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THE INTEGRATION IN SUPPLY CHAINS: AN EMPIRICAL STUDY ON CONTAINER TERMINALS

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INTRODUCTION

In the Supply Chain Management (SCM) emerging discipline (Harland et al., 2006), the theme of the integration between the focal firm and its supply chain partners, known as Supply Chain Integration (SCI), is relatively new as an area of research (Flynn et al., 2010).

The researchers have focused mainly on the manufacturing industry, even though there have been efforts to investigate the integration in supply chain with regard to other entities.

In fact, recently the theme of integration has captured the interest of the researchers in the research field on ports.

This work focuses on the integration of container terminals in supply chains. A container terminal is a facility designed to handle containers located within the port area.

There have been various reasons which have led us to investigate this issue.

First, the integration is recognized as a key issue in the SCM.

Second, the containerisation has facilitated the globalization of production which has led to a strong growth in seaborne trade. So there has been an increasing interest in the role of ports in supply chains (Tongzon et al., 2009). Ports are complex and dynamic entities, where various activities are carried out by and for the account of different actors and organizations (Bichou and Gray, 2005). The container terminals are important components of ports and they have been recognized as units of observation and analysis (Slack, 2007).

Finally, it is important to highlight that ports are important assets of Italy (Ministero delle Infrastrutture e dei Trasporti, 2011) as well as being an important source of income for many European countries.

Taking into account the container traffic, the Italian ports have to meet the competition of ports of northern Europe and the other ports located in the Mediterranean area. In recent years the competition has become stronger and there is the necessity to rethink the Italian port system in order to avoid losing competitiveness.

So, the research theme is relevant and important considering the strategic role of ports in the economic scenario.

The port of Rotterdam is the most important European port where the container traffic has reached eleven million of Twenty-Feet Equivalent Units (TEUs) handled in the year 2010 (see p. 30). This value is significant. The port of Rotterdam is well positioned in the ranking of the world container ports where the best performer was the port of Sjanghai (China) which has handled twenty nine TEUs in the year 2010 (Port of Rotterdam Authority, 2011).

In Italy, the container traffic has reached a total of above ten million of TEUs in the year 2010. This value includes the traffic produced by the transhipment ports (e.g. Taranto, Gioia Tauro), located in the south of Italy. These ports are suffering the pressure of the other ports located in the Mediterranean area, especially in the north of Africa (e.g. Port Said). As a consequence, their performance in terms of number of containers handled reveals a negative trend over the years 2008-2010 (Ministero delle Infrastrutture e dei Trasporti, 2011).

Other two geographical areas are significant in terms of containers handled in Italy. The former includes the ports of Genoa, La Spezia, Savona and Livorno, located on the Ligurian sea in northwester Italy. The latter comprises the ports of Trieste, Ravenna, Venezia e Ancona, situated on the Adriatic sea in northeastern Italy.

In order to investigate the research theme we performed a research project characterized by three fundamental steps. The first one has been used in order to review the literature both on ports and SCI. This phase has been important in order to develop two research questions. The second step has been used in order to define the research framework which has been developed using both literature review and in-depth single case analysis. The last step has been focused on the theory building through multiple case studies.

The literature review on ports has put in evidence that port research field is an emerging research field (Pallis et al., 2010) and it is necessary to build theories using empirical evidence (Woo et al., 2011). Moreover, the analysis of literature has highlighted that only two researchers, Panayides and Song (2008) have conceptualised the integration of container terminals in supply chains and have empirically developed some measures.

On the other hand, the literature review on SCI has put in evidence that over the years various definitions and measures of SCI have been proposed (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found. Moreover, in contrast to the number of studies which have examined the

consequences of supply chain integration (e.g. the relationship with performance), few researchers have focused on the factors that enable or hinder the integration (Vijayasarathy, 2010).

Taking into account the literature review we decided to perform research in order to investigate the factors that enable the integration of container terminals in supply chains and to study the relationship between the integration and performance. So, the research questions were defined.

The subsequent step was to choose a rigorous methodology in order to carry out our analysis. The case research is consistent with our intent to build theory and with the stage of the research in the port research field.

The starting point of a case research is the research framework which explains the key factors, constructs or variables, that are to be studied, and the presumed relationships amongst them (Voss et al., 2002).

Our research framework has been developed taking into account the existing literature both on ports and on SCI. We used a pilot case in order to better formulate our research framework (Yin, 2009). We selected the case of ECT Delta Terminal which is the most important container terminal in the Port of Rotterdam, know as the main European container port. It was chosen due to the fact that it is a representative terminal and allows capturing and describing the characteristics of other container terminals.

In the framework, the integration is conceptualized as a higher order construct composed of two key dimensions, called “integration driven investment” and “degree of openness”.

In this way, it possible to distinguish the harder dimension, that’s to say the integration driven investment, and the softer dimension, that’s to say the degree of openness. This approach finds support in the SCM where the constructs fall into two broad groups: the soft and the hard constructs (Burgess et al., 2006).

The framework is composed of other two important constructs: the context and the performance. Moreover, the relationships between the constructs have been identified.

The application of the case research methodology has required great care in order to choose cases. Five cases have been chosen and the selection has been effected using both literal and theoretical replication (Yin, 2009; Voss, 2009) in order to have a theoretical sample (Eisenhardt, 1989).

Following the procedure recommended by various scholars (Eisenhardt, 1989; Voss et al., 2002) we first conducted the within-case analyses and then we performed the cross case analyses in order to compare and contrast the cases.

The findings of this work are synthesized in the form of three theoretical propositions which answer the research questions.

We have demonstrated that the context is a factor which influence the degree of integration of container terminals in supply chains. However, a favourable context is necessary but not sufficient to reach a high degree of integration because there are the two key dimensions which the terminals have to manage, that's to say the integration driven investment and the degree of openness. Moreover, our study provides evidence on the relationship between integration and performance.

This work is composed of five chapters.

The first chapter deals with the literature review both on ports and on SCI. The port research field is analyzed and its subfields are highlighted. Then, the issue of integration of container terminals in supply chains is analysed. Finally, the literature review on SCI is performed in order to put in evidence how SCI has been conceptualized and the studies focused on the relationship between integration and performance.

The second chapter focuses on the research questions and the research framework. A great part of the chapter is dedicated to analyse the case of ECT Delta Terminal while in the last paragraph the research framework is presented.

The third chapter is about the research methodology. It covers many different issues on the case research methodology, from the selection of the cases to the case study protocol, from the field data collection to the quality of the research design.

The fourth chapter presents the case analyses. In the first part, the five terminals selected, that's to say Voltri Terminal Europa, La Spezia Container Terminal, Trieste Marine Terminal, Terminal Container Ravenna and Taranto Container Terminal, are analysed according to the within-case perspective. In the second part, the cross-case analyses are performed.

The last chapter deals with the development of the theory and it covers the theoretical propositions.

The final section contains the conclusions, summarizing the main theoretical and managerial contributions of this research and providing opportunities for future research.

CHAPTER 1: LITERATURE REVIEW

1.1 The port entity

The traditional definition of ports describes them as areas made up of infrastructures and superstructures capable of working as bi-directional logistics systems (Paixao and Marlow, 2003). In fact ports move the goods received from the ships to other transportation modes, as trucks, trains or barges, which are responsible for the last leg of the transport. At the same time ports deliver to ships goods arriving by rail, road and inland waterway.

This conceptualization seems to conceal the complexity which characterizes the ports. Really, the ports are "*complex and dynamic entities often dissimilar from each other, where various activities are carried out by and for the account of different actors and organizations*" (Bichou and Gray, 2005).

If we consider all ports in the world, taking in account both the characteristics of the port and the actors and organizations in the port environment, we will unlikely find the same entity.

On the side of the port characteristics, the main differences can be grouped in four categories (Bichou and Gray, 2005):

- *Organizational differences*: issues of ownership (public versus private), institutional status (landlord/tool versus service), etc.
- *Operational differences:* types of cargo handled, ships serviced, terminals operated, etc.
- *Physical and spatial differences:* location, access, connectivity, available capacity, etc.
- *Legal and regulatory differences:* trade and transport policy, administrative procedures, safety and security regulations, etc.

Differences between ports can also be due to the actors and organizations which take part in the port community which consists primarily of five organizational groups (Martin and Thomas, 2001):

- ✓ Providers of port infrastructure and facilities
- ✓ Providers of cargo handling services

- ✓ Maritime transport operators
- ✓ Inland transport operators
- ✓ Representatives of the cargo

1.2 The port research field

In recent years, the scholars' interest in economics and management issues of the port sector has grown remarkably. This can be confirmed analyzing three papers written in three different historical periods.

All these papers are based on the literature review of the research in port economics and management. However, there are differences in terms of number of papers used as references.

Suykens and Van de Voorde (1998) published a literature review based on 24 journal papers. They reviewed a quarter of a century of academic publications in the field of port management in Europe.

Heaver (2006) published a literature review based on 68 different journal paper, 51 of them published since 1997.

Recently, Pallis et al. (2010) have performed the systematic review of the content of all the academic journal papers in port economics, policy and management that were published during the period 1997–2008. Their analysis is based on 395 journal papers, 109 of them published since 2007.

The recent increase of publications suggests a growing interest and a more scientific approach to the study of ports (Pallis et al., 2011).

This growth can be linked, at least partly, to the change of the port industry, due to different forces as the strong growth in seaborne trade and the development of new technologies which has captured the interest of the researchers (Heaver 2006).

The work of Pallis et al. (2010) goes in depth with the analysis and identifies:

1. The characteristics of the port research community
2. The main characteristics of this emerging scientific research field
3. The main research subfields

With regard to the first point, the research community is rather small taking into account the number of leading authors of journal papers. This community is growing rapidly. In

fact the number of new authors (especially researchers from Europe and Asia) have increased remarkably in the last years.

The exploration of the main characteristics of this emerging scientific research field puts in evidence that the scholars focus on different units of analysis when they perform their researches. Some researchers deal with the analysis of an international port systems or an international port region (e.g. the Hamburg- Le Havre range). Others focus on a national port system (e.g. the Italian port system). Finally some researchers analyse an individual port or a terminal in a port. Although the port can be composed of different types of terminals, most of the studies focus on the container terminals. Across all units of analysis, only a few researchers engage in comparative studies.

The Table 1 reports the seven research subfields which characterize the port research field. Each subfield is characterized by specific themes. If we take into account the total number of papers published during the period 1997-2008 for each subfield, we can state that some subfields (e.g. port competition and competitiveness, port policy and regulation) have attracted the attention of the research community more than others. If we consider the last period (2007-2008) and the trend during the years, we can state that the examination of ports in transport and supply chains has expanded remarkably.

Moreover, the work of Pallis et al. (2010) provides indications that the port research is still a research field of low coherence and within a pre-paradigmatic phase, a typical phenomenon for an emerging research field. As the authors clarify, the pre-paradigmatic phase is characterized by several small research communities which works on their issues within the own research group, with limited references to other researchers and by the lack of consensus on definitions, concepts, problems to be investigated and methodology to be applied.

The work of Pallis et al. (2010) is important because it identifies seven port research subfields, even though the researchers do not go in depth with the analysis of each of them.

This work constitutes the basis of the subsequent work performed by Pallis et al. (2011). In the latter paper the authors present a content analysis of the research in port studies using the same set of journal papers published in the period 1997-2008.

In the last year, Woo et al. (2011) investigate how seaport research has been conducted from the methodological viewpoint. Their work is based on the review of 840 papers

published over the last three decades, i.e. from 1980 to 2009. Their analysis reveals a methodological bias of port research towards the positivistic paradigm, and economic and mathematical modelling approaches. They put in evidence the necessity to use qualitative research methods to develop theories from empirical phenomena taking place in port industry.

Table 1. Port research subfields

Category	Themes	Total number of papers	2007-2008	2002-2006	1997-2001
1. Terminal studies	Performance measurement of terminals Terminal operations Description of (strategies of) TOCs	40	10	22	8
2. Ports in transport and supply chains	Shipping (networks) and implications for ports Supply chain trends and implications for ports and port authorities Logistics activities in seaports Information flows in supply chains; issues for ports Hinterland chains	56	22	20	14
3. Port governance	Port models and port reform The role of the Port Authority Industrial relations in ports The port community cooperation in seaports	61	15	23	23
4. Port planning and development	Trends and developments Descriptive (case) studies of ports and port development Forecasting (Economic) impact studies of ports and cost estimates Port expansion projects Tendering and concessions in ports	57	10	24	23
5. Port policy and regulation	Port pricing, state aid and national policy Environmental, safety and security regulations in ports Anti-trust regulation; issues in ports Supranational port policies	67	19	24	24
6. Port competition and competitiveness	Port competition Strategy analysis Port performance Port choice	74	22	43	9
7. Spatial analysis of seaports	Spatial change in seaports Spatial studies of port networks Studies of spatial change of port cities and the port city interface Analysis of port hinterland	40	11	15	14
Total		395	109	171	115

Source: Pallis et al. (2010)

1.2.1 The role of ports in transport and supply chains

The port research subfield that deals with the role of ports in transport and supply chains is analyzed in order to have an overview of the different themes of research.

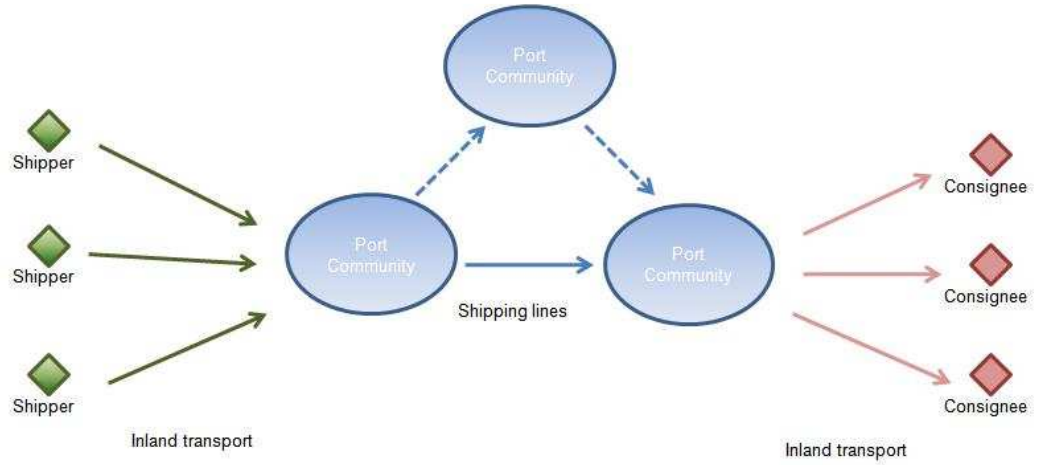
The works of Pallis et al. (2010, 2011) converge in the identification of five themes which can be analysed in this research subfield.

Taking into account these works we will try to explain each theme, also considering the most recent publications which have not been included in the works of Pallis et al.

The first theme deals with the theorization of the role of the ports in supply chain. In recent years the companies have globalized their supply chain more and more over time in order to perform competitively their processes. The growth of globalization and the consequent challenges for Management have motivated the interest of both practitioners and academics on Global Supply Chain Management (Meixell and Gargeya, 2005).

Global supply chains are actually complex networks, which consist of many different actors (Figure 1). Ports are nodes and vital components of many supply chains (Mangan et al., 2008).

Figure 1. Embedding of ports in global network



Globalisation has led to a strong growth in seaborne trade and to an increasing interest in the role of the ports in the supply chains.

Although the ports have always been an important part of global supply chains, their role in the supply chains is changing (Robinson, 2002; Carbone and De Martino, 2003; Mangan et al. 2008; Pettit and Beresford 2009).

Robinson (2002) argues that ports must be seen as elements in value-driven chain systems, not simply as places with particular, if complex, functions. He recognises that ports are places characterized by the essential function of facilitating loading and discharging of ships but, at same time, theorises a new role for them. The ports should deliver value to shippers and other third party service providers in the value-driven chain.

The work of Robinson can be considered as the milestone in theorising the new role of the ports in supply chain, resulting the most cited paper in the research subfield that deals with the role of ports in transport and supply chain (Pallis et al., 2010).

Carbone and De Martino (2003) consider the port as a cluster of organizations in which different logistics and transport operators are involved in bringing value to the final consumers. In order to perform well its role, the port needs to work in several directions, also taking into account the requirements of the shippers and consignees of goods as well as the traditional needs of the shipping companies, forwarding companies, etc.

Paixao and Marlow (2003) put in evidence that ports should play the role of distributors rather than of warehouses. They underline that if storage is eliminated, space is left available and ports are able to make investments in value-added activities that can also be a source of income. In order to do this the ports should adopt a new logistics approach, agility, which has already been employed in other industries.

Mangan et al. (2008) state that the role of ports in supply chains can vary from that of simple transhipment hub to important logistics node. The role depends in part upon the supply chain strategies of those who use these ports. At the same time, Mangan et al. (2008) develop the concept of port-centric logistics, defined as the provision of distribution and other value-adding logistics services at a port. The ports need to move toward a more active role in the supply chain and port-centric logistics may be the way to obtain it.

Pettit and Beresford (2009) observe that ports could take part in many supply chains simultaneously. So if the ports are clear about how they fit into various supply chains they can more accurately focus on the types of facilities which they provide. In fact, the ports are critical nodes in supply chains, and the provision of logistics facilities has been established as a necessary activity in many ports for several years.

The second theme of research deals with the supply chain trends and its impact on ports.

Under this category it is possible to group various papers which focus on the changing logistics strategies of shipping lines and terminal operators. The strategies developed by shipping lines and terminal operators take into account the forces which are changing the market environment (e.g. globalisation, technological advances, containerisation, etc.). In order to improve the performance, the shipping lines act on various means such as scale increases in vessel size, co-operation, mergers, acquisitions, deployment of landside logistics, rationalizing the hub-and-spoke network and a global coverage. The terminal operators are mainly focused on increasing the scale of operations (Notteboom, 2004).

Slack and Freemont (2005) address the transformation of port terminal management and put in evidence the contrast between the management of the terminal operating companies and that of the shipping lines.

Other scholars have analysed how shipping lines and the stevedoring industry is adapting to the new realities (De Souza et al., 2003; Midoro et al., 2005; Parola and Musso, 2007; Bichou and Bell, 2007).

Franc and Van der Horst (2010) put in evidence why and how shipping lines and terminal operating companies enlarge their scope in intermodal and inland terminals by making use of insights from Transaction Cost Economic and Resource-Based View.

It seems to emerge that the companies try to disrupt the status quo rather than preserve it in order to gain a competitive advantage.

This second theme of research covers other sub-themes such as the impact of the market changes on port environment, also in terms of road congestion, and the configuration of the liner service networks.

The third themes of research focuses on the logistics activities which can take place in the ports. In fact the activities can be effected in the terminals or in some areas within the port or in logistics parks, located nearby the ports. The development of the hinterland with specific infrastructures, such as the inland terminals, where some logistics activities can be performed, have required to analyze which logistics activities are truly port-related.

The last two themes of research address the information technology and the hinterland chains.

The use of information technology gives the port the possibility to improve its performance in supply chain. In fact the use of IT and EDI applications improve port operations, make faster custom clearance and reduce transit time in the nation supply chain (Paik & Bagchi, 2000).

The importance of information technology in port terminal operations is also underlined in the work of Kia et al. (2000).

With regard to the theme of the hinterland chains, Pallis et al. (2011) identify four specific sub-themes: the coordination problem among actors who compose the hinterland transport chains, the hinterland access regimes, the role of inland ports and the role of freight corridors.

The research subfield presents some characteristics as highlighted by Pallis et al. (2011).

First, the literature is mainly descriptive, even though some scholars have attempted to change this tendency in the last years. In fact, Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualization of what really is meant by port/terminal integration in the supply chain and they have empirically developed measures to evaluate the degree of integration of seaport container terminals in supply chains. Tongzon et al. (2009) have done a similar effort in order to define the concept of port's supply chain orientation. They have developed some measures to assess the degree of orientation of the port of Incheon.

Secondly, this research subfield is focused on the container flows without taking into account what is held in the container. So, there is the opportunity to extend this research subfield considering the different logistics requirements of the goods.

1.2.2 The terminal studies

The container traffic has had a remarkable growth in last years. Notteboom and Rodrigue (2008) put in evidence that the container volumes around the world have grown in the last 50 years, with a higher rate since the mid-1990s. Based on different reports of Institutions and consultant companies, they highlight that the total number of

full containers shipped on worldwide trade routes (excluding transshipment) is expected to reach 177.6 million TEU in 2015. In the year 2002, the volume reached 77.8 million TEU while in 1990 its value was 28.7 million.

The importance of container traffic over the last 40 years has drawn the attention of academic researchers (Slack, 2007).

Pallis et al. (2010) put in evidence that the examination of container ports and terminals remained the core of the research interest over the period 1997-2008.

A port can have one or more container terminals which are facilities designed to handle containers, with specialized equipment such as container cranes, straddle carriers or stacking cranes and container stacking areas (Rodrigue and Notteboom, 2009).

Although the container terminal is an important section of the port, it can be considered as a separate unit of observation and analysis. In fact Slack (2007) underlines that the container terminals could represent an important focus of research, even though some topics (e.g. long-term infrastructure planning, environmental regulations, etc.) are issues addressed by the port and not by individual terminals. In order to support this statement he recognizes that commercial activities, cargo handling and network links are shaped by actors who operate at the level of terminal.

So, the research subfield which considers the terminal as unit of analysis results focused on the container terminals and there are few studies that have been dedicated to other types of terminals (Ro-ro, dry bulk, etc).

Pallis et. al (2010) identify three main themes related to the terminal studies:

- Performance measurement of terminals
- Terminal operations
- The strategies of Terminal Operating Companies

This division does not take into account the abundant literature in the field of operations research (Pallis et al., 2011).

The studies dealing with the application of operation research techniques to container terminals focus on container terminal planning and optimization. An update literature review is provided by Stahlbock & Voß (2008) and Steenken et al. (2004).

It seems to emerge from the analysis of this research subfield the necessity to perform research considering the terminals as a part of the supply chains.

It remains, however, to be seen how supply chain practices influence operations of container terminals and vice versa (Pallis et al., 2011).

1.2.2.1 The container terminals: processes and key actors

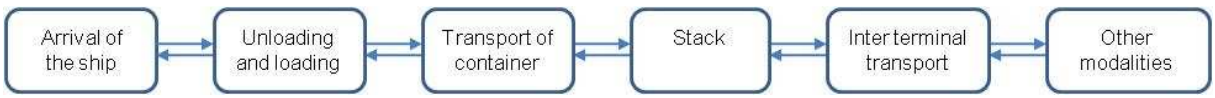
The analysis of the literature puts in evidence that there is a specific research subfield that deals with the container terminals. In order to better know a container terminal, we proceed first to the identification of the key processes which are executed in the terminal and then to the examination of the key actors of the terminal community.

An accepted classification of the container terminal, which agrees both the practitioners and the researches, is based on the division of terminals into import/export terminals and transshipment terminals.

A container terminal is composed of two external interfaces. These interfaces are the quayside with loading and unloading of ships, and the landside where containers are loaded and unloaded on/off trucks and trains (Steenken et al., 2004).

The typical processes of a modern import/export container terminal are shown in Figure 2. When a ship arrives at a port, the import containers are unloaded by quay cranes and transferred to vehicles that travel between the ship and the stack, where containers can be stored for a certain period. The stack consists of a numbers of lanes, served by systems (e.g. automated stacking cranes) which are responsible for the storage phase. Then, the containers are transported by vehicles to other transportation modes like barges, trucks or trains. The loading of export containers onto a ship is made executing the processes in reverse order (De Koster et al., 2009).

Figure 2. Processes at a container terminal.



Source: Vis and De Koster, 2003

The processes differ from the import/export terminals to the transhipment ones. In fact in the transhipment terminals the containers are transferred from one sea going vessel to

another sea going vessels. So the import/export terminals handle multiple transport modalities (De Koster et al., 2009).

It is important to underline, however, that there are terminals which operate as both transshipment and import/export terminal.

The container terminal community is characterized by different organizations. It is possible to distinguish the main organizations (Martin and Thomas, 2001).

- *The terminal operator* manages the terminal and controls all the activities, from the arrival of the containers to a final departure. Many times, the terminal operator undertakes all the operations within the terminal.
- *Shipping lines* are responsible for the maritime mainline and feeder services. They can offer also door-to-door services and integrated logistics activities. In some cases they manage directly the container terminal operations.
- *Feeder operators* offer the feeder services which connect the hub terminals with the feeder ports, either operated as a common user service or dedicated to a shipping line
  or alliance.
- *Freight forwarders* offer logistic services and deal with the international trade of goods performing directly or subcontracting to others the various activities.
- *Road hauliers* which perform the road leg of the transport. This category groups both big operators which are professional service providers and small operators which receive the task to perform a small portion of the transport as subcontractors.
- *The rail operators* offer scheduled train services which connect the container terminals with the inland terminals.

1.3 The issue of the integration of the container terminals in supply chains

The analysis of the literature shows that there are seven subfields of research about the ports. We have gone in depth with the analysis of two subfields. The former regarding the ports in transport and in supply chains, the latter focused on the container terminals.

