The picture on the cover is one of Pierce County Container Terminal at the Port of Tacoma. It was supplied by Evergreen Marine Corp., and is available from Dunelm public related limited (http://www.dunelmpr.co.uk)

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Writing a doctoral thesis shows many similarities with container handling: it is a process which requires optimisation of the number and quality of a vast number of inputs, it is subject to a whole lot of factors of uncertainty, one needs to make output choices nearly constantly, and congestion (of to do's) and capacity shortage (of time) are recurrent phenomena. It is a process whereby obviously one does not start from zero knowledge, but where one appeals to what one has learned before, and most of all where the contributions and useful remarks from many people are included.

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CHAPTER I: INTRODUCTION

I.1. Rationale for the thesis

The competitive environment in the maritime and port sector is changing at an ever increasing pace. 'Globalisation' and 'the reinforcement of the world economy' are frequently used concepts to summarise current economic developments. Both concepts appear to be applicable also to the port sector and to cargo handling in particular. Large cargo-handling players like Hutchison Port Holdings (HPH), Port of Singapore Authority (PSA), APM Terminals and P&O Ports have expanded and attained decision power over cargo-handling activities in a network which covers ports in all continents.

The efficiencies of the cargo-handling companies are important as they are large and affect the cost of sea-borne trade. In 2000, not less than 50% of total trade in value and 70% in volume made use of maritime transport and therefore required cargo handling (Crook, 2002). Shipping charges on average stand for 6.11% of the value of commodities imported (UNCTAD, 2003, p. 118). Increasing a country's port efficiency, so that the country ranks among the 25% best countries instead of the 75% best, reduces shipping charges on average by 12% (Clark et al., 2004; Sánchez, *et al.*, 2003). Among all port-related charges, cargo-handling charges with a 70% share are the most important ones, so that the largest efficiency effects are to be expected there (Stopford, 2002).

Expansion and trying to gain efficiency also have their price, and therefore such decisions are to be carefully considered. PSA's (two-step) acquisition of HesseNoordNatie for example involved cash expenses of 585 m EURO by the Asean operator, which made it control terminals in Antwerp, Zeebruges and Rotterdam (Drewry Shipping Consultants, 2003, p. 15). International Container Terminal Services, Inc. (ICTSI) at Gdynia acquired BCT, the state-owned local operator, against payment of 41 m USD, and committed themselves to investing 80 m USD more in the terminal (World Cargo News Online, 2003b). Insufficient consideration or unforeseen market developments can turn expansion into a financial disaster. Take ICTSI, which rendered its 71% stake in ICTSI International Holdings to HPH in 2001 against payment of an estimated 600 m USD for covering its financial deficits (World Cargo News Online, 2003b). PSA took a 40% stake in Pipavav Port in India in 1998 (World Cargo News Online, 1998), reduced this share to 22,5 consequently, and finally sold its final shares

to Maersk in 2004 (Informare, 2004), according to various sources because the terminal's results did not meet expectations.

Despite the importance of efficiency gains in cargo handling, especially in relation to expansion, efficiencies were only in a few cases quantified in literature. A number of references, such as Kim and Sachish (1986) and Jara-Díaz et al. (2002), try to quantify port economies at an aggregate level, making no distinction between cargo handling and other port functions. Jansson and Shneerson (1982) and Haralambides et al. (2002) include in their costs also port users. Marlow and Paixao (2002) emphasize qualitative efficiency aspects. Others, like Tongzon (1993), Marchese et al. (2000), Tovar de la Fe et al. (2003 and 2003c) and Turner et al. (2004), focus on cargo handling, but make no or little distinction among the specific cargo-handling products. Only a few references, among which are Heaver (1995), Heaver et al. (2000 and 2001) and Ferrari and Benacchio (2000), examine aspects of the economic expansion context of cargo-handling companies. Furthermore, there is a substantial amount of literature focusing on very specific aspects of terminals, especially the literature on terminal optimisation and simulation. But most of these references take a very partial perspective. The number of references which apply cost and supply function analysis to expansion in cargo handling are particularly limited in number: Cariou (2001), Musso et al. (2001) and Trujillo and Serebrisky (2003) are among the few who have done so, without distinguishing among separate product types in their specifications.

The absence of a framework for analyzing efficiencies in cargo handling is also felt as a problem by decision makers in the business. Pricing of acquisition moves for instance should be based on the efficiencies of the terminal(s) under consideration, but there is often disagreement on the future financial prospects of terminals. Dubai Ports Authority (DPA) for instance for its 2004 acquisition of CSX Worldwide Terminals (CSXWT) is said by competitors and business analysts to have paid an excessive amount of money in view of the CSXWT terminals' capabilities (Hussain, 2005). Moreover, many sector representatives admit that cargo-handling companies currently lack resources and techniques to thoroughly and especially quickly scan the market for expansion opportunities.

The purpose of this thesis is to provide insight into the economics of cargo handling and of cargo-handling companies, many of which expand and build a network of facilities, while others feel the impact of the large players invading their market. Such insights may be of value for future developments.

I.2. Setting for the expansion of cargo-handling companies

Expansion of cargo-handling companies assumes two major forms: at own strength or through some form of co-operation. Expansion at own strength can be internal as well external. Internal expansion at own strength occurs through organic growth of a terminal. It is observed that many terminals can hardly keep pace in expanding their terminals' capacity in an enduring way in reaction to rising demand. External expansion at own strength incorporates greenfield investments as well as the start-up of a subsidiary in cargo handling. PSA and P&O's terminal developments at the new Deurganckdock, Antwerp, are two recent examples of greenfield investments. Contship Italia sa set up La Spezia Container Terminal Sp.A as a cargo-handling subsidiary, which itself can set up or take a stake in other terminals or businesses.

Expansion through co-operation involves a wide spectrum of agreements between one or more cargo-handling companies and one or more horizontal or vertical transport chain partners or non-related investors. Common forms of horizontal co-operation aiming at expansion are the following.

- Mergers/acquisitions: DPI for instance took over all activities of CSXWT through its subsidiary Dubai Ports International (Manoj, 2004).
- Joint ventures: Shanghai Container Terminals Ltd for example was set up as a 50/50 joint venture between Shanghai Port Container Co. Ltd and Hutchison Ports Shanghai Ltd. (Port of Busan, 2005).

Vertical expansionist co-operation occurs when upstream or downstream transport actors are involved, the most frequent types of which are the following.

• Joint ventures with port authorities: in Guangzhou for instance, PSA formed a joint venture with the local Harbour Bureau for the operation of the Guangzhou Container Terminal (Maritime Global.Net, 2001).

- Joint ventures with shipping lines: Stevedoring Services of America (SSA) for example set up a Long Beach container terminal company together with China Ocean Shipping Company (COSCO) (SSAMarine, 2003).
- Joint ventures with hinterland transporters: Hessenatie for instance, which merged into HesseNoordNatie within the PSA-group, set up Ocean Container Terminal Hessenatie Zeebrugge in joint venture with Inter Ferry Boats, a subsidiary of the Belgian Railways (Le Lloyd, 2000).

Also co-operation for expansion with non-transport partners occurs: PSA at Incheon for instance set up a terminal in joint venture with Samsung Corporation (Informare, 2004b). Finally, combinations of the previous structures occur: in Shekou, P&O Ports and Modern Terminals are in a joint venture together with China Merchant and Swire Pacific (Informare, 2002c).

All of the previous forms of expansion focus on expansion in cargo handling. Other directions of expansion for cargo-handling companies are in vertically-related or non-related sectors. The former is also named vertical integration. An example is Eurokai KGaA, which, like many other cargo-handling companies, started up or took a stake in shipping agencies, hinterland transporters, shipping companies,...

Many of the forms of cargo-handling expansion are found in other business sectors too, but there are three main complexities that make decision making on expansion for cargo-handling companies particular and that imply the need for specific methods of analysis: the volatile chain environment, a number of local terminal specifics, and policy impact.

I.2.1. The chain environment

The volatile environment as a first complexity visualizes in a large number of chain partners taking decisions on expansion parallel to the decisions of a particular cargo-handling company. Such decisions can affect the cargo-handling company and its expansion strategy directly or indirectly.

The cargo-handling company will presumably feel direct influence of chain movements when it is target of a horizontal acquisition move itself, or when a vertical partner tries to integrate the existing cargo-handling activity. In both cases, the cargo-handling company automatically loses (part of) its control, whether voluntarily or involuntarily through a friendly respectively a rival bid. Vertical integration in cargo-handling is all the more likely as profitability in cargo handling outstrips that of other activities in the transport chain. CSX Corp. saw its terminal unit, CSXWT, make an operating profit of 71 mn USD in 2000, whereas CXS Lines, its intra-US sea carrier company, only broke even. Within the P&O Group, P&O Ports made an operating profit of 153 mn USD in 2000, whereas its share in P&O Nedlloyd gave the group an operating profit of 99 mn USD. Not only absolute figures but also operating profit margins in cargo handling are typically high: 47% for PSA in 2000, 38% for (HPH), 23% for CSXWT and 19% for P&O Ports (Damas, 2002). But also traffic assurance can be a motive: the Rotterdam Port Auhority taking a stake in Europe Combined Terminals (ECT) was the first example of a port authority integrating vertically, with the aim of binding terminal operators as well as shipping companies as one of the motives (Heaver et al., 2001, p. 299), next to motives of national or local interest.

Indirect influence is normally felt in three cases. First, there is influence on handling economics when a cargo-handling competitor grows organically, sets up a greenfield investment or a cargo-handling subsidiary, is taken over by a third party, or set-ups a joint-venture structure. Second, a cargo-handling company will feel the influence of a vertical chain partner starting up a greenfield cargo-handling project or a cargo-handling subsidiary on its own. COSCO, China Shipping Group (with its China Container Development Company), Maersk Sealand (with APM Terminals) and Mediterranean Shipping Company (MSC) are only a few of the shipping companies that have done this. CSXWT was set up as a subsidiary within the multimodal logistics group CSX. Another example is Dole Corporation, the fresh fruit producer, which erects its own terminals, and furthermore also owns vessels through a subsidiary. Third, expansion at levels in the transport chain other than the cargo-handling level can influence cargo-handling companies' economic context for expansion. Conferences, consortia, vessel sharing agreements, alliances and mergers among shipping companies are very influential forms (Heaver et al., 2000; Massac, 1997).

I.2.2. Local terminal specifics

A second complexity specific to expansionist decision making in cargo handling is the impact of local or national culture and history, mainly through labour and port organisation. Labour relations in the port sector have traditionally featured frequent strikes and strong union control. European port workers' strikes against the proposed Port Package (European Commission, 2001) and similar strikes by their US counterparts made cargo-handling companies but also other chain actors incur large internal costs, indemnities and lost contracts¹. Moreover, union strength has in some countries been more expressed than in others, scaring some cargo-handling companies to see some of their traffic diverted to competing ports in neighbouring countries where no strike was going on, with sometimes irreversible competitive damage. As far as port organisation is concerned, some countries, like France for instance, have traditionally had strong centralist port authority control, with the port authority sometimes also assuming a limited operating or operating role, whereas other countries, like the United Kingdom, had decentralised and even corporatized port authorities. Port organisation has direct influence on supply and demand conditions of a cargo-handling company operating under a specific system, and indirect influence on the position of competing cargo handlers. Labour relations and port organization illustrate that individual cargo-handling operators cannot take decisions in isolation from the local port context.

I.2.3. Policy intervention

The third complexity is the intervention of a large number of policy levels in the cargohandling environment, not always with the same interests and therefore not always acting in similar directions.

- At local level: cities / municipalities; city-states; municipal districts.
- At regional level: multi-state agencies; special districts; counties; departments; regions.
- At national level: (federal) states.
- At the super-national level: European Union; IMO.

¹ Anderson and Geckil (2002) value the reduction in earnings to US port and maritime companies due to 28 days strike at 48 mn USD, and the total cost to US society at somewhat less than 5 bn USD.

Government impact on ports has always been considerable, mainly due to their macroeconomic impact, although there have been national gradations in government intervention. Environmental concerns and safety and security issues increase governments' involvement, affecting cargo-handling supply and demand.

I.3. Hypotheses and Objectives

Focusing on the economics of the cargo-handling business from the point of view of expansion, gives rise to the following main hypotheses for this thesis.

- 1. There are economies of scale in cargo handling.
- 2. Economies of scale differ according to the operational context.
- 3. Cargo-handling efficiency can in particular be gained through co-operation.

Testing these hypotheses should not only produce interesting information from a field which has hardly been researched, but should help cargo handlers to scientifically found expansion decisions. The testing is done by establishing supply functions, which can then, in a later stage, serve as inputs to an industrial-economic model where supply and demand interact. These supply functions should allow identification of specific factors generating efficiencies.

Using the functions in later analysis in a formal model including supply as well as demand should allow getting a full view on what economies materialize under what supply and demand conditions. Such model could also be used to evaluate expansion decisions taken in the past and eventually to learn from them. Looking forward, such model could be useful to evaluate opportunities for expansion. To a certain extent, it should allow selection of the best alternative when a choice set of opportunities is available. Finally, a full-fledged supply and demand model could also be of use for actors somehow related to cargo handling, for instance, to public government bodies. Suppose a public body is planning to impose a (set of) measure(s) to cargo-handling companies. An industrial-economic model including a game setting should then help getting grip on cargo-handling companies' reaction patterns, and should therefore help visualizing whether government measures are indeed effective or not. It will be argued in CHAPTER III that a one-stage game model fits the cargo-handling business.

I.4. Definition and limitation

Expansion in cargo handling as such is a very broad area of research. Therefore, in this thesis, seven main constraints are introduced with respect to the scope of the field of study.

- 1. The perspective taken in this thesis is that of the <u>decision maker in cargo handling</u>. Objectives of other chain actors and of activities other than cargo handling are only dealt with in as far as they influence cargo-handling supply and / or demand. The decision maker can be the management of a cargo-handling terminal itself, as well as for instance a shipping company owning and directing a cargo-handling business unit. Decisions evaluated in this thesis deal with expanding cargo-handling activities, and consider other decisions only as conditions which may alter the expansion decision's outcome. In that respect, the cargo-handling activity for which expansion decisions are taken needs to be a separable product.
- 2. A second constraint is on expansion: decision makers are assumed to look for efficiencies through <u>mergers</u>, <u>full acquisitions</u> (take-overs) or <u>partial acquisitions</u>. Other forms of expansion, whether at own strength or through co-operation, are only relevant as conditions which change cargo-handling supply and / or demand if the particular cargo-handling company is involved in them.
- 3. A third constraint is also on expansion: the focus is on <u>horizontal</u> expansion. Combined with the second constraint, this means that the analysis focuses on a cargo-handling company looking to acquire one or more other <u>cargo-handling companies or units</u> fully or partially, or to merge with them. Focusing on horizontal expansion also implies looking only for cargo-handling opportunities in <u>sea ports</u>, not in inland ports, and of course not in airports, where cargo handling also occurs, be it of a totally different nature. Sea ports are defined as *"areas within which sea-going ships are loaded with and/or discharged of cargo, and which include the usual places where sea-going ships wait for their turn or are ordered or obliged to wait for their turn, no matter the distance from that area; usually, sea ports have an interface with other forms of transport and in so doing provide*

connecting services" (definition adapted from Branch, 1986, p. 1^2). Non-horizontal expansion is relevant only in as far as it determines cargo-handling demand and / or supply conditions.

- 4. A fourth constraint is on the sea-port activities which compose the cargo-handling product. Paelinck (2001, p. 11) defines cargo handling as "The act of loading and discharging a cargo ship". As a synonym, the author mentions "stevedoring". In the course of time however, with evolving technologies and changing relationships within the transport chain, the content of the concept 'stevedoring' has broadened from what it originally was. Untill the mid 1900s, there used to be a distinction between the actual (un-)loading (done by stevedores) and warehousing (done by 'naties' in Antwerp for instance). Nowadays, both are comprised in what is called 'stevedoring' or 'cargo handling' (Devos et al., 2004), and also paid for as part of the same product. Unfortunately, there is no existing reference which defines what activities cargo handling at present exactly involves. A review of literature on sea-port activities³ and on which actor in the transport chain pays for what product, reveals that in most contracts and locations 'cargo handling' involves (un-)loading cargo, storing it and delivering it to or receiving it from a hinterland mode. In case of transhipment, inter-modal delivery / receipt as a second move is of course replaced by a supplementary ship (un-)loading move. This way, three distinct main cargo-handling products can be distinguished.
 - Outbound-cargo handling⁴.
 - Inbound-cargo handling.
 - Transhipment-cargo handling.

Sea-port activities which are not part of cargo handling but which are sold as separate products are only considered here if they interfere with cargo-handling supply and / or demand.

² Appendix A.1 puts the choice of this sea-port definition into perspective.

³ Appendix A.2 assesses and categorizes literature summarizing sea-port activities.

⁴ The definition of 'outbound' and 'inbound' depends on the perspective taken. This thesis puts maritime transport in the center, so 'outbound' cargo is cargo being unloaded from vessels, while 'inbound' cargo is cargo being loaded onto vessels. This is the most common perspective in maritime and ports literature.
- 5. A fifth constraint is on the differentiation of the cargo-handling product over <u>time</u>: if different operating-cost conditions apply to cargo handling at different points in time. For instance night, weekend or holiday wages may give rise to as many products as there are different conditions. These products occur sequentially in time, which implies that setting a production quantity for one type of product, for instance cargo handling during day shifts, does not affect capacity available to any other type of product, cargo handling during night shifts for instance. If this capacity independence condition would not be met, one would end up with un-comparable cargo-handling products.
- 6. A sixth constraint deals with the type of commodities: <u>containers</u> are the focus of this thesis. A container is defined as "a van, flat rack, open top trailer or other similar trailer body on or into which cargo is loaded and transported without chassis aboard ocean vessels; a large rectangular or square container/box of a strong structure that can withstand continuous rough handling from ship to shore and back. It opens from one side to allow cargo to be stacked and stowed into it" (Paelinck, 2001, p. 16). Containers are usually distinguished from general cargo, dry bulk and liquid bulk (Stopford, 2002, p. 388). Motivations for focusing on containers are that it is the fastest growing cargo type, and that it is a cargo-handling sector with considerable growth and merger and acquisition activity. That some operators deal with several commodity types implies the need to analyze the existence of economies of scope with an impact on container-handling supply and demand.
- 7. The seventh constraint is on the physical location which is used as a unit for cargo-handling activity: the <u>terminal</u>. The terminal definition used here is one adapted from Port of Miami (2004): "One or more structures comprising a terminal unit, and including, but not limited to wharves, warehouses, covered and/or open storage space, cold storage plants, landings and receiving stations, used for the transmission, care and convenience of cargo in the interchange of same between land and water carriers or between two water carriers". Such terminal is the largest unit whose cargo-handling activities are grouped into one product, or a set of products if the terminal provides multiple or joint products. Eventually, several cargo-handling companies may run part of the same terminal, and therefore several products may be supplied at the same terminal. In the latter

case, the separate companies are the terminal units under consideration in this thesis. Supply functions in CHAPTER V are analyzed at the terminal level, or the business level if several companies run part of the same terminal. Economies at company level are only considered in as far as these impact on economies at the terminal level.

Moreover, to the third hypothesis, it should be added that modern industrial economics asserts that economies of scale at company level are neither a necessary nor a sufficient condition for a company to be large. Economies are not necessary: companies can be large due to an expanding market, or due to accidental factors (Gibrat's law). Economies are not always sufficient either: sometimes, contracts may allow obtaining similar results like under a merger or acquisition. These properties of economies of scale company level will be reflected in economies at terminal level.

8. The eight and final constraint delineates the time perspective: the focus in calculating supply functions is on the short run. The reason for this is twofold. First, the literature in CHAPTER II shows that mergers and acquisitions are co-operation agreements which typically have a long-run mission, aiming more at market positioning than at costeconomizing. Cost-economizing appears to be a typical short-run mission for co-operation agreements like technology exchange agreements or customer-supplier relationships. This does not mean that in reality, a merger or acquisition by themselves do not generate synergies, or that agreements with a short-run mission do not have long-run market effects. Proof of the existence of long-run efficiencies through mergers and acquisitions is given in CHAPTER III. But as the efficiency aim is typically short-run, it is right to stick to short-run supply functions in this thesis. A second argument for considering the shortrun cost-function is typical to the container-handling business: merger and acquisition efficiencies typically only show up after a longer time: when equipment renewal or capacity extension for instance are required. Moreover, it takes time for the company to co-ordinate activities at a newly acquired terminal. This implies that the first years after a merger or acquisition usually have existing operating conditions maintained. Only after a few years, merger or acquisition synergies materialize. By that time, the operating and / or market environment at the terminal may have changed, which implies that the terminal is in a new situation, which equals a new cell in the matrix introduced in CHAPTER IV.

I.5. Methodology

Answering the research hypotheses requires a methodology which uses two main inputs: literature review and face-to-face meetings with business people. Throughout the research, these elements were processed in parallel.

1. A first input in the research process was a <u>literature review</u>, assessing both <u>port-economic</u> and broad <u>industrial-economic</u> literature, theoretical as well as applied to comparable business sectors. The aim of the literature review was to check how previous research has approached questions similar to our research question. Translation to the cargo-handling sector requires sufficient creativity. Further on, a review of literature dealing with the <u>operational and economic characteristics of cargo handling</u> was used for gaining knowledge about the sector.

For the literature review, use was made of university libraries worldwide, presentations from various conferences, and scientific literature available through the internet. For the specific operational data on cargo-handling, on the one hand specialized documents, such as reports by Drewry, Ocean Shipping Consultants reports, Marconsult, etc., and on the other hand data available through specialist sector websites and individual company websites were used.

2. A second research input was <u>meetings with cargo-handling stakeholders</u>, which include cargo-handling operators as well as shippers, shipping companies, hinterland transporters, and other related chain actors. Furthermore, a number of maritime and port experts and industry-watchers were consulted. The aim here was again to get a better understanding of the functioning of the cargo-handling sector.

Meetings with cargo-handling operators were arranged on a problem-specific basis. The Port of Antwerp has a port authority with specialized people on its board and its administration for nearly every field relating to cargo handling, and the port is host to a vast number of cargo-handling operators, shipping companies, hinterland transporters, agents, etc. The University of Antwerp through its Department of Transport and Regional Economics and its Institute of Transport and Maritime Management has close relationships with the local port and its companies, and besides its own specialists, often calls on a number of external specialists who watch the port sector closely. Having the Port of Antwerp closeby is an advantage, as it is one of the major ports in the world, also as far as containers are concerned, being host to a number of competing container-handling operators, and having recent experience with expansionist moves in container handling.

During the research process, the inputs were combined in the following setting, in order to confirm or reject the hypotheses.

- 1. It was acknowledged that a necessary element in the analysis of economies of scale at container terminals was the construction of <u>supply functions</u>. For this, use was made of company data and sector contacts. Company data mainly consist of production function indications and cost elements. Contacts from the sector supplement or qualify the available supply data.
- 2. In order to be able to frame the specific supply setting from which the existence of economies of scale was to be derived, a typology of terminal settings was to be developed. This task used sector data, of a quantitative nature where available, but often of a qualitative nature, as exact cost specifications often lack. Next, also contacts from the container-handling sector were called at, in order to complete the frame, qualify information from literature, and distinguish important factors from less important ones.

The resulting frame takes the form of a <u>matrix</u>, having as dimensions the factors that impact upon the size of cargo-handling efficiencies at terminals. Each cell then represents a specific set of conditions under which a terminal is operating. For each cell, specific supply and demand functions can be constructed.

3. It was deemed that estimating specific supply functions not only requires knowledge of all characteristics of the specific container-handling context at a terminal, but also a notion of how a container terminal relates to other terminals and its own and other markets. Equally

important is awareness of <u>dynamics</u> in container-handling markets. Market data as well as sector contacts helped getting grip, at least in a qualitative way, on <u>relationships</u> in container-handling and between container-handling companies and other actors in the transport chain.

4. An important element in building the framework of terminal settings as well as in visualizing and understanding sector relationships, is to know what are the <u>usual forms of expansion and co-operation</u> in container handling. Expansion and co-operation determine the specific conditions to which a company's terminals will be subject. They are also an important element in viewing the types of strategies and relationships that typify the container-handling business and particular companies. Company data and contact persons in various container-handling companies were the main input in this step of the methodology.

The four steps in the methodology, combining both literature and personal contacts like shown in the previous paragraphs, allow concluding on the three hypotheses in the following way.

- 1. The picture of forms of co-operation and expansion allows answering hypothesis 3 partially and in a qualitative way, namely to the extent that literature shows what forms of expansion and co-operation typically lead to what types of economies.
- 2. Sector dynamics and relationships allow answering all three hypotheses in a partial and qualitative way.
- 3. The matrix of container-handling conditions again answers part of all three hypotheses in a qualitative manner, as different cells are distinguished on the basis of different demand but especially different supply conditions.
- 4. Supply function estimations finally allow answering the first and the second hypothesis, not the third, as sufficient and consistent data for this part are lacking.

I.6. Text Outline

analyzes the importance of mergers and acquisitions in container handling, and gives an overview of other forms of expansion and co-operation in container handling and related sectors which alter supply and / or demand conditions.

CHAPTER III reviews the literature dealing with merger and / or acquisition efficiency analysis. The few useful industrial-economic applications to the cargo-handling sector are highlighted, as well as the possibilities for development of hypothesis testing methods similar to those applied in other businesses. Useful insights provided by general industrial-economic literature are selected. Special attention is paid to market structures, company goals and operational areas where expansion through merger and / or acquisition allows efficiency gains.

CHAPTER IV first of all defines the sub-activities that the container-handling product comprises in order to enable (un-)loading, storage and inter-modal delivery. Second, it also identifies the factors affecting supply and demand in container handling and introduces the matrix into which they may be organized. The factors are treated in four groups, in an order from less to more terminal-specific items: political factors, scope activities, chain interactions and terminal characteristics. Policy factors are the relevant actions undertaken by governments at several levels. Scope factors are the activities which a cargo-handling company may undertake in combination with cargo handling. Transport chain factors comprise the extent to which the cargo-handling company is vertically integrated or has vertical relations. Local terminal elements are those factors specific to the merger or acquisition targets. Each factor has a number of possible states which make a difference to supply and demand conditions.

CHAPTER V presents the supply estimations related to cells in the matrix of CHAPTER IV. Efficiencies can be derived from the cost functions, as well as a number of conditions under which efficiencies are larger or smaller. The conclusion in CHAPTER VI summarizes the results from the hypotheses tests. It also gives directions for future research, based on the gaps that remain or opportunities that arose during this research.

In summary, the relationship between chapters, literature and personal-contact inputs, and answers to hypotheses runs like in Figure I-1.





CHAPTER II: CO-OPERATION AND EXPANSION IN CONTAINER HANDLING: STRUCTURING THE FIELD

II.1. Rationale for the chapter

Although the focus in this thesis is on horizontal expansion in container handling through merger or acquisition, it cannot be denied that container-handling companies get involved into other forms of expansion and co-operation, and that these may impact to a larger or lesser extent the supply and demand conditions at their terminals. This chapter gives a framework for possible forms of expansion and co-operation based on their impacts on supply and demand conditions, and analyzes to what extent each of the forms is applied in the container-handling sector. This way, the chapter elaborates on the co-operation classification given in Heaver *et al.* (2000 and 2001) for maritime actors, and puts the container-handling actor into perspective.

The historical track record of the major container-handling companies is drawn and used as input to the chapter. The analysis provides various useful inputs to next chapters.

II.2. Co-operation definition

In general economic literature, the concept 'co-operation' has been defined in various ways, indicating either a narrow or a broad set of forms of inter-firm contact. Contractor and Lorange (1988, p. 5) use the term 'alliances' to indicate several specific forms of co-operation which range from full integration into one firm to pure market transactions. This thesis starts from the same broad perspective and distinguishes among a varied set of co-operative forms, in as far as necessary in view of container-handling supply and demand impacts.

II.3. Major container-handling companies

The major container-handling companies, for which co-operation track records are reconstructed, are the first six players from Drewry Shipping Consultants' 2003 throughput league. In 2003, those players were still seven, but in the meantime, two of them, DPA and CSXWT, merged, so that their throughputs are combined for this thesis' ranking.

		2003 TEU throughput	% of all container-ha	f total indling operators
	Operator	(mn TEU)	2001	2003
1	HPH	41.5	11	13.1
2	PSA	28.7	7.7	9.1
3	APM Terminals	21.4	6.5	6.8
4	P&O Ports	16	4	5.1
5	Eurogate	10.8	3.5	3.4
6	DPA + CSXWT	9.6	1.9	3
	Total	128	34.6	40.5

Table II-1: Top-six global container-handling companies

Source: Informare (2004e), Drewry Shipping Consultants (2002)

A comparison with Drewry Shipping Consultants' 1996 ranking learns the top positions have been occupied by about the same container-handling companies: HPH and PSA switched places, APM Terminals, as a merger of Maersk and Sea-Land terminals, leapfrogged P&O Ports, and the latter regrouping made Eurogate move one position up and made DPA enter in the top six (Drewry Shipping Consultants, 1998). SSA and especially ICTSI saw their global throughput share shrink over the period 1996-2003, the latter through the sale of its international division to HPH in 2001. Figure II-1 shows how the major container-handling companies have regrouped over time, and what their resulting throughput rank was. Full regroupings are in full lines, partial regroupings in dotted lines.

Using available capacity instead of actual throughput as a ranking criterion leads to the same top league: in 2001, only DPA ranked ninth in terms of capacity compared to sixth in terms of throughput (Drewry Shipping Consultants, 2002). DPA lost its sixth throughput position in 2002 (Drewry Shipping Consultants, 2003), but eventually regained this position after acquiring CSXWT in 2004. Important to note is that DPA's position was taken by growing container carrier operators Evergreen and Cosco. Not all carriers involved in container handling experienced similar throughput growth: MSC more than doubled its throughput figures over the period 2001-2003, Evergreen and Cosco saw their absolute throughput nearly double, whereas APL had a 16% increase.

	1996		2001		2003
1	PSA		, ▲ ▲ HPH		HPH
2	НРН	1	PSA		♠ PSA
3	P&O Ports	, i -	APM		APM
			▲ Terminals		Terminals
4	Maersk		P&O Ports		▲ P&O Ports
5	Sea-Land	<i>i</i> /	Eurogate		Eurogate
6	Eurokai		DPA		Cosco
7	DPA 🦯		// Evergreen		Evergreen
8	ICTSI ´		/ Cosco		DPA
9	SSA		Hanjin		SSA
10	Hamburger Hafen und		SSA		APL/NOL
	Lagerhaus				
11	Aktiengesellschaft (HHLA)	/ /			TITIT A
11	Pacific Ports Co.		HHLA		HHLA
12	Ceres Terminals Inc.	/ //	APL/NOL		Hanjin
13	Europe Combined /		NYK		MSC
1.4	l erminals	(<u> </u>	TT 1.		NINZIZ
14	Bremer Lagernaus /		Hyundai		NYK
15	Gesenschalt		COVWT		OOCI
15			Mitaui OSV		CSYWT
10	APL/NOL	/	Lines		CSAW I
17	OOCI				Mitsui OSK
1/	OOCE		OUCL		Lines
18	Haniin		K Line		Dragados
19	Mitsui		Dragados		K Line
20	Fyergreen		TCB		TCB
20	K Line		MSC		ICTSI
22	Cosco		ICTSI		P&O
			ie i bi		Nedllovd
23	CSXWT		Yang Ming	///	i (Ganoja
			Line	¥	
24	Terminal Contenedores de				
	Barcelona (TCB)		/		
25	Yang Ming Line	//			
	Hyundai	()	1 /	//	
	Hessenatie		Hessenatie	1	
	Noord Natie	1	Noord Natie		
	Contship Italia sa	1		l	
	Sinport Sinergie Portuali	1			
	Egis Ports		Egis Ports		
				(1000	

Figure II-1: Container-handling regroupings and rankings over time

Source: own composition based on Drewry Shipping Consultants (1998 and 2003) and Informare (2004e)

The co-operation track records of HPH, PSA, APM Terminals, P&O Ports, Eurogate and DPA are shown in appendix A.3. Dealing with these six operators implies also considering the co-operation history of ICTSI and ECT, whose international division respectively full activities were acquired by HPH; HesseNoordNatie and Sinport Sinergie Portuali, which were both acquired by PSA; Sea-Ro Terminal nv, acquired by HesseNoordNatie; Sea-Land, acquired by the A.P. Möller Group which also APM Terminals is part of; Egis Ports, acquired by P&O Ports; BLG Logistics and Eurokai, which jointly created Eurogate; Carl Tiedemann GmbH & Co, which was acquired by Eurokai; Contship Italia sa, acquired partly by Eurokai and partly by EUROGATE; CSXWT, which was acquired by DPA.

It should be noted that in the case of APM Terminals, terminals started up under or acquired by A.P. Möller previous to its APM Terminals subsidiary creation, which were all collected under APM Terminals later, are considered to have been started up or acquired by APM Terminals. Non-cargo-handling investments by A.P. Möller are not assigned to APM Terminal's balance.

For Eurogate, all of the BLG Logistics investments are considered. This is motivated by the observations that Eurogate is closely interlinked with the BLG Logistics group. Eurogate's policy is largely coupled to BLG Logistics' strategy, some BLG Logistics divisions have started up or acquired terminals which are complementary or certainly are not competitive to Eurogate's terminals, and other BLG Logistics divisions are using Eurogate's services on internalized account terms.

II.4. Co-operation in container handling

Different (combinations of) criteria for distinguishing among forms of co-operation are used by different authors. Some authors limit themselves to one characteristic to distinguish among several varieties of co-operative forms, whereas others prefer a simultaneous combination of criteria.

Combining several dimensions leads to a multi-dimensional ranking of forms of co-operation. The more dimensions are incorporated, the better forms of co-operation can be characterized. This thesis comes to a classification combining 14 dimensions, integrating the dimensions suggested by various authors.

The classification developed in this thesis is mainly based on Nooteboom (1999, p. 66-67), who provides one of the most complete classification systems available in the literature by combining nine dimensions: legal form, number of participants, duration, range of joint assets, distribution of asset ownership among the participants, range of activities in which cooperation takes place, intensity of co-operation, distribution of decision rights and network pattern of relations between participants. To these dimensions are added from other authors: geography and nationality, vertical or horizontal co-operation, risk, compensation and mission. All authors assign a number of possible states to the previous dimensions. In this section, the states for each of the dimensions are screened for their occurrence in container handling. Supporting use was made of Hansmann (1996) for structuring forms of company ownership.

II.4.1. Legal form

The first dimension focused on is the legal form of the co-operation agreement. Osborn and Baughn (1990, p. 504-505) separate forms of co-operation into market-dominated forms like contractual agreements on the one hand, and hierarchically dominated forms like joint-ventures on the other hand. Nooteboom (1999) and Hagedoorn (1993, p. 374-375) distinguish among the forms of Table II-2, which besides legally enforceable forms of co-operation also contains so-called relational forms of co-operation (Nooteboom, 1999, p. 70). Legally enforceable forms can also be called authoritarian, whereas relational forms are then called deliberational (Nooteboom, 1999, p. 70)

Table II-3 gives an overview of the legal-form values mentioned by Bresser (1988). They are ranked according to their level of formalization.

A further series of legal-form values are ranked by Fombrun and Astley (1983) according to their degree of restraint. In Table II-4, a distinction is made among bilateral and multilateral forms of co-operation.

Limited company	Legal partnership	Society	Foundation	Contract
∢		 	 	
Joint venture		1 1 1	Association	R&D agreement
Research corporation	h	 	 	Information exchange
				agreement
Minority investment		1 1		Customer-supplier
				relationship
		 		One-directional
				information flows
				Joint advertising
		• 		arrangements
		 		Joint advertisin arrangement

Table II-2: Nooteboom's (1999) legal-form dimension

Source: Nooteboom, 1999, p. 66-67 and Hagedoorn, 1993, p. 374-375

Degree of formalisation	Form of co-ordination				
High	Collective lobby				
High	Contractual agreement				
High	Merger				
High	Joint venture				
Medium	Connected board of commissioners				
Medium	Commercial association				
Low	Secret understanding and industrial leadership				
	Source: Bresser, 1988				

Table II-3: Bresser's (1988) legal-form dimension

Degree of restraint	Bilateral structures	Multilateral structures
Low	Informal meeting	Study group
	Informal agreement	Commercial association
	Formal contract	Secret agreements
	Joint venture	Cartel
High	Merger / acquisition / takeover ¹	Joint venture

Table II-4: Fombrun et al.'s (1983) legal-form dimension

Source: Fombrun and Astley, 1983

The six major container-handling companies considered do not seem to have appealed to legal partnerships, societies or joint study groups. Connected boards of commissioners seem to be very rare from the very limited data that are available on container-handling companies' commissioners. Interlocking, or the phenomenon whereby board members and / or managers swap company, indirectly leads to connection, although not of co-operative nature. Foundations have been used only to a very limited extent in container handling, and only in one case such foundation was co-operative, namely Europe Combined Terminals' (ECT) staff foundation in 1999. Li Ka Shing brought Hutchison Whampoa (under which HPH was later formed) under the Li Ka Shing foundation. In a wider port context, associations like FEPORT represent private port operators' interests. They can be considered as collective lobby organisms or commercial associations. In an even wider context, there are sea port associations like ESPO or AAPA which represent entire sea ports. In contrast to the above-mentioned legal forms, which are not or only moderately used, limited companies and contracts are very often used.

Limited companies have been started up co-operatively as well as non-co-operatively, and often they have also been acquired or subject to merger. Container-handling companies have started up or acquired limited companies in container-handling as well as in other related or non-related sectors. Table II-5's figures pack together container-handling and non-container-handling limited companies. Figures between brackets show the numbers of limited companies started up or acquired by companies or business units which were at some point in

¹ The difference between a takeover and an acquisition is that with a takeover, the new companies are not integrated. They do normally not occur in container handling.

time acquired by one of the six major container-handling companies. Those figures between brackets are not included in the figures before the brackets.

Only limited companies initiated or acquired by any of the six major container-handling companies are counted in Table II-5. When the main company or one of its subsidiaries itself was acquired, this is not allocated to the company's account. Neither is the disappearance, through bankruptcy or other cause, of the main company or one its subsidiaries registered on the company's account. Sequential partial acquisitions of the same limited company, or partial acquisitions following a co-operative start-up are dealt with as separate acquisition moves. When two or more subsidiaries of one of the six main container-handling companies are involved in the same start-up or acquisition move, this is considered to be one single move.

Company name changes² are not interpreted as start-up moves. Neither are start-up subsidiary companies which only act as holding companies and which only acquire limited companies acquired or started up by the company earlier, or which only start up subsidiary companies, but which in any case do not have economic activities in their own name. But if the holding company changes the major operator's ownership share of previously acquired or started subsidiaries, the holding company needs to be taken into account. Acquisitions of and mergers with limited companies which only act as holding companies are treated in a similar manner: they are not taken into account. Only the latter's earlier acquisitions and start-ups in the figures between brackets are considered. Failed attempts to start up or acquire or merge (due to lost bids, early withdrawal after expression of interest or start of bidding process, etc.) are not counted either.

		Start-up co-	Start-up non-co-	Merger /
	Operator	operatively	operatively	acquisition
1	HPH	25 (16)	2 (5)	26 (4)
2	PSA	83 (27)	35 (20)	18 (10)
3	APM Terminals	11 (3)	17 (1)	15
4	P&O Ports	22	2	16 (4)
5	Eurogate	34 (7)	60 (11)	19 (13)
6	DPA + CSXWT	2 (7)	8 (5)	(3)

Table II-5: Container-handling operators' limited companies over their life time

² With company name changes, the newly started-up company exactly replaces the old one whose name disappears and whereby ownership remains spread in an equal manner.

Form of co-operation	Many						► Few
Merger/acquisition	HPH	Eurogate	P&O Por	ts			DPA
		PSA	APM	Termin	als		
Start-up co-operatively	PSA				Eurogate	P&O Ports	DPA
					HPH	APM T	erminals
Start-up non-co-	Euroga	te		PSA	APN	M Terminals	HPH H
operatively						DPA P&	20 Ports

Figure II-2: The major six container-handling operators' relative position

From Table II-5 and Figure II-2, it can be observed that HPH, PSA and P&O Ports have started up far more limited companies co-operatively than non-co-operatively, whereas APM Terminals, Eurogate and DPA/CSXWT have started up more companies non-co-operatively. The number of limited companies started up (co-operatively as well as non-co-operatively) outweighs the number of mergers and acquisitions for all of the operators. Some of the co-operative start-ups are minority investments and / or are research corporations, and these are dealt with in more detail in Sections II.4.5 and II.4.6 respectively.

Contracts are used by container-handling operators to an even larger extent than limited companies, be it rather vertically than horizontally: in order to acquire inputs (labour, IT services, leasing, maintenance, know how, etc.), where they often function as R&D agreements, or in order to bind customers (shipping lines), where they are pure customer-supplier relationships, or in order to provide additional services to customers, like for instance shuttle services from sea ports to inland terminals from where further dispatching occurs. In each of these cases, there can be information exchange or one-directional information flow agreements.

The presence of informal meetings is harder to discover than the existence of limited companies, contracts and foundations. Some business literature refers to meetings between top managers of the major container-handling operators, but the existence and the scope of these meetings is hard to prove and assess, since they are informal by nature. In any case, there seems to be no trace of the existence of a financial or other group of container-handling companies, in the sense mentioned by Weinstein and Yafeh (1995). Informal or secret agreements among container-handling operators are not very likely, just as cartel agreements, like those applied in maritime and air transport for controlling and / or pooling capacity and

tariffs, due to the competitive nature of the business. CHAPTER III deals with this in more detail. One may, in the absence of self-regulatory retaliation techniques, expect for an agreement to be effective that it is formalized on paper.

Usually, legally enforceable forms of co-operation are closed in number of participants and activities to be included, whereas deliberational forms of control are open and leave more degrees of freedom to the participants (Nooteboom, 1999, p. 70). The number of participants and the range of activities included are dealt with in Sections II.4.2 respectively II.4.6.

II.4.2. Number of participants

Nooteboom's (1999) second co-operation dimension is the number of participants involved.

Many	Several	Two
✓Franchise, association	Consortium	Joint venture
C.	Nastahaam 1000 n 66 67	

Table II-6: Number-of-participants dimension

Source: Nooteboom, 1999, p. 66-67

Although Nooteboom (1999) does not delineate the concepts 'several' and 'many' with exact numbers, the literature seems to agree that a co-operation agreement among eight participants is still considered to be a consortium. Table II-7 reveals that none of the six major container-handling operators is involved in co-operation agreements with more than eight participants. The only exception is their membership of business sector associations like FEPORT, which defend interests of a large number of members.

In Table II-7, a distinction is made between on the one hand acquisitions, where by definition two companies are involved, and start-ups and mergers on the other hand. For the latter group, a further distinction is made according to the number of participants involved. Also solo-start-ups are mentioned in Table II-7, although those are not co-operative, but they function as a benchmark. New terminals started up under the same limited company or other legal form are counted as separate start-ups, and in such case the limited company is not interpreted as a start-up. Forms of co-operation other than limited companies are included where applicable.

Note that in some cases start-ups of distinct terminals in the same location are considered as one start-up when the exact number of terminals erected or the exact date of creation of the new terminal is not known. Therefore, the number of start-ups in Table II-7 is the absolute minimum and may be an underestimation. Purely contractual agreements are not included in Table II-7.

Just like with Table II-5, Table II-7's figures bring together container-handling and noncontainer-handling initiatives. Figures between brackets again show the numbers of acquisitions respectively start-up initiatives and mergers undertaken by companies or business units which were at some point in time acquired by one of the six major container-handling companies. Double counting therefore is again avoided. Initiatives not initiated by the major container-handling company are not taken into account, and neither are disappearances of companies or business units. Sequential acquisitions of the same company or business unit are again treated as separate moves. Name changes do not count, and neither do start-ups of holding companies involving no ownership share change nor do failed start-up or acquisition attempts.

	Operator	Acq.		Merger/start-up							
			1	2	3	4	5	6	7	8	?
1	HPH	26 (4)	5 (6)	14 (8)	3 (1)	2	1 (1)	0	0	0	14 (5)
2	PSA	17 (10)	41 (30)	12 (8)	3 (4)	7 (1)	3	0	0	0	64 (15)
3	APM Terminals	13	14 (15)	9 (1)	3 (1)	0	(1)	(1)	0	0	0
4	P&O Ports	16 (4)	5	5	6	1	1	1	1	1	6
5	Eurogate	16 (12)	61 (12)	1 (1)	1 (1)	1	0	0	0	0	30 (6)
6	DPA + CSXWT	(3)	10 (5)	2 (6)	(1)	0	0	0	0	0	0

Table II-7: Container-handling operators' number of co-operation participants

Figure II-3: Average number of participants for the six major container-handling operators' mergers and co-operative start-ups

Many (eight)			⊳ Two
			HPH
	PSA		
	1.011		APM Terminals
			AI WI Tellilliais
		P&O Ports	
	Eurogate		
		DPA	
•			

Table II-7 and Figure II-3 show that of all mergers and start-ups for which the partners are known, 62% are initiated non-co-operatively, 23% involve two participants, more than 7% have three participants, and nearly 4% have four participants. It should be noted that the last column of the table, representing the mergers and start-ups for which the number of participants is at least two but is not known exactly, has considerable amounts of undetermined mergers and start-ups. Especially for PSA, the exact number of participants could often not be determined. Knowing that the last column refers to initiatives with at least two participants, it is confirmed that HPH, PSA and P&O Ports clearly have more co-operative than non-co-operative initiatives, whereas the reverse is true with APM Terminals, Eurogate and DPA/CSXWT.

