unique, with unique needs and characteristics. In some cases, Porter's theory could be the ideal solution to identify ways to improve the efficiency of our port's function and in other case Supply Chain Management Theory could do the same work in another case when the structures are more complicated. For this reason, is extremely crucial to perform a deep dive and spherical analysis in all these theories in order to be able to extract the most accurate data and insights for our scientist approach. In the our main purpose is to identify efficient ways to ensure the improvement of the efficiency of a port either based on and only theory or by combining two or more theories for the same purpose.



## 4.2 Transaction Cost Theory

As introduced by many researchers, "Coase" is known as the creator of the concept and of the Transaction Cost Theory (hereafter TCT). Raising the point about the limitation of the price mechanism as resource allocator, Coase (1937) suggests the alternative of price mechanism such as entrepreneur-coordinator. The 'transaction cost' is interpreted as 'a cost of using the price mechanism' while addressing the issue of "the main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism" Discovering what the relevant prices is one of the examples of the cost when organizing production through the price mechanism.

According to Coase's view, the core of the TCT can be summarized as the avoidance of using the price mechanism and hiring hierarchy (or Organization) for efficient production or resource allocation. In connection with this, Hobbs defines 'transaction costs' as 'the costs of carrying out any exchange, whether between firms in a marketplace or a transfer of resources between stages in a vertically integrated firm' and provides three types of transaction cost as information costs, negotiation costs, and monitoring costs. The two approaches are not exactly different between each other, but in a most diplomatic way we can name them as two parts of the same coin. Coase was the creator of the concept as a theory, and Hobbs managed to identify the most important part of it. Transaction cost is indeed crucial to identify because as a term is extremely important for the whole concept of the Transaction Coast Theory.

In the field of logistics (or ports), the main discussions of TCT are focused on the reason of Supply Chain Management and vertical integration of organizations. Compared with manufacturing studies, little use has been made of TCT in the field of logistics or ports. Recognizing the importance of human assets among TCT variables (specific assets: human asset, dedicated assets; uncertainty: external, internal uncertainty), shipper is inclined to increase the use of private fleet if the shipper perceives that carrier changes would be costly or require significant carrier retraining. That means logistics managers see using private fleet to reduce transaction cost rather than as a means of providing specialized service. Hobbs (1996) brings TCT to logistics in the context of Supply Chain Management. He maintains that the reduction of the transaction costs is the key of the supply chain management as a tool of vertical coordination within a supply chain. Co-operation, teamwork, and the rapid interchange of data among companies are provided as the elements that make possible the reduction of transaction costs.

Compared with RBT, TCT is described as a useful tool for decision of outsourcing. According to Skojett-Larsen's view (1999), using Third party logistics (TPL) can reduce the transaction cost by shrinking the actual number of transport firms used and entering close and long-term cooperation with a few key operators. However, close cooperation can result in the risk of opportunistic behavior. Therefore, it could be necessary to incorporate safeguards and credible commitments in TPL agreement. Hence, it is pointed out that the limitation of TCT is relationships based on strong trust and openness. Even though it is not directly related to the logistics, pertaining to reduction of transaction cost, E-commerce or information technology can be regarded as offering opportunities to extend existing works, suggest that the avoidance of high uncertainty in e-commerce business can be explained by TCT and RBT in the light of relationship management in supply chains.

He concludes that TCT can provide the understanding what is the most efficient system for organizing integration through 3 ways including spot market contract, long-term contract with inland distributors, and vertical integration with distributors by joint venture, and acquisition or

forming own logistics organization. It should be noted that the listed studies might not be a comprehensive profile of all logistics-related works; however, they provide a representation of the application of the theory in logistics area. Thus, it can be understood that there are studies on the TPL (Third Party Logistics), reasons for SCM, impact of e-commerce, and governance structure of intermodal transport.

As Das and Teng (2000) discussed studies on strategic alliances applied TCT, vertical or horizontal integration of shipping liners can be explained by TCT in terms of internalization and market exchanges. Regarding the horizontal integration, literatures regarding horizontal strategic alliances among mega-carriers seem to be based on TCT. However, it is unclear which theories were about TCT, and which were about RBT in the studies considered by Ryoo. Panayides and Cullinane (2002) introduced some general studies based on various approaches including TCT, game theory, strategic behavior model, social exchange theory, power-dependence theory, and RBT. However, the question remains. Can management theories like game theory or strategic behavior model be applied in supply chain processes? In the end is a port a "normal" management structure and can we as scientists treat it as one of them?

The above discussions support an argument that TCT can be a useful tool to explain TPL (Third Party Logistics), reason for SCM, impact of e-commerce, and governance structure of intermodal transport. However, as discussed later, TCT has been criticized by some authors. The weaknesses of TCT vis-a-vis RBT (or capabilities views of the firm) are witnessed by many researchers.

Hodgson (1998) criticizes that TCT has limitations in three aspects, i.e.

- 1) Given, atomistic individuals,
- 2) Assumption of a uniformity of technology, and
- 3) A focus on comparative static explanations (neglect of technological innovation and dynamic change).

He lays out that the assumption of given and atomistic individual is the key difference against competence-based theories such as Resource Based Theory (RBT). Assumptions are not easy to be posed and most importantly are not easy to be answered. Should we base a theory based on these assumptions? And of course, are these assumptions able enough to provide us significant insights for making these theories widely accepted to the scientific world? He suggests that a competence-based view can be an alternative to TCT and a hybrid explanation can be useful (Ibid.). Furthermore, as the viability of competence-based theories, learning capacities related to cultural development and cultural transmission within organizations are stressed. Langlois (1992) emphasizes that transaction costs reach zero in the long run and the firm's internal capabilities through learning provides the firm with cost superiority over the market. Skjoett-Larsen (1999) maintains that TCT is not very well suited for an explanation of the SCM concept. Such integrated cooperation, which is a prerequisite in SCM, involves too large risk of opportunistic behavior.

Trying to build a unified theory in the field of logistics, Mentzer et al. (2004) point out that TCT does not provide an appropriate explanation about the growing number of long-term, committed, and strategic partnerships between buyers and sellers. The relation between buyers and sellers is dynamic relation and needs to be strictly defined for the benefit of both parties. Neither buyers nor sellers can afford explanations that are not concretely defined as this may cause issues of functionality in the whole supply chain cycle. In the end, ports is nothing more than a wholistic supply chain cycle where every part needs to co-exist in harmony in order to achieve the maximum possible efficiency.

Dynamic transaction costs are suggested as an alternative against TCT's a static aspect, and defined as 'the cost of persuading, negotiating, coordinating, and teaching outside suppliers'. Furthermore, the representative of the TCT, admits that competence theories are more concerned with learning. In logistics research area, Wagner and Frankel (2000) "stress the importance of establishing stable and long-term relationships rather than cost reduction." In port area, Olivier (2005) criticizes that Panayides' TCT view is not suitable to explain societal aspects of governance including cultural embeddedness of partnerships which are strong in China. According to his view, vertical disintegration of carriers separating their port operations as stand-alone business units is neglected.

Furthermore, the benefits of introducing e-logistics are strongly supported by TCT. However, the necessity of combining relationship strategy, long-term relationships, dynamic aspects like learning, and cultural & historical relationships lead to other perspectives. Thus, this new concept of combining e-logistics with the traditional parts of supply chains tends to be transformed into a new trend within the logistics industry whether traditional models and new technological trends are being combined in order to achieve the best possible results.