The reason, which has led to analyze these two subfields of research, is linked to our original intent of dealing with the issue of the integration of ports in supply chains.

The role of the ports in supply chains is changing as we have highlighted in paragraph 2.1.1. In this new role, as members of supply chains, the ports need to achieve a high degree of integration in the supply chains (Paixao and Marlow, 2003).

We have also put in evidence that the ports can be composed of one or more terminals. In particular we have decided to address the issue of the integration of the container terminals, taking into account the importance of the container traffic in the maritime scenario and the fact that the container terminals have been recognized as units of analysis, separate from ports (Slack, 2007).

There have been only two researchers, Panayides and Song, who have conceptualized the integration of container terminals in supply chains. They define seaport terminal supply chain integration 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 operations"*. (Panayides and Song, 2008).

They have also defined and empirically developed some measures in order to evaluate the degree of integration of seaport container terminals in supply chains.

In particular they conceptualized the integration as an higher order factor composed of four main constructs which are the information and communication systems, that would facilitate the integration of the terminal with supply chain partners, the valued added services, the multimodal systems and operations and the supply chains integration practices.

From the theoretical side, the work of Panayides and Song contributes towards shifting the integration of container terminals in supply chains from an abstract concept to a theoretical construct.

At the same time, the work opens several directions of research. It seems particularly interesting performing research in order to investigate the factors which may lead to high level of integration of the container terminals in supply chains.

1.4 The conceptualization of the supply chain integration

Changing our unit of analysis, from a container terminal to a manufacturing company we can find a great variety of definitions and measures with regard to Supply Chain

Integration (SCI). In fact, over the years, various definitions and measures of SCI have been proposed (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found.

This abundance can be also explained with the different theories which have guided the research in this field. Vijayasarathy (2010) underlines that the transaction cost analysis, the resource-based view and the inter-organizational studies have been three different theories which have influenced the research in supply chain management.

From a conceptual point of view, the literature review reveals two different approaches. Few researchers have conceptualized SCI as a single construct (Rosenzweig et al., 2003; Vickery et al., 2003). Others, instead, have proposed to conceptualize it as a multidimensional construct (Wong et al., 2011; Flynn et al., 2010; Vijayasarathy, 2010; Paulraj et al., 2006).

The analysis of the dimensions, which characterized the multidimensional approach, puts in evidence a lack of uniformity in defining them.

An overview of the different dimensions referred to SCI concept is provided by the papers of Flynn et al. (2010) and Van der Vaart and Van Donk (2008).

The more recent works are oriented to underline the multidimensional nature of SCI. Some researchers (Wong et al., 2011; Flynn et al., 2010) have defined SCI as a multidimensional construct composed of three dimensions: customer, supplier and internal integration. Customer and supplier integration are known as external integration. While the internal integration highlights the importance to coordinate the activities of different functional areas and internal structures within a company, the external integration focuses on the importance of establishing close relationships with customers and suppliers. Both perspectives are important in allowing supply chain members to act in a concerted way, to maximize the value of the supply chain (Flynn et al., 2010).

Vijayasarathy (2010), instead, formulates SCI as a multidimensional construct that includes investments, practices and structures that support material/goods flow, information flow, planning and control, and organization.

In order to measure SCI, three categories of items can be distinguished: practices, patterns and attitudes (Van der Vaart and Van Donk, 2008).

The first category includes those items related to tangible activities that play an important role in the collaboration of a focal firm with its suppliers and/or customers. The second category groups those items related to the interaction patterns between the focal firm and its suppliers and/or customers. The third category includes those items that measure the attitude of buyers and/or suppliers towards each other or towards Supply Chain Management in general.

1.5 The relationship between SCI and performance

There is an interesting debate on the relationship between SCI and performance. The majority of researchers agree that a higher level of SCI has a positive impact on the performance of the focal firm (Vickery et al., 2003; Van der Vaart and van Donk, 2008; Flynn et al., 2010).

The researchers are also focused on the type of relationship. Vichery et al., (2003) put in evidence the positive indirect relationship between SCI and financial performance. Rosenzweig et al. (2003) indicate a positive direct relationship between SCI and financial measures and, at the same time, the moderating role of manufacturing capabilities on the relationship. Kim (2009) investigates the direct and indirect effect of supply chain integration on firm performance. The variety of research design of the studies have to be recognised. In fact it is necessary to consider the different ways used to capture both SCI and performance when the relationship between SCI and performance is investigated.

There are differences not only in the way of conceptualizing SCI, but also with respect to the items used to measure performance.

In a critical review of 33 survey-based research paper on supply chain integration, Van der Vaart and Van Donk (2008) distinguish three types of measures used from researchers: overall measures (market share, financial, etc.), operational cost measures, and customer service measures. Flynn et al. (2010) provide a summary of prior literature on the relationship between SCI and performance which shows the type of performance analysed in the different works of the researchers.

CHAPTER 2: RESEARCH FRAMEWORK

2.1 Introduction

Although the case research can be used for different types of research purposes, it results to be particularly well-suited for the theory building purpose (Voss, 2009).

Our intent is to build a theory, as we highlight in the next chapter on the research methodology where we provide the reasons which have lead to use the case research approach.

The starting point for case research is the research framework and the question or questions (Eisenhardt 1989, Voss et al., 2002).

According to Eisenhardt (1989), an initial definition of the research question is important in building theory from case studies in order to have a well defined research focus.

The research questions may precede, or follow directly from the conceptual framework.

The framework explains, either graphically or in narrative form, the main things that are to be studied – the key factors, constructs or variables-, and the presumed relationships amongst them (Voss et al., 2002).

A priori specification of constructs can also help to shape the initial design of theory-building research (Eisenhardt, 1989).

The definition of the constructs or variables should be done taking into account the existing literature. This phase can use a pilot study in order to capture some empirical evidence, so that the pilot data are used in parallel with an ongoing review of relevant literature (Yin, 2009).

In fact pilot case may help the research to clarify the research design. The selection of the pilot cases can follow various criterions. In general, convenience, access, and geographic proximity can be the main criteria for selecting a pilot case or cases (Yin, 2009).

Our research framework has been developed taking into account the existing literature both on ports and on Supply Chain Integration. We used a pilot case in order to better formulate our research framework. We selected the case of ECT Delta Terminal which is the most important container terminal in the Port of Rotterdam, known as the main

European container port. It was chosen due to the fact that is a representative terminal and allows capturing and describing the characteristics of other container terminals.

2.2 The research questions

The literature review has put in evidence that the role of port in supply chain is changing (Robinson, 2002; Carbone and De Martino, 2003; Mangan et al. 2008; Pettit and Beresford, 2009). In this new role, the port, part of which the container terminal is, needs to achieve a high degree of integration in the supply chains (Paixao and Marlow, 2003; Panayides and Song, 2008).

Although the scholars have theorised that the ports need to become more integrated in the supply chain, few empirical works have been performed on the topic (Pallis et al. 2011).

Only Panayides and Song (2008) have proposed a conceptualisation of integration of container terminals in the supply chains and have empirically developed measures to evaluate the degree of integration.

The literature on SCI has put in evidence that various definitions and measures of SCI have been proposed over the years (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found.

Hence, more research is needed in order to investigate this issue and to capture both the real essence of container terminal integration in supply chains and the dynamics which lead to a successful container terminal integration.

It seems particularly interesting to perform research in order to investigate the factors which influence the integration of container terminals.

Based on this elements, we can state our main research question:

How the container terminals can achieve a high degree of integration in supply chains?

The majority of researchers agree that a higher level of SCI has a positive impact on the performance of the focal firm (Vickery et al., 2003; Van der Vaart and Van Donk, 2008, Flynn et al., 2010).There is no empirical evidence on this relationship with regard to the container terminals. Based on this elements, we can state the subsidiary research question:

How does the integration impact on the performance of a container terminal?

2.3 The definition of the constructs of research

Although there is limited empirical work on container terminals integration in supply chains, the existing literature both on ports and on SCI is used to capture the key dimensions of container terminal integration.

The first dimension is *the integration driven investment*, while the second is *degree of openness* to the integration in the supply chains. The integration driven investment evaluates the "asset" of terminal that facilitate the integration. This dimension takes into account both the technologies and systems (e.g. EDI) and the endowment of a container terminal in terms of infrastructures and superstructures. The distinction between infrastructures and superstructures characterizes the port environment (Bichou and Gray, 2005).

The degree of openness is a softer dimension which takes into account the interaction between the terminal operator and the users of the terminal. In fact the container terminal community is characterized by different organizations (Martin and Thomas, 2001). It is possible to distinguish two significant categories of organizations in this community. The first category is that of the terminal operator which manages the terminal and controls all the activities, from the arrival of a container to a final departure. The terminal operator in most cases also undertakes all the operations within the terminal. The other category is that of the users of the terminal which come in contact with the terminal in order to perform their services/activities. Different organizations can be grouped in this second category (shipping lines, feeder operators, inland transport operators, freight forwarders).

Integration driven investment

The literature puts in evidence the importance of this dimension with regard to three elements: the information and communication systems, the value added services and the integration of transport modes.

Pallis et al. (2011) identify the role of information technology in facilitating further integration of ports in supply chains as an important topic of interest. Carbone and De Martino (2003) put in evidence the importance to have advance information and

communication systems to facilitate the integration process between supply chain partners at the Port of Le Havre. Panayides and Song (2008) recognize the importance of information and communication systems in order to evaluate the integration of container terminals in supply chains.

With regard to the second variable the importance to have adequate facilities to effect activities to add value to the cargoes is widely recognized (Panayides and Song, 2008; Paixao and Marlow, 2003; Tongzon et al., 2009).

With regard to the third variable we have to consider that since ports are bi-directional logistics systems (Paixao and Marlow, 2003) and the container operations have an intermodal character (Tongzon et al., 2009) the terminal needs to have adequate infrastructures and superstructures to inter-connect the multiple modes of transport.

Degree of openness

The researchers have highlighted the importance for a terminal to build a long-term co-operative relationships with its shipping lines and inland transport providers in order to reach a high level of integration in the supply chains (Song and Panayides, 2008).

Ducruet and Van der Horst (2009) seem to put in evidence the need for the terminal to build close relationships with the freight forwarders, who have an important role in establishing efficient integration within transport chains.

In order to build up a long term relationships between the terminal and its users, a positive attitude towards collaboration is required. As highlighted by Van Der Vaart and Van Donk (2008) with regard to buyer-supplier relationships, a positive attitude towards collaboration leads to actions (practices and interaction patterns) that facilitate integration.

Both attitude and practices and interaction patterns between terminal and its users are important to reach the integration of container terminal in supply chains. The terminal interacts with different categories of users. So we define the degree of openness as that dimension which takes into account both the attitude and the practices and the interaction patterns between the terminal and each category of user

2.4 Pilot study: The ECT Delta Terminal

The ECT Delta Terminal is the most important container terminal of the port of Rotterdam which can be considered the most important European port. The analysis has been conducted in depth in order to search for evidence from ECT delta Terminal that fits the two dimensions defined from the literature review.

The data came primarily from three sources: semi-structured interviews, documents and direct observations. The use of different sources of information was necessary in order to guarantee the respect of the principles of interaction and source triangulation (Eisenhardt, 1989; Yin, 2009).

An interview tool was developed in order to capture the port situation, the context of the terminal, and the information on the two dimensions defined. The persons, who were best informed about the data being searched, were indentified and interviewed (Voss, 2009).

The interviewer guided the conversations with flexibility but making sure that all the questions on the interview tool were addressed.

Different documents were collected in order to search for information. Some documents were requested from the ECT company while others were requested from the Port Authority of Rotterdam and from the terminal users. Moreover ECT company and Port Authority web sites and articles have been used.

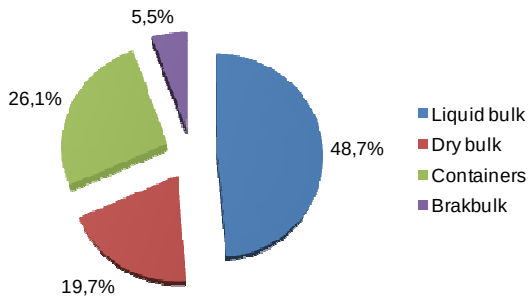
A terminal tour was requested at the ECT company. During the tour, the direct observation of operation processes has been useful in providing additional information about the topic being studied. Moreover a port tour was effected in order to have an overview of the port of Rotterdam.

2.4.1 The port of Rotterdam

The port area of Rotterdam is located directly on the North Sea and is the only port in Northwest-Europe that offers direct and unrestricted access to ships with the deepest draughts. The port offers a wide range of market segments and flows of goods, as well as high-quality, all-round facilities for the storage, handling and distribution of all kinds of commodities and products.

The throughput of 430 million tones makes the port of Rotterdam by far the largest seaport in Europe. The port of Rotterdam derives its position from its excellent accessibility by sea, hinterland connections and the many companies and organisations that are active in the services of the port area. In the port of Rotterdam both bulk (dry and liquid bulk) and general cargo (containers and break bulk) are handled. The Figure 3 shows the proportion of the throughput for each type of cargo. In the liquid bulk cargo a great proportion is due to the crude oil.

Figure 3. Throughput by segment



Source: Port of Rotterdam Authority – Annual Report 2010

The containers handling is an important part of the business. Rotterdam is the main container port in Europe and the total throughput (in TEU's) has increased remarkably in the last year (Figure 4) . Taking into account the throughput in the year 2010, the port of Rotterdam occupies the tenth position in the word container port ranking.

The reasons of this growth are various and are linked to the variety of container terminals, their accessibility from the seaside, the quality and the cost of the service, the hinterland connections (roads, inland waterway, rail), the variety of the linear services (deep sea, short sea, feeder), the possibility to perform value-added service on the cargo in the distriparks, etc.

The analysis of the containers flow (Figure 5) shows that there is an intensive traffic between Rotterdam and Asia, due to deep sea services and an intensive traffic between Rotterdam and Europe, due above all to the feeder services.

In Rotterdam, shipping companies can choose between several competing terminal operators, located in different areas of the port. Some terminals are located in

Maasvlakte, directly on the North Sea while others are situated in the Waalhaven/Eemhaven, closer to the center of city of Rotterdam.

Figure 4. Top 20 European container ports, 2010 – 2008. (Unit: number of TEU's x 1,000)

Port	Country	2010	2009	2008
Rotterdam	Netherlands	11,146	9,743	10,784
Antwerp	Belgium	8,468	7,310	8,663
Hamburg	Germany	7,896	7,008	9,737
Bremen	Germany	4,888	4,565	5,529
Valencia	Spain	4,207	3,654	3,602
Felixstowe	United Kingdom	3,400	3,100	3,200
Gioia Tauro	Italy	2,851	2,857	3,468
Algeciras	Spain	2,810	3,043	3,324
Zeebrugge	Belgium	2,500	2,328	2,210
Marsaxlokk	Malta	2,371	2,330	2,300
Le Havre	France	2,356	2,241	2,450
St. Petersburg	Russia	1,930	1,340	1,983
Genoa	Italy	1,759	1,543	1,767
Southampton (*)	United Kingdom	1,600	1,400	1,710
Barcelona	Spain	1,422	1,800	2,569
Ambarli	Turkey	1,312	1,836	2,262
La Spezia	Italy	1,285	1,046	1,246
London	United Kingdom	869	846	1,167
Constanza	Romain	557	594	1,381
Bilbao	Spain	531	443	557

* 2010 Provisional figure
Source: Adapted from - Port of Rotterdam Authority, 2011

Figure 5. Incoming and outgoing TEU's, grouped by continent, 2009 – 2008

(Unit: number of TEU's x 1,000)

	2009			2008		
	Incoming	**Outgoing**	**Total**	**Incoming**	**Outgoing**	**Total**
Europe	1,455	1,687	3,142	1,795	1,914	3,709
Africa	167	135	302	158	131	289
America	898	646	1,544	1,005	783	1,788
Asia	2,347	2,236	4,583	2,524	2,288	4,812
Oceania	11	24	35	14	34	48
Not Specified	84	53	137	0	138	138
Total	**4,962**	**4,781**	**9,743**	**5,496**	**5,288**	**10,784**

Source: Port of Rotterdam Authority, 2011

2.4.2 The Port Authority

The Authority is a limited company and it operates as a private company. There are two shareholders, the municipality of Rotterdam (approx. 70%) and the Dutch State (approx. 30%).

Since 21 July 2008, a more enlightened two-tier board system has been applicable to the Port of Rotterdam Authority. The Executive Board members conduct day-to-day management of the company and independent Supervisory Board supervises the Executive Board and oversees the state of affair in the company.

Both shareholders, the municipality of Rotterdam and the Dutch State, exercise influence on the company through the General Meeting of Shareholders which are authorized to assign and dismiss Executive Board members.

The Port Authority aim is to develop the area of the port and to assure that everything goes safe and secure. So, its tasks are:

- ✓ fulfilling the role of manager, operator and developer of the port and industrial area.
- ✓ Besides that, the Port of Rotterdam Authority, personified by the (State) Harbour Master, has the task of managing the shipping traffic effectively, safely and efficiently

The Port of Rotterdam Authority works to enhance the competitive position of the port of Rotterdam. To this end, the Port of Rotterdam Authority is investing in the development of new port sites, especially Maasvlakte 2, in public infrastructure, such as roads in the port area, and customer-specific infrastructure, particularly quay walls and jetties. In order to handle shipping as effectively as possible, we maintain the waterways at a certain depth and we are investing in a traffic management system, traffic control centres and patrol vessels.

The Port Authority customers are the shipping lines and the so called “location related customers”, such as terminals, refineries, chemical companies, etc.

With regard to the second type of customers, the Port Authority acts on the basis of the landlord model. In fact Port Authority invests in terrains which lease out to customers as well as investing in real estate or infrastructure, such as quay walls and jetties. In turn

the customers invest in specific business-related capital equipment, such as cranes and storage tanks.

So, the main operating income flows of Port Authority are harbour dues and contract income (long term leases of port sites).

2.4.3 The ECT Delta Terminal

The Europe Container Terminals (ECT), founded in 1966, is the leading terminal operator in Europe and Rotterdam. ECT is a member of the Hutchison Port Holdings (HPH) Group, a subsidiary of the multinational conglomerate Hutchison Whampoa Limited (HWL). HPH is the world's leading port investor, developer and operator with interests in a total of 51 ports, spanning 25 countries throughout Asia, the Middle East, Africa, Europe, the Americas and Australasia.

In Rotterdam, ECT operates three deep sea terminals (Figure 6): the ECT Delta Terminal and the Euromax Terminal Rotterdam are directly situated on the North Sea while the ECT City Terminal is located further inland, closer to the city center. The ECT Delta Barge Feeder Terminal focuses on the feeder-barge services and forms an integral part of ECT Delta Terminal. In fact these two terminals are neighbors and are located on Maasvlakte peninsula. They can be considered as an unique terminal, forming the ECT Delta complex.

In 2010, the ETC handled a throughput of 7.1 million TEU which represents about 64% of the total throughput of port of Rotterdam. Our analysis deals with the ECT Delta complex which is the most important terminal in Rotterdam in terms of performance, infrastructures and equipment. In year 2010, the ECT Delta complex handled about 40% of the total throughput of port of Rotterdam.

Figure 6. The ECT terminals in Rotterdam

	Sector	Location	Total area	Quay lenght	Depth
ECT Delta Terminal	Deep sea	Maasvlakte peninsula	272 ha	4.0 km	Max 16.6 m
ECT Delta Barge Feeder Terminal	Feeder/Barge	Maasvlakte peninsula	8 ha	0.8 km	10 - 11 m
Euromax Terminal Rotterdam	Deep sea	Maasvlakte peninsula	84 ha	1.5 km	16.8 m (max. 19.6)
ECT City Terminal	Deep sea/Short sea	Eemhaven	59ha	1.4 km	Max 14.15m

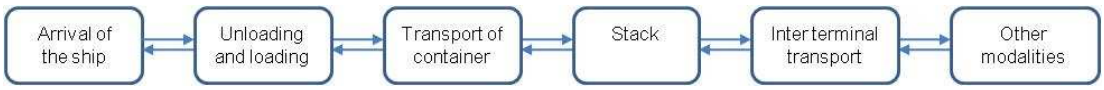
Source: ECT company

The Delta Terminal Complex is an automated terminal and the processes are executed following a sequence (Figure 7).

When the ship arrives at the terminal, the import containers are unloaded by quay cranes and transferred to Automated Guided Vehicles (AGVs) that travel between the ship and the stack, where containers can be stored for a certain period. The stack consists of a numbers of lanes, served by automated stacking cranes (ASCs) which are responsible for the storage phase.

After a certain period the containers are transported by vehicles (straddle carriers and multi trailer systems) to other transportation modes like trucks, trains, barges or feeder ships. The sequence can also be executed in reverse order, to load export containers onto a ship.

Figure 7. Processes at Delta Terminal Complex



2.4.3.1 The integration driven investment

Value added services

Although the terminal focus is on containers handling and loading/unloading services, there are other additional services which can be grouped in four categories:

- Delta Reefer Care
- Special cargo

- Empty depots
- Fumigation/de fumigation services

The first category includes the services linked to the reefer containers. The customers can rely on comprehensive services, including (remote) reefer monitoring, repairs etc.

The second category regards the services for any cargo that can not be containerized (e.g. yachts, planes, locomotives, propeller*s, etc.).* The ECT takes care of the efficient loading and unloading of this type of special cargo. Special services also salvages damaged containers and carries out stuffing and stripping.

The third category deals with the empty containers. Directly next to the Delta Terminal, there are various high-quality facilities for the storage, inspection and maintenance of empty containers. One of the companies located here is Delta Container Services (DCS): a joint venture of ECT and Kramer Container Depots. Apart from its landside accessibility for trucks, DCS also has its own quay to handle empty containers from barges.

The last category includes the services of fumigation/de fumigation of containers.

Recently ECT launched European Gateway Services in order to offer the shipping lines, transport companies, forwarders and shippers a variety of services to facilitate the optimal flow of container between the deep-sea terminals in Rotterdam and the direct European hinterland. In fact ECT owns seven inland terminals located in Netherlands, Germany and Belgium (Figure 8). All these inland terminals are considered as "extended gates" and are connected by rail, inland shipping or truck with ECT's deep-see terminals in Rotterdam on a daily basis. It is important for customers to realize that an extended gate can be more than just a starting point and end point. They are also super-efficient hubs for transporting containers deeper into Europe and vice versa. All the extended gates/inland terminals offer storage facilities for empty and full container, local transport, fumigation/de fumigation of containers and customs services.

As a part of the extended gates concept, ECT offers its customers many additional options: the Release Service, Paperless Service and Premium Service. Through the Release Service, ECT arranges for the custom release of customers containers at the ECT deep-sea terminals in Rotterdam. This is always easy and efficient; there is no need for the customers to invest in systems or manpower. So the containers are next

moved to the extended gate chosen by the customers. The cargo is transported to the hinterland under the own customs license of the customer.

With the Paperless Service, customers containers are moved by barge or train to the extended gate. The customers do not need to worry about customs documents: the transport is carried out paperless under the customs license of ECT. It is not until the extended gate near to the final destination that the customer needs to take care of its customs formalities.

The Premium Service is identical to Paperless Service but also includes a time guarantee. Premium Services furthermore ensures that customer cargo arrives at the inland terminal at the agreed-upon time.

Figure 8. ECT inland terminals

Source: ECT company

In the port of Rotterdam there are three distriparks: the Eemhaven, the Maasvlakte and the Botlek. In the distripark all activities relating to transport, logistics and the distribution of goods are carried out by various operators. The main activities that take place at these distriparks are: warehousing, distribution and value adding activities. The value-added services comprise storage, repacking, labeling, assembling and stripping and stuffing of containers.

The distripark Maasvlakte is located very close to the North Sea and to the ECT Delta Terminal. The containers that arrive at Delta Terminal can easily be transferred to the

warehouses at the distripark Maasvlakte. In fact there is a dedicated internal track between the distripark Maasvlakte and the Delta Terminal which allows for the ultra-fast delivery and dispatch of containers from ship to warehouse and vice versa.

Information and communication systems

The electronic exchange of data has been mandatory at all deep-sea terminals of ECT (Delta, City, Euromax) since 1st of June 2008. As a consequence, all communications with the terminal users about the delivery, loading, discharging and picking-up of containers are fully electronic.