The number of participants in co-operative ventures however is sometimes subject to changes. Referring back to the data from Table II-5, for co-operative start-ups and partially acquired limited companies an analysis is made of the number of companies of which the number of participants changed while the operator in focus or its subsidiaries (figures between brackets) were involved. The operator's own entry and eventual exit moves are not incorporated in Table II-8. A participant's exit and later regain of ownership is counted as two ownership changes. Ownership-structure changes where the partners involved are not known, are not dealt with in Table II-8, since it is impossible to discern in this case whether the move is merely an internal reshuffling of ownership shares or whether one or more partners enter or leave the company. A replacement of one owner by another in one large move at about the same time is not interpreted as a change in number of participants.

	Operator	Participant number changes
1	HPH	7 (13)
2	PSA	5 (3)
3	APM Terminals	2 (1)
4	P&O Ports	6
5	Eurogate	3
6	DPA + CSXWT	0

Table II-8: Container-handling operators' changes in number of co-operative partners

Table II-8 indicates that a change in number of participants is not that frequent compared to the total number of co-operative limited companies started up or acquired. Note moreover that HPH's high figure for subsidiaries is highly determined by the ECT holding ownership change, which causes all of its container-handling subsidiaries to have ownership changed, all of the changes being interpreted as separate ownership changes although being caused by one move. Not indicated in the table is that most participant-number changes involve only one partner joining or leaving, and involve the same limited company only once.

II.4.3. Duration

Duration of the co-operation initiative is Nooteboom's (1999) third dimension. Backman 1983) makes a distinction between temporary and permanent co-operation agreements. Nooteboom adds latent as an intermediary value in Table II-9.

Table II-9: Duration dimension

Continuous	Latent	Once
4		
	Source: Nooteboom 1999 n 66-67	

Source: Nooteboom, 1999, p. 66-67

Most of the co-operation agreements dealt with in Table II-5 and Table II-7 are meant to be forms of continuous co-operation. This contrasts with contractual co-operation, which, as stated higher, is in most cases not used as a means to expand container-handling activities, and therefore often takes short(-er)-term perspectives. Table II-10 uses the co-operation agreements from Table II-5 and looks at how many of the co-operation agreements were stopped in the meantime.

An agreement is considered as ended when it fulfils one of these conditions.

- The co-operative venture stopped activities.
- The number of participants to the venture was reduced from more than one to exactly one, which means that the specific operator bought all of the other partners' shares, so that he remained as the sole owner.
- The operator sold all of his shares in a venture.

Under consideration are ventures which were earlier started up co-operatively or which became co-operative agreements later, and businesses which were partly acquired or were at first fully acquired and later sold partly to another operator. In Table II-10, stopped containerhandling and non-container-handling co-operation agreements are merged. The figure between brackets is a stopped co-operation agreement due to share sale, which was later reactivated by means of partial re-acquisition.

	Operator	Co-operation stopped
1	HPH	4 (2)
2	PSA	13
3	APM Terminals	6
4	P&O Ports	1
5	Eurogate	2
6	DPA + CSXWT	2

 Table II-10: Container-handling operators' stopped limited company co-operation agreements

Compared to the Table II-5 figures, Table II-10's figures are very low, which shows that most co-operation agreements are meant to and do indeed last for a longer period of time.

II.4.4. Range of joint assets

Notoeboom (1999) has the range of assets as a fourth dimension to distinguish among forms of co-operation.

	0	
Full range	Specific range	No
4		
Joint venture	Co-makership	Associations
	Source: Nooteboom, 1999, p. 66-67	

Table II-11: Range-of-joint-assets dimension

Associations like FEPORT for port companies and ESPO or AAPA for sea ports mentioned higher share no assets, only common interests. Co-makership applies to nearly all contractual relationships in container-handling: when a container-handling operator contracts a shipping company, mutual use of specific assets is agreed upon in order to produce a certain output which serves customers. Co-makership is also applied for developing certain inputs like IT systems: an IT contractor dedicates a certain number of people and capital goods to a specific terminal in order to start up a certain system, whereby the IT personnel gets contractual access to certain assets of the container-handling company at the terminal. Joint ventures, or by

extension limited companies with more than two participants, whether by initial joint creation or by partial acquisition, are widely used in container handling, as was shown in previous sections. All assets specific to the joint venture are (prone to be) shared by the participating companies.

II.4.5. Distribution of asset ownership

Next to the number of participants and the range of assets shared, Nooteboom (1999) judges the actual way in which asset ownership is shared among participants an important distinguishing factor among forms of co-operation.

	F and a set of the s
Skewed	Uniform
4	
Dominated Joint Venture	Balanced Joint Venture

Table II-12: Asset-ownership-distribution dimension

Source: Nooteboom, 1999, p. 66-67

Table II-13 summarizes asset ownership for co-operation agreements started up or acquired by container-handling companies, based on the data from Table II-5. Focusing on co-operation agreements means that solo-start-ups are not considered. In the case of dominated co-operation limited companies, no distinction is made between the container-handling operator dominating or one or more of the partners. Neither is a distinction made between highly or moderately dominated co-operation agreements: when ownership division is equal among participants, the agreement is considered to be balanced, in all other cases it is not. Limited companies for which not all owners' shares are known, are classified as companies for which ownership division is not known. An exception is made when the operator's ownership share is higher than 50%, which is clearly a situation where ownership must be unbalanced and therefore dominated.

		Balanced	Balanced	Dominated	Dominated	Unknown	Unknown
	Operator	start-up	acquisition	start-up	acquisition	start-up	acquisition
1	HPH	9 (7)	5 (1)	14 (8)	12 (15)	2 (1)	
2	PSA	(7)	1 (2)	61 (8)	17 (9)	7 (6)	
	APM						
3	Terminals	3	1	5 (3)	15	3	
	P&O						
4	Ports	1	(1)	19	14 (6)	2	
5	Eurogate	4		9(7)	13 (1)	12	5
	DPA +						
6	CSXWT	(3)		(3)	(1)	2 (1)	(2)

 Table II-13: Container-handling operators' limited company asset ownership distribution

Table II-13 shows that dominated start-ups and acquisitions generally occur a lot more than their balanced counterparts, except in the case of DPA/CSXWT's start-ups, where both figures are equal. Even if all co-operation agreements for which the ownership division is not known, are considered as balanced, dominated agreements generally outweigh balanced agreements, except in the case of Eurogate's and APM Terminals' start-ups and all of DPA/CSXWT's agreements.

Table II-8 showed that the number of partners in agreements changes not that often. Table II-14, which is based on Table II-8, shows that changes in ownership division are much more frequent. Note that Table II-14 includes more than just shifts from balanced to dominated agreements: the shift can be of any size, but in any case not 100%, since this is a first and full entry into a company, a move which is not included.

	Operator	Ownership division changes
1	HPH	22 (9)
2	PSA	23 (4)
3	APM Terminals	5 (3)
4	P&O Ports	9
5	Eurogate	27 (10)
6	DPA + CSXWT	(1)

Table II-14: Container-handling operators' changes in asset ownership distribution

The number of ownership changes in general is a multiple of the number-of-participants changes. Only DPA experienced very few changes in its subsidiaries' ownership structure.

II.4.6. Range of activities in which co-operation takes place

The range of activities incorporated in the agreement is Nooteboom's (1999) sixth dimension in distinguishing forms of co-operation. This dimension is closely related to the range of assets included in the agreement, as the activities will determine the assets to be included. Nooteboom's values are summarized in Table II-15.

Extensive	Considerable	Limited
4		
Joint Venture	Co-makership	Association
	Source: Nooteboom, 1999, p. 66-67	

Table II-15	Range-of-activities	dimension
-------------	----------------------------	-----------

The observations for the six major container-handling operators conform to those made in Section II.4.4: all three degrees of inclusion of activities are found in container-handling. Apart from the extensiveness of the co-operation agreement, the exact fields of co-operation are important. Root (1988, p. 71) therefore assesses co-operation possibilities over the valueadded chain and ends up with the structure of Table II-16, which, although originally set up for manufacturing industries, also applies to container handling.

Table II-16: Activity dimension combined with legal-form dimension
--

Ownership	Contractual agreements	Equity joint ventures
Value-added chain		
R&D	Turnkey contract	
Raw materials /	Supply agreement,	
component manufacture	representative licensing	
	agreement, turnkey contract,	
	contract manufacturing	
	agreement	
Assembly	Representative licensing	
	agreement, turnkey contract,	
	contract manufacturing	
	agreement, co-production	
	agreement	
Marketing	Foreign distributorship	Equity joint venture
	agreement, representative	
	licensing agreement	
Distribution / customer	Representative licensing	Equity joint venture
service	agreement	

Source: Root, 1988, p. 71

Co-operation in R&D is often used by container-handling companies in order to have at their disposal good technologies and ICT systems. Turnkey contracts seem to be most frequent there.

Raw materials in case of container handling are the containers to be moved on or off ships. Contractual supply agreements between shipping companies on the one hand and containerhandling operators on the other hand ensure the provision of a certain amount of containers during a certain period of time, no matter the specifics of the arrangements: dedication of part of or the entire terminal capacity, preferential treatment, etc. Representative licensing, turnkey contracts and contract manufacturing agreements do not apply to container handling.

Assembly translates to the container-handling sector as the actual moving of containers. Socalled management contracts in fact are turnkey contracts when the terminal's entire container-handling business is run by the contractee, or they are contract manufacturing agreements when only part of the business is contracted while the remainder stays in the hands of the contractor. Co-production is not familiar in moving containers, and neither is licensing. It should be noted that management contracts in most cases transcend the assembly activity and also include R&D, container supply, marketing and customer service.

Separate contractual marketing agreements appear to be very rare in container handling, and neither is evidence found of marketing joint ventures set up by one of the major containerhandling companies. The same observation applies to customer service: separate contracts or companies are not formed solely for this activity. Distribution of course does not apply to container handling, as the actual moving of containers on and off ships in se is some form of distribution.

Buckley and Casson (1998) specify forms of co-operation where two participants co-operate in either technology sourcing or marketing or both. As pure marketing arrangements are not found in container handling, the corresponding cells are marked grey in Table II-17.

<u> </u>				5.4	
	Firm 2	Technology	Marketing	Both	
Firm 1					
Technology		R&D collaboration	Market access by	R&D collaboration	
			Firm 1 to Country B	with access to market	
				B (Firm 2 'buys	
				back')	
Marketing		Market access by	Collusion in markets	Firm 2 supplies	
		Firm 2 to Country A	A and B	technology for use in	
				both markets (Firm 2	
				'buys back')	
Both		R&D collaboration	Firm 1 supplies	R&D collaboration	
		with access to market	technology for use in	with access to both	
		A (Firm 1 'buys	both markets (Firm 1	markets (both firms	
		back')	'buys back')	'buy back')	

Table II-17: Activity dimensions for two-firm co-operation

Source: Buckley and Casson, 1998, p. 112 – 117

Pure R&D collaboration occurs when the two container-handling operators are already present in the specific market. Sinport Sinergie Portuali's start-up of Terminal Darsena Toscana together with Italian partners CLP and Sintermar is especially meant to forge all three participants' strengths. R&D collaboration with market access for one of the two firms occurs when one participant enters a new market, which the other participant is already familiar with. HPH's start-up of Korea International Terminals combined Hanjin's and Hyundai's familiarity with the Korean market and their experience in container-handling. R&D collaboration with market access for both participants involves two container-handling companies who are not familiar with the specific market. ICTSI's and American President Lines' joint start-up in Karachi was a new-market entry for both participants.

II.4.7. Intensity of co-operation

Nooteboom (1999) measures intensity of co-operation in terms of mutual dedicated adjustment, type and extent of knowledge exchange, frequency of meetings and / or exchange of staff. This type of indicators is hard to measure in container handling. Observation however learns that the classification of the forms of co-operation is similar when using legal form and duration are criteria rather than intensity of co-operation. Moreover, exchange of staff in container handling observably never goes so far as to create a group of interrelated companies in the sense of Weinstein and Yafeh (1995).

II.4.8. Distribution of decision rights

The basic division to be made here is that used in Section II.4.5, between skewed and uniform distribution. Anderson and Gatignon (1986) however develop a more detailed typology of cooperative forms according to the strength of decision control, outlined in Table II-18. Control is defined as the ability to influence systems, methods and decisions. It allows to obtain a higher share of returns, but it also implies the need to assume responsibilities and risks. A fully-owned subsidiary is a non-co-operative form and therefore stands between brackets.

Table II-18:	Distribution-o	f-decision	-rights d	limension
--------------	-----------------------	------------	-----------	-----------

High-control modes: dominant equity interests:
(Wholly-owned subsidiary)
Dominant shareholder (many partners)
Dominant shareholder (few partners)
Dominant shareholder (one partner)
Medium-control modes: balanced interests:
Plurality shareholder (many partners)
Plurality shareholder (few partners)
Equal partner (50/50)
Contractual joint-venture
Contract management
Restrictive exclusive contract (e.g. distribution agreement, license)
Franchise
Nonexclusive restrictive contract
Exclusive nonrestrictive contract
Low-control modes : diffused interests :
Nonexclusive, non-restrictive contracts (e.g. intensive distribution, some licenses)
Small shareholders (many partners)
Small shareholders (few partners)
Small shareholder (one partner)

Source: Anderson and Gatignon, 1986, p. 5

For the limited-company structures from Table II-18, the decision-rights situation of the container-handling sector is shown in Table II-19. This table details data from Table II-7 and Table II-13 and takes the perspective of the specific operator's decision rights.

	Operator	Acquisition			Start-up												
					2 participants			3 participants			4 participants						
		Ma	Pl	Mi	?	Ma	Pl	Mi	?	Ma	Pl	Mi	?	Ma	Pl	Mi	?
1	HPH	16	3(3)	7(1)	0	0	3	3(2)	(1)	2	1	2	0	0	0	0	1
2	PSA	6(5)	3(1)	8(1)	0	1	6(1)	7(1)	2	0	1	3 (1)	1	0	3	1	(1)
	APM																
3	Terminals	1	1	9	0	1	2	1	1(1)	0	0	1	1	0	0	0	0
	P&O																
4	Ports	13	1	4	0	0	3	1	0	1	1	5	1	0	0	0	0
5	Eurogate	4(4)	(2)	3(3)	1	0	0	0	0	0	0	0	1	0	0	0	0
	DPA +																
6	CSXWT	0	0	(1)	(1)	0	0	0	0	0	(1)	(2)	2	0	0	(1)	0

	Operator		Start-up														
		5	partic	ipants		6 participants			7 participants			8 participants					
		Ma	Pl	Mi	?	Ma	Pl	Mi	?	Ma	Pl	Mi	?	Ma	Pl	Mi	?
1	HPH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	PSA	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
	APM																
3	Terminals	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	P&O																
4	Ports	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1	0
5	Eurogate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DPA +																
6	CSXWT	0	0	0	(1)	0	0	0	0	0	0	0	0	0	0	0	0

	Operator				
			? participants		
		Ma	Pl	Mi	?
1	HPH	1	1(1)	4	(1)
2	PSA	3(1)	6	40(2)	5(5)
	APM				
3	Terminals	0	1	1	0
	P&O				
4	Ports	1	0	2	1
5	Eurogate	2(2)	1(1)	16(4)	4
	DPA +				
6	CSXWT	0	0	0	0

A dominant position in Table II-19 is considered to be one where the operator has 80% or more of the shares, but not all of them in case of a start-up, since then there is no co-operation in the venture. The number of such start-ups is already known from Table II-7. A plurality position then is one with ownership of shares between 50 and 80%. A small shareholder

finally is one who owns less than half of the shares. 50% start-ups are not considered in Table II-19.

PSA, APM Terminals, Eurogate and DPA/CSXWT clearly have more minority than majority or plurality start-ups and acquisitions. P&O Ports's start-ups and acquisitions are nearly equally spread between majority and minority ones, whereas HPH has more majority start-ups and acquisitions. Plurality start-ups and acquisitions are the smallest category for HPH, P&O Ports and Eurogate.

Having the six major container-handling operators' acquisitions in focus learns that most of them are of such nature that the major container-handling operator takes or already has a dominant position. Only APM Terminals has clearly made more minority acquisitions than plurality or dominant acquisitions. These observations imply that except for APM Terminals, all of the major container-handling operators have gained substantial control in their acquired companies. No link is made however to the number of participants which were involved in the acquired company before and after the acquisition.

The start-ups of HPH, PSA, P&O Ports and Eurogate are mostly minority start-ups. For HPH, the number of participants in most cases is limited to two or three, which strengthens their minority control. P&O Ports has relatively less control over its start-ups since the average number of participants is higher. For PSA and especially Eurogate, the number of participants for its start-ups is in most respectively all cases not known, which makes concluding on their effective decision power difficult. For APM Terminals and DPA/CSXWT, there is no clearly dominating start-up form.

Devlin and Bleackley (1988) measure control as restraint and its counterpart autonomy, as in Table II-20.

Degree of restraint			
High			Low
Acquisition	Merger	Classical strategic alliance	Independent approach
Degree of autonomy	I		
Small			Large
	C		



Source: Devlin and Bleackley, 1988

From Table II-5, it is known that for HPH and P&O Ports, the number of mergers and acquisitions outweighs the number of non-co-operative start-ups, which implies that those operators have relatively smaller autonomy compared to operators like PSA, Eurogate, DPA/CSXWT and to a lesser degree APM Terminals, who clearly have more non-co-operative start-ups than mergers and acquisitions. Classical strategic alliances are very hard to initiate in container handling, due to the location-bound nature of the business.

Nooteboom (1999, p. 65) couples distribution of decision rights to ownership distribution in order to rank different forms of organization, as in Figure II-4. Financial concentration measures the way asset ownership is distributed, like in Section II.4.5, whereas organizational concentration multiplies the operator's specific asset ownership share (Section II.4.5) by the square root of the number of participants (Section II.4.2), in order to get a division like in Table II-18.

From Figure II-4, the forms licensing, industrial district, keiretsu, virtual firm, franchise, and purchasing co-operative are not applied by container-handling operators. A retail chain structure by its nature is impossible in a container-handling context. On average, the six major container-handling operators' acquisitions fit into Nooteboom's (1999, p. 65) structure like in Figure II-5, their start-ups do like in Figure II-6.

Organizational	
concentration of decisions 1	Centralized single owner firm
0.9	Firm with large bank finance
0.8	Centralized firm with dispersed shares
0.7	Dominated joint venture
0.6	Retail chain
0.5	Traditional supply Balanced joint venture Purchasing co-operative
0.4	Consortium Franchise
0.3	Co-makership Divisionalized Keiretsu firm
0.2	Industrial district Virtual firm Association Holding company
0.1	Contract Licensing
0	0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 Financial Source: Nooteboom, 1999, p. 65 of ownership

Figure II-4: Decision-rights dimension combined with ownership-distribution dimension







Figure II-6: The six major container-handling companies' average distribution of decision rights and ownership for mergers and start-ups

Root (1988, p. 75-76) measures the degree of control by combining ownership distribution with relative bargaining power in the specific case of joint ventures. The exercise of control is more important the stronger the agreement contributes to a greater share of the company's growth or profit or other indicator in case an other activity goal applies.

Ownership of partner	Minority	50:50	Majority
A	joint venture	joint venture	joint venture
Relative			
bargaining power			
of partner A			
Inferior	Very weak control	Weak control	Shared control
Equal	Weak control	Shared control	Strong control
Superior	Shared control	Strong control	Very strong control

Table II-21: Relative bargaining power, ownership and control in joint ventures

Source: Root, 1988, p. 75-76

As shown in Table II-21, stronger control can be obtained by increasing bargaining power and / or ownership. Little is known however about the exact bargaining power of container-handling operators in the joint ventures they set up, not only with container-handling partners, but also with partners involved in other sectors of the logistics chain or even unrelated partners.

Control and bargaining power can be determined by the degree to which companies are interrelated. The situation of Weinstein and Yafeh's (1995) and Amel and Rhoades' (1988) company groups, with very strong mutual ties among companies, is not found among the major container-handling companies: there is no mutual shareholding, no reciprocal management, and no mutual functioning as lender.

II.4.9. <u>Network pattern</u>

Nooteboom's (1999) ninth and last dimension is the network pattern of relations between participants.

Hub and spoke	Parallel connections
Associations	Research consortium

Table II-22: Network-pattern dimension

Source: Nooteboom, 1999, p. 66-67

Container-handling associations like FEPORT have a hub-and-spoke structure, where the association management has loose links with members. In co-operative start-ups, acquisitions and mergers in container handling, participants have parallel connections, depending on the division of decision fields among them. Contractual container-handling agreements also lead to parallel relations between participants in most cases.

II.4.10. Geographic scope and nationality

Geographic scope is a co-operation dimension not mentioned by Nooteboom (1999) but by other authors, like for instance Root (1988). The geographic scope of the agreement may be confined to the own (domestic) country, a foreign country, a multi-country region, or the entire globe. That scope may be determined on the basis of an operations market on the one hand, for instance in the case of co-operation for technology or component acquisition, or a target market on the other hand, for instance in the case of co-operation for technology or component acquisition, or a target II-23, the combination of the elements scope and activities is completed with corresponding types of co-operation.

		r	
Geographic	Home country	Foreign country	Regional / global
scope			
Mission			
Technology sourcing			
Components /	Subsidiaries		
assembly sourcing	Co-operation		
	agreements		
Market entry		Distributor / agent	
		contracts	
		Licensing	
		Franchising	
		Technical agreements	
		Service contracts	
		Joint ventures with	
		local partners	

Table II-23: Geographic-scope dimension combined with activity range

Source: Root, 1998, p. 72-73

Building further on the base data from Table II-7, it can be analysed how many ventures have been started up or acquired at home and abroad. A distinction is made among non-co-operative and co-operative start-ups. Acquisitions are automatically considered as co-operative forms in Table II-24. The domestic character is determined by the operator's country of incorporation: if the venture is located in a different country than the country of registration, the venture is considered to be abroad. Countries of registration are like in Table II-25. Figure II-7 summarizes the relative positions of the six major container-handling companies.

		Dome	estic	Abroad			
		Non-co-		Non-co-			
	Operator	operative	Co-operative	operative	Co-operative		
1	HPH	4 (4)	25 (5)	1 (2)	45 (14)		
2	PSA	33 (27)	34 (31)	8 (3)	72 (7)		
3	APM Terminals	(6)	0	14 (9)	25 (4)		
4	P&O Ports	4	1	1	38 (4)		
5	Eurogate	56 (9)	43 (19)	4 (2)	6(1)		
6	DPA + CSXWT	3 (3)	1	7 (4)	1 (10)		

Table II-24: Container-handling operators' geographic scope
Domestic		Abroad
		•••••
	PSA	HPH APM Terminals
Eurogate	DPA	P&O Ports

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1 16 11 1	II / •		major	containt	manune	companies	0,01,011		συρυ

	Operator	Country of registration	
1	HPH		Hong Kong
		ICTSI	Philippines
		ECT	The Netherlands
2	PSA		Singapore
		HesseNoordNatie	Belgium
		Sinport Sinergie Portuali	Italy
3	APM Terminals		Denmark
		Sea-Land (International Terminal	
		Operations)	USA
4	P&O Ports		Australia
5	Eurogate		Germany
		BLG Logistics	Germany
		Eurokai	Germany
		Carl Tiedemann	Germany
		Contship Italia	Italy
6	DPA + CSXWT		United Arab Emirates
		CSXWT	USA

Table II-25: Container-handling operators' country of registration

From Table II-24, it appears that most domestic ventures for most container-handling operators are non-co-operative ones, except for PSA, where the division is balanced, and HPH, which has markedly more co-operative ventures than non-co-operative ones at home. Note that Hong Kong is considered as a separate country. Abroad, all of the cargo-handling operators except DPA/CSXWT have more co-operative than non-co-operative ventures. For the operators' acquired subsidiaries, the situation can be different: Contship Italia for instance had more co-operative than non-co-operative domestic ventures. Sea-Land had more non-co-operative than co-operative ventures abroad.

Closely related to geographic scope is the nationality dimension. Legislation often makes it impossible to enter a foreign market without establishing links with one or more local partners. Sometimes, technology must be sourced from a local partner by law. In each of these cases, an international co-operation has to be set up. Root (1988, p. 69) defines an international co-operative agreement as "any form of long-term co-operation between two or more independent firms headquartered in two or more countries that undertakes or supports a business activity for mutual economic gain. Long-term does not refer to any specific period of time, but, rather, to a duration that exceeds the duration needed to complete arm's-length, open-market transactions. The firms in question may be private or state enterprises." In this definition, the new element clearly is firm's different nationality in a co-operation agreement.

An international co-operation agreement typically involves more than one link in the valueadded chain, because each participant has its own value-added chain and moreover often contributes complementary resources. In an equity joint-venture system for instance between an international and a local firm, the former often contributes technology (R&D) and capital, while the latter contributes marketing, distribution, and customer service resources. (Root, 1998)

Combining nationality with legal form of the agreement, Root gets the typology from Table II-26.

Co-operation	Open-market	Inter-firm co-	Intra-firm co-	
Nationality	Transactions (Trade)	operative agreements	operative agreements	
Uninational	No or minimal, short-	Domestic co-	Going it alone	
	term co-operation	operation		
Binational	No or minimal, short-	International co-	Going it alone	
	term co-operation	operation		
Multinational	No or minimal, short-	International co-	Going it alone	
	term co-operation	operation		

 Table II-26: Nationality dimension combined with legal-form dimension

Source: Root, 1998, p. 70

Table II-27 and Figure II-8 provide an overview of the number of nationalities involved in the major container-handling operators' co-operative ventures, based on data from Table II-5. A division is made between inter-firm co-operation, which is co-operation among container-handling operators and / or other actors, and intra-firm co-operation, which is defined as co-

operation between the operators' subsidiaries. When there is inter- as well as intra-firm cooperation, the venture is ranked as one with inter-firm co-operation. Applying this rule leaves no intra-firm co-operative ventures: in a number of cases, several divisions co-operate, but at least one other company is involved in all cases. Open-market transactions and solo start-ups are not considered. Acquisitions are not taken into account either, since with acquisitions, there basically is interaction between at most two nationalities, which makes the distinction between uni-national and bi-national acquisitions boil down to acquisitions at home or abroad. It could of course be examined how many nationalities were involved before and after the acquisition, but as the exact partners are often not known, such exercise will have little result. The number of nationalities involved in start-ups is counted according to the nationality of the participants, which in turn depends on the location of incorporation. The nationality of the venture which is set up is not taken into account. Using data from Table II-5 implies that pure holding companies with different nationality: they are assigned the nationality of their mother company.

		· · I		- · · I .					
			Number of nationalities involved						
	Operator	1	2	3	4	7	?		
1	HPH	2 (4)	18 (8)	1(1)	0	0	3 (3)		
2	PSA	2 (7)	24 (6)	1(1)	1	0	55 (13)		
3	APM Terminals	0	9 (2)	2 (1)	0	0	0		
4	P&O Ports	0	10	6	0	1	4		
5	Eurogate	0	2	0	0	0	32 (7)		
6	$DPA + \overline{CSXWT}$	0	2(6)	(1)	0	0	0		

 Table II-27: Container-handling operators' nationalities in co-operative limited companies started up

Figure II-8:The six major container-handling companies' average number of nationalities

Many (seven)	One
APM Terminals PSA	
P&O Ports DPA HPH Eurogate	

Most co-operative ventures have two nationalities involved. More than three nationalities are hardly found in the same venture. The small number of single-nationality ventures shows that having a different nationality joining is an important factor in the decision to start up a joint venture. The results are tentative to the extent that there is a large number of ventures for which the number of nationalities is unknown, which is especially true for PSA and Eurogate.

II.4.11. Direction of co-operation

Not mentioned either by Nooteboom (1999) is the direction dimension: whether co-operation is horizontal or vertical. The direction of co-operation is to be interpreted in two ways: is there co-operation with vertically or horizontally related partners, and is there co-operation in horizontally or vertically related businesses? For the major container-handling operators' limited companies, Table II-28 and Figure II-9 deal with the first question, Table II-29 and Figure II-10 with the second one. In Table II-28, only co-operative start-ups are considered, based on the data from Table II-5. In Table II-29, all start-ups, whether co-operative or non-co-operative, as well as all acquisitions and mergers from Table II-5 are examined.

Note that in Table II-28 respectively Table II-29, the basic distinction between horizontal and vertical co-operation and / or expansion is made by determining whether the partner respectively the venture started up is performing cargo-handling or non-cargo-handling activities as its main activity in terms of turnover. The concept 'vertical' in this thesis so incorporates both the concepts 'vertical' and 'conglomerate' or 'lateral' which OECD (OECD, 1999, 58) respectively Azevedo (1999, p. 5) distinguish among. The scope of the concept 'handling' in this section is wider than merely container handling: cargo handling also involves dry or liquid-bulk handling and handling of general cargo. To the extent that container-handling operators who co-operate process different types of cargo, horizontal cooperation in this thesis also includes what De Lembre and Biesemans – De Deken (1992) call concentric co-operation. 'CH' in both tables stands for 'cargo handling'. The activity in which co-operation occurs is the basic discriminatory factor in Table II-29 but is also used as a subdimension in Table II-28. When cargo-handling and non-cargo-handling activities are acquired or started up simultaneously through the same limited company, the dominating business determines whether the co-operation is considered as a horizontal or vertical one. When cargo-handling as well as non-cargo-handling participants co-operate in the same venture, the latter is classified in Table II-28 as a venture with non-cargo-handling partners. When one or more of the partners or its main activity is not known, and when the other partners, which are known, are in cargo handling, Table II-28 classifies the venture as one where the direction of co-operation is unknown.

	Operator	СН р	artner	Non-CH	partner	?		
		СН	Non-CH	СН	Non-CH	СН	Non-CH	
1	HPH	1	1	15 (12)	2 (1)	5 (2)	1 (1)	
2	PSA	1	0	12 (8)	42 (5)	5 (8)	24 (5)	
3	APM Terminals	4 (1)	0	7 (2)	0	0	0	
4	P&O Ports	2	0	17	1	2	0	
5	Eurogate	0	0	1	1	5 (3)	27 (4)	
6	DPA + CSXWT	0	0	2 (7)	0	0	0	

Table II-28: Container-handling operators' direction dimension: with what partners?

Figure II-9: The six major container-handling companies' average partner direction

СН			Non-CH
	ADM Torminals	HI DerO Porto	PH PSA
	APM Terminals	P&O Ports	DPA

Table II-28 shows that the major container-handling companies start up most of their cooperative ventures with non-cargo-handling partners. Only for Eurogate, the nature of all but one co-operative ventures is uncertain, so that the balance may eventually shift in the direction of cargo-handling partners. APM Terminals is the only major operator appealing to cargo-handling partners relatively much for setting up cargo-handling co-operative ventures. For Eurogate and DPA/CSXWT, conclusions on cargo-handling partners in cargo-handling activities are hard to draw due to the high number of uncertainties respectively the low number of co-operation agreements.

From Table II-29, it can be observed that HPH, APM Terminals, P&O Ports and DPA/CSXWT have started up, acquired or merged with more limited companies in cargo-handling than in non-cargo-handling activities. For PSA and Eurogate, the observation goes the other way round. For all operators except PSA, the general conclusions from Table II-5 remain valid for cargo-handling and non-cargo-handling ventures separately. In the case of PSA, which overall has more non-co-operative start-ups than mergers and acquisitions, its cargo-handling ventures are created more through mergers and acquisitions than non-co-operatively.

	Operator		СН		Non-CH			
			Start-up non					
		Start-up co-	co-	Merger /	Start-up co-	non-co-	Merger /	
		operatively	operatively	acquisition	operatively	operatively	acquisition	
1	HPH	20 (14)	1 (1)	22 (3)	5 (2)	1 (4)	5	
2	PSA	15 (19)	2 (5)	9 (8)	68 (8)	33 (15)	9 (2)	
	APM							
3	Terminals	11 (3)	17 (1)	15	0	0	0	
4	P&O Ports	21	2	16 (4)	1	0	0	
5	Eurogate	6 (3)	10 (1)	5 (5)	28 (4)	50 (10)	14 (8)	
	DPA +							
6	CSXWT	1 (6)	5 (5)	(3)	1 (1)	3	0	

Table II-29: (Container-han	ndling onerators	' direction	dimension	: in what	at business	ses?
	Container nan	runng operators		annension	• • • • • • • • •	te busilies.	303.

Figure II-10: The six major container-handling companies' average business direction

СН		Non-CH
		•••••
HPH		PSA
APM Terminals		Eurogate
P&O Ports	DPA	-

For the co-operative limited companies from Table II-28 started up in cargo handling and having non-cargo-handling partners, Table II-30 details what the nature of those partners is when their nature is known. When the direct partner is a holding company belonging to a mother company with an outspoken economic activity, the mother company's activity is mentioned in Table II-30. Consortia of companies which have a stake in a venture as a group are considered to be one partner. The heading 'Industrial / investment' covers all remaining types of partners, among others industrial companies, financial or investment corporations, etc. Also governments and the public are ranked under this category, as especially in case of government funding, some kind of government agency is set up for channeling capital flows. Inland terminals are mentioned under 'Hinterland'.

	Operator	MAR	HINT	LOG	PA	AG	FFWD	DRED	IND / INV
1	HPH	5 (5)	0	0	4	0	0	(1)	15 (6)
2	PSA	2	(2)	0	4 (1)	0	0	(1)	10 (5)
	APM								
3	Terminals	(1)	1	0	0	0	0	0	5 (5)
4	P&O Ports	11	2	0	5	1	1	0	15
5	Eurogate	0	0	0	0	0	0	0	0
	DPA +								
6	CSXWT	0	0	0	(2)	1(1)	0	0	1 (7)

 Table II-30: Container-handling operators' limited companies in cargo handling: with what non-cargo-handling partners?

MAR = Maritime HINT = Hinterland LOG = Logistics PA = Port authority AG = Agency FFWD = Freight Forwarding DRED = Dredging IND / INV = Industrial / Investment

Most of the non-horizontal partners in cargo-handling ventures appear to be industrial or investment companies. Port authorities are quite often solicited as cargo-handling partners too. P&O Ports has relatively much maritime partners in its limited cargo-handling companies. For Eurogate, the absence of non-cargo-handling partners in the table is due to the lack of data on exact partners in its ventures.

Table II-31 considers what businesses the non-cargo-handling companies from Table II-29 are in. All limited companies started up co-operatively or non-co-operatively or acquired or merged with are taken into account. Distribution is covered by the logistics heading, while trading companies are categorized as financial / commercial services companies. Inspection services are interpreted as consulting services. All non-cargo-handling services to ships and cargo in ports are classified as 'Port services'. It was known from Table II-29 that APM Terminals had no co-operative non-cargo-handling ventures.

								SOFT /	SHIP				
	Operator	MAR	HINT	LOG	PORT	IND	AIR	TECH	REP	FIN	FFWD	AG	CONS
1	HPH	(1)	(6)	1	3	2	1	2	1	0	0	0	0
2	PSA	11	4 (4)	38 (13)	15(1)	10 (3)	2(1)	13 (3)	0	3	9	0	5
4	P&O Ports	0	0	1	0	0	0	0	0	0	0	0	0
5	Eurogate	4 (5	24 (4)	39(1)	(1)	11 (3)	0	10	0	1	1	(8)	2
	DPA +												
6	CSXWT	0	0	3 (1)	0	0	1	0	0	0	0	0	0

Table II-31: Container-handling operators' limited companies in cargo handling: in what non-cargo-handling businesses?

MAR = Maritime HINT = Hinterland LOG = Logistics PORT = Port Services IND = Industrial AIR = Air Transport

SOFT / TECH = Software / Technology SHIP REP = Ship Repair FIN = Financial FFWD = Freight Forwarding AG = Agency CONS = Consulting

PSA's and Eurogate's non-cargo-handling ventures predominantly are in logistics. The same is true for DPA although the total number of non-cargo-handling ventures is much smaller. HPH's ventures are spread over a large number of sectors, although services to ships and cargo are largest in number.

For contractual agreements, Vermeulen (1987) presents the overview from Table II-32, which combines direction and intensity of co-operation.

Knowledge intensity	High	Low
Direction		
Vertical	Co-makership	Standard provisioning
Horizontal	Pre-competitive co-operation	Capacity extension

Table II-32: Direction-of-co-operation dimension combined with intensity dimension

Source: Vermeulen, 1987

The use of co-makership in container handling was already demonstrated in Section II.4.4. Standard provisioning, which is a form of co-operation requiring less interaction between participants, can be assumed to occur even more, although no exact countings have been made. Labour, IT services, leasing, maintenance, know how, etc. are typically subject to vertical agreements, in contrast to for instance air transport, where they are often subject to

horizontal co-operation (Lemmens, 1991). Harder to identify and count is the occurrence of pre-competitive co-operation in container handling. The competitive nature of the business makes the likelihood of this type of co-operation very small. Neither is there evidence of contractual capacity-exchange agreements.

II.4.12. <u>Risk</u>

The risk dimension is one not treated by Nooteboom (1999), but which deserves attention due to the possible impacts on supply and demand conditions. Root (1998, p. 74-75) distinguishes among two forms of risk: fiduciary and environmental risk. Fiduciary risk entails the possible asset loss due to partners' inability to reach performance requirements agreed upon. Environmental risk involves the risk caused by 'external', i.e. political, economic and other factors. Table II-33 shows what forms of co-operation are typically subject to what combinations of fiduciary and environmental risk.

Environmental Risk Exposure	Low	Middle	High
Fiduciary			
Risk			
Low	Open-market		Intra-firm co-
	transaction		operative agreements
	(documents against		
	payment – documents		
	against acceptance)		
Middle		50/50 or majority	
		ventures	
High	minority ventures		

Table II-33: Fiduciary and environmental risk dimensions combined

Source: Root, 1998, p. 72-73

As it was shown in Section II.4.8 that the major container-handling companies' ventures started up co-operatively are minority ones, except in the case of HPH, and as Section II.4.1 learns that most operators except APM Terminals have more co-operative start-ups than acquisitions and mergers, it can be concluded that the major operators are in most of their co-operative ventures subject to high fiduciary but low environmental risk. The fact that most of the container-handling operators' acquisitions are majority ones, except for APM Terminals, shifts their risk situation for that part to medium fiduciary but higher environmental risk.

Therefore, applying Nooteboom's (1999) terminology, all operators except APM Terminals can be called moderately entrepreneurial in their acquisitions. Open-market (contractual) transactions are abundantly present in container-handling but in general have low overall risk. According to Nooteboom's (1999) terminology, the major container-handling operators can be called 'risk averse' in the fields where they apply open-market agreements. Intra-firm agreements are shown to hardly occur.

II.4.13. Compensation

Contractor and Lorange (1998), elaborating their ideas from an earlier study (Contractor and Lorange, 1988), mention the compensation dimension as a further basis for distinguishing forms of co-operation. The compensation dimension is conceptually equal to Williamson's (1999) provision of finance and sharing of costs/profits. Contractor and Lorange (1988) distinguish the types of co-operation agreements shown in Table II-34 by combining the compensation dimension with the degree of restraint, which was dealt with in Section II.4.8.

Со-ор	Typical	Degree of	
	compensation	restraint	
		method	
Technical training / start-	up assistance agreements	L	Negligible
Patent licensing		m	
Production / assembly / b	uy-back agreements	r	
Franchising		r,m	
"Know-how"-licensing		L,r	
Management / marketing	service agreement	L,r	
Non-equity co-operative	$\pi_i = f(C_V, R_V)$		
agreements in	research partnership	$\pi_i = f(C_V, R_i)$	
	development / co-production	$\pi_i = f(C_i, R_j)$	
Equity joint venture	α	• High	

Table II-34: Compensation dimension combined with degree of restraint

L = lump sum fee

m = markup on components sold or finished output bought back

r = royalty (% of turnover)

 $\pi_{\rm I}$ = profit of firm I

 C_V = venture cost

- R_V = venture revenue
- $C_i = \text{cost of firm } i$
- R_i = revenue of firm j
- α = share of dividends

Source: Contractor and Lorange, 1998, p. 7

Contractor and Lorange's (1998) main distinction is that between contractual agreements (licensing, franchising, technical assistance, and co-production) and equity joint ventures. In the former case, the participants commit resources to a business activity, without sharing the ownership or profits of the venture. In the latter case, participants in equity joint-ventures share ownership of the enterprise and compensation in the form of profits or dividends, and they also assume the (market and non-market) risks of the enterprise. In that respect, risk and compensation are interlinked.

Contractual technical training and start-up assistance agreements are often made by containerhandling companies, as stated higher. The compensation then typically is a fixed amount of money agreed upon. Management agreements too are frequent in container-handling. They are typically compensated for by fixed fees and / or performance-related bonuses. Equity joint ventures, whether through start-up or through acquisition or merger, were higher in this thesis shown to exist numerously, and they usually allow for a dividend to be shared among the owners. There is no evidence in container-handling of non-equity co-operative agreements of the types mentioned by Contractor and Lorange (1998). Higher, it was said that franchising and licensing are not used either. Production, assembly and buy-back agreements can be summarized as the contractual agreement between shipping company and cargo-handling company.

II.4.14. Mission

A last dimension, mentioned by Root (1998, p. 72 and 73), is the co-operation agreement's mission. The author discerns three reasons why companies may take part in co-operative arrangements.

- 1. To source technology that can lead to new products or cheaper production of existing products.
- 2. To assemble components or products at lower costs,
- 3. To enter into a country market or into regional or global markets.

Hagedoorn (1993, p. 375), who names the agreement's mission its aim, for technology agreements distinguishes among a short-run, cost-economizing and / or a strategic, long-term

positioning aim. The former two of Root's (1998) reasons for co-operation are costeconomizing reasons, the latter is a strategic reason. The degree to which certain forms of cooperation enable the participant to reach a certain aim is established in Table II-35.

Agreement	Joint	Joint R&D	Technology	Direct	Customer-	One-
	venture,		exchange	investment	supplier	directional
	research				relationships	technology
Mission 🔪	corporations					flows
Cost	-	-	+++	-	+++	+++
economizing						
Mixed	-	+	+	+	+	+
strategy						
Long-term	++++	+++	-	+++	-	-
positioning						

 Table II-35: Mission-dimension for technology agreements

Source: Hagedoorn, 1993, p. 375-376

Copeland *et al.* (2000, p. 125) detail the cost-economizing mission into sharing upstream risks, sharing development costs, leapfrogging product technology, increasing capacity utilization and exploiting economies of scale, whereas long-term positioning missions are detailed into filling product-line gaps, developing new product markets and penetrating new geographic markets. The extent to which each certain forms allow the container-handling operator to reach a certain mission is shown in Table II-36. There is no gradation.

As shown in Section II.4.6, in container handling, most agreements involve some technology component, so that Hagedoorn's (1993) characteristics can be applied. Development and production or core-business joint ventures, mergers, acquisitions, direct investments and customer-supplier relationships are often found in container handling. Joint R&D, technology exchange and one-directional technology flows hardly occur due to the competitive nature of the business. Sales joint ventures and production licenses, as stated higher, just like product swaps and development licenses, are not encountered in container handling. This observation, according to Hagedoorn's (1993) and Copeland et al.'s (2000) classification, implies that the focus of the limited companies started up or acquired is on long-term positioning rather than cost-economizing. However, the cost-economizing aspect can still be substantial, also when the focus is on market motives, as shown in CHAPTER IV.

Mission	Sharing upstream risks	Sharing development costs	Leapfrogging product technology	Increasing capacity utilization	Exploiting economies of scale	Filling product- line gaps	Developing new product markets	Penetrating new geographic markets
Acquisition	-	-	+	+	+	+	-	+
Merger	-	-	+	+	+	+	-	-
Core-business	-	-	+	+	+	+	-	+
joint venture								
Sales joint	-	-	+	+	-	+	-	+
venture								
Production	-	-	+	+	+	-	-	+
joint venture								
Development	-	+	-	+	-	+	-	+
joint venture								
Product swap	-	+	+	-	+	+	-	-
Production	-	+	+	+	+	-	+	-
license								
Technology	+	-	-	-	-	-	+	-
alliance								
Development	+	+	-	-	-	-	+	-
license								

Table II-36: Mission-dimension for general agreements

Source: Copeland et al., 2000, p. 125

Root (1998) states that in co-operation agreements, firms may go behind more than one mission. However, they will normally have one principal mission. Partners in a co-operation agreement will usually have to deal with different missions, which requires elaboration of a balanced solution which satisfies all partners in order for the agreement to be sustainable.

Focusing on a mission does not impede other effects than the intended, main effect to occur. More on merger effects is explained in CHAPTER III.

II.5. Container-handling companies' co-operation and expansion strategies

The six major container-handling companies are very different in nature and have very divergent strategies. HPH, ECT, ICTSI, HesseNoordNatie, Sinport Sinergie Portuali, Sea-Ro

Terminal, Egis Ports and Carl Tiedemann GmbH have always been in the terminal and warehousing business. APM Terminals and P&O Ports originated as container-handling divisions of a sea carrier and gained autonomy over the years. Contship Italia originally was in shipping but gradually focused on terminal activities. Sea-Land was a sea carrier whose container shipping activities together with international terminal activities were acquired by A.P. Möller. CSXWT was set up as a terminal division within a company which originated as a railway company. PSA and DPA were port authorities which strongly commercialized and expanded their container-handling businesses.