#### 4.3 Porter's Analysis Model

Porter's framework posits that firms compete within the same industry with homogeneity and mobility of the resources. Porter (1985) describes four dimensions of competitive scope, i.e. segment, vertical, geographical, and industry scope that can have a powerful effect on competitive advantage. Porter (1985) developed a typology of three generic strategies, i.e. cost leadership, differentiation, and focus, for creating a defensible position and outperforming competitors in a given industry. Lower cost is defined as "the ability of a firm to design, produce, and market a comparable product more efficiently than its competitors."

A definition of differentiation is expressed as "the ability to provide unique and superior value to the buyer in terms of product quality, special features, or after sale service". Focus is defined as "focusing on a particular buyer group, segment of the product line, or geographic market". In any case this focus is not necessary focus to one aspect at all. Sometimes we may focus on a specific product line for a specific region or segment. Through focus strategy, a firm can achieve differentiation or low cost. Porter asserts (1990) that if a company possesses sustainable competitive advantages, the company can succeed in the long run. He also defines competitive advantage as "some uniquely held characteristics of the firm either in product or process which cannot be easily imitated by competitors without incurring non-competitive investment costs".

Porter (1985) recognizes Value chain' as a basic tool for diagnosing competitive advantage and finding ways to create and sustain it. He stresses that many systematically divided discrete activities, not as a whole, can produce competitive advantage. He classifies this value chain activities into two types, i.e. primary activities (inbound logistics, operation, outbound logistics, marketing and sales, and service) and support activities (infrastructure, human resource management, technology development, and procurement). Adopting the value chain concept, Porter stresses vertical linkages between suppliers' value chain and a firm's value chain in the context of SCM.

In the field of port and shipping industries, some studies generally introduce Porter's framework. Brooks (1993) and Cerit (2000) apply Porter's framework to investigate shipping industry and mainly shipping industry in the view of port function. Brooks (1993) explicates ocean container carriers' competitive advantage through Porter's view. He adopts Porter's three generic strategies that employed by container shipping companies as cost leadership, differentiation, and focus

strategies. In recognition of the limitation of cost leadership, he stresses the importance of vertical integration for sustaining competitive advantage. In the context of international marketing, he implements factor analysis and reliability analysis to find factors affecting operational and functional variables of maritime transport, service quality determinants, and the level of the importance of each specific variable to the customer of Turkish maritime transport, i.e. Turkish dried fruit exporters.

Recognizing Porter's framework as a critical theoretical basis in understanding how firms create competitive advantages, Robinson (2002) suggests that the port is a third-party service provider as one element in the value-driven chain systems (supply chain) of individual firms. Based on the framework of the value-delivery system, we can explore and analyze the deep relationship between internet technology and supply chain performance.

Recognizing the existence of challenges for a theory of strategy, i.e. difficulties to develop a theory of strategy with limited complexity, chain of causality (Questions continue to arise why some firms attained favorable position etc.), and time horizon, and difficulties of empirical testing with cross section data. Porter (1991) pointed out the necessity of developing a dynamic theory of strategy. Using concepts such as 'activities as source of competitive advantage', and 'drivers' (reasons of creating superior value than others, e.g. learning, vertical integration, government regulation), he stressed the importance environmental determinants, e.g. presence of local rivalry, home demand, presence of home based-suppliers and related industries.

He also posited that environment affects both a firm's initial conditions, and its managerial choices. Maintaining that resources are only meaningful in the context of performing certain activities to achieve certain competitive advantages, he concluded that RBT (Resource based theory) could not be an alternative theory of strategy for the purpose of searching dynamic theories. However, he conceded that RBT adds an important dimension to the concepts of activities and drivers. As claimed in many studies, the necessity to adopt a new perspective is recognized regarding analyzing firm-level factors which determine the competitive advantage, owing to the limitation of Porter's view. To this end, RBT (Resource Based Theory) and SCMT (Supply Chain Management Theory) will be discussed as main theoretical bases of the current study.

This statement does not mean that Porter's theory regarding the performance of a port is not efficient or is not able to solve serious and significant problems regarding the function of a port. What means that the theory can be combined with other theories or theoretical approaches in order to maximize the results of the scientific research. In the end the purpose of this thesis and all scientific exercise is to find the most appropriate and efficient way to ensure that the efficiency is a measurable element and can be improved in benefit of the port itself as an existence.

#### 4.4 Ports Selection Criteria

There is a body of research on port selection criteria. Song (2002) provides a summary of studies on port selection criteria. He suggests important dimensions for hub-port including port location, port infrastructure and superstructure, port service, port charge and cost, carriers' service in port, port connectivity, hinterland accessibility, and distribution centers & info-structure.

Other important factors from these studies are cost of transport & port charges, number of sailings, road and rail services, and inland distances etc. Because of an emerging carriers' dominant role, carriers' perspective has become popular in port selection studies. Researchers have found that

the most important factors for regional liners in port selection were cargo volume and global liners' look at the size of the market and the expense item, and other various variables such as intermodal hinterland connection through berth length and availability to cargo safety.

Furthermore, they listed eight factors, i.e. cargo expense, land connection, reliability of service, water draft, cargo safety, overtime working, IT, and management/worker relationship. The main criteria are carriers' terminal cost (38.12%), port geographical location (35.12%), port physical and technical infrastructure (16.38%), and port management & administration (10.38%). Recently, other researchers and scientists utilize the criteria from Song's research for comparisons between Montreal and New York port.

In the recent studies, it is recognized that port choice is about choosing one within a supply chain. In the context of SCM, Herfort (2002) maintains that two key factors related to the integration of a port into an automotive supply-chain in Europe are geo-strategical position of the port and economy & overall costs. The second point is extremely important for the research methodology as it justified that the existence of a port is an example of the "Economies of Scales Theory". The most expensive are the services provide by the port, this can influence the final price of the cargo transferred within this port and as a result this can transform a port into a competitive choice or not. It is stipulated that port location, infrastructure, and service are crucial in decision making process of port choice. Based on Robinson's value-driven chain system, recent researcher usually argue that port users, e.g. shippers, choose a package of logistics services rather than a port per se. Thus, under the new circumstances, it is stressed that new criteria should reflect the competition of ports in supply chain. To overcome the limitation of traditional port selection theory, a new perspective on performance indicators that reflect the SCM context, i.e. Supply Chain Performance (SCP) will be discussed later in this chapter.

#### 4.5 Ports Performance

As Talley (1994) introduces, one of the traditional port performance indicators is comparing actual throughput with its optimum throughput for a specified time period, which is decided by physical maximum throughput that can be handled by a port. Recent studies still use port traffic as an important port performance. Because port logistics costs are incurred by shipping lines and inland carriers, performance indicators related to economic optimum throughput rather than physical one, i.e. efficiency or effectiveness have been used popularly like the study by Mentzer and Konrad (1991).

Effectiveness is concerned with 'how well a port provides service to users'. Efficiency is about 'how well a port utilizes its available. As Wang and Cullinane (2006) recognize, Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) are widely employed to measure port efficiency. DEA is defined as a nonparametric method of measuring the efficiency of a decision-making unit (DMU) with multiple inputs and/or multiple outputs.

In other perspective, Tsambounas (2001) briefly introduces traditional logistics measurement systems aiming to capture five types of performance including asset management, cost, customer service, productivity, and logistics quality. Traditional performance indicators, e.g. efficiency, are inappropriate for measuring performance in terms of SCM properly as discussed earlier. The importance of measuring performance of container terminals in the context of global supply chain management is recognized by recent studies. Thus measuring the performance of a container terminal is essential for the total insights regarding the performance of a port as its needs to upscaled logistics is essential for their function. Acknowledging the importance of port supply

chain, Lee et al. (2003) suggested a measure for performance of entire supply chain as container handling time, number of vessels to be serviced, port time, and berth utilization.