Data is transferred, obtained, shared or exchanged by three means:

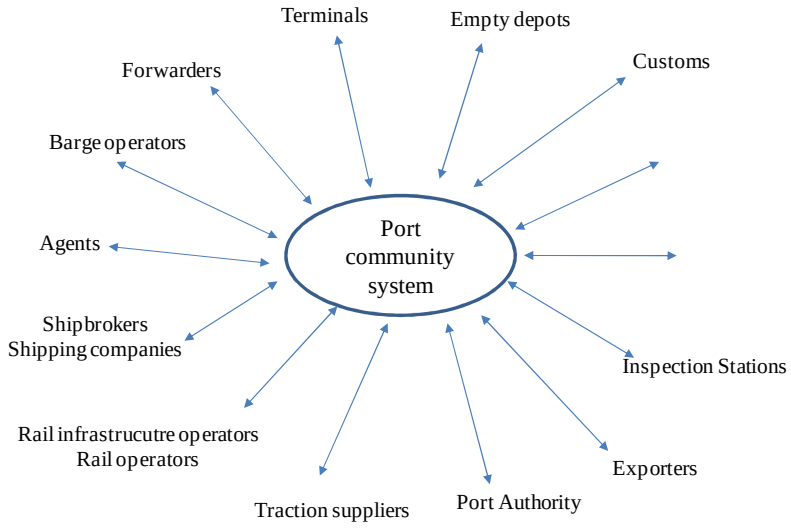
a. Via Electronic Data Interchange (EDI),
b. Via the ECT website
c. Via the port community system of Port Infolink

The ECT Website is divided into a public and a non-public part. To access the non-public part it is necessary to register yourself. ECT offers different kind of services ("E-services") for deep sea, feeder, barge, rail and road operators. The services are divided into different categories, like orders, reports and tracking & tracing.

Port Infolink is a private company, founded in 2002, which is completely owned by the Rotterdam Port Authority. The company has developed a port community system with services geared towards specific target groups, which facilitate the simple and efficient exchange of data. In this way there is an optimization of information flows and work processes of the organizations. The port community system currently offers 37 different services, with around 4500 users who send more than 20 million electronic messages a year. The services in the Port Community System are aimed at all port sectors: containers, general cargo, dry bulk and liquid bulk. All the links in the logistic chains can exchange information easily and efficiently. Each of these target groups has its own service package with tailor-made services within the Port Community System.

Figure 9 gives an overview of the users of Port Infolink and the related communication lines. The supply chain organizations communicate with each other via the Port Community System.

Figure 9. Users of Port Infolink



Source: Port Infolink web site

The integration of transport modes

The ECT Delta Terminal forms the starting point and destination of a great number of European connections. Customers can choose from a wide range of transport options: feeder, barge, train or truck. Nearly every major economic centre can be reached within 24 hours.

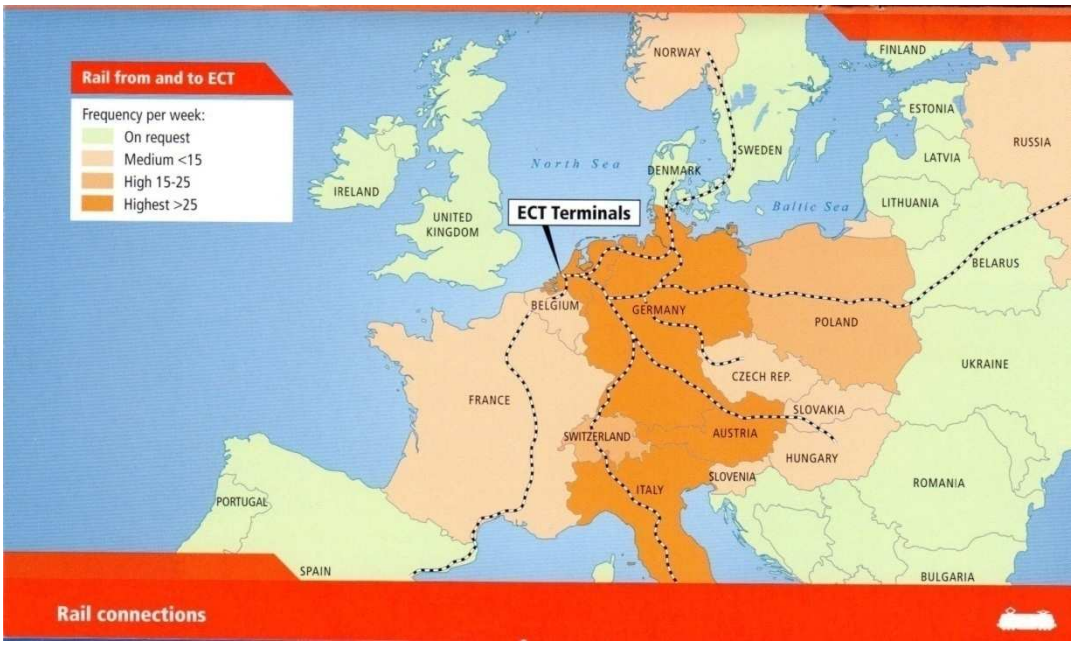
Rail connections

The ECT Delta Terminal at the Maasvlakte has its own rail terminal which is in operation 24/7.

The terminal constitutes the starting point and terminus of the Betuweroute, the 160-kilometre-long dedicated freight rail link between Rotterdam and Germany. In Germany, at the inland terminal in Duisburg, the Betuweroute directly connects to Europe's Extensive railway network.

The liberalized rail market ensures that there's a competitive range of service providers to choose from. In addition, the ECT 'European Gateway Services' operates own rail connections together with partners to and from its extended gate, in Venlo in the Netherlands and Duisburg in Germany.

Figure 10. Rail connections



Source: ECT company - brochure 2011

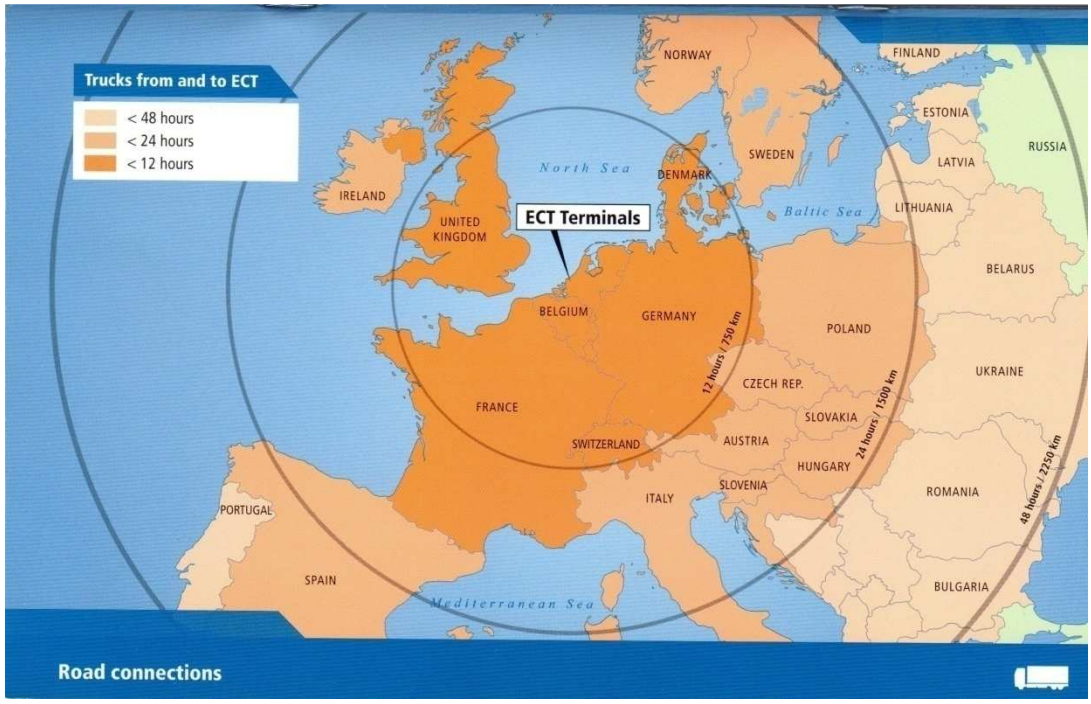
Road connections

Most of Europe can be reached by truck from Rotterdam within 24 hours (Figure 11). The ECT Delta Terminal is directly linked to the A15 national motorway. In and around Rotterdam, there are hundreds of hauliers which offer highly competitive services. To ensure the shortest possible turnaround times, ECT has substantially optimized the handling of trucks at its terminal, for example by means of the Cargo Card and other additional IT solutions.

The Cargo Card was successfully introduced at the ECT Delta Terminal at the end of 2007. Truck drivers use this personalized ID card for the entire terminal visit. This starts with gaining access to the pre-gate area. At the reception building, all the information necessary for the pick-up and the delivery of containers is then linked to the driver's Cargo Card.

The driver holds the Cargo Card up to a reader at each process point on the terminal (inspection gate in/out, landside transfer points, customs) and consequently the terminal systems automatically generate the required action.

Figure 11. Road connections



Source: ECT brochure 2011

Inland shipping connections (Inland waterway connections)

The location of Rotterdam on the estuary of the rivers Rhine and Maas makes inland shipping a perfect mode of transport to reliably move large numbers of containers into the European hinterland.

The ECT Delta Terminal offers specific inland facilities (equipments) such as separate barge cranes. Moreover there is the dedicated inland shipping terminal, such as the Delta Barge Feeder Terminal.

Rotterdam's inland shipping sector is made up of many private enterprises which are all highly customer-oriented. In addition, under the name of 'European Gateway Services', ECT maintains its own connections to the extended gate. These highly frequent and reliable connections comprise dedicated services with fixed windows.

Feeder connections

From ECT Delta Complex, there are daily feeder connections to and from ports in the UK/Ireland, Scandinavia, Baltic, Spain/Portugal and other locations throughout the Europe. Companies can choose between various independent operators.

2.4.3.2 The degree of openness

Attitude toward each other

The ECT company considers all the users of the Delta Terminal as key users because it recognizes the importance of all users in order to improve the performance of the supply chain.
The project which has led all communications to be completely electronic demonstrates a positive attitude between the ECT terminal operator and the users of the terminal.
The ECT company has been the driving force behind the realization of the project, offering support to individual terminal users in the creation of good electronic communication. But the terminal users have collaborated actively.

Interaction Patterns

The ECT Delta terminal collaborates with its users in the design of the services which can facilitate the container transit. An example of this collaboration has been realized with a private rail operator, called Distri Rail. The ECT has collaborated with Distri Rail in the design of fast rail shuttle connection form the ECT Delta Terminal to the inland terminal of Duisburg in Germany and vice versa.
The ECT Delta Terminal collaborates with its users in the planning tasks/procedures in order to optimize the container flow. An example of this collaboration has been realized with the truck drivers in the Cargo Card project
The ECT collaborates with terminals users in big projects which can optimize the flow of information. This has been done for the realization of ECT's aim to have 100 percent electronic data exchange with customers and other logistical partners..

Practices

The ECT Delta Terminal shares information daily with its users using the EDI systems, the web site and the port community system. In particular there is an intensive exchange of information between the ECT and the deep sea operators, the feeder operators, the barge operators, the rail operator, the truck operators, and the 3PL. In the

communication with each category of users there is a well defined type and sequence of data exchange.

2.5 The development of the research framework

In spite of growing interest in the integration of container terminals in supply chains, researchers are still in an early stage of investigating how a high degree of integration can be reached.

Le literature review has pointed out that the integration of container terminals in supply chains can be captured in two dimensions, defined as *integration driven investment* and *degree of openness* to the integration in supply chains.

A pilot study has been used to get some empirical insights on the two dimensions in order to better formulate our research framework.

The ECT Delta Terminal can be considered a well integrated terminal. This status can be explained taking into account the key dimensions and the contextual conditions (Figure 12).

The ECT Delta Terminal has been able to invest in dedicated infrastructures (e.g. own rail terminal) and superstructures (dedicated barge/feeder quay cranes) in order to improve the inter-connectivity at the interface between ship/road and ship/rail. Moreover, the terminal has built an internal track in order to link with the distripark Maasvlakte.

The investments have been possible also because there were some conditions in the context in which the terminal is embedded.

The port of Rotterdam is managed on the basis of the landlord model. The Port Authority is responsible for the development of the port area in order to enhance the competitive position of the port of Rotterdam. So it is interested to build the infrastructures (e.g. the distripark) that goes in this direction. While the terminal operator is responsible for the investment in the specific infrastructures and superstructures in order to enhance the competitive position of the terminal.

At the same time ECT Delta terminal has been able to make some right decisions in order to increase its integration with the users (e.g. the electronic exchange of data has

been mandatory at ECT Delta Terminal since 1st of June 2008). So, the ECT Delta Terminal has a high level of investment driven by integration aim.

The analysis of the other dimension shows a high degree of openness to the integration in supply chain. The ECT company and the terminal users show a positive attitude toward each other and this leads to actions (interaction patterns and practices) that make the relationships stronger.

Figure 12. The analysis of ECT Delta Terminal

Context	
Business type	Import/export oriented terminal
Geographic location	Located in important sea route, directly on the North Sea
Infrastructures in the port environment	The terminal is directly linked to the A15 national motorway. The distripark Maasvlakte is located very close to the terminal. Availability of a Port Community System
Port governance mode	The Port Authority of Rotterdam is responsible for the development of the port and manages the port area on the basis of the landlord model
Integration driven investment	
Information and communication systems	EDI systems. Web portal. Connection with the Port Community System
Value added services	The valued added activities on the cargo (e.g. labelling, packing) can be effected at the distripark Maasvlatke
Integration of transport modes	Own rail terminal. Dedicated area for the barge/feeder services (Delta Barge Feeder Terminal). Dedicated internal track between the terminal and the distripark Maasvlakte
Degree of openness	
Attitude	A positive attitude toward collaboration between ECT and the users of the terminal.
Interaction Patterns	Collaboration between the terminal and its users in the design of services and processes which can facilitate the container transit. Collaboration between the terminal and its users in the planning of task/procedures in order to optimize the container flow.
Practices	Daily information sharing between ECT and the deep sea operators, the barge operators, the rail operators, the truck operators, and the 3PL

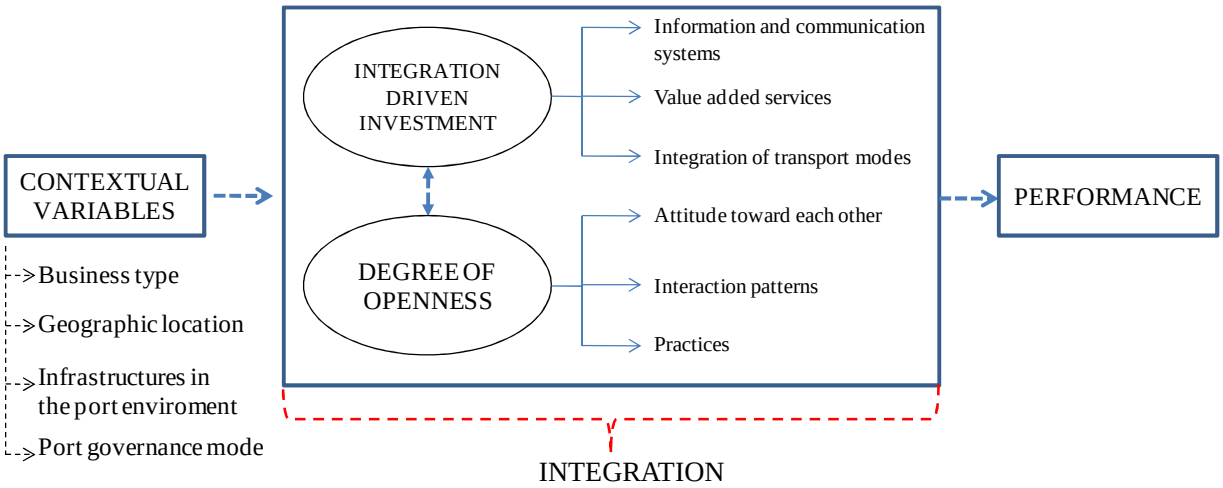
The analysis of the literature and the case pilot suggest that development of the research framework shown in Figure 13.

The integration of container terminal in the supply chain can be captured through two key dimensions, that is to say the integration driven investment and degree of openness. Each dimension can be evaluated taking into account some variables.

Is not to be excluded a relationship between the two dimensions. For example the presence of its own rail terminal may push toward the collaboration the terminal and a rail operator in order to introduce a new shuttle train service. However, one should not overlook the fact that the interaction may affect the future choices of investment (e.g. the building of a new dedicated siding within the terminal). As noted earlier, the context which characterized the terminal may influence the reaching of a high degree of integration.

The relationship between SCI and performance has been investigated over time with regard to the manufacturing company. Changing our unit of analysis, from manufacturing company to a container terminal, we can see that empirical evidence on the relationship between the integration and the performance is few. The key issue is whether the integration of container terminal in supply chain has an impact on its performance. Our pilot study seems to suggest that a high degree of integration has a positive impact on the performance. But a single case limits the generalizability of our findings.

Figure 13. The research framework



CHAPTER 3: RESEARCH METHODOLOGY

3.1 The case research

As shown in Chapter 2, a single in-depth case study was used in order to define our research framework. Then, it was important to choose a rigorous methodology in order to carry out the empirical analysis based on the research framework.

The case research was selected within various methodologies because:

- Our intent is to build theory considering that the port research is an emerging research field (Pallis et al, 2010) and it is necessary to build theories using empirical evidence (Woo et al., 2011)
- Building theory from case research is especially appropriate in new topic area (Eisenhardt, 1989)
- The case research is particularly suited in order to answer to "how" and "why" research questions (Yin, 2009)
- Case research has been recognized as one of the most powerful research methods in operation management, particularly in the development of new theory (Voss, 2009)

A fundamental step in case research is the choice of the number of cases to be analysed. According to Eisenhardt (1989), while there is no ideal number of cases, a number between four and ten cases is usually suited in order to build theories from case studies. The range defined by the scholar can be explained taking into account the trade-off between the complexity and volume of data generated from more than ten cases and the difficulty to generate theory with fewer than four cases.

Voss et al. (2002) put in evidence that multiple case studies are suited to build theory. In fact one case study limits the generalizability of the findings, models or theory developed form the research. At the same time, Voss et al. (2002) argues that "*for a given set of variable resources, the fewer the case studies, the greater the opportunity for depth of observation*".

According to Yin (2009), the evidence from multiple cases is often considered more compelling and the research design is regarded more robust.

Taking into account our research aim, a multiple case study approach has been adopted, involving a sample of five container terminals located in different Italian ports. This number is consistent with what is emerged by the literature.

3.2 The selection of cases

After the choice of the multiple case studies, a vital question is the selection of the cases or sampling.

According to Yin (2009), and Voss (2009), the selection of the cases has been effected using both literal and theoretical replication in order to have a theoretical sample (Eisenhardt, 1989). So, the replication technique was used in the selection phase. Each case was selected in order to obtain contrasting results but for predictable reasons (theoretical replication) or to predict similar results (literal replication).

The Figure 14 shows the cases which were selected. The five container terminals analysed are located in five different ports, that's to say, the ports of Genoa, La Spezia, Trieste, Ravenna and Taranto. A container terminal is a specific facility within the port area where the containers are handled. The analysis is focused on the most important container terminal, in terms of TEU's handled, of each port.

Figure 14. The five cases selected

3.3 The case study protocol

As highlighted by Yin (2009), it is important to develop a protocol when the case research is performed. In fact the protocol enhances the reliability of case research (Voss, 2009; Yin 2009), especially in multi-case studies.

The protocol contains procedures and general rules to be followed in performing the case research. The sections of the protocol have been elaborated following the indications provided by Yin (2009). So, the protocol is focused on the letter of introduction to be sent to interviewees and organizations involved in the study, the field procedures to be followed in collecting data and the set of questions used in the interviews. The case research protocol has been piloted in the pilot case as suggested by Voss et al. (2002).

The letter of introduction contains the general description of the study, the purpose of the research and the issues to be addressed as well as a presentation of the researcher.

The field procedures have been distinguished in procedures to be followed before the visits (e.g. before the visits being, the internet web site should be investigated in order to obtain information on the company) and procedures to be followed during the collection of data.

The set of the questions used in the interviews represents the core of the protocol (Voss, 2009) and can be found in the Appendix.

3.4 The data collection

In collecting field data we used a combination of different methods to study the same phenomena. The methods include semi-structured interviews, direct observations and content analysis of documents. The use of different sources of information was necessary in order to guarantee the respect of the principles of interaction and source triangulation (Eisenhardt, 1989; Yin, 2009).

3.4.1 Semi-structured interviews

An important point is the identification of key informants, that's to say the persons who are the best informed about the data being researched (Voss et al, 2002).
In our case, the key informants have been identified in the following organisations: terminal operator and port authority.
These organizations could provide important information about the port situation, the context which characterized the terminal and the two key dimensions of the container terminal integration in supply chains.
A terminal operator manages the container terminal which is the focus of the research. So, the terminal manager, who has the responsibility of the terminal, has been interviewed. In order to capture other information, especially about the value added services or to better understand the sales performance, the marketing & sales manager of the terminal has been interviewed.
Instead in order to obtain data about the port situation and, consequently, about the context which characterizes a container terminal, the head of the marketing, port promotion and international relations department has been interviewed.
Moreover, one user for each terminal has been interviewed with the purpose of data triangulation.
The interviews have been effected using the set of the questions developed in the protocol.
The interviewer has guided the conversations making sure that all the questions on the interview tool were addressed (Yin, 2009).

3.4.2 Documents

According to Yin (2009), we decided to use documents in order to have other specific details to corroborate and augment evidence from other sources. Different documents were collected in order to search for information. Some documents were requested to the terminal operators, others to port authorities and terminal users. Moreover companies and port authorities web sites and articles have been used.

3.4.3 Direct observations

A field visit of each container terminal was effected. During the tour, the infrastructures and superstructures and the equipment to effect valued added services were identified as well as the technologies used in the operations. The purpose of these observations was primarily to verify the information collected from interviews and documents.

3.5 The quality of the research design

It is important to ensure the validity and the reliability of study (Voss et. al, 2002; Yin, 2009). In particular:

- Construct validity is the extent to which correct operational measures have been identified for the concepts being studied. Two tactics have been used in order to increase construct validity. The use of multiple source of evidence and having the draft case study report reviewed by key informants (Yin, 2009).
- Internal validity is the extent to which right causal relationships have been established. This dimension of the validity has been ensured through the use of the pattern-matching logic (Yin, 2009) which was used in within and cross case analysis.
- External validity is referred to the generalization of the results of research beyond the study. The use of multiple case studies selected with the replication technique, as you have done in our work, permits to achieve the external validity (Yin, 2009)
- Reliability demonstrates that the study's operations can be repeated, with the same results. The use of case study protocol is a means to achieve reliability (Yin, 2009)

CHAPTER 4: CASES ANALYSIS

Our research is focused on integration of the container terminals in supply chains. So the level of analysis is the container terminal. Following the procedure recommended by Miles and Huberman (1984) and Eisenhardt (1989) we first conduct the within case analysis where we go in depth with the analysis of each terminal and then we perform the cross-case analysis where we compare and contrast the cases.

4.1 Within-case analyses

The within-case analyses of the five cases have been conducted using the data sources. The data have been interpreted and elaborated. Each case reports data on the variables defined in our research framework.

Before starting with the analysis of each case we decided to analyse the role of the port authority and to focus on the ports, part of which the terminals are.

Although there are 25 port authorities in Italy, each authority operates according to a specific Italian law. So there are not differences between the Port Authorities in terms of tasks, procedures, etc. The analysis of the ports is important in order to get some information about the context in which the terminals are located.

After the analysis of the five cases, we conclude the within-case analysis with a summarizing table.

4.1.1 The port authority

The port authority was established by Italian Law 84/94 on "Reorganisation of Legislation concerning Ports" which defines the tasks and the legal status of the this entity. The port authority is a public corporation which has the following main tasks:

- Planning, development, promotion of the port and control and security of port operations and other activities carried out within the port
- Maintenance of shared port infrastructures
- Attribution and control of general services provided to the port users.

The port authority acts on the basis of the landlord model. In fact it manages the port area according to its tasks and leases out the port sites to private companies. The private operators have the operational management of the terminals and they invest in specific business-related capital equipment (e.g. cranes).
So, the main operating income flows of port authority are harbour dues and contract income, derived from long term leases of port sites.

4.1.2 The location of container terminals

The terminals are located in five different ports (Figure 15). The ports of Genoa and La Spezia are situated on the Ligurian Sea which is an arm of the Mediterranean Sea, between the Italian Riviera (Liguria and Tuscany) and the islands of Corsica and Elba. The ports of Trieste and Ravenna are located on the Adriatic Sea while the port of Taranto is situated on the Jonio Sea.

Figure 15. The geographical location of five terminals

The port of Genoa

The port of Genoa is located in northern Italy. Its geographical location is strategic because the port is situated in the industrial and consumer heartland of Northern Italy and Southern Europe.

In fact, the port is located near Milan and Turin, which are approximately 150 km away, as well as important economic centres of the Europe, such as Bale (Switzerland), Munich (Germany) and Vienna (Austria).

This position makes the port of Genoa an ideal southern gateway for traffic to/from Europe and the natural hub for Far East trade. Over 150 regular liner services connect Genoa to ports worldwide.