In this section, the strategies applied by the six major container-handling companies in their geographical expansion are reviewed. Dates mentioned are the dates of official announcement of a specific move, at least in as far as available. In some cases, there is a significant time gap between date of official announcement and date of start of operations or integration (Peters, 2003, p.9).

II.5.1. <u>Hutchison Port Holdings</u>

HPH's first foreign terminal operations started in 1991 with the full acquisition of the port of Felixstowe, although all activities were then still performed under mother company Hutchison Whampoa's name, as HPH was formed only in 1994. Due to its early internationalization, HPH is classified by De Souza *et al.* (2003, p. 400) as a first-wave global terminal operator. The Hong Kong and Whampoa Dock Company, Hutchison Whampoa's predecessor, had been operating warehouses and terminals in Hong Kong since 1866. In subsequent years after 1991, HPH's international focus was on China and to a lesser extent South America / Caribbean. 1998 and 1999 saw big moves into Europe with the majority acquisition of Thamesport and Harwich ports respectively the minority acquisition of ECT. After that, HPH returned to the Asia / Far East and South America / Caribbean areas to develop new terminal activities. A terminal acquisition in Poland, the co-operative start-up of a terminal in Egypt, and the bid to start up a terminal in Madagascar have been the only exceptions. HPH's continued focus on Asia shows that the market saturation mentioned by some authors (for instance Musso *et al.*, 2001, p.12) can be reversed over time as economic activity in the area increases.

ECT, since 1966 active under the names of its predecessors Europe Container Terminus and Europe Combined Terminals, started its first foreign sea-terminal activity in 1999 with the start-up of the Suez Canal Canal Container Terminal. A year before however, ECT had its very first foreign experience in a hinterland terminal in Belgium (Willebroek). Among its four shareholders, all of them Dutch, ECT had two stevedoring and warehousing companies, (Koninklijke Pakhoed and Internatio-Müller), as well as hinterland transporter NS Groep and sea carrier Koninklijke Nedlloyd. After the entry of HPH into ECT capital in 1999, ECT's new activities were only on Dutch territory, except for a partly failed attempt to start up a terminal in Trieste. The acquisition of part of DeCeTe in Duisburg was the only exception.

ICTSI was founded only in 1987, initially having sea carrier Sea-Land as one of its shareholders. Its first foreign terminal activity came quite quickly with the start-up of the Argentina Buenos Aires Container Terminal in 1994. 2001, ICTSI sold its international terminals to HPH. Till then, ICTSI had not been involved in any non-cargo-handling activities. This changed after the sale of the international terminals to HPH: two software initiatives were started, just like a large number of new and very dispersed terminals worldwide.

HPH's acquisition of ICTSI's international terminals, a large number of them located in South and Central America, was a move into complementarity. In the meantime, the acquisition made HPH enter into the Philippines, where a year before HPH had failed to start up a terminal. Together with the acquisition of ECT, HPH had terminal feet on the ground in Asia / Far East, Middle East, Africa, Europe and South America / Caribbean, as shown in Figure II-11, where the green bullets mark existing terminals, whereas red bullets mark terminals which were formerly part of the company or failed acquisition or start-up attempts. In 2004, HPH submitted but lost a bid on CSXWT, which would have given it access to new cargohandling regions in its portfolio like the US west and east coast, the Russian east coast and Australia. HPH's involvement in non-cargo-handling activities has always been limited: it only has a few participations in towage companies, inland terminals and depots, software companies and an airport company.



In its co-operative ventures with shipping companies, HPH joined COSCO, Jiangmen Shipping Company, Hyundai Merchant Marine and Hanjin Shipping. In each of the previous co-operation agreements, the shipping companies have the nationality of the country where the venture was set up, except for COSCO if we consider Hong Kong a separate country like was done higher. The A.P. Möller Group and P&O Nedlloyd have been partners of ECT and therefore later of HPH. P&O Nedlloyd is a semi-Dutch company and again has the same nationality as the terminal venture. American President Lines and the Maritime Company for Navigation were partners of ICTSI and changed with the latter's international partners into partners of HPH.

II.5.2. Port of Singapore Authority

PSA's terminal-operating roots go back to 1849. Geographic scope was confined to Singapore till 1996, when PSA erected Dalian Container Terminal. As this is considerably later than was the case for HPH, De Souza et al. (2003, p. 400) name PSA a second-wave global operator. Over the years, PSA's terminal network expanded over countries like China, Korea, Japan, India, Yemen, Portugal, till Belgium and the Netherlands with the acquisition of HesseNoordNatie in 2002. There were some notable bids and expressions of interest for Southern American terminals, but eventually PSA withdrew or bids were rejected. PSA's European experience started with the acquisition of Sinport Sinergie Portuali in 1998, which had cargo-handling as well as non-cargo-handling operations running, mainly in Italy, but furthermore also in India and China. PSA itself clearly had much more non-cargo-handling than cargo-handling operations.

HesseNoordNatie originated from the merger between Hessenatie, which was founded in 1859, and Noord Natie, which was founded in 1882. Hessenatie, before its merger with Noord Natie and the subsequent acquisition by PSA, had terminal operations in Antwerp and Zeebruges but also in Uruguay and Morocco. Noord Natie traditionally focused on Antwerp, but in 1998 started up a terminal in Ventspils. In 1999, HesseNoordNatie entered The Netherlands with the start-up of the Westerschelde Container Terminal. This terminal however to date is still not operating due to various legal obstructions. Shortly after its sale to PSA, HesseNoordNatie started a second Dutch terminal, in Rotterdam, in direct competition



with HPH. Before as after its acquisition by PSA, HesseNoordNatie has been involved in a substantial number of non-cargo-handling activities, through Hessenatie as well as Noord Natie.

Acquiring the Belgian operations clearly meant entering a new geographical area for PSA, where moreover HPH had entered two years before, whereas taking ownership of Montevideo allowed PSA to enter the Southern American region which it had unsuccessfully tried to enter a couple of times. PSA's relative absence in the Southern American / Caribbean region, as can be noticed from Figure II-12, is a big difference between PSA's and HPH's terminal network.

PSA has teamed up with Orient Overseas Container Lines and P&O Nedlloyd, the latter of which was also a partner of ECT and therefore HPH. Maersk Line, an ECT partner equally, became PSA's partner by acquiring part of the assets of the Dalian terminal where PSA was involved. P&O Nedlloyd became a partner in one of PSA's logistics daughters. Compagnie Maritime Belge and Cobelfret became partners of Hessenatie respectively HesseNoordNatie. Both companies have the same nationality as Hessenatie / HesseNoordNatie. The former quit a year after the merger between Hessenatie and Noord Natie was completed.

II.5.3. APM Terminals

The A.P. Möller group took off in 1904 as a steamship company, but over the years started to do business in ship building, supermarkets, software development, air transport, oil and gas extraction. A.P. Möller's first terminal venture was in Tacoma in 1975. The next ventures were mostly in Asia. 1999 started A.P. Möller's entry into the European terminal scene and equally the American scene through the acquisition of Sea-Land's international terminal operations and its global container shipping division from CSX Corporation, which had acquired Sea-Land's entire activities in 1987. APM Terminals was set up as a separate legal entity in 2001 and took over all of A.P. Möller's existing terminal ventures. APM Terminals continued to expand in the familiar regions Asia, Europe and the US, but also entered new markets like Africa, India and Eastern Europe. 2004 and 2005 were years with a particularly large number of new terminal start-ups and acquisitions.

Sea-Land started activities in 1956 as the first shipping company transporting containers, a concept introduced by the company's founder, Malcolm McLean. Terminals started were mainly in the US, till 1975, when terminals in Europe, Middle East and Asia were erected. 1993, Sea-Land entered the Australian market. Sea-Land had started one foreign terminal earlier, in 1970 in Hong Kong, but this terminal under the 1999 split-up was assigned to the 'domestic trade' division and therefore remained under CSX and later came under DPA ownership.

Acquiring Sea-Land enabled A.P. Möller to reinforce its cargo-handling position in the US, Asia and Europe, and to get access to the Middle East market. In the US, APM Terminals got a hold on terminals on the South-West Coast, the Caribbean and the East Coast. In Asia, especially Hong Kong was an interesting entry for APM Terminals. The most important motive for the acquisition however was Sea-Land's large container-shipping network, which was complemented by the network's terminals. A striking observation from Figure II-13 is APM Terminals' very strong position in North America and Africa, especially if compared to HPH's and PSA's situation. In Damas and Mottley (2003), Sondergaard, A.P. Möller's vice-president, states that the company's aim is to have what they call 'direct' ports near population and distribution centers, whereas transshipment hubs are preferably located on the equatorial routes.

APM Terminals had no shipping companies other than its own with which it has partnered in terminal ventures. Sea-Land has partnered with the A.P. Möller Group in the Salalah terminal, right before this terminal together with Sea-Land's other international ventures was acquired by A.P. Möller. Appendix A.3 shows that this goal has been achieved so far.





II.5.4. <u>P&O Ports</u>

P&O Group is a British-Australian company with roots dating back to 1830 and whose first terminal activities focused on Australia. Foreign ventures only came into existence after formation of P&O Ports in 1981. Clearly, P&O Ports is a first-wave global operator (De Souza, 2003, p. 400). New start-ups and acquisitions had a worldwide spread, which makes P&O Ports unique in that it has terminals in all continents, as is shown in Figure II-14. Entering into a so many different markets can pose a risk due to unfamiliarity with specific markets, but in the meantime it can mitigate overall risk by spreading terminal operations over independent markets which may balance the portfolio, especially with developed markets like the US, Europe and Australia being included in the portfolio. This confirms the ideas from Musso *et al.* (2001). Moreover, P&O Ports compared to other operators quite often relies on acquisitions, which, as far as information is available, allows selection of terminals that did well in the past. The start-up of its London terminal in 2000 and the acquisitions in the UK and The Netherlands, and precede PSA's entry in Antwerp.

P&O Ports has a fairly good tradition of partnering with shipping companies for terminal exploitation. In 4 out of the 11 cases, sister companies P&O Nedlloyd or P&O Containers are P&O Ports' partners, but in all other cases, non-members of the P&O Group are partners. CMA-CGM had the same nationality as the acquired company Egis Ports, and COSCO is a Chinese company just like the Shekou terminal started up with P&O Ports. With Gearbulk, Sea-Land, Neptune Orient Lines, Marita Marine Co and Evergreen Group, there was no nationality link with the terminals started up.

II.5.5. Eurogate

Eurogate's terminal ventures have a very limited geographic scope: the group has no terminal interests outside Europe. Bremer Lagerhaus Gesellschaft, which was founded in 1877 and became BLG Logistics Group in 1997, only had terminals in Bremen. Eurokai, incorporated as a Hamburg cargo-handler in 1961 but with roots going back till 1902, started a terminal in Lisbon in 1984 and acquired part of La Spezia Container Terminal in 1985 from Contship



Italia. Next to cargo-handling activities, Eurokai developed activities in logistics and hinterland transport, whereas BLG Logistics next to logistics and hinterland also added ICT and consulting. In 1999, BLG Logistics and Eurokai jointly set up Eurogate as the cargo-handling operator for both mother companies. The new company immediately took full ownership of Contship Italia, a company with experience in the Mediterranean area. BLG Logistics continued to start up new initiatives in automobile and general logistics, businesses complementary to Eurogate's cargo-handling activities. For automobile logistics, a separate joint venture was set up together with Egon-Herbert Harms. No new terminal stakes were taken by Eurogate, although some were considered in Russia in 2002. Two management contracts were signed in 1999, for the ports of Klaipeda (Lithuania) and Sepetiba (Brazil). Contship Italia started as a container shipping company but eventually set up agency, cargo-

handling, hinterland, logistics and port-related activities. After its partial acquisition by Eurokai in 1989, Contship Italia intensified participation in terminals, although only in Italy. After the full acquisition by Eurogate in 1999, Contship Italia's terminal participation was again boosted, this time not only in Italy but also in Croatia and Russia.

II.5.6. Dubai Ports Authority

DPA started its activities upon completion of Port Rashid in United Arab Emirates in 1969. It became an international player in 1999 when a terminal was started up in neighbouring Saudi Arabia. Other terminal initiatives, except the terminal in Romania, were all in the same region: Iran, Djibouti and India. DPA's acquisition of CSXWT granted the Emirates' company full access to Sea-Land's US, Asian, Australian and Finnish terminals, as well as to CSXWT's Caribbean and Asian terminals. The acquisition of CSXWT made DPA a full-fledged world cargo-handling player, who also operates in the related logistics business.

CSXWT, just like its predecessor Sea-Land, used to have a preference for greenfield investments over use of existing terminals, as was stated by a CSXWT director in Mongelluzzo (2002, p. 30), and as is confirmed from the data in appendix A.3. CSXWT in most cases also teamed up with local partners for its foreign ventures, in contrast to Sea-Land, which mostly started up new terminals on its own.





II.6. Summary on expansion and co-operation in container handling

The analysis of this chapter leads to a number of important conclusions in view of the chapters that are to come. Conclusions with respect to general and company-specific strategies are relevant for CHAPTER III. The result of expansion and co-operation may be a different setting in the framework of CHAPTER IIIV.

Limited companies and contractual agreements are the most used forms of co-operation by container-handling companies. More limited companies are started up abroad than domestically. This differs however between two extremes in container handling: P&O Ports on the one hand with a terminal network covering all continents, and Eurogate on the other hand, with a terminal network limited to one continent. This means that P&O Ports compared to Eurogate is involved in a lot more markets, each market and location probably having its own specific operating conditions.

Most limited companies are started up co-operatively, at least abroad. At home, the reverse conclusion is to be drawn. This has repercussions on the possibilities for co-ordination over the companies' terminal network: co-operative start-up implies less power to direct terminal co-ordination. Most co-operative ventures have two participants and two nationalities involved. The number of single-nationality ventures is very low. On the other hand, more than five participants and three nationalities are hardly ever found in limited companies started up. Most start-up ventures have one of the two participants dominating, and in most cases, this is the partner, not the major container-handling company in focus. This places the container-handling operator in a position with rather high fiduciary but low environmental risk, and with a share in dividends which usually is rather small. These are important strategic inputs to CHAPTER III.

Most co-operative ventures have one or more non-cargo-handling partners. Ventures with only cargo-handling companies are limited in number, also when the business started up is in cargo handling. Favorite partners are industrial or investments companies and port authorities. Having such partners is an important indication of specific operating conditions compared to terminals not in this situation. Except for the major operators PSA and Eurogate, all operators have started up more limited companies in the cargo-handling business than in non-cargo-handling businesses. The logistics sector is most often a target sector. The fact that PSA and

Eurogate have a large presence in non-cargo-handling activities most probably makes the operating conditions at their terminals specific compared to the conditions at the terminals of the other major operators.

In majority, limited companies in both cargo-handling and non-cargo-handling businesses are meant to co-operate in technology (R&D). A second possible field of co-operation, which however is always combined with technological co-operation, is marketing. Most limited-company agreements are very stable, as exit of business and even change in number of participants is very low. Higher is the number of changes in distribution of asset ownership. The longer duration of limited companies stresses their long-term positioning character, which is again an important observation in view of CHAPTER III.

New terminals under the same limited venture are frequent, even at very different locations. Acquisitions are less in number than start-ups, but what is similar is that they occur in majority abroad. Most acquisitions are majority acquisitions from the part of the major container-handling company. Combined with a relatively small number of partners, this yields relatively high decision power to the major container-handling operator, but also implies medium environmental risk, which is rewarded with a rather high share in dividends. There exist counter-examples of operators which overall have higher numbers of partners in their ventures. Acquisitions as limited companies focus on long-term positioning rather than cost-economizing, just like ventures started up. As to strategies in CHAPTER III, this does however not imply that no economies may result from merging or acquiring a company. This confirms hypothesis 3, which states that mergers and acquisitions may generate specific economies.

Contractual agreements are frequently used for acquiring inputs, binding customers and providing additional services. Especially where contracts serve the provision of inputs, the focus is on cost-economizing. Where some type of co-makership applies, for instance in IT installation, a number of assets are shared. The presence of contracts puts such terminals in a specific operating condition in CHAPTER IIIV.

Management contracts are frequently applied in container-handling and arrange for container handling to be outsourced in exchange for a fixed amount of money, part of which may be conditional upon turnover or other criteria. The amount of money to be paid by the operator again creates a specific operating condition for CHAPTER IIIV.

A number of associations represent container-handling companies' interests towards external parties. They have radial links with their members, and have a very limited number of assets and activities in common. The presence of such associations may alter a terminal's supply as well as demand function, as shown in CHAPTER IIIV.

The next chapter looks at company strategies, market structure and merger and acquisition effects in container handling from a more conceptual point of view.

CHAPTER III: MARKET STRUCTURE, FIRM BEHAVIOUR AND CO-OPERATION EFFECTS IN CONTAINER HANDLING: AN ANALYSIS

III.1. Rationale for the chapter

It was indicated in CHAPTER I that literature on efficiency gains through co-operation in container handling is fairly limited. The few resources that explicitly deal with this topic are reviewed in this chapter. They are supplemented by literature that deals with other operational aspects in container handling, as well as by literature that elaborates on co-operation processes and effects from a general-economic point of view or applied to a specific business.

Economic sectors the literature on which is useful for studying container-handling economics due to the similarities that exist, and which is more substantial than comparable literature on container handling, are seven and are summarized in Table III-1. A sector with many similarities which is not included due to lack of literature is ground handling in airports.

Sector	Similarities	Dissimilarities
Airlines	Network	Spoke part instead of hub
		part, except when ground
		handling is considered
Banking	Location-bound (although to	Financial products with own
	decreasing extent through	logic
	ICT evolutions)	
Electricity	Network	Spoke part instead of hub
		part
Pharmacy	Location-bound	Smaller markets
	Purely physical product	Health-driven
Railways	Network	Spoke part instead of hub
		part
Retail	Location-bound	Smaller markets
	Purely physical product	End-consumer-driven
Shipping	Network	Spoke part instead of hub
		part
Telecommunications	Network	Spoke part instead of hub
		part, except when for
		instance telephone shops are
		considered

Table III-1: Economic sectors with container-handling similarities

The chapter consecutively deals with relevant literature on market structure, firm behaviour and co-operation effects. Market structure involves product variety, market size and number and size of players. Firm behaviour entails activity goals and firm decision types. Cooperation effects involve horizontal merger and acquisition effects on the terminal, effects of other forms of co-operation, and merger aspects which are abstracted in this thesis.

III.2. Product nature

The importance of correctly defining products is shown by Clark (1984, p. 54), who distinguishes among three methods to define products.

	1	
Method	Advantage	Disadvantage
Total volume	Relatively easy to assess	Not suitable in multi-product environment and no recognition of joint production
Production function	Suitable in multi-product environments	No recognition of joint production Harder to assess
Weighted index from income statement and balance sheet	Suitable in multi-product environments and recognition of joint production Flow variable	Requires intensive assessment

Table III-2: Methods for product definition

Source: own translation to container handling from Clark, 1984, p. 54

Business observation learns that container handling at a terminal often is a multi-product business with joint production. The multi-product character can be a consequence of demand as well as supply characteristics.

From the demand side, it was shown in CHAPTER I that containers either have outbound, inbound or transhipment status. Each of these container status types represents a different product. A specific terminal may be subject to high willingness-to-pay for inbound containers, while demand for outbound containers is low, or vice versa. Container-handling production functions may equally differ among inbound, outbound and transhipment cargo, depending partly on the characteristics of terminal operations.

There are however more container-handling products to be distinguished among, based on container characteristics summarized in Table III-3. These characteristics can apply to outbound, inbound as well as transhipment containers.

Container	Typology
Characteristic	
Container	Containers with different destinations may be subject to different
destination	demand conditions. Kok (2004) for instance shows how sea-port
	congestion can affect transhipment, intra-continental and
	intercontinental container flows differently. Ziss (1995) shows how
	location-bound differentiation can have an impact on competition and
	co-operation.
Container dimension	Twenty-foot equivalent unit containers (TEUs) impose handling
	requirements but have willingness-to-pay that are both different from
	those imposed by fourty-foot equivalent unit containers (FEUs). High
	cube containers have even different dimensions ¹ , and are gaining
	importance in total traffic. Half-height containers ² are less used: they
	typically contain heavy loads.
Container security	Secure containers can bring down terminal security expenses. An
	example is the Tamper Evident Secure Container (World Cargo News
	Online, 2004ar)
Container state	Damaged containers require different (un-)loading processes than
	containers in normal shape.
Cargo nature	Export 911 (2004) refers to cargo that requires climatisation:
	refrigeration or heating. Paelinck (2004) mentions cargo that requires
	cooling ³ . Van de Merbel (1998), Steenken <i>et al.</i> (2004) and
	Meersmans and Dekker (2001, p. 5) furthermore mention
	containerized cargoes that need to be ventilated/vented, and also
	dangerous or fragile cargo. Handling requirements will normally
	differ in each of these cases, and willingness-to-pay may alter too.

Table III-3: Container characteristics delineating different container-handling products

¹ High cube containers measure 20' x 8' x 9.5' or 40' x 8' x 8.5', whereas standard containers measure 20' x 8' x 8.5' (TEU) or 40' x 8' x 8.5' (FEU) (Export 911, 2004)

² Half-height containers measure 20' x 8' x 4.25' or 20' x 8' x 4.30' (Export 911, 2004)

 $^{^3}$ Cooling is keeping temperature low but not under -4° Celsius. The term 'refrigeration' is used where temperature goes under -4° Celsius.

Container	Typology
Characteristic	
Cargo weight	Containers may be empty, which will have an impact on their
	associated willingness-to-pay. If containers are loaded, their payload
	may differ, impacting mainly on handling productivity.
Vessel	Vessel type will limit the techniques available for (un-)loading a
characteristics	vessel. One can distinguish among the lift-on/lift-off (lo/lo), roll-
	on/roll-off (ro/ro) and stowage/roll-on/roll-of (sto/ro) techniques ⁴ .
Vessel size	Container vessels are classified as first to fifth-generation ships
	according to their size. D'Hondt (2002) shows what impact different
	vessel sizes can have on productivity.
Hinterland transport	Containers may be delivered to or received from the hinterland via
modes	either road, rail or waterways. The specific mode used for a specific
	container will impose different requirement on the internodal sea-land
	exchange.
Handling / quality	Requests from shipowners and / or shippers involve handling speed,
requests	FCL-LCL ⁵ or reverse status change, container orientation, loading
	specifications concerning location in the ship, and partial self-
	handling.

From the supply side, it was mentioned in CHAPTER I that different operating conditions in time can lead to different products constrained in time. Special operating conditions can for instance consist of different wages for night work, holiday work, etc.

At a terminal, several products can be processed sequentially, even under equal operating conditions. This implies that a terminal can be a multi-product environment. Gambardella and Rizzoli (2000) refer to different products which require different terminal settings, elements of which in turn change at different moments in time: yard area use is planned weeks ahead,

⁴ Under lo/lo, containers are lifted on and off the vessel vertically. In case of ro/ro, the containers go on the vessel horizontally. Sto/ro finally is a combination of both: containers are driven on or off the vessel in some way or another, and on the vessel itself they are lifted on or off through some kind of crane. (Van de Merbel, 1998)

⁵ FCL = Full Container Load, LCL = Less than Container Load

berth and resource allocation are planned a few days in advance, for stowage plans this is done a few hours before the ship arrives, and loading and unloading lists are composed minutes before operations start, and often even in real time. Murty et al. (2003, p. 14) and Steenken *et al.* (2004) make a distinction between static and dynamic terminal characteristics, where the static ones remain constant at least for a certain part of the planning horizon, whereas the dynamic ones nearly constantly change.

But several products can also be processed simultaneously. At one berth at a terminal for instance, a crane or other equipment can handle one type of product at a certain point in time, while, at a separate berth at the same terminal, a separate crane handles a different type of product. Depending on terminal configuration and work organization, common superstructure may be used for the two berths simultaneously. At the same ship, two cranes can process containers with different product status. Again, common superstructure may simultaneously be used. Also at the same ship, one crane may apply double-cycling (also called back-loading): unloading a container in one cycle and use the reverse cycle, which would be unproductive under single-cycling, for loading a container⁶. Finally, twin spreaders allow to process containers of different product types at the same time. In each of the previous cases, joint production occurs, with the possibility of economies of scope. If at a terminal other types of cargo than containers are handled simultaneously with containers, involving use of joint inputs, there also is joint production, with possibly economies of scope. Normally, no direct interference with other than cargo-handling products occurs.

The eventual occurrence of multiple products as well as joint production in container handling implies that sometimes a weighted index from income statements and balance sheets may be needed in addition to production functions. Perceiving multiplicity of products correctly is also an important duty in determining economies of scale, as indicated by Baumol (1977).

As terminal capacity is limited, each product will be able to absorb a finite amount as a share of that total capacity. That finite amount of capacity allows producing a limited quantity of the product. This implies that the total production set is closed (Mas-Colell *et al.*, 1995),

⁶ Single-cycling stowage strategies are these: first unload all containers to be unloaded, and then load, or unload from some bays, while loading to others, with separate cranes or other equipment.
which is an important conclusion as to the models that qualify for further analysis of the container-handling sector.

An issue of particular interest is compatibility of container-handling products. It is well known that not all vessel types are compatible with all sea ports: the largest vessels are only able to enter a limited number of ports whose draught is large enough. Conversely, not all terminal infrastructure and superstructure settings allow handling all types of vessels. Both compatibility problems derive from the fact that container-handling is embedded in a network setting. The first problem determines market power of the container-handling terminal, the second determines supply options to be chosen. Carlton (1992), Weisman (2002) and Shy (2001) show how compatibility does influence network deployment and operation, and how standard-setting enables co-ordination. They also deal with network externalities like these may occur in container handling. Ship standardization leads to standardization on the container-handling operations side, and also determines the number of players within a certain market. Standardization of handling operations itself enables the container-handling terminal to control the number of competitors.

III.3. Market size

Market definition is a prerequisite for industry definition, if no use is or can be made of technological characteristics. The traditional view is that an industry comprises all products between which there is a high cross-elasticity of supply. Reekie (1989, p. 52) however stresses the importance of the level of aggregation in assessing cross-elasticity: it could well be that, at aggregate level, cross-elasticity is high, whereas cross-elasticity between disaggregate groups of products at market level is often a lot lower. The importance of the level of aggregation also applies to container handling. However, intuitively, the container-handling business as an industry can be clearly delineated from other businesses. Even from handling of non-containerized cargo, although some of this cargo may be containerizable, and thus there is some degree of substitutability, which needs to be taken into account in competition analysis.

Sleuwaegen and Devoldere (2001) note that geographical market delineation is well developed in antitrust literature. EC and US antitrust policy generally define a relevant market as "the smallest grouping of sales for which the elasticity of demand and supply are sufficiently low that a firm with 100% of that grouping, the hypothetical monopolist, could profitably reduce output and increase price substantially above marginal cost or the prevailing price" (Church and Ware, 2000).

It is however difficult to apply this market demand elasticity analysis to container handling in a thorough, quantified manner, as price data are in most cases highly confidential. This observation also implies that there is no indication of whether container-handling demand is linear or takes some other form. Most models, for ease of analysis, deal with linear demand. Examples are Gaudet and Salant (1992) for general economic analysis and Werden and Froeb (1998) for merger analysis.

Other methods for market delineation are discussed in the literature, each of which has its drawbacks, especially with respect to container handling. Moreover, they focus on pure geographic market definition. Elzinga and Hogarty (1973) for instance start from physical shipments: if between and within two geographical areas there are substantial shipment flows, both areas together should be considered as one market. As a related approach, Landes and Posner (1981, pp. 963-970) mention the diversion, the exports, and the Areeda-Turner method. The diversion approach considers how many of a company's sales are in a different geographical area than the company's production plant. If this share is substantial, the area should be included in the company's market. The export approach considers how many of a company's sales are abroad in order to decide on inclusion of the foreign market. The Areeda-Turner method combines both the shipments and price approach: all export destinations are included unless (i) there is also a substantial reverse, import flow of the same good, and (ii) the price of the export product augmented with transportation costs exceeds the price of substitute products in the destination country. McCallum (1995) deals with border effects: if flows between two areas only occur at borders, one can discern the areas as distinct markets.

Werden (1981) sees two major drawbacks in Elzinga and Hogarty's (1973) approach.

- It is not because there are no shipments between two areas, that there are no shipments towards or from other areas. Not taking into account these other flows implies that both markets are not correctly delineated.
- 2. It is not because there currently are no shipments between two areas, that this could not become the case, whether by an endogenous development (for instance a merger between two suppliers) or an exogenous factor (like a change in production cost in one area).

With respect to container handling in particular, it can be added that applying Elzinga and Hogarty's (1973) approach is particularly difficult due to the fact that there are no physical flows of commodities. Container handling is a service, which cannot be transferred like a commodity can be transferred. The same problem arises with McCallum's (1995) approach.

Shrieves (1978) works with similarity and significance measures: if there is ample similarity in flows within two areas, and these flows represent a large share of the total volume of the product, then the two areas are to be viewed as one market. Although in general not often applied because of measurement problems with similarity and significance, the method fits the container-handling industry: similarity can be defined according to criteria from Table III-3. In order to be similar, two containers need to have equal scores on all characteristics from Table III-3.

Kwast *et al.* (1997) use this type of methodology for defining markets in banking. A difference with the container-handling industry is that for banking, Kwast *et al.* merely deal with immaterial monetary transactions, which are not location-bound. This allows the authors to distinguish among use of local and non-local service providers. The local and non-local banks do not correspond to local and global service providers in container handling: in container handling, global service providers need to be locally present in order to be able to provide services. In banking, where most transactions are virtual, they do not. On the other hand, due to the service nature of container handling, product transportation or production costs nor exchange rate risk are conditions for foreign container-handling investments.

Borenstein and Bushnell (1999) apply Shrieves' (1978) methodology to the electricity industry. The electricity business is more comparable to container handling than banking in

the sense that physical local presence is needed. Laaser *et al.* (2000) deal with Shrieves' methodology for determining airline markets. They consider three market dimensions: airports (hubs in the network), routes (spokes) and global traffic. The second and the third can be translated to container-handling: a certain terminal can compete for traffic on a certain route, and as more local players are being absorbed by global players, competition becomes near to global.

Landes and Posner (1981, p. 947 - 948) refer to the number of imperfect substitutes in consumption as a determinant of market size. The number of substitutes is one of the dimensions in Porter's (1980) five-forces model, which was applied to the sea-port sector in Office of the Regulator-General – Victoria (1999). Business observation learns that in container-handling, there normally is at least one substitute to each product. Spulber (1995) refers to consumer switching costs as a determinant of market size. In container handling, switching costs or other barriers to mobility occur primarily in the form of contracts which have a fixed term, but also in the form of search and loyalty costs.

III.4. Number and size of suppliers

The counterpart of the number of customers in market structure is the number of suppliers. The two possible extremes in market forms are monopoly and perfect competition, but like in most businesses, real market structure in container handling is a form in between.

The scientific literature on market structure in container handling is fairly limited. Ferrari and Benacchio (2000) conclude that in container handling, an equilibrium à la Stackelberg prevails. This situation is true for a number of container-handling markets but certainly not for all of them, and moreover has changed during recent years as terminals in the same market approach each other's size.

A number of publications quantify the number of container-handling players in specific geographic areas, but none of them considers the market level like it is defined in this thesis, as is shown in Table III-4. The results in general do only allow drawing partial conclusions at market level.

An interesting result from Turnbull and Weston (1993) is that the large majority of port operators perceives overall cargo-handling competition to have increased during 1989-1999. Trujillo and Nombela (1999, p. 22-23) mention general treshold levels of numbers of players, which necessitate regulation at various geographical levels of competition. Their definition of the concept 'terminal' is not equal to the definition used in this thesis.

Ocean Shipping Consultants (2003) group ports into sub-continents, most of which include several ranges. The resulting range structure is the one from Figure III-1 and is based on appendix A-4. Historic evolution and trend forecasts on container-handling volumes in these ranges are available from Ocean Shipping Consultants (2003).

Publication	Geographic scope	Product scope
Chambers (2001, Chambers)	North China – port level	Container handling
Charles River Associates	New Zealand - intra-port and	Container handling among
(2002)	inter-port level	other port services
Estache et al. (2001, p. 2-3)	Mexico - national level	Port overall
Office of the Regulator-	Port level	Container handling among
General – Victoria (1999)		other product types and other
		port services
Gillen and Cooper (1995)	Sea ports vs. other intermodal	Container handling among
and Pawlik (2003, p. 2)	transfer points – port range	other product types
	level – port group level – port	
	level – port companies within	
	port	
Penfold (2002, p.7)	Asia – South-East Asia	Container handling
Trujillo and Nombela (1999,	Intra-terminal, inter-terminal	Container handling
p. 22-23)	and inter-port level	
Turnbull and Weston (1993)	Great-Britain - intra-port,	Cargo handling in general
	regional, national and	
	international level	

Table III-4: Analysis in literature of the number of container-handling terminals

Ocean Shipping Consultants' (2003) structure however does not cover container-handling markets entirely the way they are dealt with in this thesis in two ways. First, Ocean Shipping Consultants (2003) primarily deal with ports, whereas container-handling competition in practice evolves around terminals. Second, there is a major distinction between container-handling product types. Take as an example the Mediterranean sub-continent and focus on the Western-Mediterranean range. In Ocean Shipping Consultants' (2003) analysis, this range

includes terminals in Mediterranean Spain and Southern France on the European continent as well as Moroccan and Algerian terminals on the African continent.

It is clear that the Western-Mediterranean range does not cover the correct players for container traffic which is bound for Eastern Spain through domestic delivery, since the Northern-African terminals and also the non-Spanish terminals in Southern-European do not fit there. Neither will the range cover the correct players for traffic which is bound for Southern Europe through regional delivery, since the Northern-African terminals do not fit there. Moreover, terminals in the Atlantic and Hamburg-Le Havre range are most probably competitors which are not taken into account in Ocean Shipping Consultants' (2003) analysis. For transhipment traffic, the Western-Mediterranean range will most probably not be sufficiently large to cover all competing terminals: also terminals from other Mediterranean ranges will compete for this type of traffic.

It should be noted that the type of traffic which a terminal qualifies for, is a function of demand and supply characteristics. On the demand side, shippers' and shipping companies' preferences for instance will determine willingness-to-pay for a certain container-handling service. Shipping companies' decision for setting up a hub-and-spoke system will have a particularly large impact on demand for container-handling. On the supply side, choices made by governments and container-handling companies among others will determine the attractiveness of a certain container terminal. For a terminal, demand and market structure will be substantially influenced by government's decision to assign the port a domestic, transit or hub role, and plan and design the port accordingly. As demand and supply factors not only impact on market structure but also on magnitude of demand, they are analysed in greater detail in CHAPTER IV.



Source: own composition based on Ocean Shipping Consultants, 2003

European Parliament and Council (2001), in a previous version of their Port Package, proposed to assess the number of container-handling terminals and operators within a particular sea port, and to impose that there should be more than one supplier. Competitive analysis therewith is done port per port, whereas in practice the relevant market often reaches a lot further and is to be considered product by product. A container-handling terminal could be a monopolist for one type of container-handling product in the relevant market, while he comes into competition with other terminals in other product markets.

An interesting twist is the distinction between terminals and operators. Once the condition of several terminals competing in the same product market is fulfilled, it is of particular importance to know whether the terminals are operated by different companies or not. If the companies having decision power are the same, competition will be of a totally different nature compared to when several companies own terminals. In the former case, there will normally be a tendency to co-ordinate activities over the terminals one owns and to modify the terminal's activity goal according to company goals, for instance in order to obtain overall profit maximization. A further interesting twist is the multi-market or even global presence of many container-handling companies. Global presence may generate the tendency to co-ordinate activities over companies, but not so in container handling. Both issues get further attention later in this thesis. The impacts of both multi-terminal and multi-market presence on demand and supply are dealt with in CHAPTER IV.

If a product market is delineated using a method from Section III.3, measurement of market concentration is a helpful method for getting a hold on the type of interaction between market players. Aggregate concentration, which measures the economic importance of a company relative to the entire economy (OECD, 1999, p. 23), is not considered here. A useful tool is calculating a concentration index. Reekie (1989, p. 45 - 49) and OECD (1999, p. 25) discern eight concentration-index types, many of which have substantial weaknesses.

Index name	Index formula	Disadvantage
Concentration ratio	Fixed % of sales, assets, employment in hands of fixed number of firms Fixed number of sales, assets of employment in hands of how many firms	Calculated only for one %, does not allow to grab full picture of concentration at other %
Cumulative share curve	Spread of cumulative market share versus absolute number of firms	Does not take into account all firms in an industry
Hirschmann- Herfindahl index (HHI)	$(c^{2}+1)/n$, where c = coefficient of variation of firm sizes and n = number of firms in market	High emphasis on large firms
Numbers equivalent index	Number of firms of equal size which could produce same output and have same HHI as in actual situation	Does not use relative numbers of firms
Lorenz-curve	= cumulative share curve, but with relative number of firms	
Gini coefficient	Surface obtained under Lorenz-curve	
Hannah and Kay (1977)	 Index satisfying: intersection of cumulative share curves in market implies that no conclusion is made on relative concentration sales shift between companies increases index value addition of small firm decrease index value any merger increases index value 	
Entropy index	Equals the entropy formula from chemistry	

Table III-5: Concentration indexes

Source: Reekie, 1989, p. 45 - 49 and OECD, 1999, p. 25

All indexes from Table III-5 only consider one point in time. Rivalry indexes allow to assess structural changes over time. Reekie (1989, p. 49) discerns the rank correlation coefficient and the Hymer-Paschigian index.

Index name	Index formula	Disadvantage
Rank correlation	Firms are ranked by size, and	Meaningless if size more or less
coefficient	correlation over time between ranks	equal
	is calculated	Ignorance of economic
		importance of firms
Hymer-Paschigian	Absolute share changes are summed	
index		

Table III-6: Rivalry indexes

The indexes from Table III-5 and Table III-6 can be calculated at industry level for the container-handling companies, but can only be calculated at market level once the correct market is determined, an exercise which is hampered by lack of market data, as was shown in Section III.3.

For the number of and interaction among players at market level, we are bound to more intuitive observations. Although it is very hard to get data on the volume of maritime container traffic bound for instance for Belgium or leaving the country through a Belgian sea port compared to the volume using a foreign port, it can be observed that the majority of traffic passes through a Belgian port. It can furthermore be observed that the Belgian container terminals have different service characteristics: performance diverges depending on the location of the specific sea port, and within ports, location in front or behind locks for instance plays an important role. The total container traffic entering or leaving the country is further decomposed according to the other characteristics from Table III-3. This leads to the conclusion that at most a few terminals will for each product be equally valued by shipping companies and shippers. In this case, an oligopoly setting applies. It is derived that in most contrasts with conclusions for the logistics sector, where studies show that the market is fragmented and there is no oligopoly (De Lloyd, 2003).

The previous paragraphs have been dealing with number of players and concentration. Gale and Branch's (1982) observation, that market share rather than concentration is crucial for explaining performance, deserves due attention however, also in the case of container terminals. Landes and Posner (1981, pp. 944-946) moreover state that market share is an important determinant of market power, next to market demand elasticity and fringe supply

elasticity. Market demand elasticity was dealt with in Section III.3. Charles River Associates (2002, p. 9) add sector knowledge, regulation, product differentiation, occurrence of natural monopoly, mergers and collusion as important determinants of market power. Merger effects are dealt with in Section III.8. The Lerner index normally is a useful tool to measure market power, but lack of price data make it hard to be applied to container handling.

With respect to market share, it can be observed that, in the course of time, size differences between terminals have decreased. Large, global operators got involved in many of the container terminals. Container terminals which remained smaller have often specialized in niche markets. In the other markets, players often have comparable size, and there are no dominant players. This does not necessarily imply that supply structures between terminals are more or less equal: between AGV⁷ and straddle-carrier systems for instance, substantial operational cost differences may exist.

Landes and Posner (1981, pp. 947–950) stress that market share needs to be put into perspective as it is subject to high volatility due to a high number of substitutes in production, changing output of fringe firms, and entry by a new competitor.

Observing that in container-handling markets, a limited number of terminals are competing, who do not differ too much in size, and observing that there is no real trace of collusion, a combination of within-market Cournot competition and between-market Bertrand competition seems to occur. In a one-stage, static game, container-handling terminals simultaneously determine the amount of output to produce, given supply and demand conditions within the market, whose eventual tendency to change may be observed and anticipated, and they determine prices taking into account possible reactions at other product markets. Such static game can be solved by using analyses from Mas-Colell *et al.* (1995) and Gaudet and Salant (1992). Table III-7 illustrates the existence of Cournot competition with a case where container-handling terminals compete in quantities, whereas Table III-8 illustrates the existence of Bertrand competition in prices. There are however not sufficient price and volume data to perform thorough conductive analysis like Brander and Zhang (1990) did for the airline sector.

Date	Terminal	Move	Goal
2005	China – Ningbo	Competing with	Compete with Shanghai head to head,
	– Jintang	neighbouring	instead of being complementary to them (as
	project	Shanghai	originally planned)

	Table III-7	: Examples of	of quantity	competition in	container h	andling
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Source: World Cargo News Online, 2005p

Table III-8: Examples of price competition in container handling

Date	Terminal	Move	Goal
2005	Italy - PSA Sinport Voltri Terminal Europe	Attracting Grand Alliance and giving P&O Nedlloyd equity stake at bargain price	Attract Grand Alliance traffic previously handled at Eurogate facilities (MCT Gioia Tauro, CICT Cagliari and LSCT La Spezia), and keep Eurogate out of Voltri
2004	Singapore – PSA Terminals	Improve service quality	Lessen congestion and regain traffic lost to Tanjung Pelepas
2004	Hong Kong - Kwai Chung - CT 1 - 9	Slashing container- handling charges	Capture mid-stream traffic Fill underutilized berths
2004	Hong Kong - Kwai Chung	Offering price discounts up to 30%	Fill traffic void
2002	China - Hutchison Shanghai Container Terminals	Cutting fees by 5%	Fend off competition from neighbouring Shanghai terminals; Price still 12% higher than at Waigaoqiao port
2002	Singapore - PSA Terminals	50% discount on empty boxes handling charges, for 12 months	Attract traffic from Port Klang among others
2002	Port Klang Northport and Westport terminals	Improve service quality	Diversify from PSA Singapore service and be able to compete in prices
2002	Singapore - PSA Terminals	Slashing charges after Maersk and Evergreen moved the bulk of their traffic to Tanjung Pelepas	Regain traffic lost to Tangjung Pelepas; Tanjung Pelepas terminals seem to be perfect substitutes for Singapore terminals; Tanjung Pelepas had slashed charges and attracted large customers from PSA

Source: De Lloyd, 2002b, 2002c and 2002d; Rao, 2004b; World Cargo News Online, 2004by,

2005m, 2005w

⁷ Automated Guided Vehicle

To the rule that in container handling no collusion is found, two exceptions were encountered: at Port Klang in Malaysia, Westport and Northport unified handling charges in order to concentrate on competition with primarily PSA (De Lloyd, 2002d); PSA and PTP too were said to be in rate talks (Fairplay, 2003 and De Lloyd, 2004d).

Different market share in Cournot and Bertrand settings may be the consequence of differing cost structures between terminals. In container handling, it is indeed not the case that all terminals have identical constant average costs, like in the analyses of Salant *et al.* (1983) and Reitman (1994). One reason may be different technologies. Moreover, there are fixed costs. These are not directly observable, like they are in Bresnahan and Reiss (1991), but they can be derived when terminal technology is analysed. The presence of fixed costs implies that there is no fixed proportion of outputs to inputs, like in Azzam's (1997) analysis. Container handling is in a situation where inputs are distinct from outputs, so the market analysis from Mas-Colell *et al.* (1995) applies. Furthermore, terminal capacity is lumpy, like it is in Faulí-Oller (1997): new capacity additions are usually large compared to market demand. Capacity also involves a large amount of sunk investments.

III.5. Other relevant market characteristics

In container handling, market players do often only dispose of incomplete information: they do not know all of their competitors' supply functions exactly, they do not know how exactly demand may change over time, and it is hard for them to assess what the exact effect of a merger may be. It is assumed however that the terminal's profit function is known by the operator. Also rivals' past decisions are assumed to be known. The exact absolute value of profit, in contrast to the profit function, is not known beforehand, as demand imposes a number of uncertainties, like in Mas-Colell *et al.* (1995) and Friedman (1971).