However, this measure focuses on effectiveness rather than supply chain performance. Based on SCM perspective, Tsambounas (2001) introduces 'intermodal performance' and 'measures' that of European terminals. These discussions suggest that SCM context should be pondered for the development of port performance. To this end, Supply Chain Performance (SCP) will be considered as a major performance indicator for ports (or ports in supply chain). Regarding SCP, further details will be discussed later in this chapter.

#### 4.6 Resourced Based Theory

Originated from Penrose's work (1959) which argued the firm as a collection of productive resources, RBT was highlighted in 1980s. Concentrating on the strategic management studies, scientists and recent researchers revealed that RBT was one of dominant theories about a firm's performance. The distinctive difference between General Porter's Competitive Strategy Framework and RBT is that neatly observed, RBT emphasizes on a firm's internal strengths and weaknesses rather than external opportunities and threats. Stressing the importance of the exploitation of a firm's core competences to create radical new products, however, their work failed to provide academic interest somehow.

Grant (1991) suggested the five-stage procedure for strategy formulation: analyzing a firm's resource-base; appraising the firm's capabilities; analyzing the profit-earning potential of the firm's resources and capabilities; selecting a strategy; and extending and upgrading the firm's pool of resources and capabilities. One of his contributions to RBT was to distinguish resources from capabilities. He defined a capability as 'the capacity for a team of resources to perform some task or activity'. While resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage (Grant, 1991).

The present research, mainly based on Barney's view, combines Grant's and Barney's view. According to this integrated perspective, a conceptual sequence can be developed for the present research. Recently, to overcome the static nature of Barney's view, resource exploitation and dynamic capabilities were discussed. Eisenhardt and Martin (2000: 1105p) reclarified 'dynamic capabilities' as from 'routines to learn routines' to 'a set of specific and identifiable processes such as product development, strategic decision making, and alliancing'. Dynamic capabilities have been stressed because of the importance of adapting in environments of rapid technological change.

Furthermore, it is argued that long-term competitive advantage lies in the resource configurations that managers build using dynamic capabilities, not in the capabilities themselves (Ibid.). Later on, as Hoskisson et al. (1999) pointed out, research on RBT has been more specialized in many areas, e.g. comparison with five approaches (Conner, 1991), combining with institutional view (Oliver, 1997), applying in marketing, logistics and International Business.

Especially, shipping and port industries are typical multinational businesses and these industries can be supported and explained well by RBT. Peng (2001) designated that RBT contributed to multinational corporations (MNCs) and market entries, especially in three new areas (strategic alliances, international entrepreneurship, and emerging market strategies). His research highlighted the nature of resource overcoming the liability of foreignness, elucidating the

resources that provide the foundation for product and international diversification (Cited in Barney et al, 2001). Adopting the RBT, Mentzer et al. (2004) clarified the importance of the strategic role of logistics in the firm performance. They argued that logistics capabilities were a source of competitive advantage.

In the meantime, the port supply chain is different in some ways against manufacturing supply chain (Lee et al., 2003). It is suggested that differences should be recognized when the RBT is applied in shipping and port industries compared with manufacturing industry. However, what was not pointed out is the fact that ports tends to be and to remain dynamic organizations. Optimizing its operations may be one parameter to increase their efficiency but this need to be followed by new technologies and mechanisms towards the same direction.

However, recently, there is an increasing awareness about port and shipping related literature using RBT. Heaver (2001) proposes a framework for the strategies of liner shipping companies based on RBT. Concentrating on the economics of vertical control in liner shipping and logistics, he seems to adopt similar logic with Grant (1991) in the sequence of strategies-resources capabilities (or logistical service quality)-competitive advantage.

As Olivier (2005) acknowledged the contribution, Panayides and Cullinane (2002) suggest Porter's framework, RBT and Supply Chain Management Theory as relevant theoretical basis for the empirical studies on competitive advantage of shipping companies. Olivier (2005) asserts that RBT is more suitable for explaining private entry in global container terminal network rather than transaction cost theory. Furthermore, he maintains that RBT has strength in explicating cooperative agreements, e.g. alliances, vertical and horizontal integration strategies which are directly related to SCM strategies (Ibid.).

Combining RBT and SCMT, Robinson (2006) lays out the principle that critical assets of landside chain that are indispensable, unique, and scarce will provide the basis for chain power by investigating the integration of the landside chains of Melbourne port. Such framework including RBT and SCMT can be useful to understand the current research. As discussed, earlier RBT has distinctions whereby making many advantages over other theoretical bases possible.

Researchers maintain stagnate that the strength of RBT would be the better description of the interorganizational partnership development in the long term. Mentzer et al. (2004) propose a framework that includes resource management, logistics capabilities, management of shareholder's goals, competitive advantage, customer satisfaction, long-term profitability, and survival of a firm. Lee (2005) stresses that RBT is an effective tool to explain logistics and supply chain management issues and analyses the relationships between firms' integrated supply chain management and their sustainable competitive advantage. Thus, RBT and SCMT can be recognized as a useful theoretical tool as combined one to explain a port's competitive advantage.

#### 4.7 Supply Chain Management Theory

SCM seems to have ambiguity in terms of its theoretical origin, despite of its popularity. The examples of Supply Chain Management (SCM) include procurement, production, marketing, sales, and distribution. Also, the management of multiple relationships across the supply chain is often regarded as SCM.

Through survey on 208 logistics educators, they concluded that there are actual four groups of opinions on the logistics vs. SCM issue. According to Mentzer et al. (2001), there are two categories of perspective on SCM. One is SCM as a management philosophy and the other is a

set of management processes. Mentzer et al. (Ibid. 7p) summarize the characteristics of SCM as a management philosophy as "1) A systems approach to viewing the supply chain as a whole, and to managing the total flow of goods inventory from the supplier to the ultimate customer; 2) A strategic orientation toward cooperative efforts to synchronize and converge intrafirm and interfirm operational and strategic capabilities into a unified whole; 3) A customer focus to create unique and individualized sources of customer value, leading to customer satisfaction". Mentzer provide various activities necessary to successfully implement a SCM philosophy including integrated behavior, mutually sharing information, mutually sharing risks and rewards, cooperation, the same goal and the same focus on serving customers, integration of processes, and partners to build and maintain long term relationships.

Considerable studies assuming SCM as a process are reported by Mentzer et al. (2001). This view understands SCM as "the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption" He also elucidate the concept of supply chain orientation (SCO) apart from SCM. They defined 'supply chain orientation' as "the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain." It is clearly maintained that the possession of SCO does not mean the implementation of SCM.

In considering all aspects of SCM, they specify the concept SCM as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole." It is also suggested that the consequences of SCM would be improving profitability, competitive advantage, and customer value/satisfaction of a supply chain as well as its participants in the following model of SCM.

In terms of maritime related SCM, Kuipers (2005) points out the SCMmaritime transport paradox which means there is difference between manufacturing SCM and maritime transport SCM. Despite the SCM-maritime transport paradox, Kuipers (2005: 227-8p) claims that it is clear there is a demand for "high differentiated logistics services; increasing levels of flexibility related to unique customer demand; high speed services; and an increased knowledge intensity and the need for developing industrial relations and high levels of trust in the industrial network as a whole".