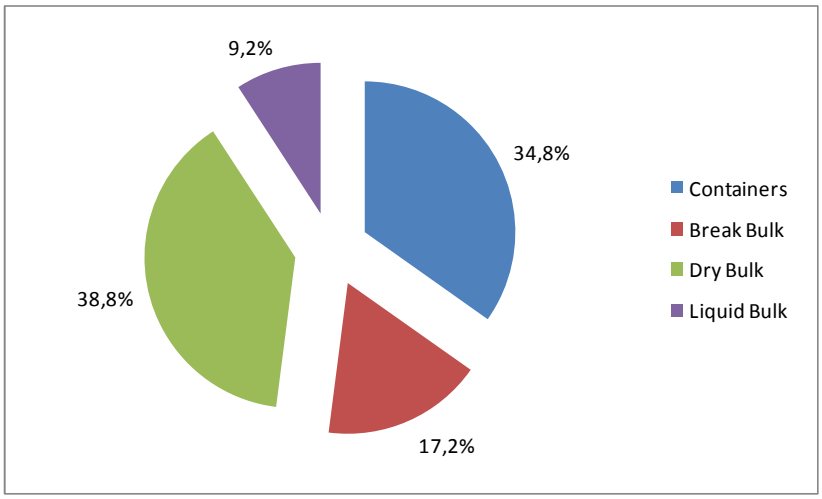
The port is characterized by 22-kilometre coastline and it covers a total surface area of approximately 7 million sqm. The port is composed of 22 terminals which handle different cargoes: container, general cargo, perishable goods, steel, forest products, solid and liquid bulk, petroleum products and cruise and ferry passengers.

The port of Genoa is a multi-service port which occupies the first position in the Italian ranking in terms of total throughput, approximately 52 million tons (Port Authority of Genoa, 2010). The Figure 16 shows the proportion of the throughput for each type of cargo while the Figure 17 shows the position of port of Genoa in Italian ranking with regard to the container traffic.

Considering the container traffic in the year 2009, the port of Genoa occupies the fourteenth position in the world container port ranking (Van den Berg and De Langen, 2011).

Within this context, the port authority of Genoa and the private terminal operating companies are working in order to develop the port and to consolidate its role in the Mediterranean Sea. In the short term, the works are underway to improve road and rail access to the port, facilitating the flow of goods, expand the facilities to effect value added services and landfill and restructure specific area in the port terminals.

Figure 16. Throughput by segment



Source: Adapted from Port Authority of Genoa , 2011

Figure 17. Container traffic in the main Italian ports

Porto	2008 (TEUs)	2009 (TEUs)	2010 (TEUs)
Gioa Tauro	3,467,824	2,857,440	2,851,261
Genova	1,766,605	1,533,627	1,758,858
La Spezia	1,246,139	1,046,063	1,285,155
Livorno	778,864	592,050	628,489
Taranto	786,655	741,428	581,936
Cagliari-Sarrich	307,527	736,984	576,092
Napoli	481,521	515,868	532,432
Venezia	378,072	369,474	393,913
Trieste	335,943	276,957	281,629
Salerno	330,373	269,300	234,809
Savona-Vado	252,837	196,317	220,000
Ravenna	214,324	185,022	183,041

Source: Adapted from Confetra, 2010

The port of La Spezia

The port of La Spezia is situated in the north of Italy, in the middle of the coast between Genoa and Leghorn. The port has a particular position at the end of a deep gulf North-West / South-East oriented. A mountain chain protects the port backwards, while the cape of Portovenere and the islands Palmaria and Tino save the port from the strong south-west winds.

A outer breakwater assures very good sea conditions to the gulf all over the year, allowing port operations in all weather conditions.

The outer breakwater is 2,210 metres long and cuts the gulf between cape S. Maria westwards and cape S. Teresa eastwards, leaving two passages of 200 and 400 metres for the ships entering into the port. The bay is about 4.6 km deep and 3.2 km wide.

Inside a 150 hectares harbour and protected by an outer breakwater, the port has over 5 km quays and 575,000 sqm surface at its disposal, with rail tracks for 17,000 metres and roads for 3,500 metres. The draught is up to 14 metres, which allows the newest container ships to enter the port. Current dredging works will increase draught up to 15 metres. The terminals have cranes up to 100 tons capacity and covered warehouses for a total of 13,000 sqm at their disposal.

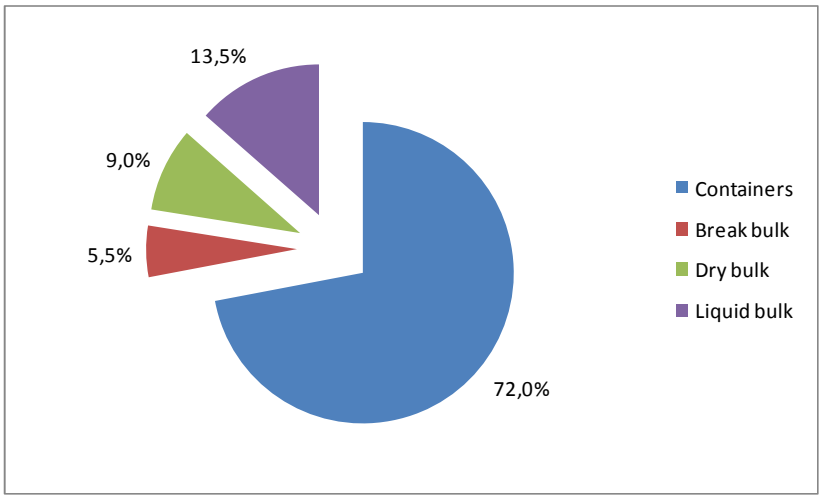
In the port, two container terminals, one multipurpose terminal, one coal terminal, two oil terminals, one LNG terminal and two cement terminal are operative.

The throughput of 14,328 million tones (Ministero delle Infrastrutture e dei Trasporti, 2009) makes the port of La Spezia an important port in Italy. In the port of La Spezia both bulk (dry and liquid bulk) and general cargo (containers and breakbulk) are handled. The Figure 18 shows the proportion of the throughput for each type of cargo.

The containers handling is the most important part of the business. Taking into account the TEUs handled in 2010, the port occupies the third position in Italian ranking and the seventeenth position in European ranking.

The port is directly connected to the Italian rail and highway net and is located at the crossroad between the Tyrrenian-Brenner and the coast lines. Regular services of rail transport connect it with most important centres of North Italy. More than 50 ship lines link the port with over 200 ports all over the world.

Figure 18. Throughput by segment



Source: web site of Port Authority of La Spezia

The port of Trieste

The port of Trieste is situated in northeastern Italy, towards the end of a narrow strip of land lying between the Adriatic Sea and Italy's border with Slovenia. It is located near to the Central Europe, at the crossroads between the maritime routes and Corridor 5 (Lisbon-Kiev).

Deep sea-bottoms, excellent accessibility to shipping, outstanding rail and road connections, closeness to end markets, make Trieste an efficient and competitive port of call.

The long-distance intercontinental maritime connections and short-to medium intra-Mediterraean links play an important role in the development and the growth of the port.

The position of the port and the rail connections have permitted the development of intermodal services. More than 50 trains a week link Trieste to the productive and industrial areas in North-East Italy, the South of Germany, Austria, Hungary, the Czech Republic and Slovakia, serving an extremely varied economic hinterland.

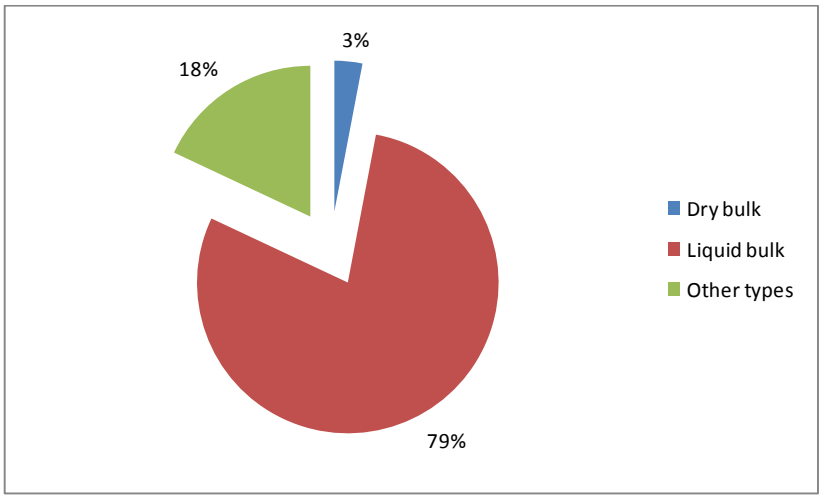
The port of Trieste is a free area for goods and operators. There are five Free Areas: Old Free Area, New Free Area, Timber Terminal Free Area, Mineral Oils Free Area, Industrial Free Area.

The advantages are much. The goods arriving by sea from non-community countries can be freely introduced into Free Areas, irrespective of their origin or destination and without being subject to taxation in the port area. These goods can remain in store within the port area for an unlimited period and can be sent to the overseas destinations without requiring any community customs declaration. Customs duties and taxes on goods imported into the community market through the Free Areas may be paid with delays of up to six months at a particularly low rate of interest.

The throughput of 44,393 million tons (Ministero delle Infrastrutture e dei Trasporti, 2009) makes the port of Trieste one of the most important port in Italy. In the port of Trieste both bulk (dry and liquid bulk) and other types (containers, ro-ro, break bulk) are handled. The Figure 19 shows the proportion of the throughput for each type of cargo.

With regards to the containers traffic, the port of Trieste occupies the ninth position in Italian ranking (Figure 17). In the port there is only one container terminal, managed by Trieste Marine Terminal Spa.

Figure 19. Throughput by segment



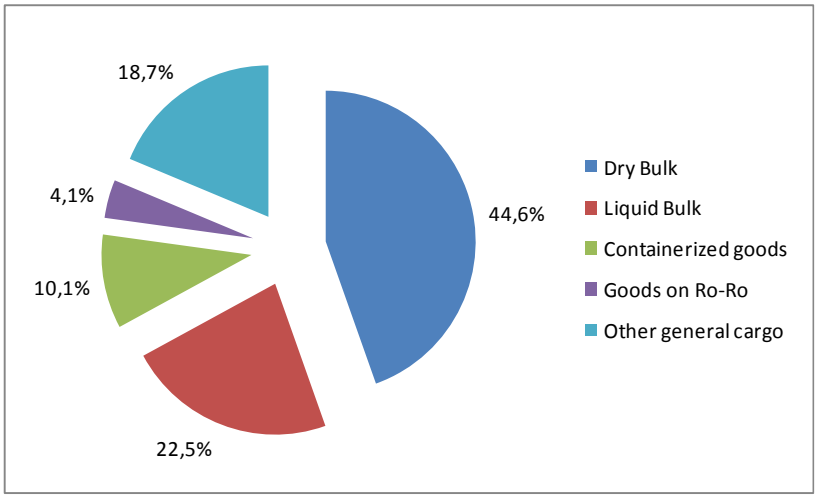
Source: Port Authority of Trieste – Statistics 2009

The port of Ravenna

The port of Ravenna in located on the Adriatic Sea, in an important economic area of Italy. Several refineries and petrochemical industries occupy the port sites, because the deposits of methane are situated some miles away from the coast.

The port of Ravenna is one of the most important ports in Italy with regard to the handling of the dry bulk cargo. However, the numerous port terminals are equipped to receive any kind of cargo. The throughput has been 21,915 million tons in the last year. The Figure 20 shows the proportion of the throughput for each type of cargo. With regards to the containers traffic, the port of Ravenna occupies the twelfth position in Italian ranking with a total throughput of 183,041 TEUs in the year 2010.

Figure 20. Throughput by segment



Source: Port Authority of Ravenna – Statistics 2010

The Port of Taranto

The port of Taranto, situated in the south of Italy on the north coast of the Gulf of Taranto, is a natural harbour embracing a wide sheltered bay, Mar Grande, and a smaller inlet, Mar Piccolo. The port of Taranto has a strategic location in the Mediterranean – halfway between east and west and only 172 nautical miles from the main shipping route from Gibraltar to the Suez Canal.

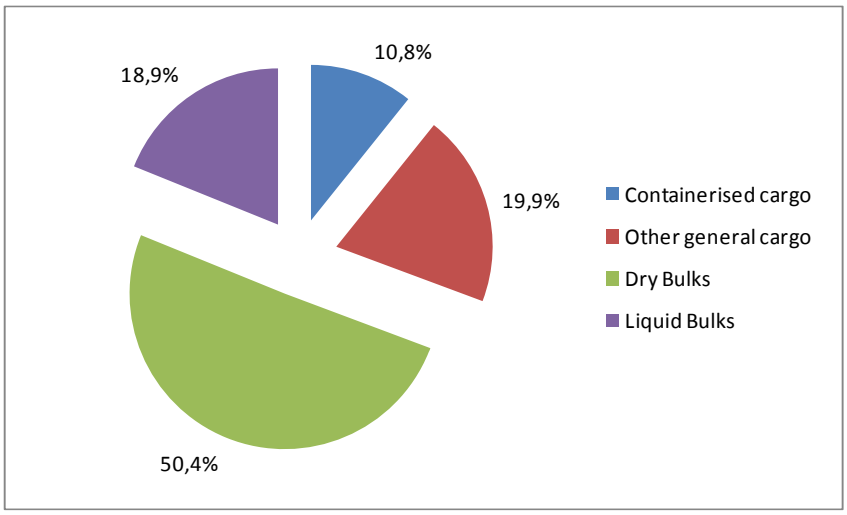
With the opening of the container terminal in 2001, this geographical advantage has brought a welcome growth in port traffic, allowing Taranto to join the league of Mediterranean hub ports which, year by year, have won a large share of the trade generated by the emerging economies of the Far East – in strong competition with the ports of the Northern Range.

Thanks to a range of mainline services to the Far East and the United States, plus an extensive network of feeder services linking with major ports in the Mediterranean, the Port of Taranto has rapidly gained an important role.

The throughput of above 35 million tones reached in the year 2010, makes the port of Taranto one of the most important Italian port. In the port of Taranto both bulk (dry and liquid bulk) and general cargo (containerised cargo and other general cargo) are handled. The Figure 21 shows the proportion of the throughput for each type of cargo.

The containerized cargo is handled at Taranto Container Terminal, the only container terminal of the port. Taking into account the TEUs handled in 2010, the port occupies the fifth position in Italian ranking.

Figure 21. Throughput by segment



Source: Port Authority of Taranto – Statistics year 2010

4.1.3 The case of Voltri Terminal Europa (VTE)

Voltri Terminal Europa (VTE), located in the area of the New Prà - Voltri harbour, is the most important container terminal of the port of Genoa.
Its strategic location, directly on the open sea, offers direct and unrestricted access to all kinds of vessels that can arrive and depart easily, quickly and safely.
With a quay length of 1,450 metres along 6 modules and a draft of 15 metres, the terminal is equipped to accommodate simultaneously five last generation full-container vessels and three ro-ro ships.
The terminal has a handling capacity of about 1,200,000 TEUs/year and the total area is 1,100,000 sqm. The terminal is managed by Voltri Terminal Europa SpA, part of the Singapore-based PSA Group. The PSA Group also controls, through its subsidiary company Sinport SpA, the Prà Distripark Europa, the company which manages the distripark of Voltri, situated within the terminal area.
The terminal can be classified as an import/export terminal. In fact the transhipment accounts for nearly 7 per cent of the terminal's throughput, while the remaining 93 per cent is made up of imports and exports. Throughput has moved from 1,009,487 TEUs in 2008 to 885,276 in 2009. In the year 2010 the throughput has been 980,950 TEUs.
Sales have moved from 88,795,416 € in 2008 to 75,537,053 € in 2009. In the year 2010 sales have reached 94,580,279 €.

4.1.3.1 The integration driven investment

Value added services

Although the terminal focus is on containers handling and loading/unloading services, other additional services are effected:

- **Break bulk cargo**. The terminal provides ad hoc solutions for the handling of every kind of break bulk cargo (machineries, yachts, wagons, elicopters, etc.)
- **Refeer containers.** A dedicated area with 600 reefer plugging points is available for the customers needs. The terminal provides a monitoring service of the reefer containers conditions (2 times per day physical check of the temperature). VTE does not supply any repair service but only a service of control and first level

diagnosis. In case of emergency small repairs on electrical components can be carried out as well (cables, etc).

Import containers can be subject to sanitary controls by direct inspections. In such case, containers are moved to the sanitary inspection area within the terminal.

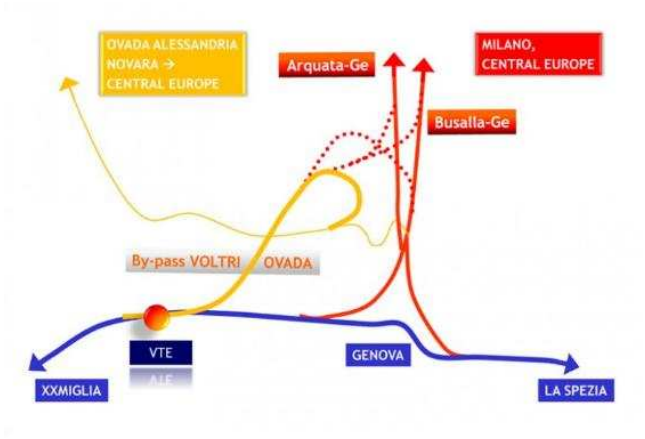
- **IMO Containers.** The area for temporary stacking of dangerous goods containers is located within the terminal area. The maximum geometric capacity of the area is 640 TEU, according to IMO classes. All IMO classes are accepted with the exception of IMO 1 (explosives), IMO 6.2 (infecting materials) and IMO 7 (radioactive materials).
- **Container Freight Station (C.F.S.) activities**. These activities are carried out in the distripark of Voltri located within the terminal. The VTE directly manages 5,000 sqm of the warehousing area of the distripark (total area 20,000 sqm). The VTE provides a wide range of services: stuffing/unstuffing of general cargo containers, machinery or other equipment either packed or unpacked, vehicles and goods on pallets with related lashing/unlashing and covering; warehousing, labelling of packages using labels supplied by the customer, wrapping of palletized packages, fastening of items with customs plumbing, marking of boxes (mask and paint supplied by the customer).

Integration of transport modes

Rail connections

Inside the terminal there are 8 rail tracks of 650 meters each, served with 3 rail mounted gantry cranes. The rail park is directly linked with to Genoa/Ventimiglia and Genoa/Milan and Turin railway lines, the latter equipped to accommodate “high cube” containers. The links to all destinations of central Europe is granted by a regular shuttle service.

Figure 22. The rail connections



Source: VTE web site

Road connections

VTE is well connected to the North Italian motorway network, with direct access to the A26 to Milan and the A10 to La Spezia.

The access to the terminal is characterized by 14 lines, 12 for the containers traffic and 2 for non containerised and heavy weight cargo.

Information and communications systems

For all the ship, yard and rail operations the terminal works with COSMOS System. The IT system integrates all the terminal facilities and equipment (always under our control room supervision) to maintain the activities under full control in real time.

The electronic exchanged of data with the terminal users is based on three means:

d. The Electronic Data Interchange (EDI)
e. The VTE website
f. The e-port of the port of Genoa.

The EDI systems are used in order to communicate with the shipping lines. The web site is used by different terminal users (shipping lines, forwarders, transport operators, etc.) in order to download or/and upload some information.

The Port Authority of Genoa has developed a port community system (e-port) which facilitates the simple and efficient exchange of data in order to optimize the information flows and work processes of the organizations. VTE uses this electronic platform in

order to communicate with the shipping lines and the forwarders. In particular the VTE uses the e-port in order to accelerate the exit of the imported containers.

4.1.3.2 The degree of openness

The terminal considers as key users the shipping lines and the freight forwarders because this two category of users "choose" the terminal where transferring the containers.

The terminal doesn't collaborate with the terminal users in the design of the services which can facilitate the container transit.

The terminal collaborates with the terminal users in the planning activities/tasks in order to optimize the containers flow. The terminal usually shares information with the terminal users in order to optimize the containers transit.

4.1.4 The case of La Spezia Container Terminal (LSCT)

Although in the port of La Spezia two dedicated container terminals are operative, the terminal managed by La Spezia Container Terminal Spa, belonging to Contship Italia Group, is the most important.

The activities of the terminal have been carried out on Fornelli pier since the Eighties and on the Angelo Ravano area since 1998, for a total actual surface of more than 280,000 sqm. The table below reports some technical data of the terminal:

Quay Length	Draft	Total area	Handling capacity
1,402 m	13-14 m	282,000 sqm (internal); 43,000 sqm (external)	1,200,000 TEUs/year

The terminal can be considered an import/export terminal.

Throughput has moved from 1,051,805 TEUs in 2008 to 851,558 in 2009. In the year 2010 the throughput has been 1,041,483 TEUs. Taking into account the TEUs handled in 2010, this terminal is in the second position of Italian ranking.

Sales have moved from 96,961,000 € in 2008 to 78,959,000 € in 2009. In the year 2010 sales have reached 95,867,038 €

4.1.4.1 The integration driven investment

Value added services

Although the terminal focus is on containers handling and loading/unloading services, other additional services are effected:

- **Break bulk cargo.** The terminal provides ad hoc solutions for the handling of every kind of break bulk cargo (machineries, yachts, wagons, helicopters, etc.)
- **Refeer containers.** A dedicated area with 384 reefer plugging points is available for the customers needs.
- **Stuffing/unstuffing.** This stuffing/unstuffing of the containers is effected both within the terminal and in the "retroporto". The stuffing/unstuffing is performed within the terminal when required by forwarders or by customs. In the retroporto area this service is effected by a specialized company, owned by La Spezia Container Terminal.
- **VAT Warehouse.** This service gives the importer the possibility to keep the cargo in dedicated warehouses without paying VAT. This service is valid only for goods which come from E.U. countries
- **Labelling and packaging.** Some perishable goods (e.g. fruits and vegetable) first undergo quality control and then the labelling is performed. The labeling and the packaging are effected on several types of goods. Generally, these activities are effected when required by the public authority (e.g. label does not conform to the laws).

Integration of transport modes

The terminal has a very close position to the main Italian railways and highways leading to the most industrialized areas of North Italy and North Europe. The terminal has eight sidings, linked directly with the national rail network. It is linked to the A12 and A15 Italian highways by a slip road. The terminal is linked to a nearby area, called "retroporto", located at Santo Stefano Magra, only 8 km from La Spezia, by shuttle trains and shuttle trucks. In this nearby area some activities are effected (e.g receipt and

delivery of container as well as loading and discharging of trains). In this way, the marine terminal forms a unique and integrated system with the "retroporto" The terminal is connected with the main Italian inland terminals.

Information and communications systems

For all the ship, yard and rail operations the terminal works with SPARCS system. The IT system integrates all the terminal facilities and equipment (always under our control room supervision) to maintain the activities under full control in real time.

The electronic exchanged of data with the terminal users is based on two means:

a. The Electronic Data Interchange (EDI)
b. The terminal web site

4.1.4.2 The degree of openness

The terminal consider all users as key users because it recognizes the importance of all users in order to improve its performance. In fact the terminal is in a condition of "saturation" and it has to reach a balance between the volume of traffic in entrance and in exit in a temporal horizon.

The terminal uses EDI systems with the shipping lines, rail operators and multimodal transport operators. The terminal uses web portal in order to communicate with freight forwarders and road hauliers.

Not only does the terminal usually share information with the users in order to optimize the container transit but it also collaborates with the users in the design of services and in the planning activities/tasks which can facilitate the container transit

4.1.5 The case of Trieste Marine Terminal

Trieste Marine Terminal is the only specialized container terminal in the port of Trieste and it has the deepest natural draft in the whole Mediterranean (18 meters alongside berth).

The table below reports some technical data of the terminal:

Quay Length	Draft	Total area	Handling capacity
770 m (operating berth); 600 m (supporting berth)	18 m	400,000 sqm	600,000 TEUs/year

The terminal is managed by the Trieste Marine Terminal which is a member of the T.O Delta Group, one of the most important logistics and transport operators in the Italian market.

The terminal can be classified as both an import/export and transhipment terminal. In fact transhipment accounts for nearly 30 per cent of the terminal's throughput, while the remaining 70 per cent is made up of imports and exports.

Throughput has moved from 338,299 TEUs in 2008 to 277,245 in 2009. In the year 2010 the throughput has been 281,629 TEUs.

Sales have moved from 24,546,607 € in 2008 to 20,095,225 € in 2009. In the year 2010 sales have reached 22,169,804 €.