There is in most cases no communication between terminals, and particularly not for exchanging inside business information and plans. There is no indication of collusion in particular, except of course when the terminal is owned by the same company. Collusion requires some form of forbearance. As neither related law nor any self-punishment mechanism exist, and as trust is hard to gain due to the volatility and international competitive

character of container handling, and as hostages are hard to set up without causing harm to ones own business, forbearance is hard to implement. Neither is there any strong sector organization which could organize collusion using existing organizational structures. Furthermore, antitrust authorities are watching container-handling closely. Finally, container-handling capacity is not at equilibrium, there is product differentiation and regional division of activities, cost differences feature and a discount rate applies, which are all supplementary arguments in disfavor of collusion (Buckley and Casson, 1998b; European Commission, 2001b, p. 8: and p. 29; Green and Porter, 1984; OECD, 1999, p. 11, p. 17 and p. 21; Spulber, 1995). One of the phenomena that strengthens the container-handling disequilibrium and that prevents collusion, is the fear for spillovers of knowledge and technology. Interlocking may initiate such spillovers: it is observed that board and / or management members frequently change company and take with them the company's entire strategic setting and financial background.

The single-stage competition game in container handling is played several times over multiple periods. Each entry for instance requires the terminal to reconsider its output and / or price decision. However, an entry process, whereby a new terminal is erected, or whereby an existing terminal changes its service characteristics so that it enters a new market, usually requires several years to be completed, planning and construction included. This translates as non-free disposal of inputs, which is supposed in the analysis of Mas-Colell *et al.* (1995). Moreover, in container handling, there are substantial barriers to entry, which bring down the number of reasonable entrants and which slow down the entry process of actual entrants. Table III-9 presents an overview of entry barriers in container handling.

Supplier profits are normally strongly in line with entry barriers, except when rents are capitalized, inefficiency features, part of the benefits are non-monetary, limit pricing is practised, or government regulation is present (Orr, 1974; Berechman *et al.*, 1994). Caves and Porter (1977) refer to mobility barriers rather than entry barriers: they discern industry subgroups, where products within a subgroup have major similarities, and where mobility between subgroups is limited. It is difficult however to apply this subgroup theory to container handling: it is hard to discern a level between the industry and the market.

Barrier category	Barrier	Impact
Company	Vertical integration	Vertical integration implies better knowledge
structure		and control of inputs and outputs
Economic	Economies of scale	Operations; management
	Fixed costs	Input prices (eventually oligopsony); sunk
		costs; capital cost
Financial	Advertising intensity	Advertising creates strategic advantage
	Capital requirements	150m USD / 1m TEU is on average required,
		including infrastructure as well as
	D 1/	superstructure
	Royalty payment	Substantial lump-sum lease payments before
	P&D intensity	R&D (also in terms of market screening or
	K&D Intensity	experience) provides knowledge about most
		efficient technologies and market structure
	Risk	Risk is harder to bear for entrants who already
		spent a lot of capital in investing
Legal	Legal claims on	Long-term lease contracts make terminal space
	scarce terminal areas	a very scarce resource; terminal size is limited
	and legal limits on	by public legislation, which is some form
	terminal size	exogenous capacity limitation in the sense of
		Mas-Colell et al. (1995)
Market	Acceptance	Being established in a market creates more trust
		and willingness from economic and political
	A (()	stakeholders
	Access to inputs	Being familiar with a market implies better
		access to inputs and offen leads to superior
	Drand lavalty /	Control over essential resources
	Benutation	incentive to change supplier
	Concentration	Concentration increases profitability and
	Concentration	therefore cash reserves: concentration also
		increases strength of co-ordinated action against
		entrants
	Long-term / Multi-	Longer terms and inclusion of multiple
	terminal contracts	terminals in contracts allow to bind customers
		more tightly
	Product	Being present in several markets means
	differentiation	controlling a larger part of the business

Table III 7. End y barriers in container nanding	T
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Source: own composition from Bain, 1956; Contractor and Lorange, 1988; Fusillo, 2003, pp. 18–21; Hagedoorn, 1993; Nooteboom, 1999; Office of the Regulator-General, Victoria, 1999b, p. 18-21; Orr, 1974; Werden and Froeb, 1998; West B.L. Panmure, 2001, p. 17-18

The previous observations are in line with the assumptions that Gaudet and Salant (1992) make in their model. Only the authors' assumption that all players in one's market are known, seems problematic in container handling.

With respect to demand, it can be stated that container handling is not in a situation like in Bresnahan and Reiss (1991), where demand grows in line with the number of customers. In container shipping, shipping lines can offer smaller or larger container packages to be unloaded or loaded at a specific terminal, depending partly on shippers' choices. A supplementary difficulty and difference with Bresnahan and Reiss (1991) is that prices and quantities are not immediately observable.

Further on the demand side, only a small degree of buyer concentration can be observed. Lines indeed have some market power vis-à-vis terminals through mergers, acquisitions and alliances and related instruments analysed in Heaver *et al.* (2001), but not to such an extent that an oligopsony is in place.

III.6. Activity goals

In industrial economics research, <u>profit maximization</u> is most frequently used as the key goal. A distinction should be made between short-term and long-term profits. In the long run, profits can become minimal in a competitive market, due to entry of new companies. Only in markets where a natural monopoly is present, this is not likely to happen. In the short run, market incumbents can also prevent entry through the construction of barriers to entry, as shown in Section III.5.

Anderson (1990) refers to <u>cash-flow maximization</u> as an alternative goal to profitability. De Lloyd (2004) shows that container-handling companies often try to build cash reserves in view of for instance later acquisitions they may make. Masschelier (2004) confirms but refers to especially Asian terminals which usually emphasize <u>EBITDA maximization⁸</u>. Each of the previous goals may be a means for <u>maximizing shareholder value</u>. Devine *et al.* (1985, p. 198)

⁸ EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization

note that shareholders may want to maximize <u>market</u> or <u>stock market</u> value. As individual terminals are not quoted in stock markets, the second goal does not apply to container handling at the terminal level. It may apply to the companies possessing all or part of the terminal's ownership shares, although of the six major container-handling companies, only APM Terminals and P&O Ports are currently quoted at stock exchanges. PSA has the intention to introduce itself at the stock market. Maximizing market value may be a goal where terminals are primarily meant to be investment projects which can be sold easily without harming the company's terminal network. This applies to none of the six major container-handling operators, as their terminals' primary goal is to fit into the network.

Gale and Branch (1982) mention <u>maximization of return on investment (ROI)</u>, which is however more often used for specific projects. Friedman (1969) mentions <u>market share</u> <u>maximization</u> as a company goal, whereas Asian Development Bank (2000, p.7) refers to <u>maximization of concentration</u>. Both of these goals can also be intermediary goals for obtaining a further goal, for instance maximum cash flow. If any of both goals is pursued as primary goals, it comes close to what Gugler *et al.* (2001) typify as irrational goals: <u>expansion</u> <u>or growth</u> for instance, or starting-up <u>prestige projects</u> (Amihud and Lev, 1981), both potentially caused by hubris. In container handling, hubris may impact on a small number of terminal-acquisition or start-up decisions, but the huge investments involved in most cases prompt terminal operators on thorough and rational market and terminal analysis. <u>Sales</u> <u>maximization</u> is normally equal to market share maximization (Friedman, 1969 and 1971).

As far as profitability is concerned, Martin (2001) distinguishes among traditional firms, where profit maximization, compatible with the utility maximization of its owners-managers, was a logical firm goal, and the modern firm with its separation of managers and shareholders, which present sometimes conflicting intentions. Managers sometimes no longer feel obliged to maximize the return to stockholders, but they may be interested in <u>maximizing managerial rewards</u> or <u>maximizing discretionary power</u> (Friedman, 1969). Alternatively, managers may also want to <u>keep risk minimal</u> (Amihud and Lev, 1981). Trujillo and Nombela (1999, pp. 29-31) discern construction, operational, revenue, financial and environmental risk. None of these managerial 'biases' are very likely in container handling, as terminal-company owners usually have a strong hand in and tight control over terminal management. Moreover,

with respect to risk, managers and owners may have common interests, be it that managers may want to reduce risk in order to protect their positions, whereas owners usually reduce risk in order not to incur loss of capital.

Managerial motives may prevail in the short run, but in the longer term, profit or cash flow is the basis for the terminal's value. Non-profit-maximizing terminals may see their terminal value decrease, making the terminal more vulnerable to takeovers or acquisitions, and in the end making managers worse off through synergy measures like elimination of duplicate jobs. Mas-Colell *et al.* (1995) refer to this phenomenon as 'external market control'. According to Mas-Colell *et al.* (1995), in the short term, profit maximization is usually to be applied when (i) prices are not influenced by company behaviour, (ii) profit is not uncertain, and (iii) managers are tightly controlled by owners. In the former two cases, absence of influence from owners' personal preferences and absence of risk behaviour helps imposing profit maximization. In the latter case, reduction of managerial decision power prevents non-profit-maximizing behaviour. The former two cases are not typical to container handling, the latter is. Mas-Colell *et al.* (1995) suggests 'internal agency contract control' as a useful tool for fulfilling the third condition.

Alternatively to maximizing, terminals may also seek to outperform their rivals in one of the previously mentioned yardsticks: reaching a level of profit, sales or growth that is good relative to rivals' levels (Friedman, 1969). Or terminals may satisfice rather than optimize, in most cases in order to avoid trouble: keep stockholders happy through high enough profits, satisfy unions through high enough wages, keep extra inventories to avoid shortage, or avoid any action that arouses suspicion at higher levels. The latter situation may result in X-inefficiency if bureaucratic management is in place. In terminals which are publicly run, some form of satisficing behaviour may be more likely than in a private environment. Doing no more than outperforming rivals may occur in more terminals, especially if the profit-maximizing level of output or prices is not exactly known.

Reekie (1989) adds <u>technical efficiency</u>, which is production at minimum possible average cost. In a single-output environment, cost minimization equals profit maximization. However, as container handling nearly always is a multiple-output activity, this duality is not valid here.

<u>Technical progressiveness or innovation</u> is a related goal which seldom applies to container handling: new technologies which do not enable the firm to reach the same profitability or cash flow are not sustained for long.

Hennart (1988) mentions <u>equity maximization</u> as a possible company goal. This however is a goal which is most closely attained in public environments, but even there disturbance factors like X-inefficiency prevent full equity from being reached. The same reasoning goes for <u>employment maximization</u> (Friedman, 1969). Lynk (1995) shows what merger effects may occur under such 'non-profit' goals.

A more 'intangible' yardstick, <u>quality</u>, is being dealt with by Oum, Park and Zhang (2000), Douglas and Miller (1974) and Jamison (2000). Hardly ever though, it is considered as the ultimate goal: a container-handling product's quality is reflected in shipping companies' willingness-to-pay.

Nooteboom (1999) pays special attention to <u>small firms</u>. They may have as a secondary goal to remain small, in order to preserve their independence, go their own way, lead a traditional life, and do things which are impossible in large firms. Their primary goal should be one of the yardsticks mentioned earlier in this paragraph. Small container terminals to date only serve niche markets.

Industrial economics recognizes that maximization of company value or shareholder value is for most companies the most important goal.

III.7. Firm decision types

In terms of behaviour, container terminals and / or the companies that own them take decisions at various levels: they decide what technology to use and how to compete, to fix or change capacity at what level, how to co-operate or collude, how to differentiate and / or diversify, and / or how to integrate horizontally, vertically or in conglomerate manner.

III.7.1. Type of technology and competition

In a combined Cournot-Bertrand context, independent terminals compete in quantities with terminals in the same market and in prices with terminals serving diversified products. They may try to reach a pure activity goal for their product activity. If a container-handling company operates or has stakes in several terminals, it may co-ordinate activities over terminals in order to obtain an overall company goal. Cash-flow maximization at the company level for instance then no longer equals profit maximization at each terminal separately. The company's terminals may be in the same or in different product markets.

Hassan *et al.* (1990) show how scale, technical and allocative inefficiencies can result from inappropriate production choices, also in container handling. Figure III-2 illustrates the concepts graphically. x_1 and x_2 are both inputs, y is an output. Algebraically, allocative efficiency is measured as the ratio oc/ob. Technical efficiency is measured as the ratio y_d / y_f . Scale efficiency finally is measured as the ratio $(y_e / x_e) / (y_d / x_d)$.





In an attempt to keep or push competitors out of the market, some form of limit or predatory behaviour may be applied, in setting prices as well as quantities (OECD, 1999, p. 63). It cannot be confirmed whether such behaviour occurs in container handling. Technically speaking, most of the major container-handling companies are in a cash position that allows them to sustain limit behaviour at least for for a while. However, pushing a terminal out of the market only helps as long as this terminal can compensate with other, more profitable markets. If the terminal goes bankrupt or its owners decide to leave the facility, the terminal will be handed over to a new owner under a new lease agreement, and the incumbent will have to start its action all over again. This contrasts with most other businesses, where a site can remain empty if a supplier leaves business or where the site can get a totally different function. Limit behaviour as a way of creating cost-based entry barriers is therefore not a sustainable solution to eliminate container-handling competition.

III.7.2. Capacity change

Capacity extension, as indicated in Section III.5, is a process that in container handling requires several months to years, depending on the type of modifications to be put into practice. Capacity expansion is very frequent: nearly all container terminals have seen their capacity increase one or several times through organizational or infrastructural changes. Capacity extension has an immediate impact on supply and demand. Oum, Zhang and Zhang (2000) consider capacity choice as a means to install technology-based entry barriers.

III.7.3. <u>Co-operation</u>

As shown in Chapter II, container-handling terminals and companies engage in a large number of co-operation agreements. Some of these agreements, most often the contractual ones, are an absolute necessity in order to be able to produce: acquiring necessary inputs, binding customers, etc. Such contracts may be made by the terminal or by the operating company owning the terminal or part of it. The latter occurs when for instance multi-terminal contracts are made, featuring special tariffs applied at all or a number of the operator's terminals. Such discounting may be a means to enforce exclusivity in supply (Shapiro, 1999 and Klein, 1996). PSA for instance discounted heavily in order to bind feeders (Business

Times, 2002b). Having many feeders calling usually is a positive element in gaining hub status in shipping companies' networks. Other co-operation agreements, like joint ventures, acquisitions and mergers, are often not indispensable, but allow the terminal to obtain better results. Such agreements are typically made by the operating companies. Co-operation is often used as a means to create entry barriers, especially market-based barriers: carriers for instance are bound to the terminal due to their participations. Van den Bossche (2002c) shows however that such co-operation does not guarantee full loyalty. In that respect, transaction cost theory shows that in environments where the risk of hold-up is high, it may often be safer to conclude long-term contracts.

Mergers in container-handling typically do not occur in waves. However, models of endogenization like in the wave analyses of Kamien and Zang (1990), Barros (1998), Fauli-Oller (2000), Barkoulas *et al.* (2001), Gugler *et al.* (2002) and Rodrigues (2002) are useful for their assessment of merger effects.

Collusion is considered as explicitly anti-competitive behaviour if it increases terminal profit (or any other yardstick applied) compared to the case where there would be no collusion (Kantarelis and Veendorp, 1988; Caves, 1999). Bloch (2002) and Economides and Skrypcacz (2003) analyse coalition formation in network industries like container handling. Collusion can also be tacit, non-cooperative: taking no aggressive action against competitors (Van Wegberg (1995). Except for co-ordinated actions among terminals having a common owner, collusion does not seem to occur in container handling, for the reasons set out in Section III.5.

III.7.4. <u>Network building</u>

An important issue in network industries like container handling, is the size of the network. The analyses of Economides and Himmelberg (1995), Economides (1996), Shaffer (1997) and Roson and Van den Bergh (2000) are useful in taking decisions on network size. Earlier contributions from McCall (1980) and Carlton (1992) analyzed network building for the banking respectively the electronic services sector and are transferable to container handling.

III.7.5. Differentiation and diversification

Also from Chapter II, it appears that container-handling terminals as well as companies may find it worthwhile to diversify. A terminal that diversifies enters into a different product market, but is bound to the terminal location and will usually have to find an equilibrium between the different products so as to reach its terminal goal. Berry and Waldfogel (1999) illustrate for broadcasting how product choice may impact on merger decisions. The results are partially transferable to container handling. A terminal company that diversifies may be in different product markets due mainly to different locations. The terminal respectively the company are then in multi-product environments, which implies multi-market presence. Due to the importance of the spatial dimension in container handling, the analyses of Braid (1999 and 2001) and Clemenz and Gugler (2002) are applicable. The importance of space with respect to merger decisions is quantified by Norman and Pepall (1999). Differentiation restricts to container handling, whereas diversification includes other cargo types. It may be a way of setting up market-based entry barriers. Quality choice, like in the models of Wauthy (1996) and Douglas and Miller (1974), may be a way of differentiating.

Multi-market presence may coincide with multi-market contact if some of the owning companies are the same. In many industries, multi-market contact increases the tendency to co-ordinate actions (Bernheim and Whinston, 1990). However, as the necessary conditions for co-ordinated action from Section III.5 are lacking in container handling, at least when the other market players are not owned by the same company, terminals seem to compete rather than to collude.

III.7.6. Integration

Container-handling companies may integrate horizontally, vertically or in a conglomerate manner. It was shown in Chapter II that logistics is a business often sought after by container-handling companies. In any case of integration, the overall company goal determines goals at terminal level: co-ordination is imposed. Damas and Mottley (2003) illustrate how container terminals owned by carriers may be influenced by their integrated character: carriers often seek for third-party container business for the terminal. This traffic is often not enough to

make the facility profitable, but it helps in bearing part of the terminal's fixed costs. Vertical integration is often used as a means to create entry barriers, especially market-based barriers: terminals who go in transport and logistics for instance have a hinterland network which newcomers usually don't have. Less than in other sectors, vertical integration is used for acquiring technologies on the input side.

III.7.7. Closing down

Closing down business is not a usual phenomenon in container handling. A company can stop activities at a terminal, but in that case, the lease agreement will usually oblige it to sell the premises to another operator, who will then start up the terminal again. Real closure usually only occurs when the facility has become obsolete or when it remains far under expectations. Among the rare examples are the Ceres Paragon terminal in Amsterdam, which Hutchison agreed to buy in order to close the facility down and move equipment to Rotterdam, with the consent of the Amsterdam municipality (World Cargo News Online, 2005r). Another example of this type is Katoennatie's withdrawal from the Flanders Container Terminal at Zeebruges, which left the terminal empty.

III.7.8. <u>Type of competition as the primary decision</u>

If a one-stage game is considered, where terminal-operating company behaviour is restricted to choosing prices and / or quantities for terminals started up and for terminals acquired or merged with. The game could be extended in several ways, if one considers the terminal to make choices also on capacity, co-operation, differentiation or diversification and vertical or conglomerate integration. A type of game like in Faulhaber and Hogendorn (2000), where a telecommunications company makes sequential decisions on entry in the business, product scope, capacity, and operations (prices and quantities), or a merger game like in Adler and Smilowitz (2003) or Possajennikov (2001), can be introduced in container handling, but is not what is observed in reality.

Note that the decisions made in a one-stage game may be repeated each time a change in the environment occurs. An environmental change could be a demand as well as a supply change.

Supply changes could be caused by competitors who change their output or price decisions, who modify capacity, who decide to co-operate, who differentiate and / or diversify, and / or who integrate. Changes in the environment occur sequentially, and therefore the one-stage game is in reality played several times, over multiple periods, like in Spulber (1995) and Friedman (1971). Such repeated interaction could again sharpen the tendency to collude, but it was shown that sufficient conditions are not present.

III.8. Horizontal merger and acquisition effects

Horizontal merger and acquisition effects can mainly be categorized as economic, financial or market-related (Azevedo, 1999). Depending on whether the partners' emphasis is on economic or market-related motives, Bensaid *et al.* (1994) call the merger co-operative or concentrative. Company merger and acquisition translate as changed terminal conditions.

III.8.1. Economic merger and acquisition effects

With respect to the economic effects of mergers and acquisitions, a distinction can be made among transaction and size effects. Farrell and Shapiro (2000) denote the first type of effects as synergies, the latter as efficiencies. Efficiencies can but need not be merger-specific. In horizontal mergers or acquisitions, only the size effect occurs. In container handling, size effects can be obtained in the operational fields from Table III-10.

The transaction cost savings from occur under the assumption of bounded rationality: in contractual arrangements, for each contract, a new search has to be initiated. This cost is avoided in a unified company setting (Nooteboom, 1999). On the other hand, firm size can make efficient hierarchical control impossible. In Table III-10, it is assumed that firm structure allows efficient management.

Operational field	Size effect	References
Administration	Fixed administrative costs can be spread over larger volume; possibility of standardization and automation	Gilligan <i>et al.</i> , 1984; Berndt et al., 1991; Bouquet, 1992 ; Martin, 2001; Van Wegberg, 1995, p. 1; Nawas, 1995; Durkin and Elliehausen, 1998; Van den Bossche, 2002d
Contracting	Bargaining power in negotiating; avoiding intermediaries	Hagedoorn, 1993; Nooteboom, 1999
Equipment	Sufficient equipment volumes to bargain input prices; equipment can be used more efficiently	Caves et al., 1984 ; Clark, 1984; Beddow, 2001; Cordts, 2001
Handling operations - technology	Possibility to standardize within constraints imposed by shipping companies; product specialization is efficient	Peltzman, 1977; Hagedoorn, 1993; Contractor and Lorange, 1988; Hennart, 1988; Encaoua, 1991; Van Wegberg, 1995, p. 1; Botelberge, 1996; Van den Bossche, 2002; Peters (2003)
ICT	ICT setup, installation and maintenance costs can be spread over larger volume; possibility of standardization; e-commerce more efficient and more attractive in larger network; sufficient volume to have in-house development, installation and maintenance of systems	Contractor and Lorange, 1988; Borys and Jemison, 1989, p. 77; Hagedoorn, 1993; Van Wegberg, 1995, p. 1; Nooteboom, 1999; Oum, Zhang and Zhang, 2000, p. 8; Beddow, 2001; Van den Bossche, 2000 and 2002d
Labour	In-house training is efficient due to job specialization	Contractor and Lorange, 1988; Beddow, 2001
Marketing	Fixed administrative costs can be spread over larger volume; more terminals means more attractive network; possibility of standardization; sufficient volume to do promotion with own staff	Devine <i>et al.</i> , 1985, p. 201; Hagedoorn, 1993; Van Wegberg, 1995, p. 1; Cordts, 2001; Van den Bossche, 2002b
R&D	Technology development costs can be spread over larger volume; sufficient volume to have knowledge in house	Devine <i>et al.</i> , 1985, p. 201; Nooteboom, 1999; Van den Bossche, 2002b
Security	Fixed security costs to be spread over larger volume; possibility of standardization and automation; security provision can efficiently be provided in house	Van Wegberg, 1995, p. 1; De Lloyd, 2003

Table III-10: Operational fields affected by economic effects of mergers and acquisitions

A number of merger and acquisition effects only materialize in specific contexts due to site specificity, physical asset specificity or human operator specificity (Stewart, Harris and Carlton, 1984; Borys and Jemison, 1989, p. 77; Berger and Humphrey, 1994, p. 6; Williamson and Masten, 1999). Effects can also depend on the acquirer or merging partner: some are universal (occur with all partners), some are endemic (occur with some partners), and some are unique (to one specific partner) (Copeland et al., 2000, p. 121).

In container handling, mergers do only allow to reduce process setup costs when terminals are within the same market, and when the terminal operator decides to shift all operations to the least-cost terminal. This contrasts with what Cordts (2001) observes in many other businesses, also in logistics. As closing down a terminal is often not an option due to lease agreements, such shifts are not likely to happen.

III.8.2. Financial merger and acquisition effects

It is known that for port investments, large amounts of capital are usually required, on the order of 150 bn USD / 1m TEU. Often, existing container-handling companies, especially the small, local ones, cannot afford the necessary terminal extensions. Mergers and acquisitions are therefore often an indispensable means to increase working capital (Bonney, 2002). Sufficient capital is also necessary for enabling innovations in technology (Declercq and Verbeke, 1994). Nawas (1995) and Bouquet (1992) deal with financial efficiency effects in banking, but their results are partially transferable to container handling.

Financial merger or acquisition motives may further be avoidance of losses, attaining positive earnings, improving operating results or getting a stable management with stable results (Van der Vennet (1994). Azevedo (1999) mentions tax benefits resulting from merger or acquisition.

Devine *et al.* (1985, p. 196) and Benefield and Perry (1994) see improved market valuation or stock market capitalization as further merger or acquisition effects. The latter effect applies to the stock-quoted container-handling companies.

Devine *et al.* (1985, p. 201), Berger et al. (1987) and Oum, Park and Zhang (2000, p. 9) refer to the beneficial effects on risk mergers and acquisitions may have. If a container-handling company merges with a different company active on different markets, risk is spread.

Mergers or acquisitions are furthermore also be a way to generate company growth (Devine *et al.*, 1985, p. 198; Anderson, 1990, p. 30). Company growth is often necessary in order to retain market value.

III.8.3. Market-related merger and acquisition effects

A merger or acquisition of companies active in the same market implies increased market power (Gale and Branch, 1982; Eckbo, 1985). Market power can have substantial effects on outputs and prices. The results Prager and Hannan (1998) and Hannan and Rhoades (1998, p. 69) obtain for banking, Brueckner and Spiller (1991), Marín (1995) and Bamberger and Carlton (2003) for aviation, and Cotterill (1986) for retailing are partially transferable to container handling.

For companies not yet active in a market, mergers and acquisitions may be the ideal way of entry, since it usually allows circumventing entry barriers (Hennart, 1988) and therefore allows quick entry (Hagedoorn, 1993; Contractor and Lorange, 1988; Borys and Jemison, 1989, p. 77; Copeland et al., 2000, p. 118). Van der Vennet (1994) calls mergers and acquisitions relatively easy ways of differentiation. Mergers and acquisitions also allow quickly adapting products to markets, acquire sources of materials or competencies, acquire a strong trademark, set market standards, pre-empt or attack competition or defend one's own product (Nooteboom, 1999; Botelberge, 1996). With a merger or acquisition, a company also acquires knowledge and control of local outputs and processes (Van Wegberg, 1995, p. 1).

Mergers and acquisitions may also enable the company to delete excess capacity in a market (Martin, 2001), although capacity deletion is not evident in a highly regulated environment like in container handling.

Negative merger or acquisition effects from a terminal point of view may be decreasing flexibility in technology choice (Nooteboom, 1999).

III.9. Effects of other forms of co-operation and integration

III.9.1. Vertical or conglomerate integration

Vertical integration may be inspired by efficiency as well as strategic motives (Martin, 2001), which differ from those accruing to horizontal mergers and acquisitions. Efficiency effects are solving the bounded rationality problem, internalizing information, internalizing technological abilities, solving small-numbers bargaining problems, solving other distortions in input choice like for instance uncertainty, and making price discrimination undone. Strategic effects are transport chain foreclosure, raising rival's costs, increasing industry understanding, and avoiding contracting, transactions and negotiations costs.

Conglomerate integration just like vertical integration allows circumventing transaction costs, but also allows spreading risk and building an empire (Martin, 2001).

III.9.2. Joint-venture formation

Joint ventures have in common with horizontal mergers and acquisitions a number of internal, competitive and strategic effects (Harrigan, 1985, p. 28; King, 1998). These effects may be re-categorized as economic, financial and market-related effects.

Economic joint-venture effects are that they allow to obtain beneficial input conditions and to gain synergies through partner coalition (Bloch, 2002). Financial effects from joint ventures are the abilities to gain means for which there is no market, to gain capital for debt leverage and to share risk. Market-related effects are to enter new markets, to circumvent trade barriers, to build locally accepted worldwide terminal networks, to acquire new technologies and customers, to get knowledge of new management practices or strategic information, to share output at least if terminals are in the same market, and to expand capacity.

Compared to mergers and acquisitions, joint ventures have a number of advantages (Nooteboom, 1999).

- There is less of a problem with cultural integration.
- Full partner screening is less important.
- Focus remains on core competencies.
- Existing brand name is maintained.
- Input autonomy is maintained.
- Local identity is maintained.

III.9.3. Contracting

Container-handling terminals or companies, like other companies, often prefer contracting to integrating, whether through merger, acquisition or joint venture, for a number of reasons (Nooteboom, 1999).

- There is hardly any cultural problem.
- Contracting allows hedging.
- Contracts can be renegotiated and allow more flexibility.
- Contracts still work, even if capital markets are not efficient.
- If quality is defective, the contract can be stopped; if under integration quality is defective, a new production technology needs to be introduced, which is much more capital- and time-intensive, and which often suffers from asset-specificity in changing environments.
- Separate companies maintain their full identity.
- Set-up costs are lower than for integrated forms of co-operation.

Drawbacks of contracts compared to mergers and acquisitions are that there may be spillovers of knowledge, and that conflicts of interest may surge which are hard to control. The latter at a terminal may for instance mean that traffic feed is not as it could be under a joint venture, and that service quality may not fully live up to shipping companies' expectations. This conclusion can be derived from Zhang (2002, p. 1), who obtained similar results for alliances in aviation.

III.10. Abstracted merger aspects

This section deals with a number of co-operation aspects to which no further explicit attention is paid in this thesis, but which need to be borne in mind when analyzing mergers and acquisitions, due to the locally strong impact they may have.

III.10.1. <u>Antitrust</u>

The possibility that a specific merger proposal is blocked by an antitrust authority, is not taken into account. In container-handling reality however, competition authorities follow closely high-profit businesses like container handling. Examples of antitrust worries and considerations are abundant. At Jawaharlal Nehru Port for instance, APM Terminals and P&O Ports among other foreign operators already present in the port were allowed to bid for the fourth container terminal, after earlier ministerial considerations on oligopoly prevention were reversed (World Cargo News Online, 2004al). India changed its bidding allowance policy on antitrust grounds: the rule that any operator cannot run more than two terminals in the same port now also includes neighbouring ports (World Cargo News Online, 2005u). Jakarta International Container Terminal in Indonesia was at first forced to close down due to alleged unfair competition, but the allegation was later recalled (World Cargo News Online, 2004cm). The grounds for merger rejection and antitrust rules are however under severe discussion, as shows for instance De Financieel-Economische Tijd (2002).

Neither does this thesis deal with the possibility that an antitrust authority can impose an ownership ceiling to a specific company, of the type mentioned in OECD (2001, p. 73)

III.10.2. Bidding

Bidding is inherent to container handling in two situations. Of course it is inherent in case of a merger or acquisition, but here it does not differ from any other business. Therefore, an analysis like in Colangelo (1995), where companies combine horizontal and vertical integration through a three-stage game including (i) bidding for a company, (ii) input price setting, and (iii) output price competition, could also fit container handling. A problem then is

determining the amount to pay and bid for the company. Copeland, Koller and Murrin (2000) and Haspeslagh (1991) note that overbidding may be caused by too optimistic estimates of market potential and of synergies or efficiencies, or by a current market value which is unknown.

A second situation where bidding occurs is specific to container handling: bidding occurs to obtain a terminal concession. West L.B. Panmure (2001, p. 13) observes that more and more the major container-handling companies are in cut-throat competition and consequently also bidding for newly developed terminals. Fees to pay, initially and annually, are incorporated in this thesis as fixed costs, and there is no reference to the bidding process as such. A bidding game, for terminal concessions in this case, could be but is not introduced here. The container-handling bidding process differs from classical bidding processes in the sense that the 'content' of the proposal is at least as important as the amount of money offered: the authority granting the concession wants to know what will be future performance of and plans with the terminal.

III.10.3. <u>Company culture</u>

Nooteboom (1999) observes that company culture is an important aspect which should not be overlooked in the merger or acquisition process. Ignoring the cultural dimension is the basis for many merger and acquisition failures. This is not different from the merger process in any other business. Cultural integration is an important part in merger human resource management. Desmet (2003) illustrates how culturally different container-handling companies can be.

III.10.4. <u>Entry</u>

Entry by third parties is in this thesis not considered to be an endogenous phenomenon. This is close to container-handling reality in the case of erection of new terminals, as public and / or port authority support or at least authorisation is required. New terminal entry therefore often has an exogenous character, where the decision to build a new terminal is of course at least partly driven by container-handling companies willing to occupy sites in a market with

high profits, but where on the other hand the decision is dependent on the willingness, capabilities and agenda of the public and / or port authority to allow a new terminal. A recent example of a port authority-induced terminal development is Philadelphia with its South Port Development (World Cargo News Online, 2005t). Government induction is found for instance in Ukraine where the Transport Ministry wants to develop a new port along the Kerch-Yenikale canal (World Cargo News Online, 2005af). Government intervention is found for instance at Port Botany, where no agreement is reached on how to develop and to whom to lease the terminal (World Cargo News Online, 2005ah), and at Dibden Bay, where the government forbade ABP's terminal construction plans on environmental grounds (World Cargo News Online, 2004bw). Foreign direct investment rules may also prevent a newcomer from entering. Like in many other industries, entry by a third party depends not only on the presence of entry barriers, but also on current market rents, reaction patterns of incumbents, nature of eventual other potential entrants, resources and market information costs (Caves and Porter (1977).

III.10.5. Market segmentation

Within the same market, differentiation among customers is possible. Such market segmentation may be the basis for price discrimination. Hausman *et al.* (1968, p. 370-371) identify as sufficient conditions for price discrimination the possibility of identification of different price sensitivity and the possibility of arbitrage obstruction. The latter condition is automatically fulfilled in case of inherently non-transferable products, but needs to be contractually fixed when products are transferable in nature. Jamison (2000) and Bamberger and Carlton (2003) deal with price discrimination in the specific case of network industries, like container handling is one.

III.10.6. <u>Principal-agent control</u>

Part of Section III.6 was devoted to managerial impact on terminal activity goals, and the tension that this can bring in the relationship between shareholders and managers. The principal-agent problem and how to keep it under control is the subject of for instance Hansmann (1996).

III.10.7. Merger process issues

Financial planning and control and are required in daily business management, but they deserve special attention in case of a merger or acquisition. Copeland *et al.*'s (2000) methodology for company valuation is specially designed for merger situations.

Financial planning is part of a wider process, which Tallman and Shenkar (1993), Geringer and Frayne (1993) and Buckley and Casson (1998) describe. In fact, the authors developed the process for joint ventures, but it is transferable to mergers and acquisitions. The process consists of steps one needs to go through to make a thoroughly founded co-operation decision.

- Decide to look for an investment option
- Determine selection criteria
- Identify partners
- Evaluate partners
- Decide on the partner to approach
- Negotiate with the partner
- Decide on the final partner and sign the contract

Jespers (1991) and Nooteboom (1999) mention an element which is often overlooked during the set-up of a merger: under what conditions and when to break up the agreement (or demerge).

III.10.8. <u>Innovation</u>

An implication of working with mergers is that innovation that is to come is not considered. Demand and supply conditions are only analyzed for existing settings.

III.10.9. Social welfare

A number of outcomes of mergers and acquisitions are not only desirable from a company point-of-view, but can in the meantime be better for society and therefore increase social welfare. Improved service, cost reduction, etc. under specific conditions are socially desirable. Although company rather than social welfare is in the focus of this thesis, welfare and antitrust analysis like in Corchón and Faulí-Oller (1999) is useful here, and, on the other hand, the results from this thesis are useful for antitrust analysis.

III.10.10. Stock markets

Although in a few number of cases, good stock market results may be a container-handling company's primary goal, stock market results and reactions are not subject to analysis in this thesis. A supplementary reason is that Copeland *et al.* (2000) pose a number of methodological questions as to when a merger or acquisition is a success according to stock-market standards. A success could be when overall value creation is higher than without merger or acquisition, when a lower premium is paid than the value of the acquired company, or when the merged company is better run than it would have been without a merger. As only a limited number of container-handling companies are stock-quoted, stock-market reactions' explanation power is limited here.

III.11. Useful techniques

It was shown in Chapter I that port production and cost functions have been quantified in a number of ways. Tongzon's (1993) production estimate and the cost estimates of Tovar de la Fe *et al.* (2003 and 2003c) and especially Marchese *et al.* (2000) and Turner *et al.* (2004) approach closest the multi-product container-handling environment. None of them however treats different products sold at different markets separately.

All of these studies use econometric estimation for determining production and cost functions. Such methodology involves a number of specific estimation problems.

- What aggregation level to choose? If the aggregation is too detailed, no data and / or no sample elements may be found. If there is not enough detail, important information may be lost
- Often the translog function is used in estimating. However, this functional form suffers from the so-called 'non-zero' property (no zero input values allowed if not zero cost) and the parameter number property (too many parameters can lead to multi-collinearity)

The Economic Frontier Approach, the Thick Frontier Approach, Data Envelopment Analysis⁹ and the Distribution-Free Approach all suffer from similar lack-of-data problems.

The alternative chosen in this thesis is to apply an engineering technique. It however remains a problem to find the required, disaggregate data. Help may come from simulation and optimization modules developed. Their results can serve as inputs for the engineering cost calculation. One should however be well aware of the specific purpose that the simulation instrument was developed for, and consequently of the simulation level and specific container-handling context that it entails. Gambardella and Rizzoli's (2000) overview of simulation techniques existing and applied for the different terminal activities, is helpful in this respect. A number of different contexts are summarized in Table III-11.

Reference	Level	Context
Daganzo (2002)	port	Crane productivity in order to minimize ship
		delay
Khan (2002)	terminal	Hong Kong International Terminals: focus on
		equipment handling rates, vessel operating
		rates, tractor turnaround times, yard grounding
		statistics, and resource utilisation levels
Kurstjens et al. (1996)	port	Dutch Maasvlakte project
King (1999)	port	Maritime entrance
Kia et al. (2002)	port	
Liu et al. (2002)	terminal	Automation
Gambardella et al. (1998) and	terminal	La Spezia port
Mastrolilli et al. (2000)		

Table III-11: Container-handling simulation contexts

⁹ Data Envelopment Analysis was applied to container handling among others by Marchese et al. (2000).
Choi and Yun (2000) apply an object-oriented approach. Herrero *et al.* (2002) distinguish among parallel and pro-active simulation. Also can different simulation and optimization levels be distinguished: Steenken *et al.* (2004, p. 34 - 35) and Boll (2002, p. 125) distinguish among these.

- Strategic simulation, dealing with terminal lay-out and handling equipment.
- Tactical simulation, looking for solutions to disturbances in terminal operations.
- Operational simulation, whereby different logistics alternatives are evaluated.

Priorities will usually be imposed on the sequence of activities to be optimised at a terminal. Van de Merbel, 1998 states that a traditional sequence of more to less crucial elements looks like in Figure III-3.

Figure III-3: Traditional importance of container terminal elements



Source: own composition based on Van de Merbel, 1998

Sometimes, an artificial agent structure is introduced, in which each agent performs a specific terminal activity. Such structure by definition does not conform to reality, so that outcomes need to be translated to the actual terminal situation. Rebollo *et al.* (2000) for example distinguish among agents and operations like in Figure III-4.



Figure III-4: Container-handling agents according to Rebollo et al.

Source: own composition based on Rebollo et al., 2000

Thurston and Hu (2002) consider three agents: the Quay Crane Agent, the Straddle Carrier Agent, and the Traffic Agent. Henesey *et al.* (2002) set up a berth planning program, in which

transactions occur between the four main agents they distinguish: a ship agent, a berth agent, a yard agent, and a gate agent. The authors apply the following system architecture:

- allocation of incoming containers to terminal yard;
- dispatch of containers from terminal yard to ships;
- allocation of yards with containers discharged from a ship;
- dispatch of containers from terminal yard to hinterland transportation;
- reallocation of containers after final decision of berth.

Typical to Cournot and Bertrand settings, is the possibility to apply game theory. Fauli-Oller (1997) is a useful reference in this respect, which combines merger analysis with game-theoretic applications in an oligopolistic setting.

III.12. Summary on market structure, firm behaviour and merger effects

Many container-handling products may be distinguished, even at the same terminal. These products may be handled sequentially or in parallel. In the first case, one has multiple products, whereas in the second case, there is joint production, with particular effects on operating conditions for CHAPTER IV. Characteristics for distinguishing products originate from the container itself, its cargo, the vessel transporting the container, the hinterland mode, or specific handling requests. These characteristics will come back in CHAPTER IV among other characteristics.

Compatibility of products is of particular interest, as it allows increasing demand for a terminal's services. The size of the market as such can in general be measured with the help of a number of methods, of which only one is more or less feasible for container handling: similarity of streams. Using elasticities is hard as prices are often unknown, and shipments theories do not apply since container-handling is a service which is not shipped. The similarity-of-streams method can be used to determine the specific market size for each of the cells of the matrix in CHAPTER IV.

With respect to the number of players, all facts seem to confirm that container handling is characterized by an oligopoly situation. This has important repercussions on the market dynamics and relationships between terminals. On the one hand, different terminal cost structures may lead to different market shares of individual terminals, whereas on the other hand, different market shares may lead to different reaction patterns, which make individual terminals behave in a way that would be different under a different market setting. Business dynamics impact on the sections of the supply function from CHAPTER IV that will in the end be reached by maximizing profits, where demand and supply meet. Game theory is a helpful tool in such oligopoly setting. Two supplementary elements which lead to different market settings are the asymmetric distribution of information in container handling, and the absence of communication, which causes recurrent disequilibrium.

It is also observed that container handling features fixed costs. This is a source of economies of scale at the terminal level, and therefore confirms hypothesis 1. The level of fixed costs depends on the specific technology used at the terminal, which supports hypothesis 2.

The type of goals that the owners of a terminal pursue may depend on the organizational setting of the terminal and of the wider port, and therefore depend on the position in the matrix in CHAPTER IV. In turn, the goals, at terminal level or at company level, determine at what output and price level the terminal will produce. It can be observed that company value maximization, or shareholder value maximization in case shareholders are present, will be the most frequent goal.

The supply functions developed in CHAPTER IV are primarily meant to support firm decisions concerning mergers and acquisitions, but they can also be applied to any output and price decision in general. Other decisions, relating to capacity change, network building, differentiation, diversification, integration and contracting indirectly equally benefit from the analysis in CHAPTER IV. All of these decisions, in as far as they have been taken in the past, be it by the terminal in focus, its competitors or other actors in the maritime chain, help structure the context in which terminal handling takes place and determine what setting out of CHAPTER IV the terminal finds itself in.

An immediate, be it qualitative, answer to hypothesis 3 is provided by the efficiency effects of mergers and acquisitions that are encountered in existing literature, and which are learned

from decision-makers in the container-handling business. As horizontal mergers and acquisitions are considered, there are no immediate synergy effects. The efficiency effects at company level, which are reflected in the terminal cost functions calculated in CHAPTER IV, originate from administration, contracting equipment, technology, ICT, labour, marketing, R&D and security. Although not immediately in the focus of this thesis, financial and market effects deserve attention to, especially as it was shown in CHAPTER IV that mergers and acquisitions in general usually have long-term motives. Financial effects like acquiring capital, avoiding losses, spreading risk or increasing company value are based on rational motives, whereas company growth is often based on more irrational motives. Market effects can be reinforcing a terminal's established position or allowing entry in a new market. Although market motives often prevail in deciding on mergers and acquisitions, the various operational areas where efficiencies may be obtained lead to the conclusion that these efficiencies are not to be neglected. Testing hypothesis 3 in CHAPTER IV is however difficult, as comparable and consistent data are lacking at this stage.

There are a number of container-handling aspects which impact on conditions in CHAPTER IV, but which get no further immediate attention in the cost function analysis in CHAPTER IV. Antitrust for instance may prevent a merger or acquisition move, but may also impose supplementary costs if approved. Bidding in container handling occurs in two ways. It may influence the capital outlay for the merger or acquisition, or it may influence the conditions under which the terminal operates through bidding for a concession. Company culture is an aspect that is often overlooked, but that deserves sufficient attention apart from the cost analysis: many merger and acquisition failures are due to lack of cultural integration or willingness to integrate. Entry is considered to be an exogenous phenomenon, whereas in reality, market structure and prospects will make it an endogenous decision. Market segmentation is not considered, although the container-handling reality asserts that terminals try to take a share of consumer surplus. Principal-agent control, just like culture, is often overlooked, but may hamper merger or acquisition plans. The entire merger or acquisition process, from the conception of the idea to the conclusion of the agreement, may be a serious cost burden by itself, which is not further considered in this thesis. To the extent that mergers and acquisitions are considered, innovations are not taken into account. The cost function analysis from CHAPTER IV, in as far as cost data are available, allows similar construction

of cost functions for new terminal settings like for existing ones. Social welfare is not included in the cost function analysis, although it may impact on operating conditions if one of the actors in the maritime chain imposes the terminal to take it into account. Stock market reactions are not considered either, but may be the expression of company value, which is the result of the terminals' operational results.

In view of data availability, an engineering approach is chosen to construct cost functions in CHAPTER IV. Results from various simulations may be useful inputs to the engineering analysis.

The next chapter goes into the detail of the container-handling process, and summarizes the factors that impact on container-handling supply and / or demand conditions.

CHAPTER IV: CONTAINER HANDLING: THE PROCESS AND THE INFLUENCING FACTORS

IV.1. Rationale for the chapter

The aim of this chapter is twofold: to visualize the container-handling process on the one hand, and to indicate what factors impact on supply and demand and therefore on efficiencies in container handling on the other hand. The following structure is adopted.

- Section IV.2 details the sub-activities of the container-handling activity as well as their sequence.
- Sections IV.3 to IV.6 give an overview of the conditions impacting on some or all container-handling activities and therefore on supply and demand, and on the level of economies of scale. These factors are classified in four main groups: policy, scope, chain and terminal-specific factors.
- Section IV.7 summarizes the factors which are brought together in a matrix structure.

IV.2. The container-handling process

Container handling requires a sequence of a number of the activities depicted in Figure IV-1 to take place. Depending on the container-handling product considered, this sequence is composed differently.