Bearing the difference between SCM of manufacturing industry and logistics in mind, SCMT studies in port and shipping industries are reviewed from now on. L6pez and Poole (1998) introduce the term 'port logistics chain' to address a quality assurance system, e.g. ISO standard as a means of signaling quality to the customers in the case of Valencia port. Frankel (1999) asserts that total Transocean supply chains include not only land and sea transport but also inter- and intra-modal transfer links as well as storage or buffer and inspection links. Each of these imposes not only time and cost on the transport chain but also introduce uncertainty and risk. He stresses that uncertainty and risks, e.g. reduction of inventories, time and schedule risk are the most expensive and least controllable elements in a trans-ocean supply chain, and effective supply chain management must now devote much of its efforts to control and reduce such risks.



Elucidating the Emits of ports as 'places', 'operating systems', and 'administrative units', Robinson (2002) claims that ports must be elements in value-driven chain systems or in value chain constellations. Furthermore, he recognizes a port as a third-party service provider which is intervening in import and export supply chain. Also, it is stressed that competitions take place in the form of competition among port supply chains.

Carbone and Martino (2003) investigate the Renault's supply chain in port of Le Havre. Using four variables (relationships, supplied services, information and communication technologies, and performance measurement), they conclude that the higher the level of integration among the actors of a supply chain, the higher the performance for the entire chain. Through interviews and questionnaires with experts in 73 ports, Bichou and Gray (2004) suggest a profit-based aggregate performance indicator (Key Performance Indicator: KPI model).

Adopting multiple regression with data from the questionnaire survey for managers of 300 ports and container terminals worldwide, Song and Panayides (2008) empirically prove the positive relationship between value added services and cost/ability of customization by the ports, positive influence of use of technology on quality of the ports' service, and positive influence of relationship with the shipping line on the ports' reliability and responsiveness.

#### 4.8 RBT and SCMT: Analyzing the key concepts

Considering the implications of TCT, benefits of SCM and firm's integration strategies are recognized, this encouraged adopting SCMT as a main basic theoretical base. Furthermore, integration strategies as a tool of SCM strategies can be considered as a variable in the research model. Literature review on traditional port performance indicators and port selection criteria shows that new port performance indicators are needed in the light of supply chain performance. In this regard, SCMT can be understood as one of the major theoretical background providing new performance indicators, i.e. Supply Chain Performance which can comply with the supply chain concept.

The concept of competitive advantage will be searched based on the suggestions of Porter's strategic theory and RBT. RBT suggests four interesting implications for this research. First, units of analysis are companies (or Supply Chain) not an industry. Second, using resources variable in the model is necessary. Like Porter's Strategic framework, competitive advantage variable is recommended. Sometimes based on Porter himself not only the competitive advantage varies but in many cases is difficult to be identified. Importance of focus on relationships can be derived from relational resources and systemic and strategic coordination within a supply chain of SCM strategy.

As a result, necessary concepts which should be investigated can be recognized at the end of this chapter. In this section, core concepts related to the framework will be searched and developed. To this end, literature on four major variables, i.e. Port Authorities' SCM strategies, Port focused Supply Chains' SCM strategies, PSCs' Resources, and PSCs' Supply Chain Performance, will have been investigated by the scientist's concept by concept.

According to the discussions, the SCM (Supply Chain Management) strategy is related to improving the long-term performance of both individual parties in supply chain. Based on the above definition of SCM, PAs' various strategies can be reviewed in the context of SCM. As Mentzer et al. (2001) stress, the purpose of SCM is improving the long-term performance of the individual companies and the supply chain through systematic and strategic coordination.

Therefore, some port policies aiming to enhance the performance of stevedoring and inland transport companies in port (or hinterland) can be recognized as SCM related strategies. Bichou and Gray (2004) imply that SCM approach to ports may be useful in highlighting the strategic role and future potential of ports within the framework of international business in general. Furthermore, stressed the importance of the role of PAs in fostering the development of an effective cooperation between interested public and private players.

Regarding the term, 'port authority', it is recognized that there are ambiguous uses of similar terms, e.g. port authority port administration, and public sector briefly introduce two types of port exploitation, i.e. the 'landlord port' and 'service port' (1). In the case of the landlord port, PAs provide the necessary port infrastructure, i.e. quays, locks, docks and yards. Financial support from national government is the common case.

The PAs in case of service port have wider responsibilities including the maintenance of maritime access routes and operation of terminals. Based on the landlord port concept, define a PA as "a land manager with responsibility for a safe, sustainable, and competitive of the port." Martin and Thomas (2001) provided the traditional 'port authority's role as the provision of the basic port infrastructure and ensuring services with fair and equitable prices. Furthermore, Baird's port function matrix provides three essential functions, i.e. regulatory, landowner, and operator. On the basis of the above discussions, a PA is defined as public or private organizations in charge of regulatory, leasing lands or operating services including the provision of basic port infrastructure, safety, navigation, ensuring competitiveness, fair and equitable prices, or container handling services.

In the current study, Supply Chain Performance (SCP) is defined as 'PSCs' performance which is estimated by its customers, i.e. liners, and freight forwarders. SCP concept is originated from manufacturing Supply Chain. Measuring the supply chain's performance is discussed by considerable research. Recognizing the necessity of new supply chain measurement, Van Hoek (1998) provides a preliminary framework developing from 1) cost level, 2) customer service/market extension into 3) integration and market creation stage. Stewart (1995) used four measurement areas including delivery performance; flexibility and responsiveness; logistics cost; and asset management. Stressing the importance of the integrated SCM measurement, Bechtel and Janyaram (1997) summarize the measures claimed by various studies in measurement area, i.e., service, cost, productivity asset/utilization, time. Beamon (1999) suggests three elements of measurement of SCP, i.e. resources (efficiency), output (customer service), and flexibility (ability to respond to changing environment).

Recognizing that SCP in transport is different from that of manufacturing supply chain (Bechtel and Jayaram, 1997), Lai et al. (2002; 2004) expand SCP concept into transport supply chain. Based on the SCOR model by supply chain council (2006), they focused on the customers of transport logistics firm, i.e. shippers at the input side and consignees at the output side. In port industry, Carbone and De Martino (2003) give some considerations on the key performance indicators in line with automotive and port SCM matrix. The effort to set up to supply chain performance measure was endeavored by Bichou and Gray (2004). They developed a profit-based aggregate performance which is called as 'Key Performance Indicator (KPI) model'.

#### 4.9 Main Conclusions

This chapter has investigated the studies on theories, bases of firm's (or port's) competence, i.e. TCT, Porter's framework, Port performance, Port selection theory, RBT, and SCMT. The

combined view of RBT and SCMT is posited as a relevant theoretical framework for the current research. To apply this framework to the study on PAs' SCM strategies and their impacts on PSCs' (Port focused Supply Chain) SCM strategies, PSCs' resources, and PSCs' Supply Chain Performance (SCP), concepts are defined, and related literatures are reviewed.

As the result of literature review, several points are suggested:

1) Recognizing the limits of TCT, Porter's framework, Theories on Port's selection & performance, it is found that the combining RBT and SCMT can successfully elucidate the PAs' SCM strategies and PSCs' SCP (or competitive advantage) issue in the port and shipping industries.

2) There are research gaps in empirical studies on PAs' SCM, PSCs' SCM, PSCs' resources, and PSCs SCP (or competitive advantage). Furthermore, empirical studies with regard to relationships between these variables are rare in the port and shipping industries, especially in Northeast Asia. Thus, the aim of the current research to accomplish empirical research on the variables would be justified.

3) Recently, Covariance based Structural Equation Modelling (SEM) is adopted in considerable studies with regard to SCM and competitive advantage. Therefore, SEM could be an option to implement the research. However, it is recognized recently that there are many misunderstandings in establishing measures in formative way using SEM.