4.1.5.1 Integration driven investment

Value added services

Although the terminal focus is on containers handling and loading/unloading services, other additional services are effected:

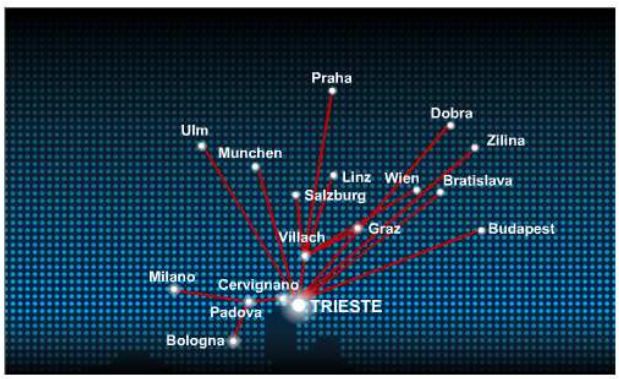
- **Dangerous containers acceptance.** There is a dedicated area for the storage, the loading/discharging and fumigation and ventilation of containers containing dangerous goods.
- **Fumigation and ventilation**
- **Storing**
- **Reefer containers services.** A dedicated area with 184 reefer plugging points is available for the customers needs. The terminal provides a monitoring service of the reefer containers conditions (2 times per day physical check of the temperature)

- **Break bulk cargo**. The terminal cranes can handle up to 75 tons (all in) under hook, allowing direct or indirect loading and discharging of yachts, engines, cases, pipes, locomotives and many other different kinds of commodities. Moreover, the handling of over 75 tons weight cargo can be evaluated and carried out based on request.
- **Container Freight Station (C.F.S.) activities**. These activities are carried out by the Adriadistripark, a company controlled by Trieste Marine Terminal and located on the terminal's premises. With 12,000 sqm of covered warehouses and dedicated personnel, Adriadistripark is in the position to provide a wide range of cargo handling services, both to containerized goods and break bulk. Stuffing/unstuffing, picking, consolidation, securing, quality control of goods, warehousing, transit and customs operations, handling of perishable goods are effected, labelling and packaging according to specific requirement.

Integration of transport modes

Inside the terminal there is a rail park, composed of five rail tracks of 600 meters each, served with 3 rail mounted stacking cranes operate up to 5 trains at the same time. This rail park makes Trieste Marine Terminal able to operate 11,500 trains per year. The terminal is linked with several important Italian and European cities (Figure 23). The terminal operates the Trieste-Budapest rail service.

Figure 23. The rail connections



Source: Trieste Marine Terminal web site

From Trieste Marine Terminal, there are feeder connections to and from ports in Italy (Venice, Ravenna, Ancona) and in other countries (Figure 24). The feeder services among the main Adriatic ports and the Trieste hub port are carried out directly by Trieste Marine Terminal company.

Figura 24. The fedeer connections

Source: Trieste Marine Terminal

The terminal is linked to the A4 National highway by a freeway. The A4 access point is about 30 km away. Besides the link with the national network, the frontiers of Fernetti and Sant'Andrea (Gorizia) allow the connection with the Slovenian highways.

Information and communications systems

For all the ship, yard and rail operations Trieste Marine Terminal works with COSMOS System. The IT system integrates all the terminal facilities and equipment (always under our control room supervision) to maintain the activities under full control in real time.
The electronic exchanged of data with the terminal users is based on two means:

a. The Electronic Data Interchange (EDI)
b. The terminal website (web portal)

4.1.5.2 The degree of openness

The Trieste Marine Terminal considers as key users the shipping lines, the freight forwarders, the multimodal transport operators (MTOs) and the rail operators. The shipping lines and the freight forwarders are important because they decide the path of the containers while the MTOs and the rail operators are fundamental in order to guarantee the dispatch of containers in the hinterland.

Communication and information exchange with the shipping lines is fully automatic in order to optimize the container flow. The information is exchanged by the EDI and web EDI systems.

For the export, the freight forwards and the transport operators, authorized by the shipping lines, can use the Trieste Marine Terminal web site in order to communicate some information about the containers status. At same time the terminal users can use the web site in order to download some information.

The Trieste Marine Terminal collaborates with shipping lines, MTOs and freight forwarders in the design of the services which can facilitate the container transit. An example of this collaboration with the shipping lines has been realized for the introduction of the new shuttle train which link the Terminal with Budapest station. In fact Trieste Marine Terminal and the shipping lines have collaborated in order to define the optimal level of service of the shuttle train (e.g. frequency of the service, specific days of the week in which the shuttle train operates, etc.).

The terminal collaborates with the shipping lines and other users in the planning procedures in order to optimize the information flow. At the level of operational activities/processes the terminal tends to be more closed.

4.1.6 The case of Terminal Container Ravenna (TCR)

TCR is the leading container terminal in the port of Ravenna. It is managed by the T.C.R. SpA. The 70% of T.C.R. is owned by the shareholder Sapir, an important company for the port community of Ravenna, and 30% by La Spezia Container Terminal, a company controlled by Contship, an undisputed leader in European terminal operators.

The table below reports some technical data of the terminal:

Quay Length	Draft	Total area	Handling capacity
680 m	10.5 m	300,000 sqm	285,000 TEUs/year

The terminal can be classified as both an import/export and transhipment terminal. The transhipment accounts for nearly 20 per cent of the terminal's throughput and the transhipment increased remarkably in the last year (+ 20%).

Throughput has moved from 203,702 TEUs in 2008 to 177,575 in 2009. In the year 2010 the throughput has been 174,073 TEUs.

Sales have moved from 16,914,152 € in 2008 to 15,857,551 € in 2009. In the year 2010 sales have reached 15,884,425 €.

4.1.6.1 The integration driven investment

Value added services

Although the terminal focus is on containers handling and loading/unloading services, other additional services are effected:

- **IMO containers.** The area for temporary stacking of dangerous goods containers is located within the terminal area. All IMO classes are accepted with the exception of IMO 1 (explosives), IMO 6.2 (infecting materials) and IMO 7 (radioactive materials).
- **Reefer containers services.** A dedicated area with 160 reefer plugging points is available for the customers needs.
- **Ancillary services**. The terminal offers the following services: stuffing/unstuffing of containers, service of groupage, storage of palletized and non-palletized goods, cleaning and repair of containers

Integration of transport modes

Inside the terminal there are five rail tracks of 420 meters each, served with rail mounted gantry cranes. The terminal is directly linked with the intermodal terminals of Melzo (MI), Dinazzano (RE) and Modena.
The A14 Italian highway (motorway) is about 10 km away. The terminal is well linked to the E45 road while the connection with Venice is not adequate.
From TCR terminal there are feeder connections to and from 26 ports belonging to 14 countries distributed in the East Mediterranean, North Africa, the Middle East, the Red Sea, sub-continental India and North-Central America.

Information and communications systems

The terminal has an IT system (SPARCS) which permits to coordinate all the gate, loading area and quay operations which are planned, controlled and updated in real time. The EDI systems are used in order to communicate with the terminal users.

4.1.6.2 The degree of openness

The TCR considers as key users the shipping lines and the multimodal transport operators (MTOs). The shipping lines are the direct customers of the terminal while the MTOs are important because they guarantee the logistic connections with the hinterland.
The TCR collaborates with the shipping lines and the MTOs in the design of the services which can facilitate the container transit. The last collaboration has led to the introduction of the rail service for the containers from and to Russia.
The terminal collaborates with several terminal users (shipping lines, feeder operators, freight forwarders, hauliers, MTO) in the planning procedures in order to optimize the containers flow.
The terminal usually shares information with the shipping lines, freight forwarders and MTO in order to optimize the containers transit. The EDI systems are used in order to

communicate with the terminal users (shipping lines, feeder operators, rail operators, MTO).

4.1.7 Taranto Container Terminal

Taranto Container Terminal is the unique terminal container of the port of Taranto. It is located in the Central of the Mediterranean, 170 nautical miles from the main Suez-Gibraltar shipping route, making it a valid and barycentric hub port.
The container terminal is managed by Taranto Container Terminal S.p.A, which is controlled by both Hutchison Whampoa and Evergreen Marine Corporation.
The table below reports some technical data of the terminal:

Quay Length	**Draft**	**Total area**	**Handling capacity**
1,500 m	14.3 m (min.)	930,000 sqm	2,000,000 TEUs/year

Throughput has moved from 786,655 TEUs in 2008 to 741,428 in 2009. In the year 2010 the throughput has been 581,936 TEUs. Transhipment accounts for nearly 90 per cent of the terminal's business, while the remaining 10 per cent is made up of imports and exports.
Sales have moved from 35,571,708 € in 2008 to 29,184,388 € in 2009. In the year 2010 sales have reached 22,995,039 €.

4.1.7.1 The integration driven investment

Value added services

Although the terminal focus is on containers loading/unloading services, other additional services are effected:

- **Reefer containers handling and storage.** A dedicated area with 900 reefer plugging points is available for the customers needs.
- **Stuffing/unstuffing of containers**

The terminal does not have facilities to perform value added activities on the cargo. During the last years some warehouses have been built inside the terminal where the

logistics service providers effect only the container deconsolidation. After the deconsolidation the cargo is sent to the final destination without being subjected to any operation.

The integration of transport modes

The terminal is connected to the Italian railways and highways networks. On the west side of the terminal there are five sidings, linked directly with the national rail network. Two railmounted 'transwagon' gantry cranes provide rapid loading and unloading of container trains. Over 20 in and out weekly container trains are operated to connect the terminal with other Central and Northern Italian Interports. Trucks leaving or entering the terminal have ready access to and from the national road network. There is a congestion-free link with the highway, 15 km away
The feeder services provide frequent and fast connections from the terminal to some 40 ports around the Mediterranean, the Adriatic and the Black Sea.

The information and communication systems

For all the ship, yard and rail operations the terminal works with an IT System (TOPO). The IT system integrates all the terminal facilities and equipment (always under our control room supervision) to maintain the activities under full control in real time. The terminal uses EDI systems.

4.1.7.2 The degree of openness

The terminal considers the shipping lines as the key users because it recognizes the importance of this category of users in order to improve its performance (e.g. throughput). The terminal uses EDI systems only with the shipping lines. The terminal shares daily information with the shipping companies in order to optimize the container transit. There is no collaboration between the terminal operator and the terminal users both in the design of services and in the planning of task/procedures in order to facilitate the container transit.

4.1.8 Summary

We summarize here what we have observed in the within-case analyses of the five cases. Key points appear in Table 2.

Table 2. Summary of within-case data

		Container Terminals				
Dimension	**Variables**	**VTE**	**LSCT**	**Trieste Marine Terminal**	**TCR**	**Taranto Container Terminal**
Context	Business Type	Import/export oriented	Import/export oriented	Both an import/export and transhipment terminal	Both an import/export and transhipment terminal	Transhipment oriented
	Geographic location	Located in the port of Genoa on the Ligurian Sea, in northwestern Italy	Located in the port of La Spezia on the Ligurian Sea, in northwestern Italy	Located in the port of Trieste on the Adriatic Sea, in northeastern Italy	Located in the port of Ravenna on the Adriatic Sea, in northeastern Italy	Located in the port of Taranto on the Jonio Sea, in south of the Italy
	Infrastructures in the port environment	Availability of e-port system	"Retroporto", located at Santo Stefano Magra, only 8 km from La Spezia			
	Port governance mode	The Port Authorities of Genoa, La Spezia, Trieste, Ravenna and Taranto act on the basis of the landlord model				

		Container Terminals				
Dimension	**Variables**	**VTE**	**LSCT**	**Trieste Marine Terminal**	**TCR**	**Taranto Container Terminal**
Integration driven investment	The integration of transport modes	The terminal has eight rail tracks of 650 meters each, served with 3 rail mounted gantry cranes. The terminal has the direct access to the A26 and A10 Italian motorways	The terminal has eight rail tracks, linked directly with the national rail network. It is linked to the A12 and A15 Italian motorways by a slip road	Inside the terminal there is a rail park, composed of five rail tracks of 600 meters each, served with 3 rail mounted stacking cranes; the terminal is linked to the A4 national highway by a free way . The A4 access point is about 30 km away	Inside the terminal there are five rail tracks of 420 meters each, linked directly with the national rail network. The A14 Italian motorway is about 10 km away.	Inside the terminal there are five rail tracks of 1,000 meters each, linked directly with the national rail network, served with two rail mounted gantry cranes. The A14 Italian motorway is about 15 km away
	Value Added Services	The terminal offers complementary logistic services (e.g. warehousing, stuffing/unstuffing,). The value added services on the cargo (e.g. labelling, packaging) are limited (e.g. the labelling is made using labels supplied by the customers)	The terminal offers complementary logistic services (e.g. stuffing/ unstuffing, IVA warehouse). Generally the labelling and the packaging are effected when are required by the public authority (e.g. label does not conform to the laws)	The terminal offers complementary logistic services (stuffing/ unstuffing, picking, consolidation, warehousing). The value added services on the cargo are effected rarely (on specific requirement of some customers).	The terminal offers complementary logisitc services (stuffing/ unstuffing, service of groupage, storage of palletized and non-palletized goods,). The value added services on the cargo (e.g. labelling, packing) are not effected	The terminal does not have facilities to perform value added activities on the cargo
	The information and communication systems	Use of EDI, web site and e-port system in order to transfer, obtain, shared or exchange data	Use of EDI and web site in order to transfer, obtain, share or exchange data	Use of EDI and web site in order to transfer, obtain, share or exchange data	Use of EDI	Use of EDI

		Container Terminals				
Dimension	**Variables**	**VTE**	**LSCT**	**Trieste Marine Terminal**	**TCR**	**Taranto Container Terminal**
Degree of openness	Attitude	The terminal considers as key users the shipping lines and the freight forwarders	The terminal considers all users as key users	The terminal considers as key users the shipping lines, the freight forwarders, the multimodal transport operators (MTOs) and the rail operators	The terminal considers as key users the shipping lines and the multimodal transport operators (MTOs)	The terminal considers the shipping lines as the key users
	Practices	The terminal uses EDI in order to communicate with the shipping lines. The web site is used by different terminal users (shipping lines, forwarders, transport operators, etc.) in order to download or/and upload some information. The terminal uses the e-port in order to communicate with the shipping lines and the forwarders	The terminal uses EDI with the shipping lines, rail operators and multimodal transport operators. The terminal uses web portal in order to communicate with freight forwarders and road hauliers	The terminal uses EDI with the shipping lines. The terminal uses web portal in order to communicate with freight forwarders and transport operators.	The terminal uses EDI systems with the shipping lines, rail operators and multimodal transport operators.	The terminal uses EDI systems with the shipping lines.
	Interaction Patterns	Collaboration between the terminal operator and the users of the terminal in the planning of tasks/procedures in order to optimize the container flow.	Collaboration between the terminal operator and the users of the terminal in the planning of tasks/procedures in order to optimize the container flow. Collaboration between the terminal operator and the users of the terminal in the design of services which can facilitate the container transit.	Collaboration between the terminal operator and the shipping lines, MTOs, freight forwarders in the design of the services which can facilitate the container transit. The terminal operator does not collaborate at the level of operational processes.	Collaboration between the terminal and several terminal users (shipping lines, feeder operators, freight forwarders, hauliers, MTO) in the planning of procedures in order to optimise the containers flow. Collaboration between the terminal and some users (shipping lines and MTOs) in the design of the services which can facilitate the container transit.	There is no collaboration between the terminal and the users of the terminal both in the design of services and in the planning of task/procedures in order to facilitate the container transit

		Container Terminals														
Dimension	**Variables**	**VTE**			**LSCT**			**Trieste Marine Terminal**			**TCR**			**Taranto Container Terminal**		
		2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Performance	Number of containers handled (TEUs X 1000)	1,009	885	981	1,052	851	1,041	338	277	282	204	178	174	787	741	582
	Sales (millions €)	88.8	75.5	94.6	97	79	95.9	24.5	20.1	22.1	16.9	15.6	15.9	35.6	29.2	23

4.2 The cross case analyses

4.2.1 The context

Port governance mode

As a first step to doing cross-case analysis, we deal with the issue of role of the Port Authority. The five terminals are situated in five different ports where different Port Authorities operate according to the Italian Law with the aim to improve the competitiveness of the ports.

Each Port Authority is a public company and acts on the basis of the landlord model. In fact it manages the port area and leases out the terminals to the terminal operators, the private companies which have the operational management of the terminals.

Both the Port Authority and the terminal operator have an important role in the development of the infrastructures of the terminal.

In fact with regard to the infrastructures of the port it is possible to distinguish three types:

- generic infrastructures which permit the access to the port both from the land side and sea side (e.g. road and railway links)
- infrastructures for a specific terminal (quay, draft, dedicated sidings, etc.)
- superstructures of a specific terminal (quay cranes, warehouses, etc.)

The Italian State is responsible for making decisions about the building of the generic infrastructures while the terminal operator makes decisions about the investment in superstructures.

For the infrastructures of a specific terminal there are actions divided between the public and private sector. In fact the Port Authority is responsible for some infrastructures (quay, drafts) and can decide to invest in other infrastructures (dedicated sidings, internal tracks, etc.) in order to support the investment of the terminal operator.

One problem is related to the Port Authority's financial autonomy that has an impact on investment decisions that the Authority has to take.

The main operating income flows of the Authority are harbour dues (tax of anchor, loading /unloading tax., etc) and contract income (long term leases of port sites).
The public entities (State, region, etc) can decide to give the Port Authority money in order to contribute to the development of the port. So, the public flow is important in order to plan the building of infrastructures.
In last years, the funding of the State has been less conspicuous and has not been made based on the traffic of the port. In Italy there are 25 Port Authorities and the State divides the financial resources between these high number of Authorities without taking into account the traffic generated in each port.

Business type

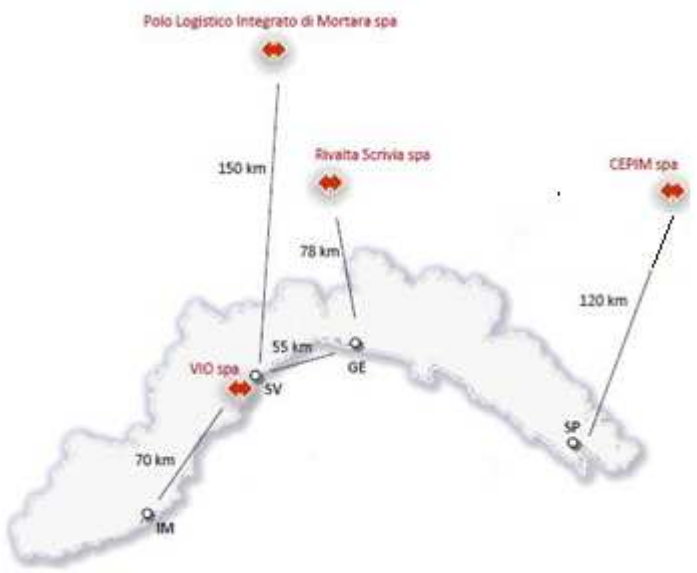
The accepted classification of the container terminals views the distinction between the import/export terminals and the transhipment terminals.
The import/export terminals are nodes which constitute the gateway of imported goods toward the end-market and, vice versa, the access to the sea for the goods in export.
The transhipment terminals develop in the Mediterranean Sea as a consequence of their position near the main Suez-Gibraltar shipping route which connects the Far Est to the Europe. In fact the big ships which leave from the Far East go though the Suez Canal in order to reach Europe. These big vessels use the transhipment terminal in the Mediterranean Sea as an hub where they leave part of their cargo which reaches other Mediterranean ports by feeder services.
VTE and LSCT can be considered as import/export terminals. In fact the percentage of volumes handled by transhipment is low.
Instead, the terminals of Ravenna and Trieste handle higher volumes by transhipment. In the case of Trieste the transhipment accounts for nearly 30 per cent of the terminals' business. While in the case of Ravenna the transhipment accounts for nearly 20 per cent of the terminals' business and it increased remarkably in the last year. These two terminals can be classified as both transhipment and import/export terminals.
In the case of the terminal of Taranto, the transhipment accounts for nearly 90 per cent of the terminal's business, making it a transhipment terminal.

Geographic location

VTE and LSCT are in a good position, near to the market of northern Italy and Europe. They are linked to the Corridor 24, which connects Genoa and Rotterdam, and to the Corridor V, which connects Kiev to Lisbon. They are near to important logistics nodes, located in the north of the Italy (Figure 25).

VTE is located in the north west area of Genoa, at the center of the main motorway junction between A10 and A26, while LSCT is near to the A15 motorway.

Figure 25. The intermodal centers near Genoa and La Spezia



Source: Adapted from Uniontrasporti, 2011

Trieste Marine Terminal is located at the crossroads of the trade between Italy and northern and eastern Europe. Trieste is an important node in the Corridor V. Some intermodal centers are situated near Trieste Marine Terminal.

The interporto[1] of Cervignano is located about 50 km away from the terminal while the intermodal terminal of Trieste is far 10 km.

The terminal of Ravenna is located in an important economic area of Italy, not so far from the interporto of Bologna. Bologna is an important node of the Corridor 1 with connects Berlino to Palermo.

[1] The interporto is a logistics center defined by Italian Low 240/90. It is characterized by the presence of rail tracks in order to have the intermodal flow.

The terminal of Taranto is located in the Centre of the Mediterranean, 170 nautical miles from the main Suez-Gibraltar shipping route. This position has led to the development of the transhipment business. In the hinterland there is a only one interporto within 100 km.

Infrastructures in the port environment

The analysis of this variable takes into account the infrastructures in the port environment which can influence the integration of the terminals in the supply chains. This variable focus on the environment outside the terminal but inside the port area.
VTE and LSCT show a better situation.
In fact the Port Authority of Genoa has developed the e-port which is a web-based solution to improve vehicle transit operations through container terminal gates and handle the import/export customs cycle for the goods carried. VTE uses this electronic platform in order to communicate with the shipping lines and the forwarders to accelerate the exit of the imported containers.
LSCT gets benefit from the nearby area, called "retroporto[2]", located at Santo Stefano Magra, only 8 km from La Spezia. This infrastructure gives the terminal the possibility to perform some activities there overcoming the space constraints which characterize the terminal.
In the other cases (Ravenna, Trieste, Taranto) the port environment seems to be lacking in specific infrastructures which can have a significant impact on the integration of the terminals.
We would like to underline that the building of the distripark at Taranto has not started even though the Port Authority has launched the project since the 2002 with the aim of promoting the role of Taranto as an intermodal logistics platform.

[2] The retroporto is a logistics center located near a port.

4.2.2 Integration driven investment

The integration of transport modes

The analysis of the infrastructures and superstructures that ensure the integration of different modes of transport puts in evidence some points.

First, there are terminals with a direct access from the motorway (e.g. VTE) or situated very close to the motorway access point, connected by a slip road (e.g. La Spezia). The other terminals are more distant from the motorway access points and this is not good for the truck drivers who have to drive on a secondary road in order to reach the terminal.

Secondly, all the terminals are equipped with internal rail tracks, connected with the national railway. There are, however, some differences in terms of the length and number of the tracks.

These two characteristics have an impact on the freight trains which can be managed within the terminal. The Terminal of Ravenna with 5 tracks, each of 420 m appears as the worst case. The terminal of La Spezia has the higher volume of containers handled by rail. The percentage of flow handled by rail is 28% of the total traffic. This means that above 300,000 TEUs are handled by train.

On the sea side, the analysis of the depths shows that the situation is not so good for the terminal of Ravenna where the draft is 10,5 m and has an impact on the container ships which can go alongside.

Value added services

The value added services evaluation puts in evidence that the terminals have not developed these services adequately.

In fact the core business of the terminals remains the containers handling and loading/unloading cycle. The terminals have extended their proposition with complementary logistic services as the container stuffing/unstuffing, warehousing, etc.

Instead the activities to add value to the cargo (e.g. finishing, packaging, labelling) are not effected in all cases. Moreover there is a different approach when these services are effected.

The terminal of Taranto and Ravenna have not facilities in order to effect activities to add value to the cargo. VTE performs the labelling of packages using labels supplied by the customer and the wrapping of palletized packages in the distripark located within the terminal.

The terminal of Trieste effects the labelling and the packaging rarely, on specific requirement of some customers. The terminal of La Spezia appears as that terminal where the value added services are more developed. In these case the labeling and the packing are effected on several types of goods, even though these activities are performed generally when required by the public authority (e.g. label does not conform to the laws).

The information and communication systems

The operations management of a container terminal is not simple. The planning, execution and the control of each processes require a great effort. The processes go from the planning of berth allocation to the management of the loading/unloading of the ships, to the routing of the equipments in the yard, etc. It is fundamental to have an IT system in order to perform the planning phase and to control the execution of each processes.

Each terminal analysed adopts an IT system. There is not any case where the IT system is integrated with the IT system of the users of the terminal.

The electronic exchange of data between the terminal and the users of the terminal takes place in different ways. In the case of VTE the data are transferred, obtained and exchanged by EDI systems, web site and e-port. LSCT and Trieste Marine Terminal use both EDI and web site while the terminals of Ravenna and Taranto use only EDI

4.2.3 Degree of openness

Attitude

The attitude that exists between the terminal operator and the users of the terminal deserves to be analyzed carefully. If the users tend to recognize the important role of the terminal operator in supply chain, the attitude of the terminal operator toward the users is not the same in all cases.

LSCT considers all users as key users because it recognizes the importance of all users in order to improve its performance. In fact the terminal is in a condition of "saturation" and it has to reach a balance between the volume of traffic in entrance and in exit in a temporal horizon. So the terminal considers important not only the shipping lines and the forwarders who "control" the market and decide the terminal where the containers are handled on the basis of certain principles (low price, security, speed), but also the other users (hauliers, MTOs, rail operators) responsible for the movement of containers in the hinterland.