Figure IV-1: Container-handling process for different container-handling products

Inbound and outbound containers both require waterside and landside operations. Transhipment-container handling only takes waterside activities. Storage is technically optional for all products. Each of the sub-activities is described in more detail below.

IV.2.1. Unloading and loading

Unloading and loading both involve the sub-activities mentioned by Linn (2003) in Figure IV-2.



Figure IV-2: Detail of (un-)loading activities:

Source: own composition based on Linn, 2003

As mentioned in Chapter III, container (un-)loading can be performed with different techniques: lo/lo, ro/ro or sto/ro. Figure IV-2 takes a lo/lo perspective. Different techniques impose different requirements, not only on infra- and superstructure, but also on operations. Figure IV-3 makes a comparison between lo/lo and ro/ro techniques with respect to the processes of <u>un-boarding and boarding</u>. It appears that the two techniques vary to a large extent in the number and type of actions to be taken, and consequently also in container-handling supply and demand conditions, the latter of which will be confirmed in Section IV.6.



Figure IV-3: Comparison of lo/lo and ro/ro techniques for un-boarding and boarding

Source: own composition based on Van de Merbel, 1998

Container un-boarding, no matter the technique used, involves a number of shipboard gang duties.

• Releasing and removing lashings.

- Unlocking securing devices.
- Releasing hatch cover cleats.
- Unlashing un-containerized and heavy lifts.
- Placing devices in baskets, bins, etc.
- Repeating this procedure for every tier.

Similar shipboard gang duties are required in case of loading.

- Inserting securing devices, tier by tier.
- Connecting reefers, open vents, etc.
- Securing container stacks with lashing devices.
- Monitoring container condition and ID.

<u>Quay crane allocation</u> is a preparatory activity to (un-)boarding. Wilson *et al.* (2001) link crane allocation to <u>berth allocation</u>, since an available berth is unproductive if no cranes are available at that berth. Closely related to crane allocation too are <u>crane work programming</u> and <u>manpower management</u>.

<u>Stowage planning</u>, like the sub-activities from the previous paragraph, is supposed to precede the actual loading of the vessel, since it deals with *"the arrangement of containers within the ship"* (Meersmans and Dekker, 2001, p. 5). Wilson *et al.* (2001) split up stowage planning into two sub-processes:

- ordering blocks of similar containers inside the ships;
- assigning slots inside the blocks to individual containers.

<u>Shuffling</u> containers is moving the containers from one stack position to a different stack position. <u>Marshalling</u> comprises movements from one location to another to suit the terminal's operational requirements. There are what Steenken *et al.* (2004) call internal movements.

Part of the shuffle-operations in case of unloading through lo/lo or sto/ro is grounding of containers: stacking them in a block in the storage area.

<u>Yard traffic management</u>, according to Meersmans and Dekker (2001, p. 8) involves retrieving containers from the stack and transporting them to the quay, or the other way round in case of unloading a ship. Retrieval only applies if storage occurs. Stacking vehicles in this case operate on stacking blocks, which are themselves divided in stacking bays.

IV.2.2. Storage

Since not all nodes in the maritime transport chain have equal capacity, storage is often needed. This buffer function of the container yard storage activity is only one of four of its functions. Other storage functionalities are allowing administrative procedures, allowing assembly of outbound containers, and accommodating delays. The storage activity, besides the physical placing of containers, also involves determination of storage space requirements and allocation of storage locations (Van de Merbel, 1998; Meersmans and Dekker, 2001, p. 13).

Not in all cases, storage is required or applied. It is only applied in what is called 'indirect delivery / receipt'. If there is no storage, direct delivery / receipt is in place. Van de Merbel (1998) discerns 6 cases where direct delivery / receipt is often – although not strictly necessarily – applied:

- in terminals operating from a railhead;
- for high value cargoes, for which extra handling time means a high time cost;
- for armaments, explosives and certain dangerous goods, where extra movements mean increased accident risk;
- for large, awkward or heavy loads;
- for fast-track containers;
- for road vehicles travelling on ro/ro vessels.

IV.2.3. Inter-modal delivery and receipt

For inbound containers, after storage, or after goods are unloaded from ships in case of direct delivery, inter-modal delivery takes place, at least where import containers are concerned. Conversely, for outbound containers, before storage, or before loading in case of direct

delivery, inter-modal receipt takes place, at least where export containers are dealt with. With transhipment containers, the inter-modal delivery / receipt stage is not required (Miglior *et al.*, 2002). Figure IV-4 gives an overview of the steps required for inter-modal delivery and receipt in general, comparing indirect and direct techniques.

Delivery		Receipt	
Indirect	Direct	Indirect	Direct
Hinterland transport	Hinterland transport	Hinterland transport	Hinterland transport
modes arrive at the	modes arrive at the	modes arrive at the	modes arrive at the
terminal	terminal	terminal	terminal
The hinterland mode	The hinterland mode	The hinterland mode	The hinterland mode
driver presents	driver presents	driver presents	driver presents
documents at the	documents at the	documents at the	documents at the
terminal reception in	terminal reception in	terminal reception in	terminal reception in
order to have them	order to have them	order to have them	order to have them
processed	processed	processed	processed
The driver takes the	The driver takes the	The driver takes the	The driver takes the
vehicle to the gate in	vehicle to the gate in	vehicle to the gate in	vehicle to the gate in
order to have it	order to have it	order to have it	order to have it
physically processed	physically processed	physically processed	physically processed
The driver takes the vehicle to the container lifting location	The driver takes the vehicle into the quay, under supervision, and a crane lifting the container from the ship onto it	The driver takes the vehicle to the container lifting location	The driver takes the vehicle into the quay, under supervision, and a crane lifts the container from the vehicle on the ship
The vehicle returns to	The vehicle returns to	The vehicle returns	The vehicle returns
the gate and being	the gate and being	to the gate and being	to the gate and being
cleared to leave	cleared to leave	cleared to leave	cleared to leave
The vehicle leaves	The vehicle leaves	The vehicle leaves	The vehicle leaves
through the terminal	through the terminal	through the terminal	through the terminal
entrance	entrance	entrance	entrance

Figure IV-4: Delivery / receipt process

Source: own composition based on Van de Merbel, 1998

The structure presented in Figure IV-4 is heavily focused on truck hinterland transport. In case containers are delivered to or received from rail, the process looks like in Figure IV-5. For barge hinterland transport, the process looks like in Figure IV-6.



Figure IV-5: Delivery / receipt process for rail hinterland transport

Source: own composition based on Van de Merbel, 1998

Figure IV-6: Delivery / receipt process for barge hinterland transport



Source: own composition based on Van de Merbel, 1998

It should also be noted that Figure IV-4 takes a lo/lo or sto/ro point of view. For Figure IV-5 and Figure IV-6, the lo/lo perspective is a logical one. In case of ro/ro, where truck transport is the only possible solution, the container would not be lifted, but the chassis including the container would be (de-)coupled. For direct delivery / receipt under ro/ro, (de-)coupling could be done inside or outside the ship: in the first case, the hinterland vehicle is allowed to enter the vessel, whereas in the second case, it is not. With indirect ro/ro delivery / receipt, (de-)coupling will automatically be done outside the ship. Under lo/lo, lifting is automatically done outside the ship. If lifting is done inside the ship, the technique used is one of sto/ro.

IV.2.4. Data interchange

An important aspect of container handling is document and data exchange. Tung (Chairman and CEO OOCL) states that "(*un-)loading a 5.000 TEU ship involves about 40,000 documents and 6,000 to 7,000 customs transactions*" (Vickerman, 2003c). Asian Development Bank (2000, p. 28) refers to the use of management information systems, electronic data interchange, automatic cargo tracking and billing.

Van de Merbel (1998) and Bang (2003) point out two main activities at the terminal which involve registration and transfer of substantial amounts of data: unloading / loading on the one hand, and inter-modal delivery / receipt on the other hand. During both unloading and loading, following ship operation work schedule documents are to be produced and transferred: a crane movement sheet, a crane sequence sheet, and furthermore also a discharge respectively loading sequence sheet. The process through which these documents are compiled and transferred is illustrated for different unloading and loading techniques in Figure IV-7 respectively Figure IV-8. For inter-modal delivery and receipt, the data-stream sequence is compared among different hinterland modes in Figure IV-9 respectively Figure IV-10.

The situation for (un-)loading and inter-modal delivery / receipt of dangerous goods is even more complex with respects to data interchange needs. The data flow of inter-modal receipt from road is compared between dangerous and non-dangerous cargo in Figure IV-11. In the

specific case of empties, documents interchange requirements are still different. In the same figure, comparison is made for empty and non-empty containers.



Figure IV-7: Container-unloading data flow according to superstructure used

Source: own composition based on Van de Merbel, 1998 and Bang, 2003



Figure IV-8: Container-loading data flow according to superstructure used

Source: own composition based on Van de Merbel, 1998 and Bang, 2003



Figure IV-9: Container-delivery data flow according to hinterland mode

Source: own composition based on Van de Merbel, 1998 and Bang, 2003



Figure IV-10: Container-receipt data flow according to hinterland mode

Source: own composition based on Van de Merbel, 1998 and Bang, 2003

Figure IV-11: Container-receipt data flow according to container content



Source: own composition based on Van de Merbel, 1998 and Bang, 2003

IV.2.5. Infra- and superstructure provision and maintenance

Two activities, termed as civil engineering activities in the approach of Op de Beeck (1999, p. 4–7), are required before any container-handling activity at a terminal can take place: infrastructure provision and maintenance, and superstructure provision and maintenance. Also outside the terminal, specific infra- and superstructure are needed for allowing containers to enter or leave the sea port by sea and for distributing commodities to or collecting them from the hinterland.

IV.2.6. Safety and security provision

Also needed at a terminal are safety and security provision. Safety has to do with prevention and lessening impacts of accidents. Security has to do with prevention and lessening impacts of criminal activities which disturb the normal container-handling process. (City of Long Beach, 2002)

Both safety and security involve prevention as well as mitigating activities. Prevention involves control and/or police power over cargo (for instance concerning treatment of hazardous goods), over persons (for example dealing with working conditions, illegal immigrants), and over equipment (condition and reliability of cranes, warehouses, etc.). Control and / or police power may be exercised by private persons/companies, by customs and/or by police. Mitigation involves for instance fire-fighting, but also having available an accident emergency procedure. Such procedure mostly goes like this: (i) the landside supervisor issues a safety stop, (ii) he seeks accident details via the outside supervisor, (iii) if IMDG¹ cargo is involved, an emergency procedure is launched, (iv) if personnel is injured, a medical / first aid team is called, (v) if no IMDG cargo is in play, an engineering team is called, (vi) engineers remove equipment, (vii) barriers are erected around the accident site, (viii) operations restart and resources are redeployed, (ix) participants are debriefed and a complete accident report is drafted, and (x) an inquiry is conducted and suitable action is taken (Van de Merbel, 1998).

IV.2.7. Container-handling combining sub-activities

Cargo handling requires a combination of the activities summarized in this section. Moreover, each of the above-mentioned activities is a dimension which can impact on cargo-handling costs and revenues through the options that are available for organizing the various activities. The cargo-handling product however which customers pay for does not necessarily cover all of these activities. And not all of the activities need be performed by one actor. Combinations of activities by actors can vary widely, so that container-handling costs and revenues as well as container-handling goals may differ according to the combination. As a consequence, a cargo-handling company will behave differently in its market under its various states, and the outcome under merger/acquisition can be one with high or low profit.

IV.3. Policy factors influencing cargo-handling conditions

Governments or related institutions can have substantial influence on the supply and demand conditions at container terminals. This section gives an overview of such fields of government impact.

IV.3.1. Antitrust

Antitrust measures, not necessarily in container handling, can weigh on container-handling demand. The EU's heavily debated exemption on conferences for instance (Fairplay, 2005), could cause a container-handling market shock if it were reversed. Also in container handling, antitrust measures are considered, for instance through the Port Package (European Parliament and Council, 2001), which may impact supply and demand conditions. The European Commission's (1997, p. 19) basic motive is that "*Port services have traditionally functioned in isolated frameworks, protected by exclusive rights and / or legal or de facto monopolies of public or private nature.*"

¹ International Maritime Dangerous Goods Cargo, an international agreement on the transport of dangerous goods in packaged form at sea, largely based on rulings made in SOLAS 1972 and MarPol 73/78, and issued by the IMO (International Maritime Organization).

IV.3.2. Charging

Governments charge ports in various ways. A classical example is lowering port dues on transhipment containers in order to attract this type of traffic. South-Korea applied this practice (De Lloyd, 2002e). The port of Los Angeles / Long Beach reduces free time available for pick-up of containers, which makes the port's terminals less attractive, but also reduces congestion, which in turn increases terminal attractiveness (De Lloyd, 2005ad). India introduced a scheme that penalizes inefficiencies but that also rewards efficient operations (World Cargo News Online, 2003ab).

IV.3.3. Customs

Customs control on containers requires the container to be moved to customs zones or port health examination areas and to be returned to container yard. These extra shuffling moves generate extra operational costs for the container-handling company and extra time costs for the commodity owner. Customs control may equally have indirect handling cost effects if they hold up the stuffing or stripping process. Eggers (2001) illustrates the benefits to shipping companies as well as shippers from improved customs procedures and international accreditation of customs documents.

The number of containers subject to control depends on the customs authority, and can vary a lot from port to port. In consequence of terrorist fear, the number has generally gone up. The thoroughness of the inspections also differs a lot. Kok (2001) notes the slowness of inspections in Rotterdam. Maersk Sealand even stopped transporting containers from the Philippines to Australia after those were subject to full quarantining and control. Terminals in Kingston (Jamaica) on the contrary benefit from minimal customs procedures. Van der Linde *et al.* (2003, p. 11) further observe large differences between sea ports in number of customs declarations which require reprocessing because of mistakes. Such time-consuming reprocessing means a competitive disadvantage for container-handling activities located in those sea ports.

IV.3.4. Employment

Sea ports are important employment centres. More than 100.000 people found a job inside the Flemish ports in 2002, and the port sector was indirectly responsible for an additional 110.000 jobs outside the port within Belgium (National Bank of Belgium, 2004, p. 12). In the USA, sea ports generate 16 million direct and indirect jobs (AAPA, 2005). It is therefore not surprising that various governments, even in this era of deregulation, support protected labour systems (Asian Development Bank, 2000, p. 26). In Belgium for instance, the law Major (Bestuur van het Belgisch Staatsblad, 1972) obliges port companies within the port perimeter to use qualified labour supplied by a fixed pool system. Strongly-held systems are sometimes also relaxed: labour rules for instance can be modified in such way as to enable terminal gates to stay open longer.

IV.3.5. <u>Environment</u>

Environmental concerns or pressure may impact on different terminal business areas. Concerns over dredging waste disposal for instance may postpone dredging or make it more costly. The port of London for instance had to strike a balance between economic growth and environmental sustainability after pressures from environmental groups (World Cargo News Online, 2004aa). As it comes to superstructure, there may be pressures to use environmentalfriendly terminal equipment, like for instance low-emission fuel tractors (World Cargo News Online, 2004aq). If purchase prices combined with operational costs do outweigh those for older, higher-emission equipment, shifting to the new type is even privately cost-efficient for the container-handling company. Such shifts can also be cost-efficient if the government compensates them, like in the case of Tacoma, where the port authority received a grant to use diesel oxidation catalysts (World Cargo News Online, 2005x). Uncompensated government regulation on emissions may make container-handling inputs more expensive. Regulation on engines for instance can increase reach-stacker prices as producers have to shift to other engine types (Van Dooren, 2002c and World Cargo News Online, 2004bb). Noise may be a particular problem too in container terminal surroundings, in which case the government may urge the port or the terminal operator to take sufficient measures (De Lloyd (2005)).

Introduction of general policies on port and terminal management, aiming for instance at better environmental performance, may also impact on supply of and demand for the terminal's products, like in Australia, where the government introduced a new port services bill (World Cargo News Online, 2003aa). Mintiens (2001) refers to the specific problem of 'flying stevedores', which, if introduced, would impose the need to have an environmental coordinator, increasing the burden for terminal operators. Also non port-specific regulation can impact on container-handling (Drewe, 2001). Policies for instance aiming at shipping can impact on terminal attractiveness. The European Commission's plans for having individual countries judge on which ships do not comply with environmental rules, may distort competition (Fairplay, 2005c and 2005e) and shift terminal demand in the respective countries. With respect to <u>hinterland modes</u>, similar regulation can be introduced, with similar effects on demand for terminal services.

Musso (1998) refers to external terminal-operating costs, which may be subject to gradual integration by the government. (for instance internalising external hinterland mode costs or enforcing competition policy)

IV.3.6. Financial capabilities

Government's or its related services' financial capabilities will have a large impact on the nature of national ports plans, port master plans and especially on port project plans, and therefore also on demand for container handling at specific terminals. World Cargo News Online (2003z) illustrates how Le Havre's terminal may have to cope with insufficient rail connection with the hinterland, due to lack of capital on the railway company's side. A counter-example is Hamburg, where the city government announced integrated plans for new terminals including balanced hinterland transport links (World Cargo News Online, 2005n). The South African government left container-handling companies and their customers in doubt when unfolding their detailed plan for 2bn SAR terminal investments to be complemented with 37bn SAR unspecified hinterland mode investments.

Pressure to prioritize certain projects in the national budget may come from various sides. De Lloyd (2002c) reports for instance how HPH's president suggested Hong Kong to build a rail

link connecting container terminals with China's main land. As public budgets shrink, private involvement through for instance public-private partnerships may become indispensable.

IV.3.7. Liability regulation

Liability regulation is an important prerequisite for trade. Mintiens (2001) refers to the liability problems that may arise in the case of 'flying nations'.

IV.3.8. Modal shift

Government or port authority modal shift policies may shift the balance between hinterland modes used to ship a terminal's containers towards or from the hinterland, therewith shifting terminal products, and eventually also the terminal's attractiveness towards customers. Examples of measures are Germany's introduction of LKW Maut (World Cargo News Online, 2004k), and the port of Felixstowe's initiative to expand rail facilities connecting the port to the British rail network (De Lloyd, 2005v).

IV.3.9. National independence

Sea ports and container terminals can be instruments of national independence in the hands of governments. World Cargo News Online (2003u) reports how Palestinian politicians hope the Gaza ports project will soon materialize, mainly for political reasons, but also because of the delays Israeli ports impose on commodities due for Gaza.

IV.3.10. Non-container-handling functions assigned to ports

Next to container handling, a sea port can perform a number of other activities, some of them assigned by the government. These other activities may interfere with container handling and consequently with container-terminal supply and demand conditions.

<u>Military</u> activities are a typical example of such an assigned activity. If military operations are making use of the sea port's facilities and services, they consume part of that sea port's

capacity, and can therefore reduce capacity available at container terminals (Vickerman, 2003). However, the number of sea ports affected by these operations is usually limited, and in ports where military activities are deployed, timing and frequency is usually so that nuisance to commercial activities is minimal. Exceptions are terminals in war zones, where naval activities may get absolute priority.

In its spatial planning policy, the government may also reserve part of the sea port for <u>industrial activities</u>. Alderton (1999, p. 13 - 14) makes reference to so-called MIDAS (Maritime Industrial Development Areas), which are sea ports showing concentrations of for instance petro-chemical or steel industry. Examples are the sea ports of Antwerp with sea-port industry generating about 65% of port value added and 30,000 direct jobs, Rotterdam with sea-port industry being responsible for 50% of port value added and 20,000 direct jobs, and Marseille generating 7,000 direct jobs. Such industry may be a generator of container traffic for terminals in the port.

IV.3.11. Penalties

Trujillo and Nombela (1999, p. 28-29) refer to penalties or fines which may be imposed upon container-handling companies in case a concession contract is breached. Grounds for breaching may be lack of agreed investments or insufficient quality. Such penalties can vary in structure and amount.

IV.3.12. Public port planning

The various levels of public planning on sea ports (national ports planning, port master planning and port project planning, see UNCTAD, 1985, p. 5) can have an impact on demand for terminal activities and on container-handling market structure. If a port gets assigned a different role, with correspondingly augmented or decreased investments, the terminal's product characteristics may change. Table IV-1 summarizes the roles that sea ports get assigned.

Reference	Possible statusses	Country
Alderton (1999)	Hub sea ports – feeder sea ports - transit ²	general
	sea ports - domestic ³ sea ports	
Asian Development Bank	Local sea ports – regional sea ports -	Asia
(2000, p. 21)	national gateway sea ports - transhipment	
	sea ports	
Forum de Concertation sur	National commercial sea ports -	Canada, after 2003
le Transport Maritime	complementary commercial sea ports – sea	
(2003	ports of local interest	
	National sea ports - regional sea ports -	Canada, before
	Local sea ports	2003
Martin and Thomas (2001,	Load centre sea ports – feeder sea ports -	general
p. 6)	transit sea ports - direct sea ports	
Suykens (1995a, p. 2 and	International sea ports – national sea ports –	Europe
1995b, p. 2)	local sea ports	
Piodi (1999, p. 12)		
Stopford (2002, p. 30)	Regional distribution centres - large	UK
	regional sea ports - large local sea ports -	
	small local sea ports	

Table IV-1: Possible sea-port statu

Drewe and Janssen (2001, p. 18) refer to the main-porting phenomenon. A relatively new concept in port planning is the agile port system (APS)⁴, which may get its own place in port planning (Transystems Corporation, 2002; Garcia, 2004). Sea ports can of course get assigned several roles. Shannon port (Ireland) for instance got a feeder terminal as well as perspectives for a transhipment container terminal (World Cargo News Online, 2004az).

If national ports planning is under reconsideration, new projects can incur a delay. HPH for instance placed a query for a strategic vision on ports in South-East England with the House of Commons, which would have delayed a number of port projects in the area, and therefore was a strategic tool to keep a new competitor out. Customers too can upset port planning: repeated complaints about bad service quality at Chennai's existing container terminal made the government decide to build an additional terminal (World Cargo News Online, 2005aa). Finally, local government's objectives conflicting with national government's may also keep what was seen as the optimal national ports plan from materializing. Fairplay (2005d) gives

² Transit ports are similar to free trade zones, in that imported containers are not subject to duties. Examples of such ports are Port Klang, Port of Singapore (until it became PSA) and Gwadar port (Pakistan).

³ Examples of domestic ports are Ostend (Belgium), Mtwara (Tanzania), and Pensacola (USA).

the example of Indonesia where local governments have voiced their concern about national port plans.

A change in port plans can sometimes cause a shock in a container-handling market. Australia's New South Wales Government surprised customers and competitors when in 2003 it announced that all handling activities at Sydney Harbour ought to be stopped when the lease agreement expired (World Cargo News Online, 2003y). An even more striking intervention occured in Vietnam, where the government decided to move many of Ho Chi Minh City's 30 ports to three new locations (World Cargo News online, 2004d).

Capacity planning is an important aspect of port planning. World Cargo News Online (2004cw) shows how insufficient capacity in the UK can cause immediate traffic loss to competing terminals, for instance Rotterdam.

IV.3.13. <u>Regional development</u>

The European Commission has the intention to create an integrated <u>European transport</u> <u>network</u> in order to strengthen cohesion between the regions. Such investments may boost sea-port activity in areas where transport infrastructure is improved.

Sea ports themselves are important instruments to advance regional competitiveness. Haarmeyer and Yorke (1993, p. 2) emphasize this macro-economic role. This role explains why the European Commission makes an exception to the rule that no <u>public aid</u> to competitive businesses is allowed. Such aid can modify supply but also demand at terminals involved.

IV.3.14. Safety

Government regulation with respect to safety can imply an increased cost burden to containerhandling operators. In the United States, the US Department of Labor (2003) created a rule on vertical tandem lifts (VTL) in which it was stated under what conditions the practice is

⁴ A definition and explanation are given in Appendix A-5

allowed. UK health and safety legislation may oblige container-handling companies to install vibration-free cabins for their crane workers (World Cargo News Online, 2003ae). An argument in the discussion surrounding the European Commission's Port Package was the safety risks involved in having ship crews do their own loading and unloading (European Parliament and Council, 2001).

Safety measures have their cost, but they can also have a negative impact on terminal demand if they are not up to standards. World Cargo News Online (2004ak) illustrates how insufficient dredging made Buenos Aires coast guard deny a ship access to the Port of Buenos Aires, in spite of the special dredging fee per tonne that was levied on containers entering or leaving the port.

IV.3.15. <u>Sea-port organization</u>

Governments make choices for port organization. This organization is important as it may impact on infrastructure and superstructure provision, maintenance, pilotage and towage, radar surveillance and traffic management, promotion, fire-fighting, police and security provision. Asian Development Bank (2000, p. 26) states that sea-port organizational choice with respect to container handling depends on seven factors.

- Activity scale.
- Eventual corruption.
- Government commitment.
- Private competitiveness.
- Private involvement in other port-related activities.
- Private capacities.
- Technical and economic regulatory capacities.

Suykens and Van de Voorde (1998, p. 254), ECLAC (1999) and World Bank (2001b, p. 6) summarize a number of socio-economic and technological pressures which induce governments to change sea-port organization. <u>Society</u> in general, and therefore also transportation as a derived economic activity, is tending towards less public involvement in operational matters. This trend is strengthened by for instance European transport policy,

which aims at abandoning state aid which distorts competition, also in the domain of transportation. <u>Technological changes</u> are partly imposed by the rise of a global economy, which forces container-handling activities to increase productivity in order to remain competitive. Heaver (1993, p. 229 - 232) refers to five technological forces.

- Other cargo-unit types: replacement of conventional break bulk by neo-bulk and containers, and specialisation in liquid and dry bulk.
- Changing sea-port layout: larger terminals and larger throughput per running metre.
- Capital-intensive investments: infrastructure and superstructure require large amounts of capital, which often only the private sector can offer, given the changed role of governments in society (Cass, 1996, p. 8 16; Piodi, 1999, p. 21; Sommer, 2001, p. 3; Wiegmans *et al.*, 2002, p. 3, Mongelluzzo, 2003). Even for the private sector, raising the necessary capital can be a problem.⁵
- Increasing share of railways and inland navigation in hinterland transport flows.
- Differentiated sea-port employment, increasing productivity and job specialisation.

In part, technological evolutions are also internal to the sector, since they can allow container handlers to materialize cost savings.

Specific reasons for a shift away from predominant public involvement in container-handling operations are that public port operators usually are hardly cost-effective, use old technologies, do hardly respond to customer requirements, provide only limited services, have small capacity and show low labor discipline (Asian Development Bank, 2000).

Trujillo and Nombela (1999, p 18-19) and World Bank (2001, p. 37-48) for the sea-port sector summarize the processes through which such reorganization can go: a choice can be made between modernization, liberalization, commercialization, corporatization and privatization. Asian Development Bank (2000, p. 25-29) adds decentralization. Estache et al. (2001, p. 3-4) add creating competition. Cass (1996) mentions selling operating concessions, setting up a joint public / private venture, creating subsidiaries under sea-port authority control but with private orientation. Asian Development Bank (2000, p. 23) adds unbundling. At the terminal

level, Holland (1999) states that privatization of existing facilities usually arouses more opposition than awarding greenfield concessions. In Nigeria for instance, landlord port reform was delayed for some time by the government, but bids were eventually introduced (World Cargo News Online, 2003v and 2005y). According to Peters (2001, p. 17), there is often reluctance to transfer the so called 'regulatory functions' to the private sector, so that often only the operational part shifts away from public involvement. A case contrasting to this view is the British ABP privatization, a unique but effective operation as shown among others by Haarmeyer and Yorke (1993). Indonesian sea-port reform went even further with a proposal to merge sea-port operators, shipyards and shipping companies (Fairplay, 2005d).

Estache and Carbajo (1996) illustrate the processes and effects of privatization for the case of Argentina. Hoffman (2001, p. 223-224) shows for the Southern-American countries how private participation can help a sea-port and its container terminals gain international competitiveness: more efficient operations and increasing demand. Marges (2002) outlines the general consequences for port labour of each of the forms of reorganization.

A reverse tendency can often be observed: a shift from no public involvement in operations to controlling part or all of it. Such trend is highlighted by Heaver, Meersman and Van de Voorde (2001, p. 6 - 9), who refer to Rotterdam where the publicly-organized sea-port authority acquired a stake in container-handling operations. Such move can have perverse effects on intra- and inter-port competition. World Cargo News Online (2003r) cites the example of Brazil, where the Association of Private Terminal Operators opposed to government plans to reverse privatization agreements. Arguments often cited and in favour of subsidies or public involvement are 'regional or national interest', and what Hughes (2003) calls sea-ports' social role.

Resulting sea-port organisational structures are mentioned in Section IV.5.9.

⁵ In Antwerp e.g., PSA's takeover of HesseNoordNatie in 2001 was partly inspired by the need for capital for supplementary and replacement investments in order to cope with increased demands (quantity and quality). In part, also the strategy of Compagnie Maritime Belge (CMB) to cash-in its precious subsidiary contributed to the speed at which the takeover was concluded.

IV.3.16. Security

External events, like terrorist attacks, may influence the share of security costs in the total amount of container-handling costs, and may impact on revenues. An often-heard debate for instance deals with the number of container inspections customs need to do. Thorough inspection for instance increases maritime chain security, but requires terminal operators as well as users to bear the time cost, apart from direct inspection costs to be borne. Helmick (2002), UNCTAD (2003) and Mullet *et al.* (2004) mention as possibly cost-increasing security initiatives the Container Security Initiative (CSI), Operation Safe Commerce, Vehicle and Cargo Inspection Systems, Radio Frequency Identification, Seals, Transportation Worker Identification Credential, Free and Secure Trade, the Customs-Trade Partnership against Terrorism (C-TPAT) and the International Ship and Port Facilities Security Code (ISPS). The US CCDoTT⁶ denotes foreign sea ports as remote ports, which are harder to control from a US point of view.

IV.3.17. Social-welfare

Sea ports may be used by the government as instruments to help increase national welfare, especially through job creation, but also through taxes and investments. Their macroeconomic role is one of the reasons why investment projects are often subject to cost-benefit analysis. In some cases, the government can give special support to specific initiatives, like in South Africa for instance, where the Black Empowerment Enterprise bidding for the Durban container terminal gets favourable treatment (World Cargo News Online, 2003ao). Such special conditions may impact on supply structure.

IV.3.18. <u>Taxes</u>

Tax systems may hamper <u>purchase</u> of cheaper equipment. ZPMC's cranes for instance seemed taxed out of Brazil under the prevailing tax system (World Cargo News Online, 2004ag). Taxes may also play on the demand side: <u>free trade zones</u>, like in Kingston

⁶ CCDoTT = Center for the Commercial Deployment of Transportation Technologies (Savacool *et al.*, 1999)

(Jamaica), where no duties on imports and exports apply, usually attract supplementary traffic (SPG Media Plc, 2005).

On the other hand, taxes are an important source of <u>revenues</u> for government. Large amounts of taxes are gained through sea ports as they handle the bulk of overseas commodities. The sea port sector handles more than 90% of the European Union's trade with third countries, and approximately 30% of intra-Community traffic (European Commission, 1997, p. 4). In 2002, about 2,379 mn tonnes of cargo were loaded and 3,701 mn tonnes were unloaded in Developed Market Economy ports⁷ (UNCTAD, 2003, p. 8-10). US sea ports handle 95% of overseas cargo (AAPA, 2005). The Flemish ports alone created nearly 11 bn EURO of direct (in-port) value added, and over 11 bn EURO more of indirect value added (National Bank of Belgium, 2004, p. 10). Taxing this value added generates a substantial share of government revenues.

IV.3.19. <u>Wages</u>

The sea port as such is a well-defined geographic zone delimited in space, and costs and revenues from cargo handling may be influenced by regulations specific to this area. E.g. in Belgium, each sea port is defined in all jurisdictional detail in Bestuur van het Belgisch Staatsblad (1993). The social and fiscal regime under which the container-handling sector is operating, is influenced by the law Major (Bestuur van het Belgisch Staatsblad, 1972), which stipulates working conditions, hours and salaries within the sea-port perimeter.

Sometimes, different definitions cover the same area several times and have complementary rules prevailing. Port of San Diego (2004) defines the concept 'port' as used in its regulations as *"the San Diego Unified Port District"*. City of San Diego (2004) specifies its port district as *"all tidelands and submerged lands which shall be conveyed to district pursuant to provisions of law"*. Both legal definitions are used for different rules.

⁷ Includes following countries: Australia, Austria, Belgium, Canada, Denmark, Faroer Islands, Finland, France, Germany, Gibraltar, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Turkey and United Kingdom.

IV.3.20. <u>War</u>

World Cargo News Online (2004bp) illustrates for Uganda how war can reduce demand for a terminal, be it directly, through the actual risk that commodities run, or indirectly, through a boycott of the respective country, affecting also terminals outside risk areas.

IV.4. Scope-activity factors influencing container handling

Container handling itself consists of a number of products which can sequentially or simultaneously be offered, but the activity can also be combined with activities in other businesses. This section summarizes what other activities are commonly performed by container-handling companies, to the extent that processing those other products interferes with container-handling goals and supply structure. Roberts (2005) shows what the effects can be of co-operation when products in different sectors are complementary, compared to the case where they are unrelated.

IV.4.1. <u>Commercializing spin-off applications</u>

These additional activities include services to shippers, shipping lines (or NVOCC, or agents), hinterland transporters, port authorities, depot operators, and other terminal operators. The activities are for instance tracking and tracing, ship arrival and berth scheduling, billing, hinterland traffic scheduling, depot management, etc. (Vickerman, 2003b, p. 5). Commercialising these functions can be a means to obtain economies of scope.

Table IV-2 summarizes the main spin-off products supplied by the main container-handling companies or by their subsidiaries.
Operator	Incorporated	Type of service					
	or subsidiary						
HPH	Combination <u>Technology and Managed Logistics</u> <u>Services</u> (for shipping lines and agents, shippers, hauliers or truckers,						
	owned	logistics providers, NVOCC, depot operators, terminal operators, port authorities and government agencies)					
	subsidiary:						
	LINE						
PSA	wholly	Several services, split over several modules:					
	owned	Ship scheduling: EZShip (for shipping lines and agents)					
	subsidiary:	Billing: EZBill (for shipping lines and agents)					
	PortNet	Container alliance management: Allies (for shipping lines and agents)					
		Cargo distribution: Cargo D2D (for shipping lines and agents, hauliers or truckers, logistics providers, NVOCC, depot					
		operators and government agencies					
		Route scheduling: Travis (for shipping lines and agents)					
		GEMS (for shipping lines and agents, hauliers or truckers and depot operators)					
		Depot reservation: EZDepot (for shipping lines and agents)					
		Fleet optimization: Portnet Marine (for shipping lines and agents, port authorities and government agencies)					
		Tracking and tracing: Infohub (for shippers, hauliers or truckers, logistics providers, NVOCC, depot operators an					
	terminal operators)						
		Terminal gate clearance: EZTruck (for hauliers or truckers, logistics providers and depot operators)					
		Terminal operations: CITOS (for terminal operators)					
		Stacking operations: CICOS (for terminal operations)					
APM	in-house	e-business solutions (for shipping lines and agents, shippers, hauliers or truckers, logistics providers, NVOCC, depot					
Terminals		operators, terminal operators)					
P&O	in-house	Real-time scheduling and routing (for shipping lines and agents, hauliers or truckers and NVOCC)					
Ports		Solutions that use EDI, XML e-commerce and m-commerce technologies to support bookings, transactions, online					
	payments and the transfer of cargo information (for shipping lines and agents, shippers, hauliers or truckers						
		providers, NVOCC, depot operators, terminal operators)					

Operator	Incorporated	Type of service					
	or subsidiary						
Eurogate	wholly	Intermodal exchange: Eurogate Intermodal (for shipping lines and agents, shippers, NVOCC and terminal operators					
	owned	Warehousing: OCEANGATE, CTB-CFS-Bremerhaven, EUROGATE City Terminal (for logistics providers, depot					
	subsidiaries	operators and terminal operators)					
		acking: SeaWorthy Packing (for shippers)					
		orwarding: PEUTE (for shippers)					
		ogistik: OCEANGATE (for shippers)					
		<u>'echnical Services</u> : Eurogate Technical Services (for terminal operators)					
		Repair and Wartung: Depot 2000 and ReMain (for shipping lines, agents and NVOCC					
SSA	in-house	Feasibility Studies (for terminal operators, port authorities and government agencies)					
		Container Equipment Maintenance (for terminal operators)					
		Warehousing (for logistics providers, depot operators and terminal operators)					

Source: Port of Singapore Authority (2003), Hutchison Port Holdings (2003), P&O Ports (2003), APM Terminals (2003), Eurogate (2003),

Stevedoring Services of America (2003), Arujo De Souza et al. (2003), Yap (2001, p. 12), Business Times (2002), Damas and Mottley (2003),

Khan (2002) and Marine Digest (2003)

IV.4.2. Handling non-containerized cargo

Next to containers, container-handling companies can also handle other types of cargo like dry bulk or liquid bulk⁸ or general cargo⁹. At multi-purpose terminals, such cargo can even be handled interchangingly with containers, or simultaneously at different berths. Container-handling activity goals are influenced in case one operator is dealing with different cargo types at the same terminal. A problem of capacity allocation arises. Appendix A-6 illustrates for the major container terminals to what extent terminals are used for multiple types of cargo. It can be observed that in most major ports, the largest volumes of containers are handled at terminals dedicated to containers. An exception is the Port of Singapore, where all terminals dealing with containers are used for multiple purposes. On the other hand, in nearly all of these sea ports, at least a part of the containers are handled at multi-purpose terminals. Exceptions to this observation are Shanghai, Los Angeles, Long Beach, Port Klang, Dubai and Qingdao, which only handle containers at specific container terminals. When multiple terminals in the same market are handling multiple products, the capacity allocation problem gets more complex.

None of the previous effects occurs in sea ports with a specific ship/shore interface, like Specific Commodity Export Ports (ports specializing in one commodity type, for example coal or iron ore, like do the ports of Swinoujscie (Poland), Mormugao (India) and Kembla (Australia). This type of specific-interface sea ports is however a minority.

In terms of impacts on supply, not only other cargo types processed at the same terminal, but also at different terminals, where some common input is shared, allow for economies of scope and will impact on the container product supply: resources do not remain idle and are therefore used more efficiently. If in simultaneous container and other cargo handling, other cargo holds up the container-handling process, the latter experiences increased costs.

⁸ Paelinck (2001, p. 9) defines bulk as cargo shipped in loose condition and of a homogenous nature. Cargoes that are shipped unpacked either dry, such as grain and ore, or liquid, such as petroleum products, vegetable oils, chemicals."

⁹ General cargo is defined as non-bulk cargo composed of miscellaneous goods, cases, bundles of steel, crates, bags, etc. (Paelinck, 2001, p. 9). Transystems Corporation (2002, p. 12) and Grenzeback et al. (2001) split up general cargo into break bulk and neo-bulk. The former is cargo on pallets, in bags, in crates, etc. Neo bulk is for instance steel, cars, etc.

IV.4.3. Inland port operation

Sea-port container-handling costs may be influenced if a sea-port terminal operator also operates one or more inland ports. Management of the sea and the inland terminal can be combined, which may allow for economies of scope. Similarly, asset acquisition may be cheaper due to common ordering. Furthermore, also the ultimate goal of container-handling activities at the sea-port may be different than in the case where the sea-port terminal were operating as an independent unit.

IV.4.4. Passenger handling

Additional cost scope effects may occur if passenger and container handling are performed by the container-handling operator, be it at the same terminal or not. Passengers hardly ever use container terminals to (dis-)embark. Savings on overhead costs may materialize. Co-ordination may again shift the container-handling goal.

IV.4.5. Services to containers

World Cargo News Online (2004bk) mentions the example of Cosco Pacific, which originated as a container leasing company and is also active in container manufacturing and repair, but which diversified into container handling, now its core business. A number of container-handling costs may be shared. For shuffling containers for instance to examination locations, or for shuffling damaged containers to repair facilities, the same equipment can be used. Co-ordination between these activities and container-handling may imply a shift in the container-activity goal.

IV.4.6. <u>Services to cargo</u>

Ferrari and Bennachio (2000, p. 10) note that "there is a high level of competition that leads terminal operators to differentiate port services from the sole port manipulation of cargoes to the (port) logistical services." World Cargo News Online (2004af) terms this group of related services 'port-centric logistics'. They may allow sharing fixed costs in container handling,

and joint co-ordination with container handling may lead to a modified container-handling goal.

Op de Beeck (1999, p. 2bis and 7) discerns following logistics activities: bagging, consolidation, marking or labelling, packing, parcelling, quality control, sampling, stockpiling, stuffing and stripping, tallying and weighing. Baird (2003, p. 8) adds warehousing and distribution.

<u>Bagging</u> in relation to containers only applies where bulk cargoes need to be transported through containers, and where the cargo allows holding in simple bags.

<u>Consolidation</u> is done by an operator "who accepts LCL shipments from individual shippers, and then combines them for delivery to the carrier in FCL shipment" (Export 911, 2004).

<u>Forwarding</u> is not to be confounded with consolidation, although both activities are often combined. Forwarding is "the delivery of goods usually from the exporter's premises to the local customs in exporting, and vice versa in importing, in case of domestic, local freight forwarding, or the delivery of goods from the exporter's premises, or from the port or point of origin, to the port or point of destination, or to the importer's premises, in international, foreign forwarding" (Export 911, 2004).

<u>Packing</u>, among others, involves putting into bags, bales, barrels, boxes, cartons, crates, drums or sacks, or on pallets. The kind of package chosen depends on seven elements.

- The kind of product.
- The mode of transportation.
- The port of destination, with risk of mishandling, pilferage or theft.
- Climatic conditions.
- Customs duties and freight rates.
- Packing material cost.
- The buyer's requirements.

(Export 911, 2004)

<u>Quality control</u> is done through inspection, of the container, the cargo contained in it as well as vehicles transporting cargo and container.

<u>Stuffing or stripping</u>, if performed at the sea-port container terminal, are done at the Container Freight Station (CFS). Planning to get a container stuffed as well as stripped involves a number of steps, just like the actual stuffing and stripping processes. The sequence of steps is summarized in appendix A-7.

<u>Stockpiling</u> involves keeping stocks of certain commodities. In a container context, this can be under form of containers but also under form of loose cargo. This activity can mean a shift of part or all of the inventory cost towards the terminal operator in case the terminal gets this inventory role within the supply chain (Harreld, 2001).

Through the process of sub-harborisation, several of the previous ancillary activities may be moved to areas outside the port, where for instance labour may be cheaper, space can be ample and not as expensive as within the port area.

IV.4.7. Services to ships

Container-handling companies or terminals may provide stores, water, medical aid, telephone service, bunkering, ship repair and ship waste disposal, all of them activities which are of use to ships and crew (Yahalom, 2002). Providing such services may allow sharing a number of fixed container-handling costs, and it may impact on the container-handling activity goal, although priority is normally on container-handling activities.

IV.5. Chain factors influencing container handling

Before the start of liner services and containerization, there was a strict functional split-up at least between the maritime, port and hinterland side, which was reflected in mostly contractual agreements and clear liability divisions. The commodity flow through the maritime chain was relatively easy, as represented by the full lines and arrows in Figure IV-12. A shipper called on a sea carrier to get his goods shipped overseas, often through an

agent. Once the carrier who would do the transport was determined, the sea port of call was selected, and a local stevedore and eventually a storage nation at that sea port were called. Trujillo and Nombela (1999) refer to the traditional distinction between stevedoring (which is the shipboard part dealt with in this section) and (un-)loading operations (the actual moving of cargo between ship and berth). Due to containerisation and corresponding technological evolution, this distinction has lost practical meaning. Sometimes loading and unloading is performed with the ship's own equipment. The shipper would then decide about hinterland transport to the commodities' final destination. Before, during and after passing the sea port, several supplementary services could be provided by the same company doing the cargo handling or not.





Source: Meersman et al. (2003)

Under that situation of functional split-up, the separate actors from Figure IV-12 could be discerned. These were supplemented by providers of port infrastructure and facilities (Drewry Shipping Consultants, 1998, p. 21 – 23 and Consilium Services Inc., 2002). Peston and Rees (1971) detail different types of shippers: (i) manufacturers / ultimate senders, (ii) marketing /

shipping managers, and (iii) consignees / ultimate receivers. The authors also mention container operators. Yahalom (2002) adds unions.

Notteboom and Winkelmans (2003) in their stakeholder approach also mention logistic service providers, ship chandlers, ship repair services, banking and insurance companies, legal firms, sea-port authorities, inland terminal authorities, central and regional governments, supranational public organisations, trade negotiation groups, local inhabitants groups, tax payers and environmentalist groups. Not to be forgotten are shareholders of the various companies in the maritime chain.

Globalisation, budgetary pressures and organisational problems have changed interrelations among the actors mentioned. Things started to move among shipping companies, who saw rates decline due to overcapacity. Among the first reactions were conferences (dating back already from the 1870's, long before containers came into use) and consortia. More refined solutions were found in all types of alliances. But these proved to be in the same time very flexible but extremely unstable. (Transystems Corporation, 2002, p. 2 - 3; OngChin, 2004; Trujillo and Nombela, 1999; Massac, 1998)

Nevertheless, this type of moves from the shipping sector made the power balance over the chain shift into their direction. Other market parties had the choice between on the one hand passively undergoing the changed market environment, undoubtedly leading to lower profits and eventually a takeover by shipping companies, and on the other hand react actively to keep power.