4) It is found that measures of SCP and competitive advantage are similar. It is likely that these two constructs can be regarded as one. This issue will be discussed in detail in chapter four. Lai et al. (2002) stress the research gap about a study finding the relationship between SCP and competitive advantage.

What needs to be clearly stated however is the fact that all these theories follow always the theoretical background of the person that conceived them. All of them may apply to a single port, several ports or nowhere. Porter tried to create a framework in order to explain efficiency when Resource Based Theory tried to analyze efficiency and performance based on current available resources.

The main purpose of the exercise is not to provide a single way to explain how Port's efficiency may be improved. That would be a scientific mistake as in any case that we may examine, different parameters may apply which will influence our final efficiency rate. What I tried to do is to present in a scientific way all the different scientific theories that not only may apply to the function of a port but also are able to improve its efficiency and functionality.

In my opinion, in the case of Piraeus that I tried to examine Porter's Theory seems more relevant, however key characteristics of other theories may apply as well. The scientists from the theoretical perspective and the line managers from the managerial point of view needs always to focus on all the parameters that appear prior to choose the most appropriate theory to follow. In the end efficiency is the result of many different stakeholders, and many stakeholders may affect it either negatively or positively

### Chapter 3

#### 5. Supply Chain Integration

##### Introduction

There are three points of analysis in this thesis. All of them have as a common aim to present all the theories that currently exist in the global literature and may be used to describe the port's efficiency and functionality.

- (1) provide a context for the research and showing where the research fits into the existing body of knowledge
- (2) Describe the basic theories used to describe supply chain organization and structure
- (3) outline gaps in previous research,

This chapter is devoted to reviewing literature specifically relating to supply chain integration of seaport terminals to achieve the second, third and fourth aims. This chapter begins by clarifying the term 'supply chain' to discuss whether seaports can be considered in a Supply Chain Management (SCM) context. Subsequently, how the integration of ports into supply chains has previously been studied is presented. This literature review is also intended to provide a theoretical framework to develop the research model. Therefore, the main constructs in this thesis are conceptualized: Port Supply Chain Integration (PSCI), Port Supply Chain Orientation (PSCO) and Port Performance (PP). Their components are identified from the literature and their causal relationships are justified in this part of this chapter. Finally, research gaps are identified to justify this research.

## 5.1 Supply Chain and Integration

In the global economy supply chain management has become a prominent issue in the business management and logistics field. Many scientists tried to approach in a scientific way this issue and to provide the most quantitatively approach to that. Lambert and Cooper (2000) show that one of the most significant shifts of modern business management is that individual businesses no longer compete as solely autonomous entities but rather as supply chains. It is generally stated that SCM and other similar terms such as network sourcing, supply pipeline management, value chain management, and value stream management have become subjects of increasing interest in recent years, to academics, consultants and business management. It is also increasingly accepted that effective management of a supply chain is a key factor in differentiating product and service offerings and gaining competitive advantage for firms.

The background reason that SCM has become so popular and recognized as a crucial firm strategy is that companies have become more dependent on supply chains and find it necessary to manage supply chains more effectively in order to meet complicated customer requirements in a global economy. Lai et al (2002) state that the emergence of the global economy and intensified competition have led firms to recognize the importance of managing their supply chain for fast product introduction and service innovations to the markets. Thus, firms have embraced SCM to increase organizational effectiveness and to achieve such organizational goals as improved customer value, better utilization of resources, and increased profitability.

Mentzer et al. (2001) also state that specific drivers to supply chain management may be traced to the trends in global sourcing, an emphasis on time and quality-based competition and their respective contributions to greater environmental uncertainty. Researchers have made efforts to define the term supply chain management which is relatively new and somewhat ambiguous. The most common and widely accepted term by the scientific community states that supply chain management has received attention since the early 1980s, yet conceptually the management of

supply chains is not particularly well-understood, and many authors have highlighted the necessity of clear definitional constructs and conceptual frameworks on supply chain management. Mentzer points out that despite the popularity of the term, both in academia and practice there remains considerable confusion as to its meaning. Others scientists on the other side define SCM as “an integrative philosophy to manage the total flow of a distribution channel from the supplier to their ultimate user”. SCM is also defined as the integration of key business processes to end users through original suppliers that provide products, services and information that add value for customers and other stakeholders.

More useful distinctions are given by Mentzer et al. (2001). They at first distinguish “supply chains as phenomena that exist in business and the management of those supply chains” which is SCM. Also, the definition of SCM is classified into three categories: a management philosophy, the implementation of a management philosophy, and a set of management processes. In addition, the activities necessary to successfully implement an SCM philosophy are presented: integrated behavior, mutually sharing information, mutually sharing risks and rewards, cooperation, the same goal and the same focus on serving customers, integration of processes and partners to build and maintain long-term relationships. These activities are frequently adopted as constructs for conceptualizing SCM.

On the other hand, they present a distinction between Supply Chain Orientation (SCO) and SCM: “SCO is a management philosophy and SCM is the sum total of management actions undertaken to realize that philosophy”. SCO can be expressed as the degree of recognition and willingness to address the strategic activities involved in managing a supply chain, and they highlight that “companies implementing SCM must first have a SCO”. Thus, SCO is used as one of the antecedents to SCM. With regard to its relation with logistics, it is accepted that SCM has a broader scope from the definition by the Council of SCM stating that “Logistics management is that part of SCM that plans, implements and controls the efficient forward and reverse flow and storage of goods, services, and related information between the point of origin and point of consumption in order to meet customer requirements”. Ballou (2007) points out that SCM is viewed as managing product flows across multiple enterprises whereas logistics is seen as managing the product flow activities just within the firm.

Despite the various dimensions of understanding about SCM, the main concept that penetrates the understandings of SCM is ‘integration’. Bowersox and Closs (1996) argue that to be fully effective in today’s competitive environment, firms must expand their integrated behavior to incorporate customers and suppliers. They refer to this extension of integrated behaviors, through external integration, as SCM. However, even though the need to expand their behaviors is stated, what is not clear yet is how to achieve this expansion. Firms are complicated organizations. Ports are not only complicated structures but also dynamic existences so this expansion is a need, yet is not defined the way to achieve it.

According to Cooper and Ellram (1993), SCM is viewed as lying between fully vertically integrated systems and those where each channel member operated completely independently. Chow et al. (1995) state the concept of integration is central to logistics. According to them, integration is the degree to which logistics tasks and activities within the firms and across the supply chains are managed in a coordinated fashion. Several terminologies are given to express the types and degrees of integration. Kahn and Mentzer (1996) identify two interdepartmental integration characteristics, namely, interaction and collaboration. In their view, interaction is information flow via communication and tends to be mandatory, formal, and somewhat tangible, thus it can be easily tracked, whereas collaboration refers to working together in a team environment under shared goals and cannot be mandated, programmed or formalized thus is more difficult to monitor.

Cooperation is a starting point for SCM but not a sufficient condition. Coordination is the next level, linking trading parties through exchanging workflow and information. The final stage is collaboration which requires high levels of trust, commitment, and information sharing among supply chain partners. The types of supply chain integration have been categorized in various ways; internal integration and external integration, intra-organizational integration and inter-organizational integration, customer integration, internal integration, material and service supplier integration, technology and planning integration, measurement integration, relationship integration.