The terminal VTE considers as key users the shipping lines and the forwarders because it is oriented to maximize the throughput. The different approach between the two terminals can not be referred to the business model because both are import/export terminals.

Instead, the terminal of Taranto considers only the shipping lines as key users. This is due mainly to its business model. In the transhipment business, the shipping lines choose the terminal where to transship the containers on the basis of economic principles (cheap cost of transhipment and economies of scale). So they have a great power and influence the performance of the terminal.

The Trieste Marine Terminal considers as key users the shipping lines, the freight forwarders, the multimodal transport operators (MTOs) and the rail operators. The shipping lines and the forwarders are considered important because they control the cargo while the MTOs and rail operators provide the intermodal connections with the inland terminals which are fundamental for the development of Trieste Marine Terminal. Instead the terminal of Ravenna considers only the shipping lines and MTOs as key users

The terminal operator relates to the key users with a positive attitude, considering them jointly responsible for the completion of tasks that require collaboration and treating problems that arise in the course of the relationship with them as joint rather than individual responsibilities.

Practices

In any cases the exchange of data between the terminal operator and the different categories of users is fully electronic.
The users involved in the electronic exchange of data differ from one terminal to the other and we can notice that the terminal operator can use different means in order to communicate with the users.
In the case of VTE the terminal operator uses EDI systems in order to communicate with the shipping lines while the web site is used by different users (shipping lines, forwarders, transport operators) in order to download or/and upload some information. Finally the terminal operator uses the e-port in order to communicate with the shipping lines and the forwarders.
In the case of LSCT, the terminal operator uses EDI with the shipping lines, rail operators and MTOs while it uses the web portal in order to communicate with freight forwarders and road hauliers.
In the case of Trieste Marine Terminal, the terminal operator uses EDI systems with the shipping lines and the web portal with freight forwarders and transport operators.
In the case of Ravenna, the terminal operator uses EDI systems in order to communicate with the shipping lines, the MTOs and the rail operators. While in the case of Taranto, the terminal operators uses EDI systems in order to communicate only with the shipping lines.

Interaction Patterns

The analysis of this variable puts in evidence that LSCT is the terminal where there is a higher degree of collaboration between the terminal operator and users of the terminal. In fact, the terminal operator tends to work with the users both in the design of new

services that facilitates the container transit and in the planning of tasks/procedures in order to optimize the container flow. At the other extreme is the terminal of Taranto. In fact, There is no collaboration between the terminal and the terminal users both in the design of services and in the planning of task/procedures in order to facilitate the container transit. The other cases lie between the two extremes.

4.2.4 Performance

An important issue is if the degree of integration of the terminal has an impact on the terminal performance.

The academic studies have focused on measures of efficiency and productivity, each looking at a specific sub-activity of the terminal process (e.g. crane productivity, vessel turnaround time, yard productivity). These studies have considered the terminal as a stand-alone node from the supply chain.

In recent years, Tongzon et al. (2009) have used some indicators in order to evaluate the relationship between the degree of orientation to the supply chain and the performance of the container terminals. Their work is useful because the concept of supply chain orientation includes that one of supply chain integration as the authors state.

So we use the number of containers handled and the amount of sales as indicators in order to evaluate the performance of the terminals.

The Table 3 presents the performance of the terminals in terms of number of containers handled (TEUs) over the years 2008, 2009 and 2010. It is evident that the year 2008 was the best year for all terminals while 2009 was the worst. The year 2010 was positive for LSCT (growth of 22.30%), VTE (growth of 10.81%) and Trieste Marine Terminal (growth of 1.58%) while the performance of the terminal of Taranto was highly negative (loss of 21.51%). Taking into account both the number of container handled in the year 2010 and the average variation in the years 2008-2010 we can see that the terminal of La Spezia has the best performance.

Table 3. Number of containers handled over the years 2008-2010

Terminal	2008 (TEUs)	2009 (TEUs)	2010 (TEUs)	Var. 2010/2009	Average var.
La Spezia Container Terminal	1,051,805	851,558	1,041,483	22.30%	-0.49%
VTE	1,009,487	885,276	980,950	10.81%	-1.42%
Taranto container Terminal	786,655	741,428	581,936	-21.51%	-13.99%
Trieste Marine Terminal	338,299	277,245	281,629	1.58%	-8.76%
Terminal di Ravenna	203,702	177,575	174,037	-1.99%	-7.57%

The Table 4 presents the performance of the terminals in terms of amount of sales over the years 2008, 2009 and 2010. The analysis of this indicator confirms that the terminals of La Spezia and Genoa have better performance than the others. The data that needs to be analysed more in depth is the VTE's sales of year 2010. The comparison between the growth of the sales and the growth of the volume for the year 2010 leads us to infer that the great increase in sales comes in part from the increase in the volumes. There has been a change in the commercial policy of the company. In fact the sales manager of the VTE said "*Our department has worked well. We have changed our commercial policy both in the content and in the prices of the services. For example we have changed the way to calculate the stop of the containers in the yard. In the year 2010 we have decided to calculate the stop on the basis of the TEU. We have also increased the price of the services*". The Table 5 puts in evidence that there has been really an increase in the price of the services in the year 2010.

Table 4. Sales over the years 2008-2010

Terminal	2008 (Sales)	2009 (Sales)	2010 (Sales)	Var. 2010/2009	Average var.
La Spezia Container Terminal	96,961,000	78,959,000	95,867,038	21.41%	-0.57%
VTE	88,795,416	75,537,053	94,580,279	25.21%	3.21%
Taranto container Terminal	35,571,708	29,184,388	22,995,039	-21.21%	-19.60%
Trieste Marine Terminal	24,546,607	20,095,225	22,169,804	10.32%	-4.96%
Terminal di Ravenna	16,914,152	15,857,551	15,884,425	0.17%	-3.09%

Table 5. Comparison between La Spezia Container Terminal and VTE

	2008 (Sales/Teus)	2009 (Sales/Teus)	2010 (Sales/Teus)
La Spezia Container Terminal	92.19	92.72	92.05
VTE	87.96	85.33	96.42

CHAPTER 5: THEORETICAL DEVELOPMENT

The evidence from the case analyses are synthesized in the form of empirical generalizations and then we develop theoretical propositions from empirical generalizations. In fact, the empirical generalizations differ from the theoretical propositions (Salvador et al., 2002).

The empirical generalizations can be considered as isolated statements summarizing observed uniformities of relationships between two or more variables along the sample (Merton et al., 1959). In order to move from the empirical generalizations to theoretical proposition it is necessary to state the boundary conditions, define the relevant constructs of the theory and explain the proposed relationships among constructs (Dublin, 1969).

5.1 Empirical generalizations

The within-case and cross case analyses reveal some aspects that are synthesized in the form of empirical generalizations regarding both the definition of the constructs and the relationships between the context, the integration of the container terminals in supply chains and the performance of the terminals.

The conceptualization of the integration

The conceptualization of integration takes into consideration works present in literature. In particular Panayides and Song (2008) define seaport terminal supply chain integration 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 operations*".

This definition puts in evidence the critical aspect of integration, that is to say, the ability of the terminal to work as an integral part of the supply chain.

Our conceptualization, that is supported by literature on both ports and supply chain integration, distinguishes two key dimensions. The former being the investments necessary to provide the terminal with the necessary "tools" to integrate in the supply chain. The latter is the relational dimension able to favour the integration between the key actors of the terminal, or that is to say, the terminal operator and the users of the terminal.

The terminal community is composed of the terminal operator, which manages the terminal according to its managerial vision, and the users, companies that come into contact with the terminal in the execution of their own activities/services. In this category there are different operators (shipping lines, freight forwarders, etc.) which, although having different role in the supply chain, enter into contact with the terminal.

Each dimension is analysed by referring to three main variables. The investments are analysed taking into account the information and communication system, the infrastructures and superstructures able to favour the integration of the different modes of transport and the value added services. The other dimension is analysed by taking into account the attitude between the terminal operator and the users of the terminal, the practices used to promote the integration and the interaction patterns which characterize the relationship.

Therefore integration is conceptualized as a higher order factor composed of two dimensions, which we have called integration driven investment and the degree of openness to integration in the supply chains

The analyses of the cases lead us to consider that there is a relationship between the two dimensions. In each and every terminal it is possible to distinguish key users, with which the terminal operator has a different attitude, more positive compared with other users. This influences the choices of the terminal operator which invests in communication systems to promote the electronic exchange of data with key users, influencing interaction practices with the latter. In this way a relationship between the softer dimension (the openness) and the harder dimension (the investment) is defined.

As further support for our hypothesis, we can consider the cases of La Spezia, Trieste, Ravenna.

All three terminals are provided with internal rail links and all have a positive attitude towards the MTOs which guarantee the necessary intermodal connections towards the

hinterland. At the same time, there has been collaboration between the terminal operator and the MTOs in the design of new services. The presence within the terminal of rail trucks has pushed the terminal operators to open up towards the MTOs and to actively collaborate. All three terminals are involved in a project for the improvement of the terminal focused also on the optimization and modernization of the internal rail links (La Spezia), the restructuring of those already existing (Trieste) or on the building of new rail tracks (Ravenna). The collaboration which has brought the terminals to reinforce the relationship with the MTOs, has favoured the investments which improve the level of integration.

This conceptualization of the integration leads us to evaluate a high level of integration when both dimensions reach significant values. A container terminal has a high level of integration in the supply chain when the integration driven investment is high and it is combined with a high level of openness to the supply chain.

An investment can be considered driven by integration when the terminal invests in equipment to perform value added services, in adequate information and communication systems as well as specific infrastructures and superstructures to obtain a perfect integration of the diverse modes of transport.

On the side of openness, it is fundamental that the terminal has a high degree of openness to the integration in supply chains, that is to say, that there is a positive attitude toward collaboration between the terminal operator and the users of the terminal and that the practices and the interaction patterns favour the consolidation of a collaborative relationship between the terminal operator and the users.

The analyses of the cases suggest that the terminal of La Spezia and VTE have and higher integration driven investment. The investment is significant in the case of terminal of Trieste. In the evaluation of the investment of the terminal of Ravenna, it is necessary to consider that the length of internal rail tracks appears not adequate and there is not equipment to effect value added services. The terminal of Taranto, instead, is focused on the transhpiment which pushes it to use EDI only with the shipping lines. In addition the terminal does not have equipment to perform value added services.

On the other dimension we can state that the better situation is that of the terminal of La Spezia where the relationship between the terminal operator and the users of the terminal appears more collaborative.

Based on these elements, we can derive the following empirical generalization.

Empirical generalization 1: *A container terminal reaches a high degree of integration in supply chain when it has a high integration driven investment and a high degree of openness.*

The relationship between the context and the integration

The analyses of the cases put in evidence a link between the context variables and the integration of the terminals.

The type of the business has an impact on the degree of integration of the container terminals in supply chains. The terminal of Taranto, which is a transhpiment terminal, is prone to work as an isolate node that focuses on the relationship with the shipping lines because it is interested in development of its core business, the transhipment. This also because its geographical location has favoured this type of business.

The terminals focused on the import/export (VTE e LSCT) are able to offer value added services on the cargo and are open to the relationships with various users of the terminal. Their geographical location, near to important markets and logistic nodes, give them the possibility to integrate with differ logistic nodes and to develop the intermodal transport.

At the same time, the two terminals are characterized by the presence of some infrastructure in the port environment which have an impact on the level of their integration.

In fact the port of Genoa, where the VTE is located, has a port community system and the VTE uses this platform in order to communicate with some users. The e-port of Genoa favours the electronic exchange of data, allowing a better integration of the users of the platform.

The terminal of La Spezia is located nearby the “retroporto” of Santo Stefano Magra which can be considered as a port infrastructure because it is located only seven kilometers away from the port and it serves the port. So the terminal has the possibility to use this area in order to effect some value added services.

Also the role of the Port Authority is critical and can have an impact on the level of integration of the terminal. The model of governance of Italian ports, based on the landlord model, gives the Authority the task to guarantee the competitiveness of ports. Therefore, Port Authority and terminal operators have to cooperate in order to develop the terminals. In other words, the Authority and the terminal operator have to achieve a synergy in the actions in order to influence the level of integration of the terminals in supply chains.

Examples of synergy can be found in the ports of Genoa and La Spezia. In the port of Genoa, the Authority has developed the project of the e-port with the aim to improve the vehicle transit operations through container terminal gates. The e-port favours the flow of documents between the public entities (Customs and Fiscal Police) and the private operators (terminal operators, forwarders, etc..) involved in the customs and operating process. The system makes it possible to eliminate the paper document transmission, speed up the exchange of information and optimize the sequence of operations to perform respected the current legislation. The VTE has taken part in the project, directly involved in order to improve its level of integration with some users of the terminal.

Another example of synergy has been realized in the port of La Spezia. The retroporto of Santo Stefano Magra has been realized by the Società Valorizzazione Aree Retroportuali (SVAR), controlled by Spedi Spa. The Authority of La Spezia is a shareholder of the Spedi Spa. The LSCT (terminal of La Spezia) uses this infrastructure in order to perform some activities/services.

The ability of the Authority of making investments in adequate infrastructures depend also on financial possibilities to spend money. In Italy the complete financial autonomy of the Port Authority has not been achieved. So it is not simple to develop projects in order to enhance the competitiveness of the ports.

Based on this discussion, we can conclude that there is a relationship between the context and the integration of the container terminals in supply chains. Therefore we can derive the following empirical generalization.

Empirical generalization 2*: The context has an impact on the level of integration of the container terminals in supply chains. There are contexts more favourable to achieve a high degree of integration.*

The context, however, can be considered necessary but not a sufficient to achieve a high degree of integration. We have put in evidence that there are two key dimensions which the terminal has to develop in order to obtain a full integration.

The terminal of La Spezia and Genoa are characterized by a similar context, favourable to the integration but the analysis of the degree of integration shows some differences.

In both cases the investment can be considered high. The terminal of La Spezia is provided with equipment to perform value added services, communication systems (e.g. EDI systems and web site) in order to allow the electronic exchange of data between the terminal operator and the users of the terminal and adequate infrastructures in order to guarantee the integration of the different modes of transport. Similarly if we consider the terminal of Genoa.

The analysis of the softer dimension puts in evidence that the terminal of La Spezia achieves an higher degree of openness because it is able to collaborate with some users in the design of the new services which can facilitate the container flow.

Moreover the analysis of the terminals of Ravenna and Trieste provides evidence of the fact that similar context can lead to a different degree of integration.

The terminals of Ravenna and Trieste have a similar context, less favourable than the context of La Spezia and Genoa. But the terminals have a different degree of integration.

The terminal of Trieste is more provided with infrastructures and superstructures than the terminal of Ravenna. There is within the terminal a distripark, where it is possible to perform some value added service, and adequate rail tracks. Moreover the terminal has the deepest natural draft in the whole Mediterranean (18 meters alongside berth) and a website which is used in order to exchange data with the users.

The analysis of the degree of openness shows an advantage for the terminal of Ravenna which is able to collaborate with the users in the planning of tasks/procedures necessary to improve the operational activities.

These empirical evidence lead us to state the following empirical generalization.

Empirical generalization 3: *A favourable context is necessary but not sufficient in order to achieve a high degree of integration of the container terminals in supply chains. There are two "endogenous" dimensions which the terminals have to develop in order to reach a high degree of integration.*

The relationship between the integration and the performance

An important issue is whether the degree of integration of the terminal has an impact on its performance.
The analysis of the performance of the terminals has been conducted by referring to two indicators, the numbers of containers handled (TEUs) and the amount of sales.
The analysis suggests that the terminals more integrated (LSCT and VTE) had the better performance in the years 2008, 2009, 2010. In particular, considering the average variation in years 2008-2010 both for the volumes and for the sales, we can see that the terminals more integrated had better results.
This leads us to formulate the following empirical generalization

Empirical generalization 4: *The terminals more integrated in supply chains obtain better performance in terms of average variation of TEUs and net sales, in a temporal horizon of short time.*

Definition of the diagnostics matrix of the integration

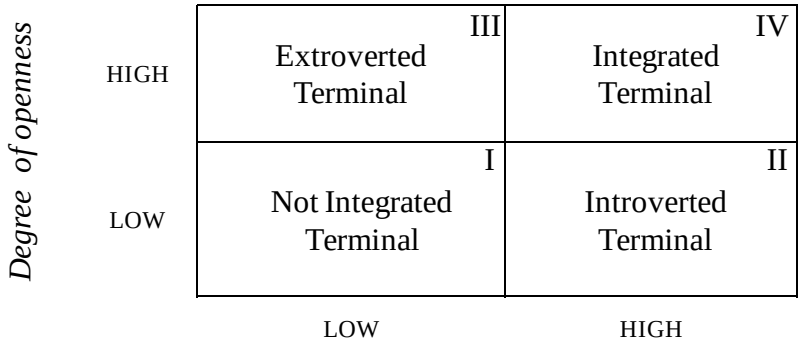
The analysis has put in evidence that the context has an impact on the level of integration that the terminals achieve.
The cases have been selected according to the principal of the literal and theoretical replication (Yin, 2004; Voss 2009). These cases are characterized by three different contexts which can be classified in favourable context, neither favourable nor unfavourable context, unfavourable context.
A favourable context is that of the terminals VTE and LSCT because the business model, the geographic position and the infrastructures in the port environment favour the integration of the terminals in supply chains.

The context of the terminal of Taranto, instead, can be classified as an unfavourable context. This evaluation is based on the type of business of the terminal, the geographical position and the infrastructures in the port environment. Taranto Container Terminal, as we have already highlighted, focuses on the transhpiment business influenced by its geographical position. At the same time in the port environment there are no infrastructures (e.g. port community system or distripark) that favour the integration of the terminal in the supply chains.

It is possible to distinguish a third context which characterizes the terminal of Trieste and Ravenna. This context can be assessed neither favourable nor unfavourable. In the evaluation it is necessary to consider the absence of specific infrastructures in the port environment and the fact that the highway is not so near to the terminal.

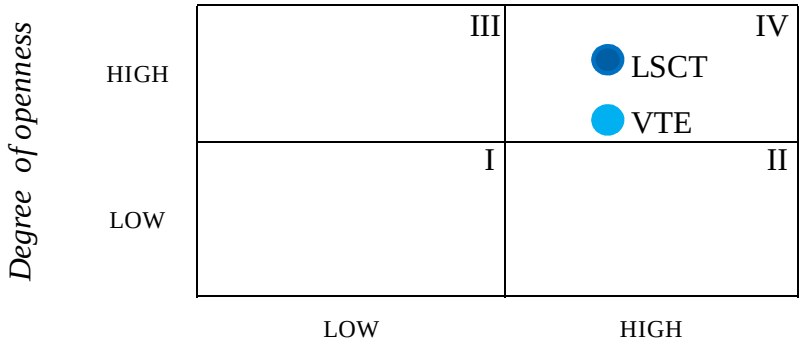
We have also empirically shown that it is important for the terminal to develop the two endogenous drivers in order to achieve a high level of integration.

Considering binary values for the two key dimensions (low or high) it is possible to define four states in which the terminals can be:



Therefore, taking into account the context (favourable, neither favourable nor unfavourable, unfavourable) and the integration, it is possible to map our five cases on the matrix.

Favourable Context



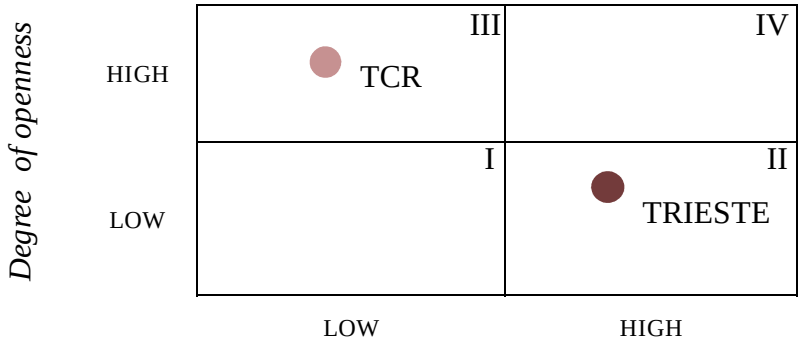
Integration driven investment

The terminals of La Spezia and Genoa are in the best situation, that is to say they can be considered as integrated terminals. Comparison between the two terminals leads us to conclude that LSCT has a small advantage on the relational dimension.

In fact the terminal operator and some users manage to collaborate in the design of new services which favour the transit of containers.

La Spezia and Genoa are also the terminals with the best performance in term of average variation over the three-year period 2008-2010 of number of containers handled (TEUs) and net sales.

Neither favourable nor unfavourable context



Integration driven investment

The analysis of the Ravenna and Trieste terminals highlights the different states of the two terminals.

The terminal of Ravenna has a high level of openness to integration in the supply chains. In fact, there are good collaborative relationships between the terminal operator and various users.

The terminal operator collaborates with all the users in the planning of tasks/procedures to optimize the flow of the containers and works with some users (shipping lines and MTOs) in the design of new services aimed at improving management of the supply chain. However, it pays for some lacks in infrastructures, especially in terms of internal tracks and communication systems.

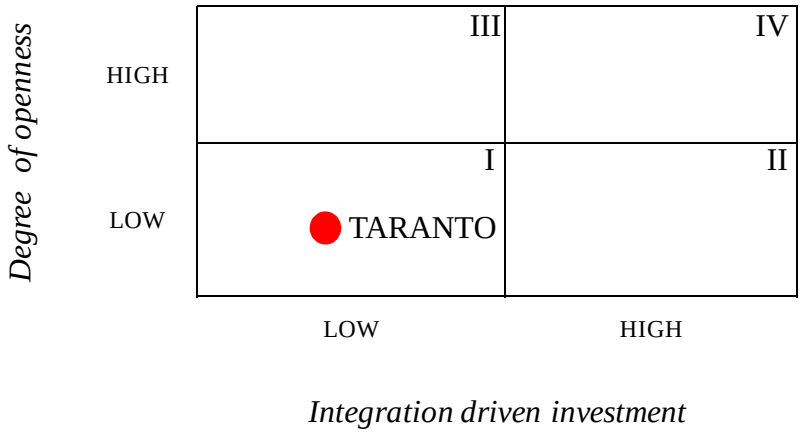
Trieste, instead, from the point of view of investment is in a good position but from the relational viewpoint it is unable to collaborate with the users in the planning of procedures/tasks which favour the transit of containers.

While the Ravenna terminal can be classified as an extroverted terminal, the terminal of Trieste has to develop the relational aspect.

If the terminal is an extroverted or introverted terminal, it has to increase only one dimension. While the extroverted terminal has to increase its level of integration driven investment, the introverted terminal has to enlarge their degree of openness.

A terminal finding itself in one of these states must act in order to reach the best state, that is to say the state of integrated terminal where the performance is better.

Unfavourable context



The context influences the degree of integration of the terminal of Taranto which results low. The analysis of the investment reveals the lack of equipment to carry out value added services on the cargo.

From the relational viewpoint, the terminal is focused on the shipping lines. The relationship, however, is limited to a commercial interaction between the seller (terminal operator) and the buyer (shipping companies) where the EDI is used in order to facilitate the exchange of data.

The Taranto terminal has the worst performance in term of average variation of TEUs and net sales in the 3-year period 2008-2010.

The ultimate mapping

It is possible to map all cases in the same matrix in order to facilitate the comparison between the different cases. It is important to underline that each case has been evaluated taking into account what has emerged from the within-case and cross-case analyses. However, in order to summarize the main reasons which have influenced our evaluation, it has been defined the Table 6.

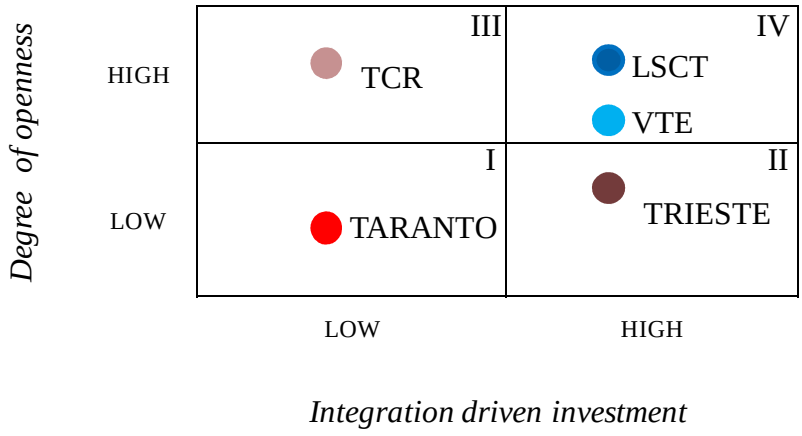


Table 6. Comparison between cases.