The next sections show the most important reactions and chain variables that impact on container-handling demand, supply and activity goal. Via network building, co-operation, differentiation, diversification and integration, container-handling cost structures can differ from those of non-integrated terminals through economies of scope and network economies, and for integrated cases again they are supposed to differ between the various degrees of integration that occur. Co-ordination in turn will influence the container-handling activity goal. And network building, co-operation, differentiation, diversification and integration may impact on demand for container handling at the terminal. Moreover, if the other actors in the

maritime chain build networks, co-operate, differentiate, diversify or are integrated among themselves, this integration will influence cost and revenue structure of the container-handling sector. Type and degree of co-operation between these parties is again determining for container-handling cost and revenue.

IV.5.1. Charges

Next to the expenses for container handling at the terminal, shipping companies also bear other costs at the sea port. Although container-handling expenses on average represent about 20% of total shipping costs, other port expenses may determine terminal attractiveness towards customers (Panmure, 2001, p. 9-10). Sea-port organization and power relations in the maritime transport chain will determine whether the terminal operator has control or not over those port charges. World Cargo News Online (2003x, 2004v and 2004ab) and De Lloyd (2005) illustrate how supplementary box charges in Shenzhen, empty-box charges in Melbourne and higher port charges in Mombasa and California, all imposed by the respective governments or port authorities, did upset customers but also terminal operators. Terminal handling charges imposed by shipping companies on shippers equally worsen a terminal's competitive position. Van den Bossche (2004) and Dynamar (2003 illustrate effects for Hong Kong – Shenzhen competition. Fung et al. (2003) show that the effect of terminal handling charges on Hong Kong's container traffic is considerable. Dekker (2002) observes South Korea's favourable position in this respect. If a terminal has to levy security charges because the government or port authority are not absorbing security costs, or if the government or port authority themselves levy such charge, this may equally alter a terminal's competitive position (Van den Bossche, 2004b).

Power relations often cause charges to diverge from marginal social cost levels, as defined by Ashar (2001) and Goss and Stevens (2001).

IV.5.2. Containerization

Shippers increasingly use containers also for transporting traditionally non-containerized commodities. Containers are multi-functional and allow transporting cartons, boxes and crates, pallets, bags and sacks, bales, drums and barrels, and rolls and coils. Examples of

newly-containerized products are paper, cars and dry or liquid bulk (World Cargo News Online, 2003t, 2003al, 2003ai, 2004j, 2004bh and 2005ac). Reasons for choosing containers for transporting are low shipping rates, low risk of damage and theft, ease of intermodality, frequency, speed and reliability of delivery (Panmure, 2001, p. 6). Such evolution is a positive perspective for container-handling demand.

On the other hand, sometimes, a shift away from container transport is observed. World Cargo News Online (2003w) illustrates how one big supplier, Boeing in this case, can have a dramatic effect on a terminal's business as the decision is taken to transport via air instead of by sea.

IV.5.3. Environment

O'Brien (2004) and Heseler (1999, p. 22 - 24) show how terminals are under growing environmental pressures. Kalmar responds to growing environmental awareness by entering into a green supply chain (Van Dooren, 2002c). World Cargo News Online (2003f) illustrates how UK environmentalists prevent new terminals from being built, which is beneficial to existing terminals as a potential new competitor is stopped.

IV.5.4. Land transport concentration

Land transport co-operation, like in Van Dooren (2002), or concentration, like in Van Dooren (2002b) may increase power of land transport modes in their relations with container terminals, shipping companies and shippers. This increased power can impose direct costs on the terminal through for instance more late arrivals. If increased power moreover leads to reduced service at connections towards and from the terminal, the volume of traffic shipped through the terminal may go down.

IV.5.5. <u>Land transport in terminals</u>

CHAPTER II shows that land transport operators took in some cases a stake in existing or new container-handling terminals, in co-operation with terminal-operating companies. Combinations with other transport actors or terminal ventures on their own are equally possible. IFB for instance in 2001 started exploiting a terminal in Dunkirk (Van den Bossche, 2001b). 2004 however, IFB withdrew from terminals in Antwerp, Dunkirk and Zeebruges (Leglay, 2004).

IV.5.6. **Quality requirements**

For a long time, terminal performance has been measured from a supply point of view. Goss (1993, p. 197 - 201) states that it is also important to consider the customer's point of view, due to the derived-demand characteristic of transportation. Each of the sea-port actors described earlier in this chapter applies its own indicators to assess the performance of a container terminal. The respective indicators are summarized in Table IV-3.

Fagerholdt (2000) describes how shipping companies can trade-off quality against cost of service. Bad container-handling quality may result in less demand for handling. MSC for instance cancelled its calls to Trieste as a result of poor service at the port's container terminals. Power imbalances in the maritime transport chain may influence the degrees of freedom terminals operators have in scoring on terminal performance indicators.

IV.5.7. Safety

An important point of attention during stowage according to Van de Merbel (1998) and Meersmans and Dekker (2001, p. 5) which is to be taken into account in stowage planning, is preserving safety. This involves ships as well as cargo. For ships, stability, seaworthiness in terms of trim and list and container stacking weight limitations are important. For the containers aboard, grouping containers with the same commodity type and maintaining their accessibility during the entire process can minimize damage in case something happens. Such planning and process increases handling cost, for instance through re-stows needed for altering weight distribution, but also has positive implications on customers' willingness-to-pay.

Actor	Indicator category	Indicator		
Shipper	Physical	Cargo dwell-time		
		• Freight integrity		
Shipping company	Physical	• Berth time		
		Handling rate		
		• Ship turn-round time		
		Waiting rate		
		• Working time over time at berth		
Terminal operator	Physical	Berth occupancy rate		
		Quay transfer cycle time		
		Number of quay vehicles		
		Mean storage dwell tima		
		Mean stack height		
		Mean time between failures		
	Factor productivity	• Lifts per quay labourer hour		
		• Lifts per yard crane operating hour		
		• TEU stored per ha of terminal		
		• Tons per berthing location or per meter		
		• Tons per crane hour		
		• Tons per working hour or gang hour		
		• Trucks per gate per operating hour		
	Economic / Financial	Charge per TEU		
		• Operating surplus per GRT/NRT or per ton handled		
		• Total income per GRT/NRT or per ton		
		handled		

Table IV-3:	Container	terminal	performance	indicators
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Source: Van de Merbel, 1998, p.41; Trujillo and Nombela, 1999, p. 45-46, p. 48-51; Talley, 2000, p. 11; Mangan *et al.*, 2001; Berkowitz and Krick, 2002; D'Hondt, 2002; Vickerman, 2003, Lobo and Jain, 2003, p. 8; Van den Bossche, 2003d; Rankine, 2004; De Lloyd, 2004e and 2005w

IV.5.8. Sailing frequency

Sailing frequency is a preliminary condition for a container terminal to attract new traffic. World Cargo News Online (2005ae) illustrates how important it is for a terminal to negotiate a good combination of deep-sea and feeder calls at a port.

IV.5.9. Sea-port authorities and terminals vs. shipping companies

Sea-port authorities and terminals try to bind shipping companies through concessions for dedicated container terminals. Musso (2004, p. 42) shows that dedicated-terminal agreements are frequent in Asia, Europe as well as Northern America. Dedicated terminals have benefits for shipping companies as well as for terminals: terminals can rely on a fixed amount of traffic, whereas shipping companies are sure of sufficient handling capacity and quality. The extent of the benefits to both parties will depend of the nature of dedication: partly or full dedication.

IV.5.10. Sea-port authorities in logistics

Sea ports may integrate into logistics. De Lloyd (2002) illustrates how the port of Barcelona invested in Chinese logistics parcs. The effect may be that more Barcelona-bound traffic is generated in China.

IV.5.11. Sea-port authority co-operation

Co-operation in the sea-port sector does not only occur between container-handling companies, but also between sea-port authorities (UNCTAD, 1996). The initiative for co-operation can originate from <u>sea ports themselves</u>, like in the co-operation agreement between Osaka and Kobe ports, which was mainly inspired by economies in overhead costs (World Cargo News Online, 2004cl). Other examples are Ghent (Belgium) and Boma (Congo) ports, or Cotonou (Benin) and Las Palmas (Spain), where technical co-operation and specific niche traffic were the primary motives (De Lloyd, 2005d and 2005n). In the case of Rotterdam and the Humber Trade Zone, market motives came into play (Humber Forum, 2004). The initiative can also come from a <u>port association</u>, like in Denmark, where Associated Danish Ports tries to attract new cargo for its members, this way making the association more attractive to new members, which in turn generates extra cargo attraction (World Cargo News Online, 20031). Finally, <u>public or customer pressure</u> may induce or oblige sea ports to co-operate. World Cargo News Online (2005am) illustrates the case of Tasmania, where studies showed that co-operation would make local sea ports more efficient and would increase their

joint market reach. Song (2003) illustrates how sea-port competition and co-operation may be combined.

IV.5.12. Sea-port organization

Sea-port organization is important since it determines costs and revenue structures which container-handling operations are confronted with.

The authority institution in place mainly differs in decisional independence, unicity of command, financial independence and commercial management methods (Op de Beeck, 1999, p. 35–48; Bichou and Gray, 2005, p. 80-82; Chouly, 2002; Chouly and De Langen, 2003). These four dimensions can be grouped and reduced to two dimensions like in Table IV-4. Decisional and financial independence of the sea-port authority institution are a function of the degree of public involvement, which corresponds to the institutional setting the port is embedded in. Unicity of command and integrated commercial management methods depend on the degree to which the port authority is involved in day-to-day operations. Op de Beeck (1999, p. 11–23 and 50–73) considers a number of states for each of the two dimensions. These states are summarized in Table IV-4. They are illustrated with examples in appendix A-8.

<u>Sea-port authority bodies under direct national jurisdiction</u> have their authority incorporated in a state department. The sea port is viewed as an instrument for obtaining a general national government objective. The economic counterpart is that losses are borne by the government, while any profit is retained to cross-subsidise other public sectors.

<u>Sea-port authority bodies under sub-national jurisdiction</u> are in the same situation as those under national jurisdiction, but a lower-level government takes the place of the state. In case of a federated state, the lower level can be a federal state, a multi-state agency, a city-state, a county, a special district, a municipal or area-wide district, a federal state together with a municipality, or a municipality itself. In case of a non-federated state, the lower level can be a province or a municipality.

	Public sea-	Public sea-	Public sea-port	Private sea-	Corporate
	port	port	authority,	port	sea-port
	authority,	authority,	Self-governing	authority	authority
	national	Sub-national			
	supervision	supervision			
Land-lord	I national –	II. sub-	III. self-	IV. private –	V. corporate
sea-port	land lord	national –	governing –	land lord	 land lord
authority		land lord	land lord		
Limited-	VI. national –	VII. sub-	VIII. self-	IX. private -	X. corporate
operating sea-	limited	national -	governing -	limited	- limited
port authority	operating	limited	limited	operating	operating
		operating	operating		
Operating	XI. national -	XII. sub-	XIII. self-	XIV. private	XV.
sea-port	operating	national -	governing -	- operating	corporate -
authority		operating	operating		operating

Table IV-4: Sea-port organization matrix

Source: own composition based on Op de Beeck, 1999, p. 11-23 and 50-73

<u>Self-governing public sea-port authority bodies</u> are given certain powers to regulate, control and improve the sea-port's operations, development and financial undertakings. Independence from the public government is expressed in the sea-port authority bodies being constituted instead of being elected. In order to be called 'autonomous', a sea-port authority institution should at least be able to regulate labour in the port. Financial independence here usually does not involve striving to profit-making but own appropriation of a budget provided by a public government.

One step further is total independence from a public body, a situation which is found in <u>privately owned and operated sea-port authority bodies</u>. This type of separate entity is subject to laws on private corporations but has no shareholders. It is often a subsidiary of some type of industrial company. Alternatively, such sea-port can also be part of a company exploiting a complementary mode of transport.

Shares are found in <u>corporate sea port authority bodies</u>, which allow limited liability and easy transfer of ownership. Commercial goals are typical in this entirely independent authority setting.

<u>Land-lord sea-port authority bodies</u> belong to the type of port where the sea-port authority least intervenes in operations. In these sea ports, possession, occupation and use of property is transferred by the sea-port authority institution to a potential user, in exchange for a payment or a rent. This arrangement usually takes the form of a lease, which can adopt three varieties: a land lease, a lease to operate, and a lease for building. (Asian Development Bank, 2000, p. 20)

- A <u>land lease</u> grants the concessionary the right to possess, use and operate a (mostly) 'naked' port area on payment of a 'fixed' concession duty (called a 'canon' by Trujillo and Nombela (1999, p. 26)).
- In case of a <u>lease to operate and manage</u>, a management agreement transfers management and operation of a sea-port site, its equipment and administration to a management company, against parting with a share of cargo handling charges.
- A <u>lease to build</u> makes the lessee financially responsible for all infra- and superstructure improvements and constructions, transferring these to the lessor (port authority) upon termination of the lease contract, but allowing the lessee to earn a toll on facilities constructed.

Several types of conditions can be imposed on the lessee signing the lease contract. In Kochin for instance, DPA International won a contract for building and operating the International Container Transhipment Terminal (ICTT), upon condition that at least 400,000 TEU be handled within 10 years after obtaining the ICTT lease contract at another container terminal in the port operated by DPA International; furthermore, operations should be fully shifted to the ICTT terminal within two years after starting construction there; the contract runs for 30 years (Manoj, 2004). Characteristics typically defined in concession contracts and limiting the lessee's degrees of freedom are length, ownership division, labour requirements, operational practices, pricing boundaries, investment requirements, financial performance indicators, liability and risk division, and arbitration terms (Estache et al., 2001, p. 3; World Bank, 2001c, p. 20-24; Crook, 2002, p.15 and Juhel, 2001, p. 166).

More port administration involvement than in land-lord sea-port types is found in <u>limited-operating sea-port authority bodies</u>, in which the sea-port authority institution provides equipment for operations. Cass (1999, p. 35) sees these as a variant of the land-lord type, where besides the sea-port area also operational equipment is leased. Nevertheless, a contracting operator in a limited-operating sea port executes operations in his own name and commercial risk (like in a land-lord sea port), but under regulatory control and on account of the port authority (Trujillo and Nombela, 1999, p. 29-31). Such an operator can be granted a permit to operate a public utility, a permit to operate a private utility, or a joint venture contract. (Asian Development Bank, 2000, p. 20)

- A <u>permit to operate a public utility</u> allows the container-handling company to operate a public facility on account of the port authority. The incentive for investing is low though in case of permits to use public utilities, since this contract is merely about private or common utilities or specific services, not about site occupation, which is the case in the land-lord system.
- A <u>permit to operate a private utility</u> has the operator build superstructure of his own, but still has him operate it on account of the administration.
- A joint-venture contract is often applied in case the operator has insufficient resources to equip the terminal himself.

Under a <u>comprehensive (or service, or operating) type of port authority</u>, the sea-port authority institution also takes care of operations, although contracts with companies are still possible, as is frequently the case for stevedoring activities.

Appendix A-9 gives an overview of the organizational forms of the 15 major container sea ports in the world at their container terminals. From this table, it appears that the land-lord type occurs most amongst the major container sea-port terminals, and more specifically the land-lease type, followed by the lease-to-build type. The largest share of the major container sea-port terminals are under local supervision, nearly half as much have a national supervisor. Moglia (2004) illustrates for some of the major European ports how different port organization impacts on port operating conditions, also with respect to container handling. Hilska (2001) shows that different market structures prevail for different port services in various European ports, and that these impact on container terminals' attractiveness. It should be noted that different organizational arrangements are applied to several terminals in the same port, even at the same time and to the same contractor. Dubai Ports Authority for instance won an operations contract for the existing Rajiv Gandhi Container Terminal in Kochi under a lease-to-operate concession (Manoj, 2004), and at the same time, it acquired a BOT contract for the International Container Transhipment Terminal in the same port (The Hindu Online, 2004).

Container-handling goals may be different when container handling is integrating infrastructure and superstructure provision, maintenance, pilotage and towage, radar surveillance and traffic management, promotion, fire-fighting, police and security provision, compared to the case where it is not integrating one or more of these activities. A specific allocation of means to container handling, depending on the degree of integration of the provision of sub-activities mentioned earlier in this paragraph, may also make the specific terminal product or products more or less attractive, and this way influences customers' willingness to pay. But also other sea-port products than container-handling and corresponding charges are under influence of sea-port organization, and can in turn determine a sea port's attractiveness. Both container-handling and other services to ships, containers and cargo can impact on the revenues of the container-handling activity.

Leasing-out of land is an important decision, since its grants the lessee the opportunity to monopolise a certain area during a fixed period¹⁰.

The port authority typically itself has relations with a number of main users: with industrial companies within the port which are interesting for instance for their cargo-generating power; with shipping companies, which the port authority might want to attract for instance for their activity generation; with hinterland transport companies, which make the port attractive through well-established and fast hinterland connections. Furthermore, there are also links between supplementary port service providers and the port authority. Each of these links may impact on terminal demand.

¹⁰ Concessions are in fact a limitation to the freedom of establishment, and they are often the source of heated public and private debate.

IV.5.13. Sea-port promotion bundling

World Cargo News Online (2004ao) shows how ports in western Finland co-operate in marketing and promotion. Such joint forces may have a positive impact on demand for container terminals in the sea ports.

IV.5.14. Security

Who deals with safety and security does not only depend on sea-port organization, but also on relationships between other actors in the maritime transport chain. Shipper demand can for instance induce container manufacturers or lessors to assume costs for installing extra security features (World Cargo News Online, 2003aj). Disagreement over who bears certain costly investments may also push certain security devices out of the market (World Cargo News Online, 2003ak), thereby shifting costs to other actors, for instance container terminal operators. Jau and Fang (2002) show how the disagreement of financing has delayed the introduction of security measures after September 11, 2001.

IV.5.15. <u>Shipper information</u>

Shippers have an increasing interest in getting information on the exact location and status of their commodities in the maritime transport chain. Cordts (2001) remarks that providing this information is more difficult and costly as demand for door-to-door services increases and more players in the transport chain are involved.

IV.5.16. Shipper trade pattern

Wilson (2005) and UNCTAD (1985) show how trade diversion through the choice of a different sourcing location, a restructuring of stockholding points, the choice of a different mode of transport or the choice of a different (un-)loading port may bring down a terminal's demand. World Cargo News Online (2003as) shows how South-Africa opts for pipeline transport, which is detrimental to container terminal demand.

IV.5.17. Shipper or shipping company routing / mode decisions

Terminal planning should be able to accommodate last-minute sea-port of discharge changes, voyage destination changes, inland route changes and hinterland transport mode changes (Van de Merbel, 1998 and Meersmans and Dekker, 2001, p. 6). Such changes require a partial or full rescheduling of unloading or loading operations, imposing a supplementary cost burden on container-handling operations. The ability to accommodate such last-minute requests is however an element of quality which has a positive impact on customers' willingness-to-pay.

IV.5.18. Shipping company concentration

Shipping companies make a number of agreements among each other, which increase their concentration and their power in relations with shippers and other transport actors. Table IV-5 summarizes the categories of co-operation agreements in shipping.

Type of agreement	Example	
Conferences	Italy is served by 19 conferences	
Consortia	Cosco, K-Line, Yangming at PSW-service	
Joint-ventures	Lloyd-Triestino and Zim in AUX-service in 2003	
Mergers	OMI's bid on Stelmar in the tanker sector	
Strategic alliances	Grand Alliance, New World Alliance, etc.	
Vessel sharing agreements	148 agreements being filed with the European Commission in	
	2001	

Table IV-5: Shipping company co-operation

Source: Creel, 2001; Francesetti and Foschi, 2001; Panayides and Cullinane, 2002; Baird, 2003, p.14; Dunelm, 2003; Hanjin, 2004; Informare, 2004; Klinger, 2004

IV.5.19. Shipping company hubbing

Bonney (2002), Penfold (2002, p.7) and Roos (2002, p.4) describe how the hubbing phenomenon fits into shipping companies' strategy for structuring traffic into main line and feeder traffic in order to save costs. Baird (2002) and Min and Guo (2004) show what savings can be obtained under what network structures.

Alderton (1999) should be qualified where he nominates a sea port to be a pure feeder sea port or a pure hub. It can well be that for one shipping company, sea port A is a hub, whereas a competing shipping operator has his hub in sea port B, while it is using sea port A as a feeder sea port in its network. This way, a sea port might be a hub for one shipping company, whereas it is just a satellite sea port in the feeder network of another shipping company. Drake (1999) makes a similar observation: what may be cost advantages to one carrier, may be cost disadvantages to another carrier.

Extent of terminal-handling activities will therefore primarily be a strategic choice by a shipping company or another partner in the transport chain, provided this party has enough power in the chain to impose this choice on the other players. Each of these decision-makers will base their decision on individual preferences, but will in the meantime also react to competitors' moves. Moreover, they all will be constrained by what other partners with more power impose. The joint decisions of several of these decision-makers in the port will determine whether the sea port is a large or a small one in activity size. World Cargo News Online (2005s) shows how PSA's Brunei terminal has experienced problems due to a 300% increase in transhipment traffic.

IV.5.20. <u>Shipping companies in land transport</u>

ERS Railways, a rail joint venture between Maersk Sealand and P&O Nedlloyd, is an example of shipping-company integration in hinterland transport (De Lloyd, 2002h). Such integration is detrimental to terminal power in negotiations.

IV.5.21. Shipping companies in logistics

NYK Line's intention to integrate into logistics means that it attains more chain power and enters into competition with terminal-operating companies where these also provide logistics services (De Lloyd, 2002f).

IV.5.22. Shipping companies in terminals

It is shown in CHAPTER II that a number of shipping companies have integrated into container handling in a number of ways. Benacchio and Ferrari (2000, p. 3 and p. 11–12) summarize the forms as taking a stake in existing or new terminals or in existing terminal

groups, or to develop projects on their own, which can be setting up terminal operating divisions or companies, or developing a specific terminal or (part of a) port. Examples are mentioned in appendix A-10.

Reasons for vertical integration on behalf of shipping companies are container-handling expenses, relatively high profits, control over container handling, priority at the terminal and capacity provision (Asian Development Bank, 2001; Beddow, 2001; Van den Bossche, 2001d).

In most cases, operations at integrated terminals will be modified in order to optimize the sea operations. This means that terminals will often need to provide more capacity in order to work the peak demand from the sea side.

Sometimes, sea carrier-owned terminals get permission to process the traffic of other carriers next to own traffic, as a measure to improve low occupation rates. CTDC for instance is a very profitable subsidiary of the CS Group, serving the parent company as well as other shipping lines (Modern Terminals, 2003; World Cargo News Online, 2001).

Only in a few cases, sea carrier-owned terminals or terminal operating companies are really profit centres on their own, who can decide for instance to deal with other companies than the parent company. This is true for example for APM terminals, established by the AP Möller Group in 2001 as a stand-alone division, which is gradually attracting more third-party business. Before, AP Möller's port division was intended to serve mainly Maersk Sealand's needs. (Damas, 2002).

For terminals, integration from shipping companies can bring traffic stability. It is the reason why Hutchison decided to sell more terminal stakes to shipping companies (De Lloyd, 2002c). A disadvantage to other, non-integrated terminals is that shipping companies get insight in prices and consequently have decreasing willingness to pay (Van den Bossche, 2003b).

IV.5.23. Shipping company independence

In some cases, shipping companies may prefer to keep full independence from terminal operators, or they may avoid dealing with concentrated terminal groups. Van den Bossche (2001) observes for instance how Maersk considered quitting Antwerp after PSA was awarded new left-bank terminals in addition to its right-bank assets.

IV.5.24. Shipping company overbookings

Shipping companies may overbook. The terminal is left with the problem of accommodating overbookings, which increases its costs, but which also impacts on its revenue if it manages to do so.

IV.5.25. Shipping company or shipper handling requests

Shipping companies can impose a number of loading specifications with respect to orientation or grouping of containers inside ships. Shippers can impose the request to change container status from FCL to LCL status or reverse. Processing such requests is costly but in the meantime beneficial to the terminal. Ward (1999) and Bruzzone *et al.* (1999) show how simulation analysis enables to deal with such requests in the least costly way.

IV.5.26. Shipping company or shipper timing requests

Late arrivals are frequent in container handling, from the sea side as well as from the land side. According to Panmure (2001, p. 11), the majority of inbound containers arrives more than 12 hours later than originally scheduled. If a terminal wants to accommodate such delays, costly spare capacity is required, or a number of extra terminal movements are needed (Van de Merbel, 1998 and Meersmans and Dekker, 2001, p. 6). On the other hand, the ability to allow for flexibility is generally considered a plus by shipping companies and shippers. This type of request boils down to a demand for priority of call (Van den Bossche, 2001c).

IV.5.27. Shipping company security requirements

Security measures asked by shipping companies may impact on the terminal's cost structure. For instance, stowing containers with doors facing complexifies stowage planning and the loading and unloading process. On the other hand, not complying with this specification is a negative element towards shipping companies which may influence demand negatively.

IV.5.28. <u>Terminals and inland ports</u>

In some cases, administrative or operational links may exist between sea ports and inland ports. As shown in Section IV.4.3, supply and activity goal effects may exist. But such agreement may also be a means for the terminal to generate more traffic. Examples of inland integration are Hessenatie's inland terminal in Kortrijk (Belgium) and ECT's inland terminal in Willebroek. Examples of mutual co-operation agreements are the Brussels, Liege, Lille and Paris ports agreement. An inland port which took a stake in a sea-port terminal is the inland port of Duisburg in P&O Ports Europe (World Cargo News Online, 2004l). In each of these cases, the sea-port terminal is assured of a larger amount of hinterland traffic than without the agreement.

IV.5.29. Terminal co-operation

Chapter II gives an overview of forms of horizontal co-operation that occur in container handling. It is observed that there is no co-operation between terminals of different handling companies. Co-operation between container-handling companies occurs at specific terminals for gaining market entry or for materializing cost economies. It is derived from CHAPTER III that ICT systems are one of the domains where cost economies can be gained. Damas and Mottley (2003) and Stumm *et al.* (2004) illustrate how uniform ICT systems may allow for cost economies and higher productivity. De Lloyd (2001b) illustrates the benefits of introducing PSA's Portnet.com software also in the group's terminals in Venice and Genoa. van der Linde *et al.* (2003, p. 12) show how higher productivity and uniform systems over terminals may increase customers' willingess-to-pay for terminal services. A terminal network with several terminals in the same market may ask for co-ordination which shifts the container-handling activity goal.

IV.6. Terminal-specific factors influencing container handling

IV.6.1. <u>Container type</u>

Major distinguishing characteristics of containers are these.

- Container dimension.
- Container state.
- Cargo weight.
- Cargo nature.
- Container destination.

Costs and / or revenues may differ under each of these conditions.

IV.6.2. Direct / indirect delivery

Meersmans and Dekker (2001, p. 13) and Van de Merbel (1998) compare advantages and disadvantages of direct delivery / receipt in Table IV-6.

Table IV-6:	Advantages a	and disadvantages	of direct deliver	y / receipt
	0	0		v 1

	Advantages		Disadvantages
•	Passage through the terminal is quicker	•	Delays to vessels or vehicles are possible
•	Cargo risk is reduced	•	Quay congestion can occur
•	The container yard is avoided	•	Stowage sequence can be upset
•	Yard stacking equipment is not needed	•	Other activities, like customs for instance,
			can experience delays

Source: Meersmans and Dekker (2001, p. 13) and Van de Merbel (1998)

IV.6.3. Economic growth

Economic growth as an exogenous variable may bring a shock in terminal planning. World Cargo News Online (2004z) for Australia, Hollmann (2005) for Hamburg and De Lloyd (2005u) for Vancouver shows how economic growth in trading-partner continents creates

congestion problems, whereas in Venezuela, terminals were left with idle capacity as trade shrank.

IV.6.4. <u>EDI</u>

Electronic Data Interchange (EDI) should support and speed up the flow of documents which accompany the cargo, and will this way have an impact on the cargo-handling process. An illustration and potential benefits of EDI processes are given by P&O Ports (2003), where improved bay planning, container-movement messaging and sea-cargo automation procedures are explained. Other illustrations of amounts that can be saved through EDI in container terminals are presented in HHLA (2000), Wehnert (2001) and Lokuge *et al.* (2003). EDI is part of what Pilsch (2001) calls the 'management-systems' element in the sea-port transfer in general and cargo handling in particular. Besides management systems, Pilsch also discerns the human and the technology elements.

Electronic automation through EDI can in general be applied in all fields where traditionally documents are to be transferred or compiled. The number of document interchanges is vast, and EDI is therefore a large concept, also involving exchange or compilation of internal documents, where so-called Management Information Systems (MIS) can be applied.

According to Van de Merbel (1998), computerized MIS have one or more of following effects.

- Reduce paperwork.
- Make data instantly available.
- Make data updating easy.
- Check entries automatically.
- Make rapid documentation possible.
- Enable automatic data analysis.
- Give system prompts.
- Give way to automatic billing.

EDI in general is stated by Van de Merbel (1998) to result in following effects.

- Reduces keying-in.
- Reduces the number of error sources.
- Makes data available to all.
- Improves advance planning.
- Stimulates short-sea services.

EDI changes container-handling costs through for instance savings in various areas as a consequence of EDI investments, and that it will change container-handling revenues as a consequence of improved terminal attractiveness if EDI is working properly or as a consequence of counteractive underperforming EDI.

An overview of recent EDI technologies and their impact on terminal operations is given by Maudrich (2000). The use of electronic inter-modal platforms like is illustrated in Marine Digest (2003).

IV.6.5. Gate procedures

De Lloyd (2004e) shows how gate opening hours may be used as a tool to relieve congestion. In Antwerp, P&O Ports decided to have gates open 24/24.

IV.6.6. Geography

Type and scale of infra- and superstructure needed depends mainly on the geographical location of the sea port and its container terminals. UNCTAD (1985) and Kieran (2003, p.9) mention geology and hydrography as important geographical factors. World Cargo News Online (2003az) illustrates how geography can be a competitive factor in container handling. Notteboom (2002) shows what role in shipping networks can be assumed by peripheral ports.

IV.6.7. Hinterland connections

On the container-handling revenue side, besides maritime access and terminal infra- and superstructure, hinterland connections deserve special attention. Major infrastructure works, like those planned by the European Commission for its TEN-T¹¹ projects, can dramatically change a port's accessibility and therefore also shift the share of sea traffic it bears, compared to the situation before the improved hinterland connection. The same is true for other infrastructural changes, as is indicated by Drewe and Janssen (2001, p. 9-10 and 17), where they refer to the importance of logistical accessibility which has outstripped that of physical accessibility. World Cargo News Online (2004cc) refer to uni-modal terminals, for instance all-rail terminals.

IV.6.8. Hinterland tariffs

Van den Bossche (2003) shows how overall high rail charges in Germany, which could hamper demand at German container terminals, are subject to exception for all traffic which is bound for or originates from the ports.

IV.6.9. Hinterland size

Hinterland size restricts demand for a terminal's container-handling services. Some terminals may have a niche market, implying a de facto monopoly situation (World Cargo News Online, 2004ct).

IV.6.10. Industrial activity

Industrial or commercial companies active in or close to a sea port are subject to the same broad operating conditions as similar companies outside or further away from the port. Only

¹¹ Trans-European Networks for Transport (see European Parliament and Council, 1996)

some very specific differences in working environment may push them to locate in or close to the port¹².

An interesting issue is the link between industrial and commercial activities on the one hand and container-handling costs and revenues on the other hand. Agglomeration effects through industry located nearby can lower container-handling costs, and a close commercial system and a large industrial basis using the sea port for acquiring consumer goods respectively raw materials and for shipping finished or semi-finished products can boost container-handling revenues.

IV.6.11. Infrastructure

In general, a number of options are available for each of the infrastructure sections from Figure IV-13.



Figure IV-13: Sea-port-related infrastructure elements

Particular problems infrastructure planning are berth type selection (World Cargo News Online, 2005v), dredging (World Cargo News Online (2004bl, 2004bv and 2004cb) and choosing a mooring system (World Cargo News Online, 2005q). JWD Group (2003) illustrates how terminal land use and configuration may differ between terminals.

¹² This can be for the agglomeration and concentration advantages offered by a sea port. The phenomenon where these activities move out of the sea port (e.g. through regulation-induced measures) is often called 'sub-harborisation', although this term applies more to functions related to cargo handling that not necessarily require a location within the port perimeter and that move outside the sea port.

IV.6.12. Inland port

Also if there is no institutionalized link between sea port and inland port(-s), the latter's presence can have an impact on container-handling revenues and / or costs at the sea port's terminal. If the radius of influence of inland ports on sea ports is sufficiently large, the inland port can lead to higher demand for container-handling services at the sea-port as well as different handling costs as barges are used for hinterland connection.

IV.6.13. Intermodal delivery / receipt

Container handling has different cost structures as a result of different inter-modal delivery systems in place.

IV.6.14. Labour

Piodi (1999, p. 12) makes a double split-up between job contract type (pool work or permanent work) and payment scale (piece rate or fixed wage). Suykens (1995, p. 3) adds reservation of port jobs to a 'recognised' class of workers as a separate type, while for our purposes we could consider this to be part of the pool system with exclusiveness conditions. Labour conditions have cost and revenue implications for a terminal. Ports which are prone to stakes usually have a negative reputation. Israel for instance had port strikes in 1997 and 2003 (World Cargo News Online, 2003am and World Maritime News, 1997). Pusan (World Cargo News Online, 2003aw) and India (De Lloyd, 2005ae) had port strikes too, but for very different reasons. Dombois and Wohlleben (2000), Vezzoso (2000) and Turnbull (2002) deal with changed labour relations in German, Italian respectively British sea ports, and how this could avert strikes. Labour productivity may be increased by adequate training (World Cargo News Online, 2004ai). This is especially needed as new terminal technologies emerge (Consortium Aristotle University of Thessaloniki *et al.*, 2000).

IV.6.15. Lease or management contract duration and conditions

Longer leases can enable operators to better recover their capital costs (World Cargo News Online, 2004cs). Lease prices and conditions impact on container-handling supply conditions.

IV.6.16. Lock operations

With respect to operation of in-port infra- and superstructure, it is obvious that different operational regimes can influence revenues. Included here are for instance operating regimes of locks, which may for example not operate on Sundays.

IV.6.17. Maintenance

Maintenance occurs over the life-time of infra- and / or superstructure, and is important in terms of container handling costs and revenues. For infrastructure maintenance, UNCTAD (1985, p. 85 - 88) for instance refers to dredging and other ways of maintaining and improving existing infrastructure. Maintenance type and frequency leads to costs of varying sizes, but forgoing maintenance or choosing an insufficient method of maintaining can mean decreasing revenues. If dredging for instance is not sufficient, maritime access depth can decrease, and this way, sizes of ships which can enter the sea port can be limited. Or technical defects can occur, which in the short run cause delays to port users, and in the long run maybe make them shift to an alternative port.

For superstructure, just like for infrastructure, maintenance may be crucial, in the short run as well as in the long run. Technical defects usually lead to an emergency procedure, which interrupts normal processing: (i) a defect is reported to the control room, (ii) civil engineers are informed, who request action, (iii) a safety stop is called for engineering inspection, (iv) if repair is needed, a safety notice is issued to controllers, (v) barriers and signs are placed around the location, (vi) engineers repair the defect, after which barriers and tools are cleared away, (vii) completion is reported to control, (viii) a safety stop is called for engineers to leave, and (ix) operations can return to normal (Van de Merbel, 1998). This way, technical defects do not only decrease revenues, but they also increase container handling costs, no matter who does the maintenance. World Cargo News Online (2002b) gives an idea of amounts to be saved through well-planned maintenance programs.

Van den Bossche (2000) mentions that in general, maintenance expenses increase with age. A new service recently introduced is on-site repair (World Cargo News Online, 2004ch).

IV.6.18. Overall sea-port traffic

Overall sea-port amount of traffic can have an impact on container-handling revenues at a terminal in that port: directly when the amount of traffic causes congestion, indirectly when traffic volume requires infrastructure which slows down port transit. Overall traffic can be composed of container traffic, including traffic from other terminals in the port, other commodity types (dry and liquid bulk and general cargo) and passengers. Passenger traffic over sea has to do with business or leisure related regular ferry-line traffic or cruise traffic.

World Cargo News Online (2004am) illustrate for Kotka (Finland) respectively Gavle (Sweden) how too much traffic makes shipping companies complain and makes them reluctant to call at the port.

IV.6.19. Promotion

Promotion strategies will influence the container-handling revenue level to a certain extent. The only downsizing effect on revenues could come from congestion caused by overly promoting the port, which could attract more traffic than some or all chain elements of sea port and / or terminal can bear.

IV.6.20. Quay crane allocation

Quay crane allocation, if well organized and planned, yields substantially more efficient container handling. An idea of possible gains is given by Boll (2002) and Zhang *et al.* (2002, p. 538).

IV.6.21. Safety

Container terminals are vulnerable to accidents, although the number of human injuries is usually low. Still, safety measures can have a positive impact as an added element of product quality. The port of Tauranga (New Zealand) for instance publicized its safe equipment tyres (World Cargo News Online, 2004cn).

Safety in fact starts at the approach channel to the terminal, where lights, buoys, beacons and other navigational aids can increase a terminal's attractiveness. Towage and pilotage enforce safety of navigation on the approach channel and in port basins, and which have a clear link with port geography. Both effects of towage and pilotage on container handling revenues are positive if they increase safety and speed of crossing the maritime entrance, but are negative if they slow down the normal entry process compared to the situation without towage and / or pilotage. Gremmecke (2000) illustrates the benefits that can be gained from improved vessel traffic services.

Safety at the terminal mainly involves responding to the weather (Schiffer, 2000).

- Following windbreak rules.
- Adopting 'wind baffle' stacking patterns.
- Block-stacking.
- Tying down to lashing points.
- Maintaining 'anchoring boxes'.
- Taking account of extreme cold.
- Preparing for heat.
- Preparing for heavy rain, with standing water as one of the possible consequences.

Each of these measures increases terminal costs but also increases willingness-to-pay for the handling product.

IV.6.22. Security

Container terminals are vulnerable elements in the transport chain. Through criminal acts, container-handling costs increase and revenues can decrease as customers look for an alternative (un-)loading operator. Security measures may bring revenues back to levels equal to those without accident risk and criminal threats.

Different options are available with respect to security provision. There is the choice between internal and external provision, where the trade-off between external charges and internal transfer charges is to be made. There is also a choice between different techniques of practical implementation. With respect to container scanning for instance, there is X-ray scanning with

fixed scanners (World Cargo News Online, 2004ci), mobile scanners (World Cargo News Online, 2004ck), or scanning while unloading (Robinson, 2003). World Cargo News Online (2004w) refers to the huge delays often caused by fixed scanning. Techniques for providing terminal security are for instance CCTV (World Cargo News Online, 2004m) and interceptors (World Cargo News Online, 2004ay).

If efficient, previous measures lead to less unauthorized people on terminal, better asset control, fewer losses due to theft, decreased insurance costs, less restart operations, less afterevent administrative work, less compensations to actors incurring damage and less repair costs (De Lloyd, 2005t, Griffitts, 2002 and Vinh, 2004b). Theft is a primary problem in particular areas like South America (Saavedra, 2002).

On the other hand, if security operations are time and energy-consuming, they may hamper normal container handling, and therefore lower revenues. Lee and Song (2003) and Lewis *et al.* (2002), illustrate how and to what extent this could be the case. Akery (1999), Brown and Botello (2001) and Bowser and Huseman (2001) suggest some automated methods for alleviating negative effects of security checks. But even if not hampering, customers may just not be willing to pay for this extra service in cases where this payment would be required, so that container handling revenues go down equally. De Lloyd (2005q) refers to Hong Kong where shipping companies were reluctant to pay security fees introduced by terminal operators. World Cargo News Online (2004cv) refers to Felixstowe where the same situation prevailed.

IV.6.23. Services to cargo

Although these services do not necessarily need the physical location of a sea port, having them there can make the maritime transport process more efficient and may therefore influence demand for container-handling at terminals in the port. Several problems in providing these services however can abolish the benefit from having the services at the port. Packing problems for instance can be these.

- Damage during packing / unpacking.
- Uneven container loading.

- Insecure packing.
- Administrative errors.

The risk of packing damage and the packing time needed is lower if a tight rather than a secure stow is being applied. A tight stow is possible if packages are regular and uniform, dimensions fit neatly, only one type of cargo is involved, and packaging is sufficiently strong. A secure stow can consist of shoring, chocking / wedging, lashing or space-filling. Different materials can be used for this stowing. (Weeke, 1998)

IV.6.24. Services to containers

Presence of services to containers, not necessarily provided by the container-handling operator, may impact on demand for the container-handling product.

IV.6.25. <u>Services to ships</u>

Usually, a ship won't enter a sea port for services to ships alone, except in case of emergency, but having these services at a sea port may be an incentive for choosing a specific terminal at a port of call.

IV.6.26. Ship size

Size of ships calling at a sea port will impose different requirements on sea-port and terminal infra- and superstructure. The general tendency in recent years has been to use increasingly large vessels. An overview of this evolution in container vessel sizes is given in Table IV-7.

Ryan (1998, pp. 1125 -1227), Critical Interface Technologies Working Group (1999), Drewe and Janssen (2001, p. 17) and Marcus and Bardijs (2003) all refer to new ship developments like fast ships (with for example the FastShip¹³ concept). Another phenomenon often referred to is an even further increase size of container ships towards types called Malaccamax (> 15.000 TEU). Some authors however doubt whether such large ships will be economically

feasible, making reference to technical requirements for such ships (see among others Stopford, 2002 and Harrison *et al.*, 1999).

Container vessel category	Time of introduction/	Average TEU	Typical	Typical
	Period of production	capacity	length (ft)	draught (ft)
1 st generation	(pre)1960-1970	1,700 TEU	450-630	
2 nd generation	1970-1980	2,305 TEU	700	
3 rd generation (Panamax)	1985	3,220 TEU	860-950	38
4 th generation	1986-2000	4,828 TEU	900-1,000	42
(Post-panamax)				
5 th generation	2000-2005	7,598 TEU	1,100	46
(Post-panamax-plus,				
jumbo, ultra-large				
container vessels, mega-				
containerships)				

Table IV-7: Container-vessel-size development

Source: Vickerman, 2003d, p. 36, Rizvi, 2003, Trace, 2002, p. 5 and Harrison *et al.*, 1998, p. 26 and 36

Ships' cellular or non-cellular character (Van de Merbel, 1998) is another important characteristic. The share of cellular vessels in worldwide container trades has increased from 48.8% in 1989 over 64,8% in 1998 to 73.3% in 2003 (ISL, 2004).

Different vessel sizes and characteristics impose different container-handling costs to terminals. Which vessel sizes call at the sea port will depend on geography, for instance depth of maritime access, as well as on sea port status within a shipping company's network, for instance a hub versus a feeder sea-port status. Steenken et al. (2004, p. 7) refer to ships of up to 8,000 TEU currently serving the main continental ports, whereas regional ports are usually served by smaller vessels of 100 up to 1,200 TEU. Larger ships calling at the port may on the one hand involve investments in larger infra- and superstructure, whereas on the other hand,

¹³ FastShip, Inc is an American joint-venture company of Izar, Rolls Royce, JP Morgan, CDC-IXIS, Cargolux, CP Ships, Lockheed Martin, TTS, BP, Aborro, CCI Cherbourg-Cotentin, and Delaware River Port Authority of Pennsylvania and New Jersey (Fastship, Inc., 2004)
this type of infra- and superstructure can probably allow larger economies of scale. Tozer and Penfold show the possible effect on container-handling productivity. D'Hondt (2002) shows how vessel sizes impact on terminal workload and attractiveness.

IV.6.27. Storage

Steenken *et al.* (2004) state that adequate storage space allocation is gaining importance since container ship's average load is increasing, and since space inside the terminal is getting a very scarce good.

The case is complicated because different storage systems can be implemented: the right number of slots in a block or row can be reserved for a specific ship, or alternatively, a yard area is reserved for a berthing space and the ship is allotted a berthing place according to the ship's cargo (Steenken *et al.*, 2004). Different systems may be sensible to interruptions to different extents. Chen (1999) mentions the major advantages of the different strategies.

One cause of interruption is a misaligned stack, where the procedure usually started looks as follows, so that a delay will occur almost inevitably: (i) a misaligned stack is reported to control, (ii) a controller directs a driver to the location of the error, (iii) the driver realigns the container / stack, and (iv) the driver sees and adjusts without prompting. Another type of interruption occurs when a stack is leaning, where the following procedure is usually followed: (i) the stack is reported to control, (ii) the controller instructs the driver to unstuck and move the containers to a level area, (iii) surface debris is cleared away, (iv) engineers repair the yard surface. (Van de Merbel, 1998)

In order to avoid the type of problems from the previous paragraph, it is important to respect a thorough planning procedure. Van de Merbel (1998) gives four fields in which lack of planning is immediately felt.

- The terminal ends up with an inaccurate allocation of storage zones.
- The terminal operator has to make unnecessary shuffles.
- Stacking errors and shifts occur, imposing supplementary and costly planning efforts.
- The hinterland modes and in the end also the final customer lose time.