## 5.2 Nature of Port Supply Chain Integration (PSCI)

The phenomenon, 'integration of ports in supply chains', has been recently studied by maritime researchers (e.g. Carbone and De Martino 2003; Notteboom and Rodrigue 2005; Panayides and Song 2008) as discussed in the previous section. Panayides and Song (2008) termed the integration of seaport/terminals in supply chains as 'Seaport Terminal Supply Chain Integration (TESCI)', and defined the term as "the extent to which the terminal establishes systems and processes and undertakes functions relevant to becoming an integral part of the supply chain as opposed to being an isolated node that provides basic ship-shore operation".

This thesis uses the term 'Port Supply Chain Integration (PSCI)' for the phenomenon. PSCI can be expressed, adapting Panayides and Song (2008)'s definition, as 'a strategy undertaken by a seaport terminal to integrate various functions and organizations in a supply chain to become an integral part of the supply chain'. Thus, the entity to implement the strategy is a company operating seaport terminal which are termed as Terminal Operating Companies (TOCs).

Most of the studies on PSCI demonstrate that PSCI is implemented through (1) providing integrated logistics services and (2) organisational integration (e.g. Beresford et al. 2004; Carbone and De Martino 2003; De Souza et al. 2003; Notteboom and Winkelmanns 2001; Paixao and Marlow 2003; Robinson 2002). De Martino and Morvillo (2008) suggested that 'the concept of integration in the port context has essentially concerned intramodality and organizational integration undertaken by global carriers aimed at responding to the changing requirements of industrial and commercial enterprises and at the same time improving their own internal efficiency.' Beresford et al. (2004) pointed out that modern ports diversified into the emerging field of logistics and began to offer integrated logistics services as they became increasingly integrated into transport and supply chains.

The integrated logistics services are primarily concerned with intermodal services and value-added logistics (VAL) services. Traditionally, VALs have provided cargo handling services and simple storage. On top of these, they have also provided inland intermodal operation and transportation. Since ports are both involved in the sea and land side of logistics operations and they have importance in the land-sea cargo supply chains, they are granted the main role in the creation of intermodal transport systems (Misztal 2007). Intermodal transport has emerged as a new transport concept in order to integrate transport modes and to provide coordinated transport activities under a single transport document in the logistics chain.

Accordingly, ports' role in this logistics chain apart from their traditional activities and functions is expected to change and become intermodal transport-oriented in order to be competitive in the transport industry. With the developments taking place in container transport and intermodal transport, land connections of ports and their hinterland have become a differentiation factor.

Ports are important elements in the logistics chain and their level of integration with intermodal transport and their hinterland is very important, and this can be suggested as a new area of research. The main reasons for this need are that costs for inland transport are generally higher than maritime transport costs and many delays can occur on the inland side of the chain such as congestion, limited infrastructure, etc.

Although more economical ships and alliance co-operation have lowered ship system costs, intermodal costs still share an increasing part of the total cost. In a typical intermodal transport system, inland transport now accounts for a much larger component of the cost than running the vessel. The portion of inland costs in the total costs of container shipping would range from 40% to 80% (Notteboom 2004). Improving the infrastructure and using cost-effective solutions for inland distribution of cargoes may help ports to achieve supply chain integration and to be intermodal transport-capable. The introduction of intermodal transport and its relation with ports have had the following consequences in the transport and port environment and these can be classified in terms of (a) hinterland connections of ports (b) the roles of the actors in the logistics chain (c) connectivity and integration of ports with different transport modes and (d) evolution of dry ports.

The integrated logistics services provision necessarily involves organizational integration. The level of the organizational integration also varies in accordance with the companies' strategy. Cases of being fully vertically integrated or full outsourcing are rare. Most cases are somewhere between the two extremes. Further investigation into corporate governance relating to PSCI would be an interesting research issue but is not the focus of this research. However some more fundamental questions regarding organizational integration need to be addressed.

Supply chain integration has been traditionally categorized into two dimensions: internal integration and external. The former refers to the logistics integration across functional boundaries within a firm and the latter, the integration of logistics activities across firm boundaries (Stock et al. 2000). From the whole supply chain's view, the integration of a port into a supply chain appears to be the activities undertaken by ports, as a service provider, to cooperate with other members in the supply chain beyond their boundary, which is external integration. However, from the ports' view, PSCI involves or should involve both internal and external integration. Paixao and Marlow (2003) propose that implementation of an agile port should cover both the external integration which implements vertical and horizontal integration along logistics chains and the internal integration which identifies and breaks down the whole process of the port, and redesign the process according to a Just-In-Time (JIT) philosophy. Caputo and Mininno (1996) also indicate that internal integration is the prerequisite for effective inter-organizational integration.

Both vertical integration and horizontal integration or either of them can be considered regarding organizational integration (De Martino and Morvillo 2008). However, when it comes to integration of ports into the supply chain, the integration can be implemented primarily through vertical integration, even though this does not necessarily exclude horizontal integration concepts. In the case of liner shipping, its integration along the supply chain is indirectly supported by horizontal integration which leads to the creation of bigger organizations with more bargaining power, and therefore facilitates entry into inland markets (Panayides 2001). Also, in the manufacturing industry context, horizontal integration is considered as a requirement for vertical integration to produce synergies (Caputo and Mininno 1996).

In contrast, it is less likely that horizontal integration brings about synergy effects on vertical

integration of ports either directly or indirectly. Developing port operating networks globally would build up bargaining power against global shipping liners, mitigating the liners' footloose practices, but it hardly facilitates ports' entry into other transport or logistics markets. Four types of integration are presented by Fawcett and Magnan (2002): internal integration, backward integration with first-tier suppliers, forward integration with first tier customers, and complete forward and backward integration which is expressed as integration from the suppliers' supplier to the customers' customer. The suppliers and customers can be differently identified according to the focal company of a supply chain. In this thesis 'supply chain' means the supply chain for goods or cargoes passing through the port, so PSCI can take place in either direction or both directions.

### 5.3 Motives and Circumstances of PSCI

SCM is implemented primarily for the purpose of improving organizational and supply chain performance. Specific objectives other than the ultimate goals are suggested to be cost reduction and the customer service improvement through providing differentiated services (Mentzer et al. 2001). The question therefore arises what can be the motives for ports to integrate into supply chains? Similarly, to SCM, port operators adopting this strategy may expect to achieve competitive advantage to some extent and eventually improve organizational performance, e.g. profitability. However, the objectives and motives at the more specific level are rarely presented in the relevant literature. Notteboom and Winkelmanns (2001) suggest that service differentiation is a more sustainable source of competitive advantage than cost leadership and this would be the basic motivation. However, some other reasons and motivations were expected to be revealed because PSCI may represent the diversification of the strategic direction of ports from shipping companies to shippers.

On the other hand, some researchers attempt to identify and outline the reasons and circumstances that logistics activities develop better in particular ports. Ferrari et al. (2006), investigating the development of Distribution Centres (DCs) in Southern European countries, present the reasons that the number of DCs in Western Mediterranean ports increases faster than that in Eastern Mediterranean ports. According to their analysis, the former has already achieved a considerable level of growth in terms of cargo throughput, and the annual growth rate is consistently 5-6%. Therefore, they aim at gaining port activities' added value. Thus, ports' strategies seek to achieve two consecutive goals; firstly, acquiring a considerable amount of traffic, and then developing facilities for value-added services and logistics services. Theys et al. (2008), firstly, citing UNESCAP (2005), suggest that ports nearby to major markets in the hinterland would feel easier with developing into a logistics center port. Subsequently, they analyse the port characteristics that make the port attractive as a logistics center and the characteristics of firm and cargo which a port region is considered as more appropriate for than a hinterland region. Their analysis, based on the surveys conducted on the Port of Busan, South Korea, presents as attractive port characteristics for logistics center, geographical location near main shipping routes; good availability of modern port infra- and superstructure; well-skilled port labor; proximity to major consumption area; and port reputation and image.