	Integration driven investment		*Degree of openness*	
	Evaluation	Main motivations	Evaluation	Main motivations
LSCT	High	The terminal has adequate internal rail tracks. It has the higher volume of containers handled by rail. There are equipment and know-how to effect value added services.	High	There is a positive attitude between the terminal operator and all users. The terminal is able to collaborate with its users not only in the design of new services but also in the planning of tasks/procedures in order to optimize the container flow.
VTE	High	The terminal has adequate internal rail tracks and direct access to the Italian motorway. Use of different means (EDI, web site, e-port system) in order to transfer, obtain, shared or exchange data. Although the value added services are limited, there are equipment and know-how.	High	Although the terminal considers some users as key, it is able to collaborate with all users in the planning of tasks/procedures in order to optimize the container flow.
TRIESTE MARINE TERMINAL	High	The terminal has adequate internal rail tracks. It has the deepest natural draft in the whole Mediterranean. The value added services are effected on specific requirement of customers.	Low	The terminal operator does not collaborate at the level of operational processes and not all users are considered key.
TCR	Low	The length of the internal rail tracks and the depths are not so good. It has not a direct access to the Italian motorway. Value added services on the cargo are not effected.	High	Although the terminal considers some users as key, it is able to collaborate with several users both in the design of new services and in the planning of tasks/procedures in order to optimize the container flow.
TARANTO CONTAINER TERMINAL	Low	There are not equipment and competences in order to effect value added services. It has not a direct access to the Italian motorways. It is a transshipment terminal and has only EDI in order to communicate with the shipping lines.	Low	The terminal considers as key users only the shipping lines. There is no collaboration between the terminal and the users.

5.2 Theoretical development

Boundary conditions

With the aim of building a theory, we mark a boundary to our propositions and we refer to container terminals situated in ports where the model of governance is that of the landlord or tool.

In a landlord port the role of the Port Authority is limited to providing and maintaining basic infrastructures and services (security, etc.). Other facilities and services, such as superstructures and specific services are provided by independent private companies.

Some scholars have distinguished between the landlord model, tool and service models (Bichou and Gray, 2005).

As regards the landlord and tool models, the Port Authority is both owner and developer of the port infrastructures and leases them to private companies. The difference between the two models is the ownership and management of the superstructures.

While in the landlord model the private operators are owners and manage directly the superstructures, in the tool model the superstructures are the property of the Port Authority and are operated by private companies.

However the distinction between landlord and tool ports is thin. Generally, the ports are divided into two types (landlord and service) as suggested by the majority of maritime economists (Cullinane and Song, 2002). In fact, the tool ports can be considered as a variant of landlord port.

In the service model, the port owns, maintains and develops both infrastructures and superstructures, operates all handling equipment and performs on its own all other commercial port functions. Port ownership can be public or private and it is therefore possible to distinguish between public and private service models.

In a public service port, it is the public port authority which supplies and manages directly the services and facilities of the port. Independent private operators are not allowed to undertake any port activity.

In private service ports, private companies buy port areas and deal with planning and building of infrastructures and superstructures as well as their relative management.

In conclusion, there is a dichotomy between landlord and service ports. This leads to different roles and tasks of the various actors of the ports (e.g. Port Authorities, Terminal Operators).

Our theory can be referred to terminals situated in ports where the model of governance is that of landlord or tool. This condition is consistent with our sample that has been analysed and excludes terminals located in ports where the service model is in force. These ports are situated in specific areas of Europe (United Kingdom or ex Soviet Union) and are limited in number.

Theoretical propositions

The research on Supply Chain Integration (SCI) of the firms is guided by theories from multiple reference discipline (Vijayasarathy, 2010). This has lead to different conceptualization of this phenomena of interest. Over the years, various definitions and measures of SCI have been proposed (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found.

It is important to underline that some researchers (Van Donk and Van Der Vaart, 2005; Paulraj, 2006, Vijayasarathy, 2010) have proposed the formulation of supply chain integration as a higher order construct recognizing its multidimensional aspect.

Changing our unit of analysis, from manufacturing company to a container terminal we can see that the variability of the definitions and measures with regard to SCI is low.

In fact only Panayides and Song (2008) have proposed a conceptualisation of what really is meant by container terminal integration in the supply chain. They conceptualise the integration of container terminal in supply chain as a higher-order factor made up of other constructs.

We formulated the container terminal integration in supply chain as a higher-order construct composed of two key dimensions, one which is more hard and concerns the asset specific investment for integration and the other softer which regards the degree of openness to the integration.

The first dimension has been called integration driven investment because it evaluates only the asset part of the terminal necessary to favour its integration in the supply chain.

The analysis of literature and empirical evidence have lead to the definition of the key variables with which to assess this dimension. These variables are value added services, the communication and information systems, the infrastructures and superstructures specific of the terminal able to favour the integration of various transport modes.

The second dimension has been called degree of openness to integration in supply chains. This dimension evaluates interaction between the terminal operator and the users of the terminal. The analysis of literature and empirical evidence have led to the definition of key variables with which to evaluate this dimension. The variables are attitude, practices and interaction patterns between the terminal operator and the terminal users.

As mentioned in the first empirical generalization, a container terminal reaches a high integration when the investment for integration is high and it is combined with a high degree of openness. However, the empirical evidence has shown that the context influences the level of integration even though a favourable context is necessary but not sufficient to reach a high degree of integration.

Based on the generalization 1, 2 and 3, it is possible to conclude:

Proposition 1.

The context is a factor that enables (hinders) the integration of container terminals in supply chains

Proposition 2.

A favourable context is necessary but not sufficient to reach a high degree of integration because the terminals have to manage the degree of openness and the integration driven investment

A salient point concerns why a terminal should increase its level of integration in the supply chain. Although some scholars have theorized that the integration has an impact on performance, there are not empirical studies focused on the relationship between the degree of integration of the terminals in supply chains and their performance.

The concept of performance is wide and requires the definition of some indicators useful for the valuation of the performance and, at same time, clarify the type of performance.

We have used two indicators express the growth and development performance of the terminal. Taking into account generalization number 4, we can state the following.

Proposition 3.

The integration of the container terminals in supply chains has a positive impact on the performance of the terminals, measured by the average variation of volumes and sales in the short time.

CONCLUSIONS

Theoretical contribution

An interesting area of research on SCI is the factors that influence the degree of integration of the focal firm with its supply chain partners (Flynn et al., 2010; Vijayasarathy, 2010).

Panayides and Song (2008), two researchers involved in the ports research field, have highlighted the importance to identify the factors which influence the integration of container terminals in supply chains.

Moreover, the area of research on the relationship between the integration and the performance has been explored in the SCI field with regard to the manufacturing firms above all. Instead, there was not empirical evidence of the relationship between the integration and performance with regard to container terminals.

To further our understanding on the issue of integration of container terminals in supply chains, the present research has been performed. The research focus is on the integration of container terminals in supply chains and on the relationships between the integration and two other constructs, that's to say the context and the performance.

The starting point of this research was the literature review and the subsequent statement of two research questions. Then, the research design, based on the case research, was developed. This methodology is suited considering the research purpose and the stage of ports research field. In order to have a well defined focus of research a research framework was developed using both literature review and in-depth single case. The use of multiple case studies has increased the quality of the research design. The empirical findings have been synthesized in the form of theoretical propositions.

This study gives a theoretical contribution extending the existing literature in several important ways.

First, it contributes to enhance our understanding on how to conceptualise the integration in supply chains. In fact the identification of two key dimensions of integration, called integration driven investment and degree of openness, is useful towards better understanding of the concept of integration in supply chains.

This study adds new insight on the conceptualisation of integration of container terminals in supply chains. Although the integration of container terminals has been conceptualised as a higher order construct in line with the approach of Panayides and Song (2008), the distinction between the two key dimensions is new.

Second, considering that our results put in evidence that the context influences the degree of integration in supply chains, four contextual variables have been identified and have been used in order to evaluate the context. A favourable context is necessary but not sufficient to reach a high degree of integration because the terminals have to manage the two key dimensions of integration.

Third, this study gives empirical evidence of the relationship between the integration and the performance. In particular our findings demonstrate that the integration of container terminals in supply chains has a positive impact on the performance of the terminals, measured by the average variation of volumes and sales in the short time.

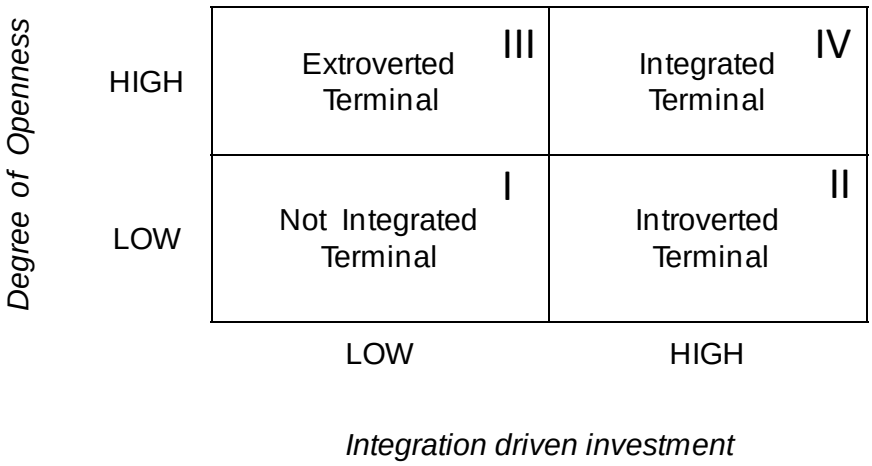
Managerial implications

This research gives also important implications for practice. From the practical side, the main contribution of this work is the validation of the diagnostic matrix of the integration of container terminals in supply chains. The matrix is based on the two key dimensions of integration, that's to say the integration driven investment and the degree of openness, which can have binary values (low or high).

We have demonstrated the applicability of this matrix which has been used in order to map our five cases.

The matrix defines four possible states in which the terminal can be (Figure 26). The best state is that of integrated terminal where the performance is better. Instead the worst state is that of not integrated terminal where the performance is worst. In this state the terminal has to increase both its level of investment and its degree of openness in order to reach the best state. If the terminal is an extroverted or introverted terminal, it has to increase only one dimension.

Figure 26 – The four possible states of a container terminal



In this way the diagnostic matrix could be used from the managers with the aim to evaluate the state of own terminal.

It is fundamental to understand the state of the terminal in order to define a strategy of growth which should be an objective of the top management. It is always difficult to design a strategy of growth because it is necessary to consider not only the points of strength and weakness of the terminal but also the external environment.

However, this diagnostic matrix could help the managers to guide the container terminals towards reaching a greater degree of integration. In fact it is possible to define the optimal path that a terminal should follow in each state in order to increase its level of integration in supply chain (Figure 27).

If a terminal is evaluated as an integrated terminal, the strategy of growth should be to maintain this state in the course of the time. This means to continue to collaborate actively with the users of the terminals and to invest in order to maintain adequate technologies, infrastructures and superstructure as well as equipment to perform value added services.

If the terminal is not integrated, it is likely there is an unfavourable context to the integration. In this situation is not simple to reach a high level of integration. On one hand the context should change. On the other hand the terminal should work on the two key dimensions. Taking as an example the terminal of Taranto, this means that some conditions in the context (e.g. the infrastructures in the port environment) should

change and, at same time, the terminal should be able to act on the two key dimensions (e.g. value added services, high openness towards all users of the terminal, etc.).

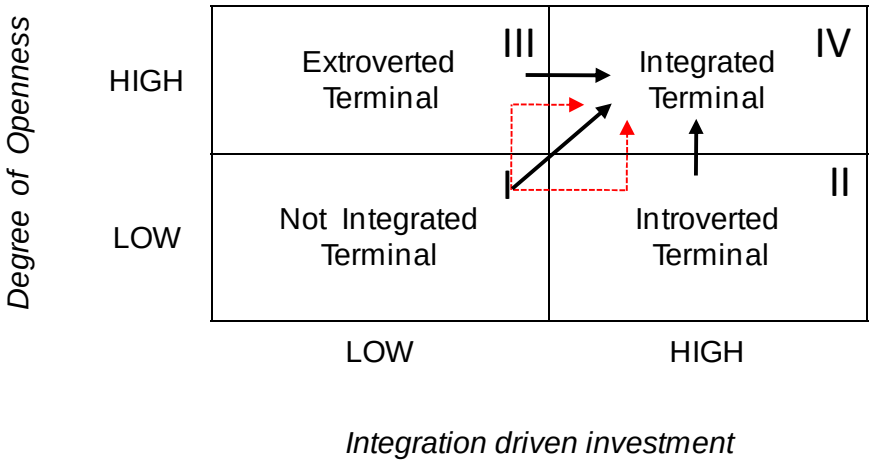
This state could characterize the terminals of transhipment which tend to work as nodes where the containers are transferred from one sea going vessel to another sea going vessel. The business model should be oriented to maximize the efficiency rather than to increase the degree of integration in supply chains.

However, with the aim of defining the optimal path to move from the state of not integrated terminal to that of integrated, it seems to be important to increase simultaneously the two dimensions. In this state the optimal path is indicated with the black line in the Figure 27 while alternative paths are indicated with the red lines.

If the terminal can be considered an introverted terminal, the strategy of growth should be to enlarge the degree of openness to the integration. In other words, the terminal should be able to collaborate more actively with all users of the terminal. This requires a great change in the way to manage the relationships with the different users of the terminal.

If the terminal is an extroverted terminal, the strategy of growth should be focused on the investments in order to provide the terminal with the necessary tools of integration.

Figure 27 – The identification of the optimal paths



Further research

While our study makes a significant contribution to the literature and has an important implication for practice, there are some opportunities for future research.

First, future research should test the theoretical propositions developed in this work. Typically this research purpose can be achieved through survey-based research design. An appropriate method in order to carry out the research is the structural equation modelling with which it is possible to define the measurement model (estimation of relationships between constructs and respective indicators) and the structural model (estimation of causal relationships among constructs).

A second possibility for future research is to extend this study considering what is held in the container. In other words, there would be the opportunity to consider the different flows of goods and how they impact on the degree of integration of container terminals.

Considering that our research is focused on the integration of container terminals in supply chains, a third possibility is to extend this study to other types of terminals which operate liquid and dry bulk cargoes.

Finally an interesting future research could be the extent of this study in order to investigate the theme of integration in supply chains of other logistic nodes (e.g. inland terminals, logistics platforms, etc.)

The container terminals are important components of global supply chains and the issue of their integration in supply chains represents an important area of research as well as having significant managerial implications.

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The last thought is for my wife Valentina who has been at my side patiently during this period.

Appendix A. Set of questions for terminal operators

A – General information

Get information about the company background-history, the geographic position of the terminal, and the users of the terminal.

B – Terminal operations

1. How your terminal can be classified?
2. Which are the processes at your terminal?
3. Indicate the equipment used to perform each process**.**

C – Value added services

4. Which value added services do you offer? (e.g. finishing, packaging, labelling)
5. Which complementary logistic services do you offer? (e.g. warehousing, consolidation/deconsolidation)

D - Integration of transport modes

6. The terminal has adequate connections to the road network? Describe them
7. Which are the intermodal links ship/rail?
8. Are there feeder connections? (If yes, describe them)
9. Are there inland waterway connections? (If yes, describe them)

E - Information and Communication Systems

10. Which are the communication systems used to communicate data with terminal users? (Specify them for each category of users).
11. Which are the information systems used?
12. Which are the information technologies (IT) used to manage the handling of containers and to support supply chain goals?

F - Degree of openness

13. Which are your key users? Why?
14. What kind of relationship do you have with your users? Do you treat problems that arise in the course of the relationship with the users as joint rather than individual responsibility? Do you consider the users as jointly responsible for making sure that tasks, which require collaboration, are completed?

15. How does the terminal collaborate with its users? (specifying the activities in which there is collaboration)
16. Which practices do you use with your users in order to have a collaborative relationship?

G - Terminal performance

17. Evolution of operational performance over the last three years (number of containers handled, dwell time, average time of waiting, ship turnaround time – average value, other indicators)
18. Evolution of financial performance over the last three years (sales, ROI and other financial indicators)

H - Plan of development

19. Are you the only one responsible for the investment in :

    [] the specific infrastructures for your terminal (e.g. quay, dedicated rail links, specific structures in the yard, etc.)

    [] the superstructures (e.g. cranes, other equipment, warehouses, et c.)

20. Which is the role of the Public Authority in the investment choices about your specific terminal? Is it responsible for a specific action?
21. Which is your plan of development? In what direction are your investments going?

Appendix B. Set of questions for port authority

During the interview with the port authority the researcher has to explore the following main topics:

- The features of the port (position, goods segments, competitors, etc.)
- The role of port authority
- The relationship with the customers
- Focus on container terminals
- The infrastructures of the port (actual situation, investment plan**)**

Set of questions

1. How the port of Genoa can be classified? (e.g. HUB port , direct call port, other)
2. Which are the goods handled in the port ?
3. Which are the competitors of the ports?
4. Which are the factors of competition?
5. Which is the role of the port authority?
6. How doesthe port authority manage the port?
7. Which is the authority structure?
8. Who are your customers?
9. Which are your main operating income flows?
10. How many container terminals operate in the port? Which is the most important container terminal? Why?
11. Which are the facilities linked to the container terminals?
12. Which is the role of the Public Authority in the investment choices about the specific terminals? Is it responsible for a specific action?
13. Which is the port investment plan?

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IN ATTACHMENT

PAPER A

This paper was presented at 18th International Annual EurOMA Conference, 3-6 July 2011, Cambridge, UK.

An empirical study on the container terminals integration in supply chains: insights from the Italian scenario

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Abstract

This paper investigates how the container terminals can reach a high degree of integration in supply chains. The results of our analysis suggest that a container terminal achieves a high degree of integration in supply chains when its investments are driven by integration aim are combined with a high degree of openness to the integration. Reaching a high level of integration for a container terminal is complex because of two main factors. The former is linked to the port governance model. The latter is due to the difficulty in establishing close and cooperative relationships between the terminal and its users.

Keywords: Global Supply Chains, Container Terminals, Integration

Introduction

In recent years companies have globalized their supply chains more and more over time in order to perform competitively their processes. The growth of globalization and the consequent challenges for Management have motivated the interest of both practitioners and academics on Global Supply Chain Management (Gargeya and Meixell, 2005).

Ports are nodes and vital components of many supply chains (Mangan et al., 2008). An important section of the port is the terminal which consists of one o more berths devoted to a particular type of cargo handling (Stopford, 1997).

The *containerisation* has facilitated the globalization of production which has led to a strong growth in seaborne trade. So, many researchers are focused on the container terminal as unit of observation and analysis (Slack, 2007).

As members of supply chains, the ports and particularly the container terminals, need to achieve a high degree of integration in the supply chains (Panayides and Song, 2008).

Although the scholars have theorised that the ports need to become more integrated in the supply chains, only Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualisation of what really is meant by container terminal integration in supply chains. Their works put in evidence that the container terminals can be integrated at various degrees and that reaching a high degree of integration is not simple.

The purpose of this paper is to address the increasingly issue of container terminals integration in supply chains. The paper investigates how the container terminals can reach a high degree of integration.

In the next section we analyze existing literature in order to motivate our study. The third section focuses on the key dimensions of container terminals integration in supply chains while the fourth section deals with the research design. Then the case studies are presented. The final section contains the discussions of the findings and conclusions, summarizing the main theoretical and managerial contributions of this research and providing opportunities for future research.

Theoretical background

In recent years the companies have globalized their supply chain more and more over time in order to perform competitively their processes. The growth of globalization and the consequent challenges for Management have motivated the interest of both practitioners and academics on Global Supply Chain Management (Gargeya and Meixell, 2005).

Global supply chains are actually complex networks, which consist of many different actors. Ports are nodes and vital components of many supply chains (Mangan et al., 2008). Although they have always been an important part of global supply chains, their role in the supply chains is changing (Robinson, 2002; Carbone and De Martino, 2003; Mangan et al. 2008; Petit and Beresford 2009).

Robinsons (2002) argues that ports must be seen as elements in value-driven chain systems, not simply as places with particular, if complex, functions. He recognises that ports are places characterized by the essential function of facilitating loading and discharging of ships but, at same time, theorises a new role for them.

Carbone and De Martino (2003) consider the port as a cluster of organizations in which different logistics and transport operators are involved in bringing value to the final consumers. In order to perform well its role, the port needs to work in several

directions, also taking into account the requirements of the shippers and consignees of goods as well as the traditional needs of the shipping companies, forwarding companies, etc.

Mangan et al. (2008) state that the role of ports in supply chains can vary from that of simple transhipment hub to important logistics node. The role depends in part upon the supply chain strategies of those who use these ports. At the same time, Mangan et al. (2008) develop the concept of port-centric logistics, defined as the provision of distribution and other value-adding logistics services at a port. The ports need to move toward a more active role in the supply chain and port-centric logistics may be the way to obtain it.

Pettit and Beresford (2009) observe that ports could take part in many supply chains simultaneously. So if the ports are clear about how they fit into various supply chains they can more accurately focus on the types of facilities which they provide. In fact, the ports are critical nodes in supply chains, and the provision of logistics facilities has been established as a necessary activity in many ports for several years.

In this new role, the port, part of which is the container terminal, needs to achieve a high degree of integration in the supply chains (Paixao and Marlow, 2003; Panayides and Song, 2008).

Although the researchers have theorised that the ports need to become more integrated in supply chains, few empirical works have been performed on the topic (Pallis et al. 2009).

Only Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualisation of what really is meant by container terminal integration in the supply chain and have empirically developed measures to evaluate the degree of integration of seaport container terminals in supply chains. They define *seaport terminal supply chain integration 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 operations* (Panayides and Song, 2008).

A similar work has been made by Tongzon et al. (2009) with regard to the container terminal supply chain orientation which cover and include the concept of supply chain integration and its constructs.

Even though Panayides and Song (2008) have developed some measures in order to assess the degree of integration of container terminals in supply chains, the literature on supply chain integration (SCI) puts in evidence that various definitions and measures of SCI have been proposed over the years (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found. Hence, more research is needed in order to investigate this issue and to capture both the real essence of terminal container integration in supply chains and the dynamics which lead to a successful container terminal integration

Theoretical framework

The container terminal community is characterized by different organizations (Martin and Thomas, 2001). It is possible to distinguish two significant categories of organizations in this community. The first category is that of the terminal operator which manages the terminal and controls all the activities, from the arrival of a container to a final departure. The terminal operator in most cases also undertakes all the operations within the terminal. The other category is that of the users of the terminal

which come in contact with the terminal in order to perform their services/activities. Different organizations can be grouped in this second category (shipping lines, feeder operators, freight forwarders, inland transport operators).
Although there is very limited empirical work on container terminal integration in supply chains, the existing literature both on ports and on SCI is used to capture the key dimensions of container terminal integration.
The first dimension is the *investment driven by integration aim*, while the second is *degree of openness*. The investment driven by integration evaluates the asset of terminal that facilitate the integration. This dimension takes into account both the technologies and systems (e.g. EDI) and the endowment of the container terminal in terms of infrastructures and superstructures. The distinction between infrastructures and superstructures characterizes the port environment (Bichou and Gray, 2005).
The degree of openness is a softer dimension which takes into account the interaction between the terminal and its users.

Investment driven by integration aim
The literature puts in evidence the importance of investment driven by integration aim with regard to three elements: the information and communication systems, the value added services and the integration of transport modes.
Pallis et al. (2009) identify the role of information technology in facilitating further integration of ports in supply chains as an important topic of interest. Carbone and De Martino (2003) put in evidence the importance to have advance information and communication systems to facilitate the integration process between supply chain partners at the Port of Le Havre. Panayides and Song (2008) recognize the importance of information and communication systems in order to evaluate the integration of container terminals in supply chains.
With regard to the second variable the importance to have adequate facilities to effect activities to add value to the cargoes is widely recognized (Panayides and Song, 2008; Paixao and Marlow, 2003; Tongzon et al., 2009).
With regard to the third variable we have to consider that since ports are bi-directional logistics systems (Paixao and Marlow, 2003) and the container operations have a intermodal character (Tongzon et al., 2009) the terminal needs to have adequate infrastructures and superstructures to inter-connect the multiple modes of transport.

Degree of openness
The importance for a terminal to build long-term cooperative relationship with is users in order to reach a high level of integration in the supply chains is recognised by various researchers (Song and Panayides, 2008; Ducruet and Van Der Horst, 2009). In order to build up a long term relationships between the terminal and its users, a positive attitude towards collaboration is required.
As highlighted by Van Der Vaart and Van Donk (2008) with regard to buyer-supplier relationships, a positive attitude towards collaboration leads to actions (practices and interaction patterns) that facilitate integration. The terminal interacts with different categories of users. So we define the degree of openness as that dimension which takes into account both the attitude and the practices and the interaction patterns between the terminal and each category of users.

Research Design

The study is based on a qualitative research design involving two case studies. Few focused case studies, as noted by Voss (2009) are suited for the theory building.

In order to reach our research aim we first investigated the literature in order to capture the key dimensions of container terminals integration. Then we derived empirical evidences through case studies. The themes derived through case analyses have been used to develop theoretical propositions.

The cases we selected – two container terminals – are representative of the Italian scenario. In collecting field data we used a combination of different methods to study the same phenomena. The methods include interviews, direct observations and content analysis of documents. The use of different sources of information was necessary in order to guarantee the respect of the principles of interaction and source triangulation (Eisenhardt, 1989; Yin, 1994). Finally the intra-case analysis and cross-case analysis have been performed.