For reason of the disadvantages of direct delivery / receipt, storage sometimes increases container-handling revenues compared to the case where storage does not occur, but on the other hand, negative storage effects may dominate, so that direct delivery / receipt allows to exploit its advantages, and especially the fact that yard stacking is avoided and stacking errors therefore do not apply.

IV.6.28. Stowage planning

Inadequate stowage planning may increase container-handling costs and may decrease revenues as errors in stowage may need to be corrected. Stowage planning is also called 'staging' by Sideris *et al.* (2002) and Transystems Corporation (2002).

IV.6.29. Superstructure

Types of superstructure on which a choice has to be made inside the terminal, are described extensively in UNCTAD (1985, p. 73 - 100 and 105 - 206) and Vis and De Koster (2003). The main options with different impacts on costs and revenues are summarized in this section.

For lifting the containers into or from the ship in case of lo/lo and sto/ro, one can use following types of shore cranes.

- Portal gantry cranes.
- Jib cranes.
- Multi-purpose cranes.
- Mobile cranes.

Alternatively, also the ship's own equipment can be used for lifting the containers:

- The ship's derrick.
- A ship-mounted jib crane.
- A ship-mounted gantry crane.

For carrying containers to the ship or for removing them from the quay in case of lo/lo, different systems can be used. World Cargo News Online (2003ah) shows that the previous concepts do not have the same meaning for all operators.

- A chassis system.
- A straddle carrier direct system.
- A lift-truck system, which also includes reach stackers.
- A straddle-carrier relay system.
- A rubber-tyred yard gantry (RTG) crane system.
- A rail-mounted yard gantry (RMG) crane system.
- An AGV system (at the quay, at the yard, or at both parts of the terminal).
- A more complex combination.

Choices with respect to both infra- and superstructure impact on costs and revenues in container handling. Container handling cost effects of certain types of terminal transport equipment are summarized in Table IV-8. Service aspects, which are also important, are only partially dealt with in the table.

With RTGs and RMGs trailers can be used for the transport between the berth and the yard gantry crane. In case of ro/ro, the last part towards the vessel is in any case to be done by trailer. The same is true for sto/ro. (Van de Merbel, 1998; Meersmans and Dekker, 2001, p. 8)

In order to have inside access to ships, one uses a lashing cage, a gondola, a spreader, a ladder, or a lashing platform. For inspecting a container, safe equipment required consists of a mobile powered hoist, a platform or a cage lifted by a lift truck, a mobile platform, a scaffolding tower, or a ladder. (Van de Merbel, 1998)

Advantages	Disadvantages						
Chassis	system						
Rapid operation	• (Usually) longer quay transfer travel						
Simple operation	distance						
• Flexibility	• Job sequence changes posing problems						
	• Absence of buffer stock at the crane						
Straddle ca	rrier system						
• Flexibility	• Safety						
	Travel distance						
	Damage sensitivity						
	• Reliability						
RTG s	system						
Ample flexibility	High wheelloads						
High productivity							
• Reliability ¹⁴							
RMG	system						
• Reliable	• Low flexibility						
Highly productive	• High investment to be made						
Less sensitive to damage							
Suitable for automation							
Limited space usage							
Low labour intensity							

Table	IV-8:	Cost	comparison	of 1	terminal	transi	nort e	aui	oment	types
Labic	1,-0.	COSt	comparison	01 0	ter minai	ti ans	ρυιιι	yui	pmene	type

Source: Van de Merbel, 1998b, Meersmans and Dekker, 2001, p. 9 and Steenken et al., 2004

Some recent technologies are described in Beauduin (1999), Higgins *et al.* (1999), Transystems Corporation (2001), Dellinger and Klinge-Habermann (2002), Pislch (2004) and Giannetti (2004). These technologies are in following areas.

- Auto-steering and container verification (World Cargo News Online, 2003d).
- Brake types (World Cargo News Online, 2004aw).
- Crane anti-sway (World Cargo News Online, 2004au).
- Conceptual arrangements like robotic handling, the Computainer, Speedport-systems.
- Container positioning, stack profiling and spreader path optimisation (World Cargo News Online, 2003at).
- Crane modernization (Chong et al., 1999).
- Energy supply (Koch, 1999).

¹⁴ This characteristic is questioned by Meersmans and Dekker (2001, p. 9)

- Engine protection (World Cargo News Online, 2004bx).
- Extendable straddle carrier (World Cargo News Online, 2004cu).
- Gate design: size and technology (Thomas and Urban, 2001)
- Hydraulics replacement (World Cargo News Online, 2003ag).
- Overheight attachments (World Cargo News Online, 2003s)
- Remote monitoring and diagnostics (World Cargo News Online, 2003o).
- Skeletal trailers (Hofman, 1999).
- Terminal design: automated terminal container handling (Aldridge, 2001; Liu *et al.*, 2002; Overton *et al.*, 2001).
- Tyre types (World Cargo News Online, 2004be).
- Wireless communication system (World Cargo News Online, 2003at).

Technological improvements in existing techniques sometimes involve large investment efforts, but meanwhile they can allow substantial gains in container handling costs through offsetting productivity gains. Moreover, technological improvements may be a barrier to entry: if a leader adopts a new technology which combines less costs with better service, followers may be obliged to equally adopt such technology, and the overall barrier level in container handling increases.

Bello and Lafitte (1999) and illustrate that not only direct cost and revenue effects, but also indirect effects through maintenance, reliability and safety may be substantial. World Cargo News Online (2004ae) illustrates high replacement costs for crane ropes. Robinson (2003) states that the trend towards larger quay cranes implies costs through longer ropes, which cause more sway, and the driver being further away, which makes precision more difficult.

Nam (1999), Rudolf (1999), Götting (2001), Nye (2001), Sandmann (2001) and Wiezorke (2000) show that not all combinations of superstructure fit together. World Cargo News Online (2003n) shows that small terminals require different superstructure than large ones.

Production of each type of equipment is done only by a few producers. Figure IV-7 sums up the respective producers.

Equipment type	Producers
AGV	Kalmar, Demag / Gottwald, Mitsui engineering, Gaussin,
	Busicar, MOL, Magnum
Reach stackers	Kalmar, Fantuzzi, Hyster, Taylor / CVS, Sisu, Terex / PPM,
	S&B
Ship-to-shore crane	Fantuzzi / Regianne, Kone, Mitsui engineering, Nelcon, Noell,
	ZPMC
Spreader	Bromma, Elme, OEMS, Smits
Stacking cranes	Fantuzze / Regianne, Gottwald, Hilgers, Kalmar, Kone, Mitsui
_	Engineering, Mitsubishi, Nelcon, Noell, Paceco
Straddle carriers	Kalmar / Nelcon, Noell
Stacking cranes Straddle carriers	Fantuzze / Regianne, Gottwald, Hilgers, Kalmar, Kone, Mitsui Engineering, Mitsubishi, Nelcon, Noell, Paceco Kalmar / Nelcon, Noell

	Table IV-9:	Container-ha	ndling equi	ipment prod	ucers
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Source: Van Dooren, 2002c and Pilsch, 2004

IV.6.30. Terminal Planning

Terminal planning is a time and cost-intensive process which is however necessary for fluent terminal operations. World Cargo News Online (2004, 2004u and 2004x) deal with the consequences of bad planning at the ports of Trieste (MSC leaving) respectively Mombasa (high demurrage charges) and Los Angeles / Long Beach (not enough trained workers).

IV.6.31. (Un-)boarding

(Un-)boarding needs to be secure in order not handle the wrong container. Bad (un-)boarding increases costs and decreases revenues in container handling.

IV.6.32. Weather

Severe weather conditions may increase costs as safety measures need to be increased. World Cargo News Online (2004bg and 2003j) illustrate safety measures needed against heavy wind. World Maritime News (1997c) shows possible effects of storms and heavy winter conditions, sometimes resulting in port closure.

IV.6.33. <u>Yard traffic management</u>

Transport itself is to be neatly organized and tightly controlled in terms of paths followed. The importance of quay transport organization is illustrated by e.g. Konings (1996). Two organization systems are applied in practice: a single-cycle mode, whereby the transport vehicle only serves the cargo of one ship¹⁵, or a dual-cycle mode, whereby the vehicle serves different ships at a time (Steenken *et al.*, 2004).

IV.7. Factors influencing container handling: summary and impacts

The factors from the previous sections can be brought together in a multi-dimensional matrix (89 dimensions in total), the basic structure of which is summarized in Figure IV-14. The dimensions of the matrix are the individual factors, and the values for the dimensions are the states that each factor can assume according to what was said in previous sections about costs and revenues. Each cell represents a combination of states for each dimension. If a container-handling company who intends to undertake a merger or make an acquisition, knows the states of the various factors in Figure IV-14 for the target terminal and for its competitors, it can construct these terminal's supply and demand functions with the techniques used in CHAPTER V.

Figure IV-14: Container-handling supply and demand dimensions



It appears that terminal-specific factors are largest in number, followed by chain factors, policy factors and scope factors. Many but not all of the terminal-specific factors are under control of the terminal operator. The same is true for chain factors. All of the scope factors can be directly managed by the terminal, whereas none of the policy factors is under direct terminal control.

¹⁵ This is a generalization of serving cranes which Steenken *et al.* (2004) refers to.

The existence of the various factors shows that economies can differ under different container-handling conditions, and this way confirms hypothesis 2. Hypothesis 3 is confirmed in this chapter by the presence of different states for each of the factors.

A change in one or more of the states implies changing cell in Figure IV-14. Table IV-10 summarizes for each of the 89 factors whether a change in their state impacts on demand, supply and / or the container-handling goal at the terminal.

CHAPTER V for a number of cells in the matrix of this chapter checks the size of eventual economies of scale by calculating cost functions for the respective situations.

Factor	Supply impact	Demand impact	Activity goal impact
Policy			
Antitrust	Yes	Yes	No
Charging	Yes	Yes	No
Customs	Yes	Yes	No
Employment	Yes	Yes	No
Environment	Yes	Yes	No
Financial capabilities	No	Yes	No
Liability regulation	Yes	Yes	No
Modal shift	Yes	Yes	No
National independence	No	Yes	No
Non-container-handling functions	Yes	Yes	No
Penalties	Yes	No	No
Public port planning	No	Yes	No
Regional development	Yes	Yes	No
Safety	Yes	Yes	No
Sea-port organization	Yes	Yes	Yes
Security	Yes	Yes	No
Social welfare	Yes	No	Yes
Taxes	Yes	Yes	No
Wages	Yes	No	No
War	No	Yes	No

Table IV-10: Container-handling factors and their impacts on supply, demand and activity goals

Factor	Supply impact	Demand impact	Activity goal impact
Scope			
Commercializing spin-off applications	Yes	No	Yes
Handling non-containerized cargo	Yes	Yes	Yes
Inland port operation	Yes	No	Yes
Passenger handling	Yes	No	Yes
Services to containers	Yes	No	Yes
Services to cargo	Yes	No	Yes
Services to ships	Yes	No	Yes

Factor	Supply impact	Demand impact	Activity goal impact
Chain			
Charges	No	Yes	No
Containerization	No	Yes	No
Environment	Yes	No	No
Land transport concentration	Yes	Yes	No
Quality requirements	No	Yes	No
Safety	Yes	Yes	No
Sailing frequency	No	Yes	No
Sea-port authorities and terminals vs. shipping companies	No	Yes	No
Sea-port authorities in logistics	No	Yes	No
Sea-port authority co-operation	No	Yes	No
Sea-port organization	Yes	Yes	Yes
Sea-port promotion bundling	No	Yes	No
Security	Yes	No	No
Shipper information	Yes	Yes	No
Shipper trade pattern	No	Yes	No
Shipper or shipping company routing / mode decisions	Yes	Yes	No
Shipping company concentration	No	Yes	No
Shipping company hubbing	No	Yes	No
Shipping companies in land transport	No	Yes	No
Shipping companies in logistics	No	Yes	No
Shipping companies in terminals	No	Yes	Yes
Shipping company independence	No	Yes	Yes
Shipping company overbookings	Yes	Yes	No
Shipping company or shipper handling requests	Yes	Yes	No
Shipping company or shipper timing requests	Yes	Yes	No
Shipping company security requirements	Yes	Yes	No
Terminals and inland ports	No	Yes	No
Terminal co-operation	Yes	Yes	Yes

Factor	Supply impact	Demand impact	Activity goal impact
Terminal-specific			
Container type	Yes	Yes	No
Direct / indirect delivery	Yes	Yes	No
Economic growth	No	Yes	No
EDI	Yes	Yes	No
Equipment	Yes	Yes	No
Gate procedures	Yes	Yes	No
Geography	Yes	Yes	No
Hinterland connections	No	Yes	No
Hinterland tariffs	No	Yes	No
Hinterland size	No	Yes	No
Industrial activity	Yes	Yes	No
Infrastructure	Yes	Yes	No
Inland port	No	Yes	No
Intermodal delivery / receipt	Yes	No	No
Labour	Yes	Yes	No
Lease or management contract duration and conditions	Yes	No	No
Lock operations	No	Yes	No
Maintenance	Yes	Yes	No
Overall sea-port traffic	No	Yes	No
Promotion	Yes	Yes	No
Quay crane allocation	Yes	Yes	No
Safety	Yes	Yes	No
Security	Yes	Yes	No
Services to cargo	No	Yes	No
Services to containers	No	Yes	No
Services to ships	No	Yes	No
Ship size	Yes	Yes	No
Storage	Yes	Yes	No
Stowage planning	Yes	Yes	No

Factor	Supply impact	Demand impact	Activity goal impact
Superstructure	Yes	Yes	No
Terminal planning	Yes	Yes	No
(Un-)boarding	Yes	No	No
Weather	Yes	Yes	No
Yard traffic management	Yes	Yes	No

CHAPTER V: CONTAINER HANDLING: COST FUNCTION CALCULATIONS

V.1. Rationale for the chapter

This chapter analyzes a number of the fields where economies of scale can be gained, using cost figures from active container-handling companies. To this purpose, container-handling cost structures, or part of the structures, are reconstructed for a number of the cells of the matrix from chapter IV.

V.2. Total operating costs

This section analyzes the total operating costs for a number of existing terminals under a number of different conditions. Calculating operating costs is necessary to assess economies of scale. Not all of the 89 dimensions can be specified for the situations used in this section. The specific contexts in this section are chosen because of their clear definition and the availability of data for the various cost elements. The main distinguishing dimension between the three different settings that are considered in this section, is the use of specific crane superstructure.

V.2.1. First-generation quay cranes

The main scenario is one where first generation quay cranes are used. A distinction is made between two yearly terminal capacities: 210,000 TEU and 600,000 TEU container terminals are considered. The 210,000 TEU terminal has 8ha terminal surface and the 600,000 TEU has 16ha. Furthermore, two types of equipment are considered: new and used equipment. No specification is made on other characteristics of the terminal condition according to the matrix in chapter IV: these are equal in all the situations considered, unless defined otherwise.

The terminal operating cost structure is split up in three elements:

- Labour.
- Maintenance.
- Other operating costs.

In the labour category (Table V-1), management, administration, operations as well as maintenance staff are considered. This implies all these functions are performed in-house and are not sourced in. With respect to maintenance (Table V-2), there is a distinction between container-handling equipment, computer and communication equipment, buildings, and other equipment. Under other operating items are analysed fuel, light and power, environmental care, legal instruments, insurance, auditing, and other overheads. Other overheads are detailed like in Table V-3.

manpower	management	general	1997	USD	per unit
		engineering	1997	USD	per unit
		terminal	1997	USD	per unit
		accountant	1997	USD	per unit
		IT	1997	USD	per unit
		operations	1997	USD	per unit
		control	1997	USD	per unit
		maintenance	1997	USD	per unit
		maintenance	1997	USD	per unit
		secretariat	1997	USD	per unit
	administration	payroll	1997	USD	per unit
		billing	1997	USD	per unit
		cashier	1997	USD	per unit
		purchasing	1997	USD	per unit
	operations	ship / yard supervisors	1997	USD	per unit
		quay crane operators	1997	USD	per unit
		forklift and other drivers	1997	USD	per unit
		tractor / trailer	1997	USD	per unit
		stowage / wharf clerks	1997	USD	per unit
		ship / yard clerks	1997	USD	per unit
		control clerks	1997	USD	per unit
		computer clerks	1997	USD	per unit
		gate clerks	1997	USD	per unit
		personnel officer	1997	USD	per unit
		roster clerk	1997	USD	per unit
		senior depot clerk	1997	USD	per unit
		depot clerk	1997	USD	per unit
	maintenance	technician	1997	USD	per unit
		mechanics	1997	USD	per unit
		electricians	1997	USD	per unit
		trade assistants	1997	USD	per unit
		welders	1997	USD	per unit
		store clerk	1997	USD	per unit
		storemen	1997	USD	per unit
		pumpmen	1997	USD	per unit
		tyreman	1997	USD	per unit

Table V-1: Detail of container-handling labour operating costs

Data from Drewry Shipping Consultants (1998) are used for each of the cost items. The Drewry figures are reprocessed to calculate total labour, maintenance and other operating costs, total costs and average costs, all of them on a yearly basis. The aggregate figures are shown in Table V-5. Appendix A-12 takes a look at the data behind Table V-5.

maintenance	container-handling	quay cranes	1997	USD	per unit
	equipment new	yard gantries	1997	USD	per unit
		straddle carriers	1997	USD	per unit
		rail-mounted gantries	1997	USD	per unit
		tractors / trailers	1997	USD	per unit
		reach stackers	1997	USD	per unit
		forklift trucks	1997	USD	per unit
		engineering service vehicles	1997	USD	per unit
		other vehicles	1997	USD	per unit
	computer and commicat	tion equipment new	1997	USD	per unit
	buildings and other supp	oly new	1997	USD	per unit
	other equipment new		1997	USD	per unit
	container-handling	quay cranes	1997	USD	per unit
	equipment	yard gantries	1997	USD	per unit
		straddle carriers	1997	USD	per unit
		rail-mounted gantries	1997	USD	per unit
		tractors / trailers	1997	USD	per unit
		reach stackers	1997	USD	per unit
		forklift trucks	1997	USD	per unit
		engineering service vehicles	1997	USD	per unit
		other vehicles	1997	USD	per unit
	computer and commicat	computer and commication equipment			per unit
	buildings and other supp	bly	1997	USD	per unit
	other equipment		1997	USD	per unit

Table V-2: Detail of container-handling maintenance operating costs

Table V-3: Detail of container-handling other operating costs

other operating	fuel, light and power	variable power	1997	USD	per TEU
		fixed power	1997	USD	per ha per year
		fuel yard gantry	1997	USD	per TEU
		fuel straddle carrier	1997	USD	per TEU
	environmental care				
	legal, insurance and	insurance	1997	USD	per TEU
	auditing	legal	1997	USD	per TEU
	royalty		1997	USD	per TEU
	other overheads	communications	1997	USD	per TEU
		travel	1997	USD	per TEU
		entertainment	1997	USD	per TEU
		marketing	1997	USD	per TEU
		other	1997	USD	per TEU

In Table V-5, following specifications are used.

- Calculations are based on figures from 1997 (Drewry Shipping Consultants, 1998).
- Manpower costs are based on following labour setting: Scenario 210,000 TEU: 1 general, 1 engineering, 1 terminal, 1 accountant, 1 IT, 1 operations, 1 control, 1 maintenance, 1 secretariat, 5 ship / yard, 25 quay crane, 42 forklift, 36 tractor / trailer, 14 stowage / wharf, 11 ship / yard, 7 control, 2 computer, 12 gate, 1 personnel, 2 roster, 1 senior depot, 2 depot, 8 technician, 12 mechanics, 7 electricians, 6 trade assistants, 6 welders, 3 store clerk, 4 storemen, 3 pumpmen, 4 tyremen, 1 payroll clerk, 3 billing clerks, 2 cashiers and 1 purchasing clerk; Scenario 600,000 TEU: 1 ceo, 1 terminal, 1 financial controller, 1 finance manager, 3 seniores accountants, 10 accounts clerks, 1 IT manager, 3 IT officer, 4 IT systems support, 1 marketing manager, 2 commercial services manager, 1 human resources manager, 1 supervisor human resources, 1 security manager, 3 securities, 4 secretaries, 6 general assistants, 1 assistant operations manager, 4 supervisors, 4 planning supervisors, 6 planning clerks, 48 general clerks, 12 gate clerks, 58 quay crane drivers, 71 yard gantry drivers, 112 tractor / trailer drivers, 55 forklift drivers, 4 foremen, 48 lashers, 10 general workers, 5 miscellaneous, 1 engineering manager, 2 engineering supervisors, 2 supervisors stores and spares, 3 technical supervisors, 14 electricians, 18 mechanics, 4 yard maintenance workers, 2 building maintenance workers and 3 engineering clerks.
- Maintenance costs are based on following superstructure setting: Scenario 210,000 TEU: 2 quay cranes, 3 spreaders, 2 reach stackers, 6 forklift trucks, 8 tractor / trailers, 1 generator and 3 work vehicles;
 Scenario 600,000 TEU: 5 quay cranes, 6 spreaders, 15 yard gantries, 1 reach stacker, 2 forklift trucks, 25 tractor-trailers, 1 generator and 6 work vehicles.
- The figures do not include maintenance costs for buildings and civil works.
- Part of the power costs are fixed, part are variable. Fixed power costs depend on terminal size.
- Different royalties apply according to the total traffic volume and according to a low or high royalty-scenario, like in Table V-4. Table V-5 counts with a low-level scenario.
- Lease payments are not included in the operating costs.

Throughput class	Low scenario (USD/TEU)	High scenario (USD/TEU)
0 - 50,000 TEU	0	0
50,001 - 100,000 TEU	1	2.5
100,001 - 150,000 TEU	2	12
150,001 -	5	25

Table V-4: Low and high-level royalties

From Table V-5, it appears that labour cost is the largest contributor to operating costs, followed by maintenance and other operating costs. Average costs are indeed decreasing in throughput, especially as a consequence of the fixed nature of labour and maintenance costs. Increasing throughput tenfold makes average costs decrease to more than a tenth of the original costs. Still, overall economies are observed: average operating costs decrease from 39.33 USD at 150,000 TEU to 32.83 USD at 200,000 TEU for a 210,000 TEU terminal with new equipment, against a move from 87.18 USD at 150,000 TEU to 68.72 USD at 200,000 TEU for a 600,000 TEU terminal.

Table V-5 assumes that all labour is permanently hired. In most container terminals, this is not the case: part of the labour force is hired on a temporary basis. Assume that management, administration and maintenance personnel from Table V-3 are permanently hired, whereas operational personnel is hired as operations require so. All labour inputs keep equal proportions for all throughputs.

Recalculating operational costs with this modification leads to the cost figures from Table V-6. It is observed that the economies from increasing throughput are lower in Table V-6 than in Table V-5: moving from 150,000 TEU to 200,000 TEU for a 210,000 TEU terminal with entirely new equipment leads to an average cost decrease from 39.33 to 32.83 USD in Table V-5 and from 34.58 to 32.24 USD in Table V-6.

						Other		Total	Average	Average
	TEU		Maintenance	Mintenance		operating cost	Total operating	operating cost	operating cost	operating cost
Throughput	capacity	Labour	new	used	Royalty	except royalty	cost new	used	new	used
1.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	0.00	96,008.35	4,496,358.35	4,651,058.35	4,496,358.35	4,651,058.35
	600,000 TEU	10,030,450.00	1,355,950.00	2,863,000.00	0.00	288,008.35	11,674,408.35	13,181,458.35	11,674,408.35	13,181,458.35
1,000.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	0.00	104,350.00	4,504,700.00	4,659,400.00	4,504.70	4,659.40
	600,000 TEU	10,030,450.00	1,355,950.00	2,863,000.00	0.00	296,350.00	11,682,750.00	13,189,800.00	11,682.75	13,189.80
10,000.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	0.00	179,500.00	4,579,850.00	4,734,550.00	457.99	473.46
	600,000 TEU	10,030,450.00	1,355,950.00	2,863,000.00	0.00	371,500.00	11,757,900.00	13,264,950.00	1,175.79	1,326.50
100,000.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	50,000.00	931,000.00	5,381,350.00	5,536,050.00	53.81	55.36
	600,000 TEU	9,194,000.00	1,355,950.00	2,863,000.00	50,000.00	563,500.00	11,163,450.00	12,670,500.00	111.63	126.71
150,000.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	150,000.00	1,348,500.00	5,898,850.00	6,053,550.00	39.33	40.36
	600,000 TEU	10,030,450.00	1,355,950.00	2,863,000.00	150,000.00	1,540,500.00	13,076,900.00	14,583,950.00	87.18	97.23
200,000.00	210,000 TEU	3,922,250.00	478,100.00	632,800.00	400,000.00	1,766,000.00	6,566,350.00	6,721,050.00	32.83	33.61
	600,000 TEU	10,030,450.00	1,355,950.00	2,863,000.00	400,000.00	1,958,000.00	13,744,400.00	15,251,450.00	68.72	76.26

 Table V-5: Operating cost figures calculated from Drewry Shipping Consultants (1998)

 Table V-6: Operating cost figures with flexible operational labour

						Other		Total	Average	Average
	TEU		Maintenance	Mintenance		operating cost	Total operating	operating cost	operating cost	operating cost
Throughput	capacity	Labour	new	used	Royalty	except royalty	cost new	used	new	used
1.00	210,000 TEU	1,431,011.86	478,100.00	632,800.00	0.00	96,008.35	2,005,120.21	2,159,820.21	2,005,120.21	2,159,820.21
	600,000 TEU	5,155,957.74	1,355,950.00	2,863,000.00	0.00	288,008.35	6,799,916.09	8,306,966.09	6,799,916.09	8,306,966.09
1,000.00	210,000 TEU	1,442,863.10	478,100.00	632,800.00	0.00	104,350.00	2,025,313.10	2,180,013.10	2,025.31	2,180.01
	600,000 TEU	5,163,691.47	1,355,950.00	2,863,000.00	0.00	296,350.00	6,815,991.47	8,323,041.47	6,815.99	8,323.04
10,000.00	210,000 TEU	1,549,630.95	478,100.00	632,800.00	0.00	179,500.00	2,207,230.95	2,361,930.95	220.72	236.19
	600,000 TEU	5,233,422.22	1,355,950.00	2,863,000.00	0.00	371,500.00	6,960,872.22	8,467,922.22	696.09	846.79
100,000.00	210,000 TEU	2,617,309.52	478,100.00	632,800.00	50,000.00	931,000.00	4,076,409.52	4,231,109.52	40.76	42.31
	600,000 TEU	9,194,000.00	1,355,950.00	2,863,000.00	50,000.00	563,500.00	11,163,450.00	12,670,500.00	111.63	126.71
150,000.00	210,000 TEU	3,210,464.29	478,100.00	632,800.00	150,000.00	1,348,500.00	5,187,064.29	5,341,764.29	34.58	35.61
	600,000 TEU	6,331,450.00	1,355,950.00	2,863,000.00	150,000.00	1,540,500.00	9,377,900.00	10,884,950.00	62.52	72.57
200,000.00	210,000 TEU	3,803,619.05	478,100.00	632,800.00	400,000.00	1,766,000.00	6,447,719.05	6,602,419.05	32.24	33.01
	600,000 TEU	6,729,672.22	1,355,950.00	2,863,000.00	400,000.00	1,958,000.00	10,443,622.22	11,950,672.22	52.22	59.75

In Figure V-1, a comparison is made among the total costs of the 210,000 TEU and the 600,000 TEU scenario with a first-generation quay crane setting with entirely new equipment and with fixed labour. It appears that the total costs for each of the scenarios are in line, with the logical observation that 600,000 TEU terminals have higher costs due to the larger fixed power costs, whereas larger-capacity terminals have higher costs due to their larger labour force and equipment setting.

Figure V-2 analyzes average costs for the same scenarios as in Figure V-1. It appears that in both cases, average costs are decreasing, which implies economies of scale. These are mainly due to fixed labour and maintenance costs. The difference in economies between the 210,000 TEU and the 600,000 TEU terminal is however small under this setting.

In Figure V-3, a comparison is made for total and average costs between the new-equipment situation like in previous figures, and the used-equipment situation, both with fixed labour. Situations where a combination of used and new equipment is in place, are not considered. It is observed that used equipment leads to higher total and average costs, but the economies are of the same order as with new equipment: average costs shrink from 39.33 USD at 150,000 TEU to 32.83 USD at 200,000 TEU for new equipment, whereas for used equipment, they shrink from 40.36 USD at 150,000 TEU to 33.61 USD at 200,000 TEU.



Figure V-1: Total operating cost scenarios with first-generation quay cranes and new equipment.

Figure V-2: Average operating cost scenarios with first-generation quay cranes and new equipment.







Figure V-3: Total and average operating cost scenarios with first-generation quay cranes and new versus used equipment.

V.2.2. Panamax and post-panamax quay cranes

Figure V-4 compares total costs under the first-generation (a), panamax (b) and postpanamax (c) scenarios, all of them new but operated by a fixed labour force. Compared to the first-generation scenario, mainly the purchase price of quay cranes changes in the panamax and the post-panamax scenarios, and in line with this the maintenance costs. It appears that operating costs are in line with those in the scenario with first-generation cranes as far as structure is concerned, but slightly larger the larger the cranes in use: total operating costs at 200,000 TEU with first generation are at 6,566,350 USD, with panamax cranes at 6,750,000 USD, and with post-panamax cranes at 6,773,550 USD. This size-effect is mainly due to maintenance, whose costs are partly linked to the size and value of the cranes in use.

Figure V-5 shows that average costs are increasing again in increasing quay crane size, but that they are in all situations decreasing in throughput, which implies economies of scale also with this type of cranes. Moreover, economies are increasing in crane size: panamax cranes have economies in average operating costs going from 40,22 USD at 150,000 TEU to 33.50 USD at 200,000 TEU, and post-panamax cranes from 40.71 USD at 150,000 TEU to 33.87 USD at 200,000 TEU for a 210,000 TEU terminal.

















V.3. Capital cost

As a short-run perspective is taken in this thesis, capital costs are not considered. However, their analysis could be useful in a merger setting, as expansion and renewal of infrastructure and superstructure, if under responsibility of the container-handling operator, may determine attractiveness of a certain terminal or group of terminals for merger, takeover or acquisition.

To give an idea of the relative importance of operating versus capital costs, a comparison between the two is made in Table V-9. Table V-7 first gives the detail of capital costs.

In order to calculate capital costs, following specifications are used in Table V-9.

- Like in Table V-5, a distinction is made among new and used equipment.
- Two possibilities are considered: a situation without lease agreement, where the total capital cost is the land and terminal cost plus the equipment cost, whereas in case of a lease agreement, the capital cost equals just the equipment cost, but the operating costs are increased with the lease payment.
- A scenario with confined dredging and one with unconstrained dredging are considered. The second has a lower unit cost than the first.
- For the entire terminal, it is assumed that the container yard construction price applies. In practice, there is a difference between container yard, storage yard and shed yard price.
- Dredging volume is assumed to be 32,000,000m³, like it was in TRi Maritime Research Group (2003) for the London Gateway project.
- A low-lease as well as a high-lease scenario can be applied. Table V-9 deals with a low-level lease of 7,300 USD/m. At some terminals, for instance the Flanders Container Terminal in Zeebruges and the Westerschelde Container Terminal in Flushing, lease payments vary with the use that is made of the terminal: efficient use is stimulated.
- It is assumed that buying used equipment is as expensive as buying new equipment. In reality, this is often not the case. In Table V-9, only new equipment is considered.

land and terminal	ninal mobilisation								
	dredging and earthwork f	dredging without restrictions	1997	USD	per m3				
		dredging confined space	1997	USD	per m3				
	quay structure	1997	USD	per m					
	container yard	container yard							
	open storage yard		1997	USD	per m2				
	sheds		1997	USD	per m2				
	buildings								
	other civil works								
	total civil works	_							
	lease	land lease	1997	USD	per m per year				
equipment	container handling new	crane purchase	1997	USD	per crane				
		spreader	1997	USD	per unit				
		yard gantry	1997	USD	per unit				
		reach stacker	1997	USD	per unit				
		forklift truck	1997	USD	per unit				
		tractor / trailer	1997	USD	per unit				
		generator	1997	USD	per unit				
		radio / communication	1997	USD	per unit				
		work vehicle	1997	USD	per unit				
		computer hardware / software	1997	USD	per unit				
		other	1997	USD	per unit				
	computer and commicat	ion equipment new	1997	USD	per year				
	power, water and fuel su	pply equipment new							
	other equipment new								
	container handling	crane purchase	1997	USD	per crane				
		spreader	1997	USD	per unit				
		yard gantry	1997	USD	per unit				
		reach stacker	1997	USD	per unit				
		forklift truck	1997	USD	per unit				
		tractor / trailer	1997	USD	per unit				
		generator	1997	USD	per unit				
		radio / communication	1997	USD	per unit				
		work vehicle	1997	USD	per unit				
		computer hardware / software	1997	USD	per unit				
		other	1997	USD	per unit				
	computer and commicat	ion equipment	1997	USD	per year				
	power, water and fuel su	pply equipment							
	other equipment								

• Superstructure settings for 210,000 TEU and 600,000 TEU terminals equal those used in section V.2.

For the scenario specific to the terminal under consideration, it is assumed that other equipment than yard gantry cranes relates to the yard gantry cranes in equal proportions as equipment relates to the gantry cranes under the 210,000 TEU and 600,000 TEU scenario. This implies following equipment settings for the terminals considered.

Equipment Type	Antwerp - Hessenatie	Bremerhaven	Hamburg - Eurokai
Quay crane	14	21	9
Spreader	9	12	8
Yard gantry	45	60	25
Reach stacker	3	4	2
Forklift truck	6	9	4
Tractor / trailer	50	70	35
Generator	1	1	1
Work vehicle	3	3	3

Table V-8: Equipment settings applied for selected terminals

From Table V-9, it can be observed that the land and terminal cost usually is a multiple of the operating cost without a lease agreement. With post-panamax cranes for instance, land and terminal cost is at 2,368,447,200 USD for Hessenatie's terminal in Antwerp, where 14 quay cranes are installed. Annual operating cost is at 37,010,702 USD when throughput is at 1,655,341 TEU, with new equipment and fixed labour force. The equipment cost is more in line with annual operating costs in this case: equipment cost is at 169,242,000 USD. When a lease agreement is in place, the annual operating cost approximately doubles in most cases. It is logical that equipment cost and consequently also annual operating cost increase as first-generation cranes are replaced by panamax and post-panamax cranes.

Table V-9: Capital cost figures for first-generation (a), panamax (b) and post-panamax (c) quay cranes and new equipment calculated from Drewry Shipping Consultants (1998)

(a)

terminal	quay length	quay	quay crane	land and	lease cost	equipment	total capital	total capital	annual TEU	annual	annual
	(m)	cranes	Ispacing (m)	terminal cost		COST	cost under	cost under	throughput	operating	operating costs under lease
							construction	lease		own	
										construction	
Antwerp -	3,234.00	2	1,617.00	740,271,200	23,608,200	12,377,000	752,648,200	12,377,000			
Hessenatie		5	646.80	1,065,906,400	23,608,200	42,217,000	1,108,123,400	42,217,000			
		14	231.00	2,368,447,200	23,608,200	117,442,000	2,485,889,200	117,442,000	1,655,341.00	35,558,202.35	59,166,402.35
Bremerhaven	3,946.00	2	1,973.00	778,719,200	28,805,800	12,377,000	791,096,200	12,377,000			
		5	789.20	1,104,354,400	28,805,800	26,317,000	1,130,671,400	26,317,000			
		21	187.90	3,058,165,600	28,805,800	165,917,000	3,224,082,600	165,917,000	1,490,819.00	34,903,633.65	63,709,433.65
Hamburg -	1,700.00	2	850.00	657,435,200	12,410,000	12,377,000	669,812,200	12,377,000			
Eurokai		5	340.00	983,070,400	12,410,000	26,317,000	1,009,387,400	26,317,000			
		9	188.89	2,936,881,600	12,410,000	71,792,000	3,008,673,600	71,792,000	803,103.00	22,736,075.05	35,146,075.05

(b)

terminal	quay length	quay	quay crane	land and	lease cost	equipment	total capital	total capital	annual TEU	annual	annual
	(m)	cranes	spacing (m)	terminal cost		cost	cost under	cost under	throughput	operating	operating costs
							own	lease		costs under	under lease
							construction			own	
										construction	
Antwerp -	3,234.00	2	1,617.00	740,271,200	23,608,200	17,177,000	757,448,200	17,177,000			
Hessenatie		5	646.80	1,065,906,400	23,608,200	54,217,000	1,120,123,400	54,217,000			
		14	231.00	2,368,447,200	23,608,200	151,042,000	2,519,489,200	151,042,000	1,655,341.00	36,499,002.35	60,107,202.35
Bremerhaven	3,946.00	2	1,973.00	778,719,200	28,805,800	17,177,000	795,896,200	17,177,000			
		5	789.20	1,104,354,400	28,805,800	38,317,000	1,142,671,400	38,317,000			
		21	187.90	3,058,165,600	28,805,800	216,317,000	3,274,482,600	216,317,000	1,490,819.00	36,316,933.65	65,122,733.65
Hamburg -	1,700.00	2	850.00	657,435,200	12,410,000	17,177,000	674,612,200	17,177,000			
Eurokai		5	340.00	983,070,400	12,410,000	38,317,000	1,021,387,400	38,317,000			
		9	188.89	2,936,881,600	12,410,000	93,392,000	3,030,273,600	93,392,000	803,103.00	23,342,975.05	35,752,975.05

(c)											
terminal	quay length	quay	quay crane	land and	lease cost	equipment	total capital	total capital	annual TEU	annual	annual
	(m)	cranes	spacing (m)	terminal cost		cost	cost under	cost under	throughput	operating	operating costs
							construction	lease		costs under	under lease
							construction			construction	
Antwerp -	3,234.00	2	1,617.00	740,271,200	23,608,200	19,777,000	760,048,200	19,777,000			
Hessenatie		5	646.80	1,065,906,400	23,608,200	60,717,000	1,126,623,400	60,717,000			
		14	231.00	2,368,447,200	23,608,200	169,242,000	2,537,689,200	169,242,000	1,655,341.00	37,010,702.35	60,618,902.35
Bremerhaven	3,946.00	2	1,973.00	778,719,200	28,805,800	19,777,000	798,496,200	19,777,000			
		5	789.20	1,104,354,400	28,805,800	44,817,000	1,149,171,400	44,817,000			
		21	187.90	3,058,165,600	28,805,800	243,617,000	3,301,782,600	243,617,000	1,490,819.00	37,081,333.65	65,887,133.65
Hamburg -	1,700.00	2	850.00	657,435,200	12,410,000	19,777,000	677,212,200	19,777,000			
Eurokai		5	340.00	983,070,400	12,410,000	44,817,000	1,027,887,400	44,817,000			
		9	188.89	2,936,881,600	12,410,000	105,092,000	3,041,973,600	105,092,000	803,103.00	23,670,575.05	36,080,575.05

V.4. Conclusion

Hypothesis 1 is confirmed in this chapter, to the extent that for all the different settings considered, economies of scale in average costs are encountered. Average operating cost curves have a decreasing nature. Also hypothesis 2 is confirmed: depending on the specific setting, economies are larger or smaller. These are the most important observations which relate to hypothesis 2.

- Economies increase in terminal capacity.
- Economies increase in quay crane size.
- Economies decrease with labour flexibility.
- Economies are more or less equal with used quay cranes as with new quay cranes.

Observing economies in terminal operating costs may stimulate a merger or acquisition, especially if combined with economies specific to a merger or acquisition of several terminals. But also capital costs are interesting, especially as these often outweigh operating costs to a large extent. Especially land and terminal costs are a large multiple of yearly operating costs, under the scenario where the terminal operator pays for all infrastructure construction. Equipment cost is more in line with operating cost. Yearly operating cost approximately doubles where land and terminal construction are replaced by a yearly lease payment. In the latter case, capital costs are confined to equipment costs.

CHAPTER VI: CONCLUSION

VI.1. Main conclusions

Container-handling companies have engaged in various forms of expansion, of which many are co-operative. This thesis tries to assess the benefits from mergers and acquisitions in particular. It is shown to what extent economies of scale occur, how these depend on container-handling conditions, and how mergers and acquisitions in particular may generate economies of scale in container-handling.

It should however first be stressed that the container-handling product, for which cost functions are constructed and economies are calculated, as such does not exist, but is composed of many products, distinguished in container destination, container dimension, container security, container state, cargo nature, cargo weight, vessel characteristics, vessel size, hinterland transport modes and handling / quality results. These products can be processed sequentially as well as simultaneously, which makes container-handling a multi-product business.

The existence of terminal economies of scale is shown in CHAPTER III, where the presence of fixed costs is stated. In CHAPTER IV, it is shown what factors contribute to the size of terminal economies. 89 influencing factors of container handling supply and demand conditions are identified. These factors are characterized as dimensions of a matrix structure, containing four groups of dimensions: policy factors, scope factors, chain factors and terminal-specific factors. Each of the dimensions in the groups has a number of states. Combinations of states lead to a specific cost and demand context for container handling. Factors can also impact on each other. The dimensions are summarized in Table VI-1.

The size of the economies and the contributing operational fields to economies of scale in container handling are quantified in CHAPTER V for a number of settings. The observation is made that economies from terminal scale are in some cases substantial and mainly due to labour and maintenance. Hypothesis 1 is confirmed in CHAPTER V, to the extent that for all the different settings considered, economies of scale in average costs are encountered. Average operating cost curves have a decreasing nature.
Delian	S	Clasin	Tamainal ana ifia	
Policy	Scope	Chain	Terminal-specific	
Antitrust	Commercializing spin-off	Charges	Container type	
	applications			
Charging	Handling non-	Containerization	Direct / indirect delivery	
	containerized cargo	F : (
Customs	Inland port operation	Environment	Economic growth	
Employment	Passenger handling	Land transport	EDI	
		concentration		
Environment	Services to containers	Quality requirements	Equipment	
Financial capabilities	Services to cargo	Safety	Gate procedures	
Liability regulation	Services to ships	Sailing frequency	Geography	
Modal shift		Sea-port authorities and	Hinterland connections	
		terminals vs. shipping		
		companies		
National independence		Sea-port authorities in	Hinterland tariffs	
		logistics		
Non-container-		Sea-port authority co-	Hinterland size	
handling functions		operation		
Penalties		Sea-port organization	Industrial activity	
Public port planning		Sea-port promotion	Infrastructure	
		bundling		
Regional development		Security	Inland port	
Safety		Shipper information	Intermodal delivery /	
			receipt	
Sea-port organization		Shipper trade pattern	Labour	
Security		Shipper or shipping	Lease or management	
2		company routing / mode	contract duration and	
		decisions	conditions	
Social welfare		Shipping company	Lock operations	
		concentration	1	
Taxes		Shipping company hubbing	Maintenance	
Wages		Shipping companies in land	Overall sea-port traffic	
		transport	· · · · · · · · · · · · ·	
War		Shipping companies in	Promotion	
		logistics		
		Shipping companies in	Ouay crane allocation	
		terminals	Q	
		Shipping company	Safety	
		independence	Salety	
		Shipping company	Security	
		overbookings	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
		Shipping company or	Services to cargo	
		shipper handling requests		
		Shipping company or	Services to containers	
		shipping company of	bervices to containers	
		Shipping company security	Services to ships	
		requirements	Services to ships	
		Terminals and inland ports	Shin size	
		Terminal co-operation	Storage	
			Stowage planning	
			Superstructure	
			Terminal planning	
			(Lu)hoordin -	
			(Un-)boarding	
			weather	
			Yard traffic management	

Table VI-1: Dimensions influencing container-handling costs and revenues

Also hypothesis 2 is confirmed: depending on the specific setting, economies are larger or smaller. These are the most important observations which relate to hypothesis 2.

- Economies increase in terminal capacity.
- Economies increase in quay crane size.
- Economies decrease with labour flexibility.
- Economies are more or less equal with used quay cranes as with new quay cranes.

Specific to mergers and acquisitions, effects on container handling conditions and economies at container terminals may be threefold: there may be economic, financial or market effects. This confirms hypothesis 3. Economic effects involve synergies and efficiencies. As the thesis focuses on horizontal mergers and acquisitions, efficiencies are more important than synergies. The economies may be obtained in the operational fields from Table VI-2.

Economic	Financial	Market
Administration	Capital	Market power
Contracting	Losses	Market entry
Equipment	Market value	Excess capacity
Handling	Risk	
ICT	Growth	
Labour		
Marketing		
R&D		
Security		

Table VI-2: Economic, financial and market effects of mergers and acquisitions

Acquisitions as limited companies focus on long-term positioning rather than costeconomizing, just like ventures started up. Most limited-company agreements are very stable, as exit of business and even change in number of participants is very low. The longer duration of limited companies stresses their long-term positioning character. The fact that market motives are shown to dominate, as confirmed by the major container-handling companies' strategies, does not imply that market effect necessarily need to be larger than economic or financial effects. As to strategies in CHAPTER II, this does especially not imply that no economies may result from merging or acquiring a company, as shown by Table VI-2. The dimensions from Table VI-1, but also company decisions like type of competition, network building, differentiation, diversification and integration impact on specific merger and acquisition effects.

With respect to network building, diversification and integration, it is shown in CHAPTER II that limited liability companies and contractual agreements are the most used forms of cooperation by the major six container-handling companies HPH, PSA, APM Terminals, P&O Ports, Eurogate and DPA.