### 5.4 Casual Relationships

As explained in Chapter 2, this research aims at investigating causal relationships between PSCI, antecedents to PSCI and its consequences. More specifically, this research concerns (1) how



organizational characteristics and attitude towards SCM practices impact on PSCI, and (2) how PSCI influences port performance and port's efficiency as a whole.

Following the traditional logistics research framework, these sorts of research objectives are achieved through, first, developing a research model (or theory) and hypotheses assuming causal relationships, and, subsequently, examining the model and hypotheses by empirical analysis. This literature review encompasses both the relevant literature in SCM research and port research because, even though PSCI is a phenomenon grounded in the port industry, the ideas and concepts applied in the model are, to a considerable extent, involved with theories used in SCM research.

The relationship between Supply Chain Management (SCM) and port's performance have been examined by several researchers. As SCM theory is expected to increase the performance and competitive advantage of supply chains as well as a port in the supply chain cycle. Mentzer et al. (2001) demonstrate that the improvement of competitive advantage within the supply chain is the motive for, and the consequence of, SCM. They propose that competitive advantage can be achieved through enhancing customer value and satisfaction by implementing SCM. The results of most research indicate that the higher the level integration occurs at; the better firm performance is in real time.

A body of literature exists which has developed more complicated models incorporating moderators between supply chain integration and firm performance, or antecedents of supply chain management and integration. The literature assesses direct and indirect relationships between them. Mentzer concluded that supply chain integration has an indirect impact on a firm's financial performance and that the performance can be improved through enhanced customer service which mediates the relationship between supply chain integration and firm performance. Johnson (1999) identified five antecedents of strategic integration which are dependence, age, continuity expectation, flexibility and relationship quality, and showed that dependence, continuity expectation and flexibility positively affect strategic integration, and, in turn, strategic integration enhances performance.

Mentzer et al. (2001) differentiate Supply Chain Orientation (SCO) from SCM, defining SCO 'the recognition by an organisation of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain' and calling 'the actual implementation of SCO across various companies in the supply chain' SCM. Their conceptual model, accordingly, identifies SCO as an antecedent of SCM, and SCM as an enhancer of firm performance. Min et al. (2007) associated their SCM concepts with Market Orientation (MO). In their model, Supply Chain Orientation (SCO) and SCM act as mediators of the relationship between market orientation and performance, in other words, MO and SCO were the antecedents of SCM.

In port research, empirical work on the interrelationships between the integration of ports into supply chains and port performance has been very limited. Song and Panayides (2008) identified seven parameters for evaluating the extent of the integration and selected variables for port performance. They analyzed the interrelationships between the parameters and the variables using multiple regression analysis. Their results showed that (1) information and communication technology positively influences the service quality of ports, (2) the relationship of ports with shipping companies has beneficial effects on the reliability and responsiveness of ports, and (3) value-added service is positively related to both port service customization and port service price.

Notteboom and Winkelmans (2001) assert that in order to gain sustainable competitive advantage, ports should provide value-added logistics and intermodal transport services and

develop advanced information systems. Paixao and Marlow (2003) also demonstrate that the internal and external integration of a port based on the agility concept can increase competitive advantage of the port, enabling the port to provide additional value-added and intermodal services, to decrease the transit and lead-times of cargoes and to reduce the total cost derived from port services. Morash and Clinton (1997) emphasize that the internal and external integrations focusing on transportation capabilities improve reliability and just-in-time delivery, which in turn, can reduce total costs and increase value to customers.

However, there are external factors relating to the logistics activities of a port, rather than internal and organizational aspects which can provide us with the managerial implications on implementing PSCI. Studies on the factors or organizational characteristics facilitating the integration strategies of ports are more limited. The features this research attempts to identify can be interpreted as the 'resources' or 'capabilities' of a firm from the resource-based view. This view considers the tangible and intangible aspects of a firm's resources enabling it to implement strategies that improve its efficiency and effectiveness (Barney 1991). Such resources can encompass physical capital resources, human resources such as knowledge, and organizational resources such as inter-organizational relationships. Barney demonstrated that the intangible resources of terminal operators such as human capital and relationships with supply chain members have become a source of competitive advantage, since these determine competences which are hard to imitate. They also emphasize that collaborative spirit and mutual trust entail a higher level of involvement of ports in supply chains.

Bichou and Gray (2004) also indicate that the ability of ports to interact with the channel members improve the level of integration and hence performance of ports. Apart from the literature, the causal relationship between PSCO and PSCI can be logically explained. When a management team or a decision-making team has to make strategic decisions, the results of the decision would be substantially affected by the organizations' attitude and willingness to SCM and logistics issues. For example, senior management may have different positions on how to respond to current competitive market situations; 'cost leadership' and 'differentiation'.

The ability of the decision-making person to manage relationships with direct- and end-customers formally or informally may positively influence the development of mutual trust which can facilitate information sharing among them and eventually result in long-term relationships. The capability to meet customers' demands by designing the existing intermodal route would make the ports services more attractive to customers. In other words, the more oriented a port is to SCM issues, the more effectively the port itself will be able to implement an integration strategy into supply chains.

## 5.5 Components and Constructs

To conceptualize a concept or phenomenon by identifying components of the concept or phenomenon is crucial when they are, in nature, abstract, or hard to define, or in lack of definition (De Vellis 1991). When research aims at measuring the concepts or the phenomena, identifying their components are of importance. In this case the constructs should be developed to measure them, because they are usually not measured directly due to the nature of being abstract, and the constructs are validated based on the identified components. The validated constructs provide a more rounded definition of the concepts and phenomena.

Considering the intensive efforts to conceptualize SCM and supply chain integration concepts, it is fair to say the components of PSCI have rarely been identified. Fortunately, the components and constructs for PSCI are presented and validated in a few recent works. De Martino identified

four SCM components: mutual relationships, supplied services, information and communication technologies and performance measurement. Based on their discussion, Panayides and Song (2008) conceptualize PSCI with four components: Information and communication systems (ICS); Value-added service (VAS); Multimodal systems and operations (MSO); Supply chain integration practices (SCIP).

Scientists also validate the instruments for the components using Confirmatory Factor Analysis (CFA), and show they are the constructs for PSCI with the second order model. In addition, Song and Panayides (2008) use seven constructs to examine the relationships between PSCI and port performance with multiple regression analysis, but the seven constructs have not been tested with the second order model. Therefore, the constructs empirically validated for PSCI are only those of Panayides and Song (2008).

Therefore, Panayides and Song (2008) would be the basis for discussing the components of PSCI. They define ICS as 'the establishment and use of seamless communication systems that facilitate efficient servicing of supply chain operations and achievement of supply chain goals\*'. The role of the establishment of ICS has been emphasized in facilitating integration among supply chain members by most SCM researchers and has been undoubtedly considered as core components for SCM and supply chain. In addition, the port literature highlights the importance of ICS for higher degrees of Port Supply Chain Integration approach.

Heaver (2001) also suggests that the quality of an IT system to a supply chain is critical to its performance since IT enables supply chains to reduce order cycle times, cut inventories and make the systems more flexible. However, it can be argued that the establishment of ICS would not be enough on its own. The definition of supply chain integration of seaport terminals (TESCI) presented in Panayides and Song (2008) implies that integration is not limited to setting up systems and processes but includes the functional activities to be an integral part of a supply chain. Thus, the activity undertaken through ICS, i.e. 'information sharing' needs considering to be included as a component, as such in the SCM literature Panayides and Song (2008) defined VAS as 'the ability of the port to add value to the services that it provides in the context of facilitating further the objectives of the supply chain system'.