The Case Studies

Case A

This particular terminal is located in the south of Italy and it is a transhipment hub. In fact transhipment accounts for nearly 90 per cent of the terminal's business, while the remaining 10 per cent is made up of imports and exports. Taking into account the TEU handled in 2009, this terminal occupies a high position in Italian ranking. The terminal is in a strategic geographic position. The feeder services provide frequent and fast connections from the terminal to some 40 ports around the Mediterranean, the Adriatic and the Black Sea.

Table 2 - Case A: exploration of key dimensions

Investment driven by integration aim	The terminal is connected to the Italian railways and highways networks. On the west side of the terminal there are five sidings, linked directly with the national rail network. Two gantry cranes provide rapid loading and unloading of container trains. Over 20 in and out weekly container trains are operated to connect the terminal with other Central and Northern Italian Interports. Trucks leaving or entering the terminal have ready access to and from the national road network. There is a congestion-free link with the highway, 15 km away. The terminal does not have facilities to perform value added activities on the cargo. During the last years some warehouses have been built inside the terminal where the logistics service providers effect only the container deconsolidation. The terminal has EDI systems.
Degree of openness	The terminal considers the shipping lines as the key users because it recognizes the importance of this category of users in order to improve its performance (e.g. throughput). The terminal uses EDI systems only with the shipping lines and shares daily information with them in order to optimize the container transit

Case B

This particular terminal is situated in the north of Italy and it is not used to tranship containers to other ports. Taking into account the TEU handled in 2009, this terminal occupies a high position in Italian ranking

Table 3 - Case B: exploration of the key dimensions

Investment driven by integration aim	The terminal has a very close position to the main railway and highway leading to the most industrialized areas of North Italy and North Europe. The terminal has eight sidings, linked directly with the national rail network. It is linked to the A12 and A15 Italian highways by a slip road. The terminal is linked to a nearby area, by shuttle trains and shuttle trucks. In this way, the marine terminal forms a unique and integrated system with this nearby area where some activities are effected (e.g receipt and delivery of container as well as loading and discharging of trains). The terminal is connected with the main Italian inland terminals The terminal has EDI systems and web-based portal. A DGPS technology is used in order to track the container in the yard The labelling and the packing are performed. Generally, these activities are effected when are required by the public authority (e.g. label does not conform to the laws)
Degree of openness	The terminal consider all users as key users because it recognizes the importance of all users in order to improve its performance. In fact the terminal is in a condition of "saturation" and it has to reach a balance between the volume of traffic in entrance and in exit in a temporal horizon. The terminal uses EDI systems with the shipping lines, rail operators and multimodal transport operators. The terminal uses web portal in order to communicate with freight forwarders and road hauliers. Not only does the terminal usually share information with the users in order to optimize the container transit but it also collaborates with the users in the design of services and processes which can facilitate the container transit

Discussion

Consistently with Panayides and Songs' work (2008), our cases suggest that reaching a high degree of integration of the container terminals in supply chains takes considerable effort. The terminal should work in two main directions, both increasing its level of investment driven by integration aim and enlarging their degree of openness.

The investment driven by integration aim evaluates the asset of the terminal that facilitates the integration while the degree of openness is a softer dimension which takes into account the interaction between the terminal and its users.

The investment driven by integration aim considers the information and communication systems, the value added services and the infrastructures and superstructures to inter-connect the multiple modes of transport. The main problem with regard to these three elements is linked to the entity responsible for making decisions on the investment.

In fact, the port institutional models are widely diverse, including models of landlord, service or tool organisations, or variations and combinations of some or all of these (Bichou and Gray, 2005)
The degree of openness evaluates the attitude toward collaboration and the actions (practices and interaction patterns) that facilitate integration between the terminal and each category of users.
Based on this elements, we can derive the following proposition:

Proposition 1: *A container terminal reaches a high degree of integration in supply chains when it has a high investment driven by integration aim and a high degree of openness*

Our analysis puts in evidence that not all the relationships between the terminal and its users are cooperative. Moreover, the relationship between the terminal and the shipping lines appears more cooperative than the relationship between the terminal and the other category of users.
The Italian context is characterized by the landlord model. Two main entities are responsible for the investment choices. The Government is responsible for making decisions about the building of the generic infrastructures which permit the access to the port both from the land side and sea side (e.g. road and railway links). While the Public Authority's main aim is to carry out the mission of planning, controlling, coordinating and promoting for all port and commercial activities. The terminal operator which manages the terminal is responsible for the investment in superstructures, information and communications systems and value added services for the specific terminal. There is a third type of investment, that's to say the investment in infrastructures for a specific terminal (e.g. dedicated sidings). For this type of investment there is an action divided between the public and private sector.
So in order to reach a high level of investment driven by integration aim it is fundamental to have for a specific terminal coherence between the actions of Government and the terminal operator. Moreover it is important to plan the investments taking into account the terminal need and the temporal horizon in which the works should be made. The synergy between the public and private actions is not simple to achieve. Hence we can argue that:

Proposition 2: *Reaching a high level of integration for a container terminal depends on two factors: the port governance mode and the cooperative relationship among the terminal and its users.*

Conclusions
This paper investigates how the container terminals can reach a high degree of integration in supply chains. In order to have a high degree of integration in supply chains the container terminals have to reach a high degree of investment driven by integration aim and a high degree of openness. This is not simple because of two main reasons. The first reason is linked to the investment choices. In the Italian scenario, where there is the landlord port governance model, the entities responsible for making decisions on the investment choices are more than one. So it is necessary to reach a synergy between the action of public and private sector. The second reason is due to the

difficulty in establishing close and cooperative relationships between the terminal and its users.

In conclusion, our paper provides both theoretical and managerial implications. From the theoretical side, our research aims to capture the real essence of container terminal integration in supply chains and the dynamics which lead to a successful container terminal integration. From the practical side, this paper could help the managers to guide the container terminals toward a greater degree of integration.

By now, our research design based on two Italian cases limit the generalizability of our findings. Consequently, more research is needed to reduce biases. A future development of this research could be the study and analysis of other container terminals in other countries.

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PAPER B

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A NEW TAXONOMY FOR CONTAINER TERMINALS

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Abstract

This paper proposes a taxonomy for container terminals based on the degree of their integration in supply chains. The key dimensions of this taxonomy are the investment driven by integration aim and the degree of openness. The two dimensions draw from the literature review and have been refined through the case-based research. Their binary values (low or high) suggest four possible states for a container terminal. The proposed taxonomy can be useful to guide the terminals towards reaching a high degree of integration

Keywords

Container Terminals, Supply Chain Management, Integration

Introduction

It is widely accepted in current literature that the port, part of which is the container terminal, is an important component of many supply chains.

The containerisation has facilitated the globalization of production which has led to a strong growth in seaborne trade. So, many researchers are focused on the container terminal as unit of observation and analysis (Slack, 2007).

As members of supply chains, the ports and particularly the container terminals, need to achieve a high degree of integration in the supply chains (Paixao and Marlow, 2003, Panayides and Song, 2008).

Although the scholars have theorised that the ports need to become more integrated in the supply chains, only Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualisation of what really is meant by container terminal integration in the supply chains. Their works put in evidence that the container terminals can be integrated at various degrees and that reaching a high degree of integration is not simple.

This paper proposes a taxonomy for container terminals based on the degree of their integration in supply chains. This taxonomy can be useful to guide the terminals towards reaching a high degree of integration.

In the next section we analyze existing literature in order to capture the key dimensions of the integration of container terminals in supply chains. The third section focuses on the research design while the fourth section presents the case studies. The final section contains the discussions of the findings and conclusions, summarizing the main theoretical and managerial contributions of this research and providing opportunities for future research.

Theoretical Background

The Supply Chain Integration

Over the years, various definitions and measures of Supply Chain Integration (SCI) have been proposed (Van der Vaart and Van Donk, 2008). A general consensus on how to capture the essence of SCI is still to be found.

Three dimensions of SCI can be distinguished: customer, supplier and internal integration (Flynn et al., 2010). Customer and supplier integration are known as external integration.

While the internal integration highlights the importance to coordinate the activities of different functional areas and internal structures within a company, the external integration focuses on the importance of establishing close relationships with customers and suppliers. Both perspectives are important in allowing supply chain members to act in a concerted way, to maximize the value of the supply chain (Flynn et al., 2010)

In order to measure SCI, three categories of items can be distinguished: practices, patterns and attitudes (Van der Vaart and Van Donk, 2008).

The first category includes those items related to the technologies or tangible activities that play an important role in the collaboration of a focal firm with its suppliers and/or customers. The second category groups those items related to the interaction patterns between the focal firm and its suppliers and/or customers. The third category includes

those items that measure the attitude of buyers and/or suppliers towards each other or towards Supply Chain Management in general.

The majority of researchers agree that a higher level of SCI has a positive impact on the performance of the focal firm (Frohlich and Westbrook, 2001; Vickery et al., 2003; Van der Vaart and van Donk, 2008).

Changing our unit of analysis, from manufacturing company to a container terminal we can see that the variability of the definitions and measures with regard to SCI is low. In fact only Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualisation of what really is meant by terminal integration in the supply chains.

The integration of container terminals in supply chains

Globalisation has led to a strong growth in seaborne trade and to an increasing interest in the port role in the supply chains. Ports are nodes and vital components of many supply chains (Mangan et al., 2008). Although they have always been an important part of global supply chains, their role in the supply chains is changing (Robinson, 2002; Carbone and De Martino, 2003; Mangan et al. 2008; Petit and Beresford 2009).

Robinsons (2002) argues that ports must be seen as elements in value-driven chain systems, not simply as places with particular, if complex, functions. He recognises that ports are places characterized by the essential function of facilitating loading and discharging of ships but, at same time, theorises a new role for them. Robinsons' work results the most cited paper in the research subfield that deals with the role of ports in transport and supply chains (Pallis et al, 2010).

In this new role, ports are considered as part of a cluster of organizations in which various logistics and transport operators are involved with the ultimate aim to bring value to the final consumers (Panayides and Song, 2008).

In this new role, the port, part of which is the container terminal, needs to achieve a high degree of integration in the supply chains (Paixao and Marlow, 2003; Panayides and Song, 2008).

Although the scholars have theorised that the ports need to become more integrated in the supply chain, few empirical works have been performed on the topic (Pallis et al. 2009). Some scholars have attempted to change this tendency in the last years. In fact, Panayides and Song (2008) and Song and Panayides (2008) have proposed a conceptualisation of what really is meant by container terminal integration in the supply chain. They have empirically developed measures to evaluate the degree of integration of seaport container terminals in supply chains. Tongzon et al. (2009) have made a similar effort in order to develop measures to assess the degree of orientation of seaport container terminal in the supply chain and they apply these measures to assess the degree of orientation of the port of Incheon. They adopt, as they state in their work, the concept of supply chain orientation to cover and include supply chain integration and its construct.

Panayides and Song (2008) conceptualise the integration of container terminal in supply chains as higher-order factor made up of other constructs. They underline that the integration of terminals in supply chains takes considerable effort and is achieved over time. Moreover the container terminals may be integrated to various degrees in supply chains.

Key dimensions of container terminals integration

The container terminal community is characterized by different organizations (Martin and Thomas, 2001). It is possible to distinguish two significant categories of organizations in this community. The first category is that of the terminal operator which manages the terminal and controls all the activities, from the arrival of a container to a final departure. The terminal operator in most cases also undertakes all the operations within the terminal. The other category is that of the users of the terminal which come in contact with the terminal in order to perform their services/activities. Different organizations can be grouped in this second category (shipping lines, feeder operators, freight forwarders, inland transport operators).

The distinction between terminal operator and terminal users is important in order to understand the key dimensions of container terminal integration.

The analysis of the literature both on ports and on SCI leads to identify the two key dimensions which are the "investment driven by integration aim" and the "degree of openness". The investment driven by integration evaluates the asset of terminal that facilitate the integration. This dimension takes into account both the technologies and systems (e.g. EDI) and the endowment of the container terminal in terms of infrastructures and superstructures[3]. The degree of openness is a softer dimension which takes into account the interaction between the terminal and its users.

Investment driven by integration aim

The literature on SCI of container terminals puts in evidence the importance of investment driven by integration aim with regard to three elements: the information and communication systems, the value added services and the integration of transport modes.

Pallis et al. (2009) identify the role of information technology in facilitating further integration of ports in supply chains as an important topic of interest. Carbone and De Martino (2003) put in evidence the importance to have advance information and communication systems to facilitate the integration process between supply chain partners at the Port of Le Havre. Panayides and Song (2008) recognize the importance of information and communication systems in order to evaluate the integration of container terminals in supply chains.

With regard to the second variable the importance to have adequate facilities to effect activities to add value to the cargoes is widely recognized (Panayides and Song, 2008; Paixao and Marlow, 2003; Tongzon et al., 2009).

With regard to the third variable we have to consider that since ports are bi-directional logistics systems (Paixao and Marlow, 2003) and the container operations have a intermodal character (Tongzon et al., 2009) the terminal needs to have adequate infrastructures and superstructures to inter-connect the multiple modes of transport.

The theoretical evidence led us to infer that the higher is the availability of "asset" the higher is the potential of integration of container terminals in supply chains.

Degree of openness

The researchers have highlighted the importance for a terminal to build a long-term co-operative relationships with its shipping lines and inland transport providers in order to reach a high level of integration in the supply chains (Song and Panayides, 2008).

[3] The distinction between infrastructures and superstructures characterizes a container terminal

Ducruet and Van der Horst (2009) seem to put in evidence the need for the terminal to build close relationships with the freight forwarders, who have an important role in establishing efficient integration within transport chains.

In order to build up a long term relationships between the terminal and its users, a positive attitude towards collaboration is required. As highlighted by Van Der Vaart and Van Donk (2008) with regard to buyer-supplier relationships, a positive attitude towards collaboration leads to actions (practices and interaction patterns) that facilitate integration.

Both attitude and practices and interaction patterns between terminal and its users are important to reach the integration of container terminal in supply chains. The terminal interacts with different categories of users. So we define the degree of openness as that dimension which takes into account both the attitude and the practices and the interaction patterns between the terminal and each category of users.

Research Design

The main objective of this study is the development of a taxonomy for container terminals based on the degree of their integration in the supply chains.

In order to reach our aim we first investigated the literature in order to capture the key dimensions of container terminals integration and than, we derived empirical evidences through case studies.

The cases we selected – the container terminals of La Spezia and Taranto – are representative of Italian scenario. In collecting field data we used a combination of different methods to study the same phenomena. The methods include interviews, direct observations and content analysis of documents. The use of different sources of information was necessary in order to guarantee the respect of the principles of interaction and source triangulation (Eisenhardt, 1989; Yin, 1994). Finally the intra-case analysis and cross-case analysis have been performed.

The case studies

The container terminal of Taranto

Taranto is located in Apulia, in the south of Italy, and it is known for its port. Taranto's huge potential as a commercial hub port was achieved in June 2001 with the opening of a container terminal.

The container terminal is managed by Taranto Container Terminal S.p.A, which is controlled by both Hutchison Whampoa and Evergreen Marine Corporation.

Throughput has grown from 0,756 million TEUs in 2007 to 0,78 million TEUs in 2008. In the year 2009 the throughput has been 0,74 million TEUs. Taking into account the TEUs handled in 2009, this terminal is in the fourth position of Italian ranking. Transhipment accounts for nearly 90 per cent of the terminal's business, while the remaining 10 per cent is made up of imports and exports.

The terminal is in a strategic geographic position. In fact it is located in the Central of the Mediterranean, 170 nautical miles from the main Suez-Gibraltar shipping route, making it a valid and barycentric hub port. The feeder services provide frequent and fast connections from the terminal to some 40 ports around the Mediterranean, the Adriatic and the Black Sea.

The Tables 1 and 2 present the analyses of the key dimensions of the integration of the terminal in the supply chains.

Table 1: Exploration of the investment driven by integration aim of the terminal of Taranto

Information and communication systems	The terminal has an IT system in order to manage the operations. The terminal uses EDI to communicate with shipping lines.
Value added services	The terminal does not have facilities to perform value added activities on the cargo. During the last years some warehouses have been built inside the terminal where the logistics service providers effect only the container deconsolidation. After the deconsolidation the cargo is sent to the final destination without being subjected to any operation.
The integration of transport modes	On the west side of the terminal there are five rail tracks of 1,000 metres each, linked directly with the national rail network, served with two rail mounted gantry cranes. Over 20 in and out weekly container trains are operated to connect the terminal with other Central and Northern Italian Interports. The A14 Italian highway is 15 km away. So, the trucks leaving or entering the terminal have ready access to and form the national road network.

Table 2: Exploration of the degree of openness of the terminal of Taranto

Attitude	The terminal operator considers the shipping lines as key users because it recognizes the importance of this category of users in order to improve the performance of the terminal (e.g. throughput).
Practises	There is only an electronic exchange of data between the terminal operator and the shipping lines.
Interaction Patterns	There is no collaboration between the terminal operator and the users of the terminal both in the design of services and in the planning of tasks and procedures in order to facilitate the containers transit.

The container terminal of La Spezia

The port of La Spezia is situated in the north of Italy, in the middle of the coast between Genoa and Leghorn. Although in the port two dedicated container terminals are operative, the terminal managed by La Spezia Container Terminal Spa, belonging to Contship Italia Group, is the most important.

The activities of the terminal have been carried out on Fornelli pier since the Eighties and on the Angelo Ravano area since 1998, for a total actual surface of more than 270,000 sqm.

Throughput has moved from 1,05 million TEUs in 2008 to 0,85 million TEUs in 2009. In the year 2010 the throughput has been 1,04 million TEUs. Taking into account the

TEUs handled in 2009, this terminal is in the third position of Italian ranking. This terminal can be classified as an import/export terminal. In fact the transhipment accounts for nearly 15 per cent of the terminal's business.

The Tables 3 and 4 present the analyses of the key dimensions of the integration of the terminal in the supply chains.

Table 3: Exploration of the investment driven by integration aim of the terminal of La Spezia

Information and communication systems	The terminal has an IT system in order to manage the operations. The electronic exchange of data with the users takes place by EDI and the web site.
Value added services	The labelling and the packaging are effected on several types of goods. The perishable goods (e.g. fruits and vegetables) undergo the quality control before the packaging. Generally the labelling and the packaging are effected when are required by the public authority (e.g. label does not conform to the laws).
The integration of transport modes	The terminal has a very close position to the main railway and highway leading to the most industrialized areas of North Italy and North Europe. The terminal has eight sidings, linked directly with the national rail network. It is linked to the A12 and A15 Italian highways by a slip road. The terminal is linked to a nearby area, called "retroporto", located at Santo Stefano Magra, only 8 km from La Spezia, by shuttle trains and shuttle trucks. In this nearby area some activities are effected (e.g receipt and delivery of container as well as loading and discharging of trains). In this way, the marine terminal forms a unique and integrated system with the "retroporto". The terminal is connected with the main Italian inland terminals.

Table 4: Exploration of the degree of openness of the terminal of La Spezia

Attitude	The terminal operator considers all users as key users because it recognizes the importance of all users in order to improve the performance of the terminal . In fact the terminal is in a condition of "saturation" and it has to reach a balance between the volume of traffic in entrance and in exit in a temporal horizon.
Practises	The terminal operator uses EDI systems with the shipping lines, rail operators and multimodal transport operators. The terminal operator uses the web site in order to communicate with freight forwarders and road hauliers.
Interaction Patterns	Collaboration between the terminal operator and the users of the terminal in the design of services which can facilitate the containers transit. Collaboration between the terminal operator and the users of the terminal in the planning of tasks and procedures in order to optimize the containers flow.

DISCUSSION

The full integration of a container terminal in supply chains requires a great effort. The terminal has to increase the level of investment driven by integration aim. So it should invest in specific infrastructures (e.g. internal rail trucks) and superstructures to allow the integration of the different modes of transport. At the same time, it should be able to develop value added services (e.g. quality control, labelling, packaging) in order to become an integral part of the supply chain and to invest in information and communication systems to allow the electronic exchange of data between the terminal and the users of the terminal.

In the two cases analysed, the level of investment is different. The terminal of La Spezia has an higher investment driven by integration aim in terms of equipment to perform the value added services and in terms of communication systems.

Our analysis, however, suggests that a container terminal achieves a high degree of integration in supply chain when its investments, driven by integration aim, are combined with a high degree of openness to the integration in supply chains.

The degree of openness is the soft dimension which takes into account the interaction between the terminal operator and the users of the terminal.

The terminal of Taranto is focused on the relationship between the terminal operator and the shipping lines. In fact the terminal operator considers the shipping lines as the key users. The relationship, however, is limited to a commercial interaction between the seller (terminal operator) and the buyer (shipping companies) where the EDI is used in order to facilitate the exchange of data.

The terminal of La Spezia has an higher degree of openness to the integration in supply chains. The terminal operator and the users of the terminal are capable of collaborating in order to lunch new services or plan tasks/procedures.

So, the terminal of La Spezia has an higher degree of integration in supply chains than the terminal of Taranto.

Another important issue is whether the container terminal's degree of integration in supply chain has a positive impact on its performance.

If we consider the number of container handled over the year 2008, 2009, 2010, we can state that the terminal of La Spezia has better performance both in terms of TEUs handled in each years and in terms of average variation in the three years.

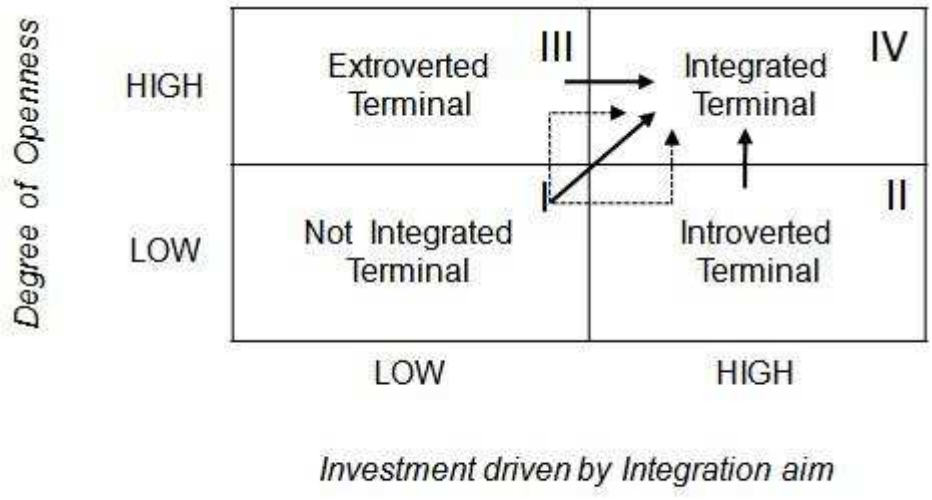
Since only two container terminals have been analysed in this study, we can only make a tentative generalization on the relationship between the container terminal's degree of integration in supply chain and its performance.

The analysis of the literature and the two case studies suggest a simple two-dimensional classification appropriate for container terminals which considers their degree of integration in supply chains. The dimensions and their binary gradations are:

- Investment driven by integration aim (low or high)
- Degree of openness (low or high)

Figure 1 shows the resulting 2 x 2 matrix which defines the four suggested states for a container terminal that emerge from the classification

Figure 1 - The four possible states of a container terminal



If both the dimensions are low, the terminal is in the worst condition because it has to increase both its level of investment and its degree of openness. In this case the critical choice is how to reach the state of integrated terminal. We suggest to increase simultaneously the two dimensions. The other possible paths, indicated with the dotted lines in Figure 1, are not optimal. If the terminal is an extroverted or introverted terminal, it has to increase only one dimension. While the extroverted terminal has to increase its level of investment driven by integration aim, the introverted terminal has to enlarge their degree of openness. The best state is that of integrated terminal The majority of researchers agree that a higher level of SCI has a positive impact on the performance of the focal firmIn this state the terminal has to be skilled at maintaining its state in the course of the time. Consistently with the works of Panayides and Song (2008), our taxonomy shows that reaching the state of integrated terminal takes considerable effort.

CONCLUSIONS

The paper proposes a taxonomy for container terminals based on the degree of their integration in supply chains. This taxonomy can be useful to guide the terminals towards reaching a high degree of integration. The key dimensions of this taxonomy are the investment driven by integration aim and the degree of openness. These two dimensions were developed from a literature review and refined through two case studies.

The cases, reported in this paper, are specific of the Italian scenario, so there would be benefit in extending the research into other countries. In this way, it will be possible to investigate if the context influences the degree of integration of container terminals in supply chains. Moreover, it would be interesting to analyse the processes and phases through which greater supply chain integration of terminals is realized. Typically, this research purpose can be achieved through longitudinal case studies.

This paper should give a contribution both to the theory and practice. From the theoretical side, our work aims to give a taxonomy for container terminals, based on the degree of integration. From the practical side, this paper could help the managers of container terminals to understand which is the state of their terminal and to guide the terminal toward a greater degree of integration.

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