Another argument is that Panayides and Song's (2008) constructs do not consider 'relationships' with other members in supply chains, even though the core concept of SCM and integration is to manage the relationship with suppliers and customers in an integrated fashion. Several researchers suggest that the development of long-term relationships are an important feature of SCM and a well-developed long-term relationship can have a positive effect on the competitiveness of supply chains (e.g. Mentzer et al. 2001; Shin et al. 2000). It is also seen that Song and Panayides (2008) and Carbone and De Martino (2003) include relationships with other members as components and constructs for PSCI. There may have been problems with data collection or analysis. Inclusion of the feature deserves to be considered.

The problem arising at this stage is that PSCO is a new concept, so it is not possible to identify the components for PSCO from the existing port. What this research relies on is the components and constructs of SCO. However, content validity could not be confirmed because the port operators view of SCM is unlikely to be exactly the same as that of a focal company in a supply chain. Therefore, this thesis attempted to identify the components of PSCO. Other relevant literature can also provide some ideas in that they deal with similar issues such as inter-organizational relationships organizational learning (Panayides 2007).

Measures for port performance also should be developed appropriately for the objectives and contexts of this thesis. Port performance has traditionally focused on the internal aspects of port operations primarily, because the role of ports has been recognized as merely being nodes between land transport and sea transport and the virtue of ports was understood to be cost- and time-efficient operation.

Brooks (2007) indicates that port literature has focused on measuring efficiency while other transport modes such as air, road and rail put a greater emphasis on external perspectives such as customer orientation, reliability and service. Bichou (2007) also demonstrates that port performance measurement systems are hardly ever used to capture both efficiency and external effectiveness, and a single focus on either efficiency or effectiveness does not seem to be the only way to increase performance. In addition, Panayides (2006) suggests that ports in the supply chain era may have other measures of performance, apart from cargo throughput, such as leanness, agility, time compression as well as the performance of other parties in the supply chain.

Another criticism of traditional port performance measure is that the traditional measures are fragmented and biased towards sea access. Most port performance literature focuses solely on sea access and overlooks other processes of the port operating system and ignores the interests of other members of the port's supply chain network. In this regard, some researchers propose new port performance measurement concepts and frameworks based on different recognition about the environment's ports are embedded in and the functions of ports in the supply chain (e.g. Marlow and Paixao-Casaca 2003; Bichou and Gray 2004). Woo et al. (2008) also develop a port performance framework which reflects the aspects of port evolution currently taking place in changing logistics environments. Their suggestion is that the effectiveness which relates to the customers' perspectives on port operation should be reflected in performance measurement. The measures for the external effectiveness encompass service quality, customer-oriented practices and service price.

Denktas et al. (2009) also suggest, in an intermodal transport context, that when designing or measuring port performance, 1) ports should be recognized as a member of an intermodal transport system and furthermore a logistics centre combining various transport modes and actors; 2) port operation should be concerned with the whole process of cargo flow through the port from entry to exit in either direction from sea to land or vice versa; and 3) effectiveness, which concerns customers' perspectives should be incorporated into performance measurements and other members in the intermodal transport channel than shipping companies should also be regarded as customers of ports.

## 6. Conclusion

### 6.1 Final Findings

After spending three months of research in the field of supply chain optimization for several industries but mainly the shipping industry and more customized the port's function, I can definitely declare that optimizing the processes that are capable of increasing the efficiency of a port is not easy. Mainly is not easy to approach this "efficiency" in a structured and mythological way. Is not easy because the key elements remain undefined and the researcher's analysis is focusing mainly in pointing out these elements rather than finding ways to improve them.

In the begging of my research analysis I posed some critical questions and concerns:

Q1: What are the key activities of the integration strategy of ports in relation with the Supply Chain Strategy?

Q2: What are the organization characteristics and capabilities of global ports that are able enough to facilitate this process?

Q3: What is the impact of this integration strategy on the performance and the efficiency of the ports?

Q4: Can these characteristics be easily applied to the external and the internal environment of every port around the world?

During the whole effort to complete this thesis my only objective was to clarify these questions and try to find the most efficient way to approach them, discuss them and provide useful insights. That was also not an easy task, as the main issue of the theoretical approach is the fact that practical knowledge is missing and as a result we cannot see in reality the results of an "implemented theory".

I also tried during my research to analyze the main and basic supply chain theories:

1. Transaction Cost Theory
2. Porters Analysis Model
3. Ports Selection Criteria
4. Ports Performance
5. Resource Based Theory
6. Supply Chain Management Theory (SCMT)
7. RBT and SCMT: Analyzing the key concepts

The reason of this approach was to present all the different aspects of the theoretical approach when it comes to supply chain theories. But still after researching three months around this issue I still cannot propose a single solution or theory based on which port authorities can increase the efficiency of the port if they implement it. What is crystal clear however is the fact that ports are "living" organizations and extremely vital for the economies of the countries where they operate. One and only solution or theory may not be enough as different circumstances need different solutions and approaches.

On the next phase I tried to analyze the integration strategies that take place within the port function. By analyzing the Supply Chain Management and Integration Nature of Port Supply Chain Integration (PSCI) my main purpose was to present the concept of ports integration and present the whole image to the readers. By any means even to cease the concept of integration is extremely difficult let alone to analyze it and adopt it to the needs of a port. Integration was and will remain one of the main question marks in the analysis of ports function and by certainty the recodification of this integration may lead the future researchers in presenting an efficient model based on which ports authorities can increase the efficiency of a port and by this way to improve the services offered to the customers.

For me this thesis is not the end of the scientific work. Tends to be the beginning of a future work in which I will try to find a practical way to improve the efficiency of the ports. Efficiency is the key for progress and I truly believe that focusing my future theoretical and scientific work in this direction is the key to unlock the potentiality that a port may have or may obtain. And all these efforts only for one purpose: To improve the services offered to the customers, increase the profitability of the port itself and as result the societal good as a whole.

## 7. Appendix

- Maritime Policy and Management (MPM)
- Maritime Economics and Logistics (MEL)
- Journal of Transport Geography (JTG)
- International Journal of Transport Economics
- Transportation Research Part A
- Transportation Research Part B: Methodological
- Transportation Research Part E
- Transport Reviews
- European Journal of Operation Research (EJOR)
- Transportation Journal (TJ)
- Coastal Management (CM)
- Geoforum (GF)
- Marine Policy (MP)
- Environment and Planning A (EPA)
- Journal of Transport Economics and Policy (JTPEP)
- Applied Economics (AE)
- Transport Policy (TP)
- International Journal of Logistics: Research and Applications (IJLRA)
- International Journal of Physical Distribution and Logistics Management
- International Journal of Integrated Supply Management
- International Journal of Ocean Systems Management
- International Journal of Public Sector Management
- International Journal of Technology Management
- De Langen 2005; Priem us 2001
- Heaver 2001
- Hayuth 1981
- Baird 1995
- Das and Teng (2000)
- Journal of Industrial Economics
- Journal of International Logistics and Transport
- Journal of Productivity Analysis
- Journal of Strategic Information Systems
- Journal of Transportation Law, Logistics and Policy
- Logistics Information Management
- Maritime Economics, Stopford 2001
- to Arlbjon and Halldorsson (2002)
- Amundson 1998; Stock 1997

➤ Rimmer 1997