As to network building in particular, it is noted that more limited companies are started up abroad than domestically, which shows that network building and entering new markets or reinforcing one's position there is an important motive for expansion. Most limited companies are started up co-operatively, at least abroad. At home, the reverse conclusion is to be drawn. Most co-operative ventures have two participants and two nationalities involved. Most start-up ventures have one of the two participants dominating, and in most cases, this is the partner, not the major container-handling company in focus. With respect to acquisitions, it is shown that they are less in number than start-ups, but what is similar is that they occur in majority abroad. Most acquisitions are majority acquisitions from the part of the major container-handling company. Combined with a relatively small number of partners, this yields relatively high decision power to the major container-handling operator.

Focusing on diversification and integration, it is observed that, except for the major operators PSA and Eurogate, all operators have started up more limited companies in the cargo-handling business than in non-cargo-handling businesses. The logistics sector is most often a target sector. In majority, limited companies in both cargo-handling and non-cargo-handling businesses are meant to co-operate in technology (R&D). A second possible field of co-operation, which however is always combined with technological co-operation, is marketing.

Container terminals are also subject to integration next to integrating by themselves: most cooperative container-handling ventures have one or more non-cargo-handling partners. Ventures with only cargo-handling participants are limited in number, also when the business started up is in cargo handling. Favorite partners are industrial or investment companies and port authorities.

Contracting is an element which may impact on size of the economies observed under hypothesis 2 and 3, and which is found in several of the chain dimensions of Table VI-1. Contractual agreements are frequently used for acquiring inputs, binding customers and providing additional services. Especially where contracts serve the provision of inputs, the focus is on cost-economizing. Where some type of co-makership applies, for instance in IT installation, a number of assets are shared. Management contracts are frequently applied in container-handling and arrange for container handling to be outsourced in exchange for a fixed amount of money, part of which may be conditional upon turnover or other criteria.

It should however be observed that, with respect to the various decisions taken by containerhandling companies, different strategies are applied by the major container-handling operators. APM Terminals, Eurogate and DPA have started up more companies non-cooperatively than co-operatively. HPH and PSA have quite often teamed up with shipping companies in their terminal ventures. Also P&O Ports did so, in contrast to APM Terminals, despite the fact that both have grown as terminal divisions out of shipping groups. P&O Ports was one of the first container-handling companies to start building an international network.

A final conclusion of the thesis, of relevance to eventual use of the results obtained in a model and / or game setting, relates to the number of market players: it is concluded that container handling is a business where oligopolies prevail. Although the literature on number of suppliers in container handling is very scarce and disagrees on the activities to be included in the container-handling product, the fact that container-handling markets are very fragmented, and the fact that there is no trace of collusion, both lead to the conclusion that containerhandling markets may be characterized by Bertrand and / or Cournot competition, or Stackelberg equilibria where leadership shows up. Other, related market characteristics are that there is imperfect information, no communication between container-handling companies, multiple periods of container-handling companies dealing with each other, and a relatively low degree of buyer concentration. Container terminals or their owners can be subject to a wide variety of activity goals, ranging from profit maximization, cash-flow maximization or shareholder value maximization, over managerial objectives, to equity goals. In industrial economics models, company value maximization is often of primary importance.

VI.2. Directions for further research

A particular problem relates to the analysis of market size and demand effects for the container-handling products like defined in this thesis. Further analysis is required to apply Shrieves' (1978) similarity approach. This method is deemed easier to apply than geographical market delineation or the diversion approach. Data on specific shipments at selected terminals need to be collected and analyzed.

Still on the demand side, shipping companies' reactions on container-handling demand are to be included as a dynamic effect.

Further, the cost function analysis, which was applied to a limited number of matrix cells, can be extended to more container-handling conditions. Combination with thorough knowledge of market size enables to fully assess the exact, quantified effects of mergers or acquisitions on the company undertaking such moves or on competitors.

The entire methodology behind this thesis can also be applied to other cargo-handling businesses, and even to other modes of transport or to any other business, respecting of course a number of translation rules. A primary aim is therefore to cover all cargo businesses in the port sector.

Finally, outputs from this thesis' methodology ought to be used as inputs to decision-making models in for instance shipping, port-related antitrust, etc. A practical interface is to be developed for this purpose, which combines scientific accuracy with practical usefulness and user-friendliness in a pragmatic way.

NEDERLANDSTALIGE SAMENVATTING

Containerbehandelaars in de haven hebben zich in geëngageerd tot verschillende vormen van expansie, waarvan er veel een samenwerkend karakter hebben. Deze doctoraatsthesis probeert de voordelen van fusies en overnames in het bijzonder na te gaan. Er wordt aangegeven in welke mate schaalvoordelen optreden, hoe deze afhangen van de goederenbehandlingsomstandigheden, en hoe fusies en overnames in het bijzonder schaalvoordelen in goederenbehandeling kunnen teweeg brengen.

Eerst moet echter benadrukt worden dat het goederenbehandelingsproduct, waarvoor kostenfuncties worden opgebouwd en schaalvoordelen worden berekend, op zich niet bestaat, maar is samengesteld uit verschillende producten, die verscheiden zijn in bestemming van de container, containerdimensie, containerveiligheid, staat van de container, aard van de goederen, gewicht van de goederen, scheepskarakteristieken, scheepsgrootte, hinterland transport modi en resulterende kwaliteit en behandeling. Deze producten kunnen sequentieel zowel als simultaan worden verwerkt, wat goederenbehandling tot een multi-product activiteit maakt.

Het bestaan van schaalvoordelen op terminalniveau wordt aangetoond in HOOFDSTUK III, waar de aanwezigheid van vaste kosten wordt bevestigd. In HOOFDSTUK IV wordt getoond welke variabelen bijdragen tot de omvang van de schaalvoordelen. 89 beïnvloedende factoren van vraag en aanbod in goederenbehandeling worden er geïdentificeerd. Deze factoren worden gekarakteriseerd als dimensies van een matrixstructuur, die vier groepen dimensies bevat: beleidsfactoren, scope-factoren, ketenfactoren en terminal-specifieke factoren. Elk van de dimensies in de groepen vertoont een aantal kenmerken. Combinaties van staten leidt tot een specifieke kost- en vraagcontext voor goederenbehandeling. De factoren kunnen ook mekaar beïnvloeden. De dimensies worden samengevat in Tabel VII-1.

De omvang van de schaalvoordelen en de operationale domeinen die bijdragen tot die schaalvoordelen worden gequantificeerd in HOOFDSTUK 5 voor een aantal specifieke contexten. Er wordt opgemerkt dat schaalvoordelen voortvloeiend uit terminal-omvang in sommige gevallen substantieel zijn, en hoofdzakelijk toe te schrijven aan arbeid en onderhoud. Hypothese 1 wordt bevestigd in HOOFDSTUK V, in de mate dat voor de

Beleid	Scope	Keten	Terminal-specifiek
Mededinging	Commercialiseren van	Heffingen	Container type
	spin-off toepassingen		
Heffingen	Behandeling van niet-	Containerisering	Directe / indirect levering
	gecontaineriseerde cargo		
Douane	Exploitatie van een	Milieu	Economische groei
	binnenhaven		
Werkgelegenheid	Behandeling van	Concentratie in hinterland	EDI
	passagiers	transport	
Milieu	Diensten aan containers	Kwaliteitsvereisten	Uitrusting
Budgettaire ruimte	Diensten aan cargo	Veiligheid (ongevallen)	Gate procedures
Aansprakelijkheid	Diensten aan schepen	Afvaartfrequentie	Geografie
Modaal beleid		Zeehavens en terminals	Hinterland verbindingen
		tegenover rederijen	
Nationale		Zeehavenautoriteiten in	Hinterland tarieven
onafhankelijkheid		logistiek	
Niet-		Samenwerking tussen	Hinterland groote
containerbehandelingsf		zeehavenautoriteiten	
uncties			
Boetes		Zeehavenorganisatie	Industrial activiteit
Publieke		Bundeling van	Infrastructuur
havenplanning		zeehavenpromotie	
Regionale		Veiligheid (misdaad)	Binnenvaarthaven
ontwikkeling			
Veiligheid		Informatie aan verzenders	Intermodale levering /
(ongevallen)		TT 11 4	ontvangst
Zeehavenorganisatie		Handelspatroon van	Arbeid
Vailighaid (misdaad)		Pouting bachingingon yon	Lange of management
venigheid (misdaad)		Kouting-besitssingen van	Lease of management
		verzenders of federijen	voorwaarden
Sociala walvaart		Concentratio van rederijon	Shuisoparatias
Belastingen		Hubbing door rederijen	Onderhoud
Lonen		Rederijen in land transport	Globale zeebaventrafiek
Oorlog		Rederijgen in logistiek	Promotie
Oonog		Rederijgen in terminals	Allocatie van kaaikranen
		Onafhankalijkhaid van	Veiligheid (ongevallen)
		rederijen	Veiligheid (öligevällen)
		Overboeking door rederijen	Veiligheid (misdaad)
		Behandelingsvereisten van	Diensten aan cargo
		rederijen of verzenders	Dienstein aan earge
		Tijdsvereisten van rederijen	Diensten aan containers
		of verzenders	
		Veiligheidsvereisten van	Diensten aan schepen
		rederijgen	
		Terminals en	Scheepsgrootte
		binnenvaarthavens	
		Samenwerking tussen	Opslag
		terminals	
			Laad- / losplanning
			Superstructuur
			Terminal planning
			Aan / van boord brengen
		1	Weer
			Management van
			terminaltrafiek

Tabel VII-1: Dimensies die containerbehandelingskosten en – ontvangsten beïnvloeden

verschillende onderzochte situaties schaalvoordelen in gemiddelde kosten worden aangetroffen. Gemiddelde operationele kosten vertonen een dalend karakter.

Ook hypothese 2 wordt bevestigd: afhankelijk van de specifieke terminalcontext zijn de schaalvoordelen groter of kleiner. Dit zijn de belangrijkste observaties met betrekking tot hypothese 2.

- Schaalvoordelen nemen toe met terminalcapaciteit.
- Schaalvoordelen nemen toe in kaaikraangrootte.
- Schaalvoordelen nemen toe met arbeidsflexibiliteit.
- Schaalvoordelen zijn min of meer gelijk met gebruikte als met nieuwe kaaikranen.

Specifiek naar fusies en overnames toe kunnen de effecten op containerbehandelingscondities en -schaalvoordelen drie vormen aannemen: er kunnen economische, financiële of markteffecten zijn. Dit bevestigt hypothese 3. Economische effecten omvatten synergieën en efficiënties. Aangezien in deze thesis de nadruk ligt op horizontale fusies en overnames, zijn efficiënties belangrijker dan synergieën. De schaalvoordelen kunnen opgetekend worden in de operationele domeinen van Tabel VII-2.

Economisch	Financieel	Markt
Administratie	Kapitaal	Marktmacht
Afsluiten van contracten	Verliezen	Toetreding tot de markt
Uitrusting	Marktwaarde	Overcapaciteit
Behandeling	Risico	
ICT	Groei	
Arbeid		
Marketing		
0&0		
Veiligheid (misdaad)		

fabel VII-2: Economische	, financiële en	market effecten	van fusies en	overnames
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Acquisities als naamloze vennootschappen focussen op lange termijn positionering eerder dan kostenbesparing, net zoals opgestarte bedrijven. De meeste overeenkomsten in naamloze vennootschap zijn heel stabile, aangezien uittreding uit de sector en zelfs veranderingen in het aantal deelnemers heel beperkt zijn. De langere levensduur van naamloze vennootschappen bevestigt hun lange termijn positioneringskarakter. Het feit dat marktmotieven blijken te domineren, zoals wordt bevestigd door de strategieën van de zes grootste containerbehandelingsbedrijven, betekent niet dat markteffecten omvangrijker dienen te zijn dan economische of financiële effecten. Met betrekking tot de strategieën uit HOOFDSTUK II hoeft dit in het bijzonder niet te impliceren dat er geen schaalvoordelen kunnen resulteren uit het fusioneren met of verwerven van een onderneming, zoals aangetoond in Tabel VII-2.

De dimensies van Tabel VII-1, naast ondernemingsbeslissingen zoals het type concurrentie, netwerkuitbouw, differentiatie, diversificatie en integratie hebben hun impact op specifieke fusie- en overnameeffecten.

Met betrekking tot netwerkuitbouw, diversificatie en integratie wordt in HOOFDSTUK II aangetoond dat naamloze vennootschappen en contractuele overeenkomsten de meest gebruikte samenwerkingsvormen zijn onder de zes grootste containerbehandelaars HPH, PSA, APM Terminals, P&O Ports, Eurogate en DPA.

Wat netwerkuitbouw in het bijzonder betreft wordt opgemerkt dat meer naamloze vennootschappen worden opgestart in het buitenland dan in het land van maatschappelijke zetel, wat aantoont dat netwerkuitbouw en het betreden van nieuwe markten of het versterken van posities in bestaande markten een belangrijk motief vormen voor expansie. De meeste naamloze vennootschappen worden in samenwerkingsverband opgestart, tenminste in het buitenland. In het land van herkomst wordt het omgekeerde vastgesteld. De meeste naamloze vennootschappen herbergen twee participanten en twee nationaliteiten. In de meeste opgestarte bedrijven domineert een van de twee deelnemers, en in de meeste gevallen is dit de partner, niet de containerbehandelaar in kwestie. Men stelt vast dat er minder overnames dan opstartende bedrijven zijn, maar beiden vinden hoofdzakelijk in het buitenland plaats. De meeste overnames zijn meerderheidsovernames vanuit het standpunt van de grote containerbehandelaar.

Als de focus ligt op diversificatie en integratie wordt er vastgesteld dat, met uitzondering van de grote operatoren PSA en Eurogate, alle operatoren meer naamloze vennootschappen hebben opgericht binnen de goederenbehandelingssector dan erbuiten. De logistieke sector is het vaakst een doelwit. In meerderheid zijn naamloze vennootschappen zowel in goederenbehandeling als daarbuiten bedoeld om samen te werken in technologie (O&O). Een tweede mogelijk domein voor samenwerking, dat echter altijd wordt gecombineerd met technologische samenwerking, is marketing.

Containerterminals zijn ook onderhevig aan externe integratie, naast de integratie die ze zelf op poten zetten: de meeste naamloze vennootschappe in containerbehandeling met samenwerking hebben een of meer niet-goederenbehandelingspartners. Vennootschappen met alleen goederenbehandelingsdeelnemers zijn beperkt in aantal, ook als de opgestarte onderneming in goederenbehandeling actief is. Favoriete partners zijn industriële of investeringsbedrijven en havenautoriteiten.

Het afsluiten van contracten is een element dat een impact kan hebben op de omvang van de schaalvoordelen die onder hypotheses 1 en 3 worden waargenomen, en dat wordt teruggevonden in verschillende van de ketendimensies uit Tabel VII-1. Contractuele overeenkomsten worden vaak gebruikt om inputs te verwerven, klanten te binden en additionele diensten aan te bieden. Vooral waar contracten gebruikt worden om te voorzien in inputs, ligt de nadruk op kostenbesparing. Waar een vorm van co-makership van toepassing is, bijvoorbeeld bij IT-introductie, worden een aantal active gedeeld. Management contracten worden vaak toegepast in containerbehandeling en houden in dat containerbehandeling wordt uitbesteed met als compensatie een een vast bedrag aan geld, waarvan een gedeelte afhangt van omzet of andere criteria.

Er wordt echter vastgesteld dat met betrekking tot de verschillende beslissing die containerbehandelaars nemen, verschillende strategieën worden toegepast door de grootste containerbehandelingsbedrijven. APM Terminals, Eurogate en DPA hebben meer bedrijven opgestart zonder dan met samenwerking. HPH en PSA hebben vaak samengewerkt met rederijen in hun terminalinitiatieven. Ook P&O Ports deed dat, in tegenstelling to APM Terminals, ondanks het feit dat beide als terminaldivisies uit scheepvaartgroepen gegroeid zijn. P&O Ports was een van de eerste containerbehandelaars die startte met de uitbouw van een international network.

Een laatste besluit uit de thesis, met relevantie voor eventueel gebruik van de resultaten in een model- of een spelcontext, heeft betrekking op het aantal marktspelers: er wordt afgeleid dat containerbehandeling een sector is waar oligoplies van toepassing zijn. Hoewel de literatuur met betrekking tot het aantal aanbieders in containerbehandeling heel beperkt is en niet overeenstemt in de activiteiten die mee in het containerbehandelingsproduct worden opgenomen, leiden zowel het feit dat containerbehandelingsmarkten heel gefragmenteerd zijn als de vaststelling dat er geen spoor van collusie is, tot de vaststelling dat containerbehandlingsmarkten gekarakteriseerd worden door Bertrand en / of Cournot competitie, of Stackelberg evenwichten waar sprake is van leiderschap. Andere, gerelateerde marktkarakteristieken zijn dat er imperfecte informatie is, geen communicatie tussen containerbehandelingsbedrijven, meerdere perioden waarin containerbehandelaars mekaar op de markt ontmoeten, en een relatief lage mate van concentratie aan de vraagzijde. Containerterminals of hun eigenaars kunnen aan een brede waaier van doelstellingen onderworpen zijn, gaande van winstmaximering, cash-flow maximering of maximering van aandeelhouderswaarde, over managersmotieven, tot evenredigheidsdoelen. In industrieeleconomische modellen wordt maximering van ondernemingswaarde vaak als de voornaamste doelstelling aangezien.

Verder onderzoek kan zich op verschillende domeinen focussen. Een eerste bestaand probleem heeft betrekking op de analyse van de marktomvang en de vraageffecten voor de containerbehandelingsproducten zoals ze in deze thesis aan bod komen. Verdere analyse is vereist om Shrieves' (1978) similariteitsbenadering toe te passen. Deze methode wordt geacht makkelijker toepasbaar te zijn dan geografische marktafbakening or de diversiebenadering.

Verder aan de vraagzijde kunnen, in een volgende stap, de reacties van rederijen op vraag naar containerbehandeling als een dynamisch effect opgenomen worden.

De kostenfunctieanalyse, die is toegepast voor op een beperkt aantal matrixcellen, kan uitgebreid worden naar meer containerbehandelingscontexten. De combinatie met een goede kennis van de marktomvang laat toe om tenvolle de exacte, gequantificeerde effecten in te schatten van fusies of overnames op de onderneming die zulke acties onderneemt of op haar concurrenten.

De volledige methodologie uit deze thesis kan ook toegepast worden op andere sectoren van goederenbehandeling, en zelfs op andere transportmodi of op om het even welke andere sector, met inachtneming uiteraard van een aantal omzettingsregels. Een eerste doelstelling is daarom alle goederenbehandelingscategorieën in de havensector te omsluiten.

Tot slot kunnen outputs van deze thesis gebruikt worden als inputs voor het nemen van beslissingen aan de hand van modellen voor bijvoorbeeld scheepvaart, havengebonden mededingingsbeleid, enz. Een praktische interface, die wetenschappelijke accuratesse combineert met praktische bruikbaarheid en gebruiksvriendelijkheid, moet vanuit dit oogpunt op een pragmatische wijze ontwikkeld worden.

BIBLIOGRAPHY

- 1. AAPA (AMERICAN ASSOCIATION OF PORT AUTHORITIES, 2000),"Port News",
Advisory, Vol. 34, n°10, http://www.aapa-
ports.org/members/advisory/html/2000/advisory34-10.htm
- 2. A.P. MÖLLER TERMINALS (2003), http://www.apmterminals.com
- 3. A.P. MÖLLER TERMINALS (2004), Rotterdam, http://www.apmterminals.com
- 4. AAPA (AMERICAN ASSOCIATION OF PORT AUTHORITIES, 2005), Increased Security Funding Vital to Protect U.S. Ports, http://www.aapa-ports.org/pressroom/jan0305.ht m
- 5. ABP (ASSOCIATED BRITISH PORTS, 2005), Group History, http://www.abports.co.uk
- 6. ACLSAL (ATLANTIC COAST LINE & SEABOARD AIR LINE HISTORICAL SOCIETY, 2005), Chronology Page, http://www.aclsal.org
- 7. ADLER, Nicole and Karen SMILOWITZ (2003), Hub and Spoke Network Alliances and Mergers: Price-Location Competition, paper presented at KU Leuven, 33p.
- AGUILA, J.M., F. BARISON and B. ITURRIETA (1997), The Future of Container Liner Shipping and Ship Agency – Including the Operational Costs in Shipping, ITMMA, Antwerp, 78 p. + annexes
- 9. AIVP (ASSOCIATION INTERNATIONALE VILLES ET PORTS, 2001), Les Stratégies des Villes Portuaires dans les Flux de la Mondialisation, http://www.predit.prd.fr/predit3/documentFo.fo?cmd=visualize&inCde=17321
- 10. AKERY, Alan (1999), "Cargo screening operations", Port Technology International, Edition 9, pp. 75 78
- 11. AKTIESELSKABET DAMPSKIBSSELSKABET SVENDBORG (2002), Annual Report 2001, http://www.maersk.com/pdf/UK/SVB_2001.pdf
- 12. AKTIESELSKABET DAMPSKIBSSELSKABET SVENDBORG (2003), Annual Report 2002, http://www.maersk.com/pdf/UK/SVB_2002.pdf
- 13. ALDERTON, Patrick (1999), Port Management and Operations, London, LLP Reference Publishing, 258 p.
- 14. ALDRIDGE, Andrew (2001), "Simple, cheaper, faster: new generation container management systems", Port Technology International, Edition 12, pp. 139 145
- 15. AME INFO (2004), Dubai International break the Ground for AED 2 billion Port Klang Free Zone, http://www.ameinfo.com/42129.html
- 16. AME INFO (2005), DPI signs 30 Year Concession with Fujairah Port Authority, http://www.ameinfo.com/55910.html
- 17. AME INFO (2005b), JAFZA International signs Agreement to manage Logistics Free Zone at Tangier Med Port, http://www.ameinfo.com/62828.html
- 18. AMEL, Dean F. en Stephen A. RHOADES (1988), "Strategic groups in banking", Review of Economics and Statistics, November, pp. 685-689
- 19. AMERICAN CHAMBER OF COMMERCE IN EGYPT (2005), New Company to upgrade Ports, http://www.amcham.org.eg/publications/BusinessMonthly/April%2005/inbrief.asp
- 20. AMERICAN CITY BUSINESS JOURNALS INC. (2004), Mid-South Terminal to buy remaining Global Materials Interest, http://www.bizjournals.com/memphis/stories/2004/10/04/daily30.html
- 21. AMERICAN CITY BUSINESS JOURNALS INC. (2004b), CSX World Terminals ups Stake in Korean Port, http://www.bizjournals.com/charlotte/stories/2004/06/21/daily19.html
- 22. AMERICAN COMMERCIAL LINES (2005), History, http://www.acbl.net

- 23. AMERICAN DEFENSE COUNCIL. (2003), Executive Summary, http://www.americandefensecouncil.com/maritimerepfin.pdf
- 24. AMERICAN STEVEDORING INC. (2004), About ASI, http://www.asiterminals.com/
- 25. AMIHUD, Yakov and Baruch LEV (1981), "Risk reduction as a managerial motive for conglomerate mergers", Bell Journal of Economics, Vol. 12, n° 2, pp. 605-617
- 26. ANDERSON, Erin (1990), "Two firms, one frontier: on assessing joint venture performance", Sloan Management Review, Winter 1990, pp. 19-30
- 27. ANDERSON, Erin and Hubert GATIGNON (1986), "Modes of foreign entry: a transaction cost analysis and propositions", Journal of International Business Studies, Fall 1986, pp. 1-25
- 28. ANDERSON, Patrick L. and IIhan K. GECKIL (2002), Flash Estimate : Impact of West Coast Shutdown, 4 p., http://www.andersoneconomicgroup.com/Pubs/articles_pressreleases/aegreports/flash_estima te port.pdf
- 29. APL (AMERICAN PRESIDENT LINES, 2004), What's a Free Trade Zone? Introducing Jebel Ali, http://www.apl.com/boomerangbox/d11100.htm
- 30. APM TERMINALS (2001), APM Terminals acquires Part of Gujarat Pipavav Port Limited, http://www.apmterminals.com/News/010705_pipavav.htm
- 31. APM TERMINALS (2002), APM Terminals announces New Company, http://www.apmterminals.com/Global+Terminals/North+America/Houston/Terminal/Local+ News/
- 32. APM TERMINALS (2002b), Maersk Venezuela S.A. acquires 49 of Almacenadora Conacentro S.A, http://www.apmterminals.com/News/3rd+July+2001+-+Maersk+Venezuela+S.A.+acquires+49+of+Almacenadora+Conacentro+S.A.htm
- 33. APM TERMINALS (2003), The consortium Gestão de Fundos and the A.P. Moller Maersk Group wins concession to operate the new Container Terminal in Luanda, Angola, http://www.apmterminals.com/News/The+consortium+Gestão+de+Fundos+and+the+A.P.+M oller+-+Maersk+Group.htm
- 34. APM TERMINALS (2003b), Shanghai International Port Group and APM Terminals Form Joint Venture, http://www.apmterminals.com/News/Shanghai+International+Port+Group+and+APM+Termi nals+Form+Joint+Venture.htm
- 35. APM TERMINALS (2004), Zeebrugge, Belgium 22nd December 2004, http://www.apmterminals.com/News/ZeebruggeBelgiumDecember.htm
- 36. APM TERMINALS (2005), APM Terminals acquires 40 per cent Shareholding in Societé d'Exploitation du Terminal de Vridi Abidjan, Ivory Coast, http://www.apmterminals.com/News/Terminal+de+Vridi.htm/
- 37. APM TERMINALS (2005b), APM Terminals named successful Respondent in Bahrain, http://www.apmterminals.com/News/APM+Terminals+named+successful+respondent+in+B ahrain.htm
- 38. APM TERMINALS (2005c), APM Terminals acquire 50% Shareholding in Teconvi, Itajaí, http://www.apmterminals.com/News/APM+Terminals+acquire.htm
- 39. APM TERMINALS (2005d), APM Terminals in Joint Venture to develop new Terminal in Tianjin, PRC,

http://www.apmterminals.com/News/APM+Terminals+in+joint+venture+to+develop+new+t

erminal+in+Tianjin+PRC.htm

- 40. APS TECHNOLOGY GROUP (2002), APM Pier 400 Completion, http://aps-technology.com/main/?cat=news&newspg=more
- 41. ARUJO DE SOUZA JUNIOR, Geraldo, Anthony KC BERESFORD and Steffen J. PETTIT, Liner Shipping Companies and Terminal Operators: Internationalisation or Globalisation?, Maritime Economics and Logistics, n°5, pp. 393 – 412
- 42. ASHAR, Asaf (2001), "Strategic pricing in newly privatized ports", International Journal of Maritime Economics, n° 3, pp. 52-78
- 43. ASIA CONTAINER TERMINALS Ltd. (2004), Products and Services, http://www.asiacontainerterminals.com
- 44. ASIA TIMES (2005), Hutchison sells Stake in Hong Kong Port, http://www.atimes.com/atimes/Southeast_Asia/GF14Ae01.html
- 45. ASIA TRADE HUB (2005), Thailand Infrastructure (Ports), http://www.asiatradehub.com/thailand/ports.asp
- 46. ASIAN DEVELOPMENT BANK (2000), Developing Best Practices for Promoting Private Sector Investment in Infrastructure -- Port, 134 p., http://www.adb.org/Documents/Books/Developing_Best_Practices/Ports/default.asp
- 47. ASIAN ECONOMIC NEWS (2000), Hutchison of H.K. seals deal with Malaysia's Westport, http://www.findarticles.com/p/articles/mi_m0WDP/is_2000_Oct_2/ai_66168742
- 48. ASLAM, Syed M. (1998), QICT an added Source of Revenue and enhanced Trade ties, http://www.pakistaneconomist.com/database1/trade-opp/trade-opp-33.htm
- 49. ASLAM,, Syed M. (1998), QICT and added Source of Revenue and Enhanced Trade Ties, http://www.pakistaneconomist.com/database1/cover/c98-21.asp
- 50. AUTORITA' GARANTE DELLA CONCORRENZA E DEL MERCATO (1998), Bollettino Anno VIII - N. 12, http://www.agcm.it/agcm_ita/BOLL/BOLLETT.NSF/0/842bdd6191d251bec12565e20036f82 5/\$FILE/12-98.PDF
- 51. AUTOSCAN (2005), Corporate Information, http://www.autoscan.biz/
- 52. AVERWERSER, Heirich-Wilhelm (2005), Eurogate, e-mail contact
- 53. AZEVEDO, Joao (1999), Why do Companies Merge? Merger Motives and Determinants, 26 p.
- 54. AZZAM, AZZEDINE M. (1997), "Measuring market power and cost-efficiency effects of industrial concentration", Journal of Industrial Economics, Vol. 45, n° 4, pp. 377-386
- 55. BACKMAN, Jules (1983), Entrepreneurship and the Outlook for America, New York, 192p.
- 56. BAIN, J.S. (1956), Barriers to New Competition, Harvard, Cambridge
- 57. BAIRD, Alfred (2002), The economics of container transhipment in northern Europe, International Journal of Maritime Economics, Vol. 4, pp. 249-280
- 58. BAIRD, Alfred (2003), Global Strategic Management in Liner Container Shipping, paper presented at 23rd IAPH World Ports Conference, 24 -30 May 2003, Durban, 18 p., http://www.npa.co.za/PDF%20Documents/IAPH%20Speaker%20Papers/Tuesday%2027%20 May%2003/GLOBAL%20STRATEGIC%20MANAGEMENT%20IN%20LINER%20CONT AINER%20SHIPPING.doc
- 59. BAIZHANG, Xu (2003), Building Shanghai, The Baltic Asia-Pacific Shipping 2003, http://www.stroudgate.net/aps/articles/038.html

- 60. BAMBERGER, Gustavo E. and Dennis W. CARLTON (2003), "Airline Networks and Fares", Handbook of Airline Economics, McGraw Hill, 35 p. + appendixes
- 61. BAMBERGER, Gustavo E., Dennis W. CARLTON and Lynette R. NEUMANN (2001), An Empirical Investigation of the Competitive Effects of Domestic Airline Alliances, Cambridge, US, National Bureau of Economic Research, 21p.
- 62. BANG, Hee-Suk (2003), Container Terminal and Performance Indicator, paper presented at Workshop on Shipping and Port Development Policy, 30 March 20 April 2003, Seoul, http://www.kmi.re.kr/english/public/html/koica/2003/8.PDF
- 63. BARAV, J. (2005), Carta de Entendimiento Terminal 4SA, http://www.uniren.gov.ar/audiencias_publicas/ce_t4.pdf
- 64. BARBER, Daniel and Lisa GROBAR (2002), Implementing A Statewide Goods Movement Strategy and Performance Measurement of Goods Movement in California, http://www.metrans.org/Research/Final_Report/99-10_Final.pdf
- 65. BARKOULAS, John T., Christopher F. BAUM and Atreya CHAKRABORTY (2001), "Waves and persistence in merger and acquisition activity", Economic Letters, Vol. 70, n° 2, pp. 237-243
- 66. BARROS, Pedro Pita (1998), "Endogenous mergers and size asymmetry of merger participants", Economic Letters, Vol. 60, n° 1, pp. 113-119
- 67. BARTON, David M. and Roger SHERMAN (1984), "The price and profit effects of horizontal merger: a case study", The Journal of Industrial Economics, Vol. 33, n° 2, pp. 165-198
- 68. BARWIL (2004), Shenzhen, http://www.barwil.com/
- 69. BARWIL (2005), Oil Refining Terminals, http://www.barwil.com/wbch3.exe?p=2004533
- 70. BARWIL (2005b), Dubai, http://www.barwil.com/wbch3.exe?p=400772
- 71. BASCOMBE, Adrian (1997), Port Competition in the Mediterranean the Threat to Barcelona's Container Traffic, Barcelona, 20 p.
- 72. BAUMOL (1977), "On the Proper Tests for Natural Monopoly in a Multiproduct Industry", The American Economic Review, Volume 67, n°5
- 73. BEAUDUIN (1999), "Ports and terminals", Port Technology International, Edition 8, pp. 123 125
- 74. BEDDOW, Matthew (2001), "All change in Antwerp", Containerisation International, edition January, p. 62-64
- 75. BEHRENDT, Michael (2003), "Globale, integrierte Logistikleistungen und ein straffes Kostenmanagement sind die Basis für langfristigen Erfolg", Student Business Review, pp. 10-13, http://www.espritsg.ch/sbr/archiv/2002c_trainspotting_behrendt.pdf
- 76. BELLEKENS, Tom (2000), Fusies en Overnames in de Telecomsector in de EU, Antwerpen, RUCA, 158 p.
- 77. BELLIO, Bruno (1998), "Il porto di Savona propone un rapporto sinergico con la città"? Informare, http://www.informare.it/news/gennews/1998/im0692.asp
- 78. BELLO, Aguedo E. and John LAFITTE (1999), "Purchase, operation and maintenance of a container crane spreader", Port Technology International, Edition 9, pp. 35 39
- 79. BENACCHIO, Marco, Claudio FERRARI and Enrico MUSSO (1999), "On the global optimum size of port terminals", International Journal of Transport Economics, Vol. XXVI, n°3, pp. 415 437

- 80. BENACCHIO, Marco, Cristina CARNEVALI, Riccardo GENOVA, Maurizio MAZZUCCHELLI and Anna SCIOMACHEN (1998), The Port as Intermodal Node: Models for Yard Planning and Management, http://www.informare.it/news/iget/1998/benacchio.asp
- BENDALL, HB and AF STENT (2001), "A scheduling model for a high speed containership service: a hub and spoke short-sea application, International Journal of Maritime Economics, Vol. 3, pp. 262-277
- 82. BENEFIELD, Michael E. and Larry G. PERRY (1994), Assessing the Motivation of Small Banks and Bank Holding Companies in the Acquisition of Thrift Institutions, Bureau of Business and Economic Research, Arkansas, 19 p.
- 83. BENEZE, W. (2005), Eurokai Container Terminal, http://members.aol.com/wbeneze/eect.htm
- 84. BENNETT, Cortlan (2002), "Full Steam Ahead", Sphere, http://www.hutchisonwhampoa.com/eng/about/journal/Sphere7_Korea%20port2_e.pdf
- 85. BENSAID, B., D. ENCAOUA and A. WINCKLER (1994), "Competition, co-operation and mergers", European Economic Review, Vol. 38, p.637-650
- 86. BERECHMAN, Joseph, Sougata PODDAR and Oz SHY (1994), Network Structure and Entry in the Deregulated Airline Industry, Discussion Paper, CORE, Louvain-la-Neuve, 26 p.
- 87. BERGANTINO, Angela S. and Albert W. VEENSTRA (2002), "Interconnection and coordination: an application of network theory to liner shipping, International Journal of Maritime Economics, Vol. 4, pp. 231-248
- 88. BERGER, Allen N. and David B. HUMPHREY (1994), Bank Scale Economies, Mergers, Concentration, and Efficiency: The U.S. Experience, Center for Financial Institutions, Wharton School, University of Pennsylvania, 34 p.
- BERGER, Allen N., Gerald A. HANWECK and David B. HUMPHREY (1987), "Competitive viability in banking – scale, scope and product mix economies", Journal of Monetary Economics, North-Holland, Vol. 20, pp. 501-520
- 90. BERGER, F. (2005), Horst Mosolf Eurocar Transportvermittlung GmbH, e-mail contact
- 91. BERKOWITZ, Richard and Kevin KRICK (2002), Breakout Group Results Group A: Shippers' Needs, summary presented at Marine Transportation System Short Sea Shipping Conference, 12-13 November 2002, New York, 9 p.
- 92. BERNDT, Ernst R., Ann F. FRIEDLAENDER, Judy Shaw-Er WANG CHIANG and Christopher A. VELLTURO (1991), Mergers, Deregulation and Cost Savings in the U.S. Rail Industry, Working Paper, National Bureau of Economic Research, 26p.
- 93. BERNHEIM, B. Douglas and Michael D. WHINSTON (1990), "Multimarket contact and collusive behavior", RAND Journal of Economics, Vol. 21, n°1, pp. 1-26
- 94. BERRY, Steven T. and Joel WALDFOGEL (1999), Mergers, Station Entry, and Porgramming Variety in Radio Broadcasting, Working Paper, National Bureau of Economic Research, 28p. + tables
- 95. BESTUUR VAN HET BELGISCH STAATSBLAD (1972), "Wet van 8 juni 1972 betreffende de havenarbeid", Belgisch Staatsblad, 10 August 1972
- 96. BESTUUR VAN HET BELGISCH STAATSBLAD (1993), "Koninklijk Besluit van 2 februari 1993 houdende eigendomsoverdracht van de havens en hun aanhorigheden van de Staat naar het Vlaamse Gewest", Belgisch Staatsblad, 4 March 1993
- 97. BICHOU, Khalid and Richard GRAY (2005), "A critical review of conventional terminology

for classifying seaports", Transportation Research A, Vol. 39, pp. 75-92

- 98. BII (SRI LANKA BUREAU OF INFRASTRUCTURE INVESTEMENT, 1999), Ports, http://www.bii.lk/sectors/ports.asp
- 99. BLALOCK, B. (2005), APM Terminals Savannah, e-mail contact
- 100. BLAUWENS, Gust, Hilde MEERSMAN and Eddy VAN DE VOORDE (1995), "Load Size, Distance and Maritime Freight Rates", Proceedings of the 7th WCTR, Sydney,1995, pp. 150 – 164
- 101. BLG Consult GmbH (2005), About us, http://www.consult.blg.de
- 102. BLG LOGISTICS (2000), Annual Report 1999, http://www.blg.de/services/pdf/annual 99/blg1999-en grey.pdf
- 103. BLG LOGISTICS (2002), Annual Report 2001, http://www.blg.de/services/pdf/annual 01/blg2001 en.pdf
- 104. BLG LOGISTICS (2003), Annual Report 2002, http://www.blg.de/services/pdf/annual 02/blg gb2002 en.pdf
- 105. BLG LOGISTICS (2004), Annual Report 2003, http://www.blg.de/services/pdf/annual_03/ft2003_english.pdf
- 106. BLG LOGISTICS (2004), Maersk boosts participation in Gioia Tauro, http://www.blg.de/news content2004/september04 en.php
- 107. BLOCH, Francis (2002), "Coalitions and networks in industrial organization", The Manchester School, Vol. 7, n° 1, pp. 16-35
- 108. BLOMME, Jan (2003), Port of Antwerp, informal meeting
- 109. BOLL, Carsten (2002), Integrated Planning System for Optimised Usage of Ship-to-Shore Cranes in Container Terminals, Port Technology International, pp. 125 129
- 110. B-ONLINE (2005), Expertenpartner, http://www.b-online-nds.de/190.0.html
- 111. BONNEY, Joseph (2002), "The big get bigger", The Journal of Commerce, Vol. 3, Issue 13, April 1-7, p. 12 13
- 112. BORENSTEIN, Severin and James BUSHNELL (1999), "An empirical analysis of the potential for market power in california's electricity industry", Journal of Industrial Economics, Vol. 47, n° 3, pp. 285-324
- 113. BORYS, Bryan and David B. JEMISON (1989), "Hybrid arrangements as strategic alliances: theoretical issues in organizational combinations", Academy of Management Review, Vol. 14, n° 2, pp. 234-249
- 114. BOTELBERGE, Anthony (1996), Fusies en Overnames in de Farmaceutische Sector, Antwerpen, UFSIA, 66 p.
- 115. BOTHMER, Holger (2003), Mobile Lösungen in der Logistik, http://www.ihknordwestfalen.de/netzwerk logistik/bindata/Vortrag Bothmer 18032003.pdf
- 116. BOUQUET, Olivier (1992), Samenwerking en Fusies tussen Banken en Verzekeringsmaatschappijen, Antwerp, RUCA, 127 p.
- 117. BOWSER, Gary F. and Richard C. HUSEMANN (2001), "Full cargo inspection possible through recent technology advances", Port Technology International, Edition 11, pp. 69 72
- 118. BRAID, Ralph M. (1999), "The price and profit effects of horizontal mergers in twodimensional spatial competition", Economic Letters, Vol. 62, n° 1, pp. 113-119
- 119. BRAID, Ralph M. (2001), Cost-reducing horizontal mergers that leave prices unchanged in models of spatial competition, Economic Letters, Vol. 71, n° 3, pp. 421-427

- 120. BRANCH, Alan E. (1986), Elements of Port Operation and Management, London, Chapman and Hall Ltd, 265 p.
- 121. BRANDER, James A. and Anming ZHANG (1990), "Market conduct in the airline industry: an empirical investigation", The RAND Journal of Economics, Vol. 21, n° 4, pp. 567-583
- 122. BREMEN PORTS (2005), Container-Terminal Bremerhaven History, http://www.ct-bremerhaven.de
- 123. BREMISCHE BÜRGERSCHAFT (2004), Mitteilung des Senats vom 24. August 2004 -Entwicklung der BLG Logistics Group, http://www.bremischebuergerschaft.de/drucksachen/98/1976 2.pdf
- 124. BRENNAN, Jim (2001), Measurement Approaches: Port Capacity Management, paper presented at Marine Board Seminar on Waterway and Harbor Capacity, 23 April 2001, http://gulliver.trb.org/conferences/2001Waterway%26Harbor/Brennan.pdf
- 125. BRENNAN, Phil (2001b), Chinese Company Continues to Encircle the World, http://www.newsmax.com/archives/articles/2001/6/12/210339.shtml
- 126. BRESNAHAN, Timothy F. and Peter C. REISS (1991), Entry and competition in concentrated markets, Journal of Political Economy, Vol. 99, n° 5, pp. 977-1009
- 127. BRESSER, Rudi F.K. (1988), "Matching collective and competitive strategies", Strategic Management Journal, Chichester, Wiley, Vol. 9, n° 4, pp. 375-385
- 128. BREST PORT (2003), Services à la Marchandise, http://www.port.cci-brest.fr
- 129. BRIDGE SINGAPORE (2005), PSA Int'l makes fresh Foray into Indian Port Market, http://www.bridgesingapore.com/bsnews_psa9may05.htm
- 130. BRITISH EMBASSY BEJING (2001), China Ports Briefing 2001, http://www.britishembassy.org.cn/english/about_china/business/sr_ports.pdf
- 131. BROWN, Douglas R. and Steven D. BOTELLO (2001), "Automatic cargo inspection", Port Technology International, Edition 12, pp. 177 – 180
- 132. BRS (BARRY ROGLIANO SALLES, 2004), Shipping and Shipbuilding Markets 2004, 115 p., http://www.brs-paris.com/annual/pdf/annual_review_2004-a.pdf
- 133. BRU, Lluis and Ramon FAULÍ-OLLER (2002), Horizontal Mergers for Buyer Power, 8 p., http://merlin.fae.ua.es/fauli/buyer.pdf
- 134. BRUECKNER, Jan K. and Pablo T. SPILLER (1991), "Competition and mergers in airline networks", International Journal of Industrial Organization, Vol. 9, pp. 323-342
- 135. BRUZZONE, Agostino G., Pietro GIRIBONE and Roberto REVETRIA (1999), "Operative requirements and advances for the new generation simulators in multimodal container terminals", in FARRINGTON, P. A., H. B. NEMBHARD, D. T. STURROCK, and G. W. EVANS (Eds), Proceedings of the 1999 Winter Simulation Conference, Vol. 39, pp. 1243 - 1252
- 136. BUCKLEY, Peter J. and Mark CASSON (1988), "A theory of co-operation in international business" in CONTRACTOR, Farok F. and Peter LORANGE (Eds.), Cooperative Strategies in International Business – Joint Ventures and Technology Partnerships between Firms, Massachusetts, Lexington Books, 513p.
- 137. BUCKLEY, Peter J. and Mark CASSON (1998), "An economic model of international joint venture strategy" in BEAMISH, Paul W. (Ed.), Strategic Alliances, Cheltenham, Elgar, 561 p.

- 138. BUCKLEY, Peter J. and Mark CASSON (1998b), "A theory of co-operation in international business" in BEAMISH, Paul W. (Ed.), Strategic Alliances, Cheltenham, Elgar, 561 p.
- 139. BUCKLEY, Peter J. and Pervez N. GHAURI (Ed.)(2002), International Mergers and Acquisitions, Singapore, Thomson, 438 p.
- 140. BUENOS AIRES PORT (2001), Hutchison se hará Cargo de la Terminal 5, http://www.buenosairesport.com.ar/ie/diario/articulo.asp?base=Puerto%20de%20Bs.%20As. &Id=154
- 141. BUSHEY, Steve (2003), Global Transportation Solutions, InfoPORT 2003 Amsterdam, 39 p.
- 142. BUSINESS TIMES (2002), "Playing the transhipment game", The Business Times online edition, published August, 3rd
- 143. BUSINESS TIMES (2002b), "The changing face of competition", The Business Times online edition, published August, 3rd
- 144. BUSK, Kent (2002), Strategic Changes by Means of Project-based Work, 14 p.
- 145. BUSS PORTS + LOGISTICS (2004), Kaiumschlag, http://www.buss-group.de/
- 146. C. STEINWEG HANDELSVEEM BV (2004), Rotterdam Terminals, http://www.steinweg.com/1024/index.php
- 147. CARACCIOLO, Elisabetta (2001), Porti alla Riscossa: il Caso Genova, http://www.trasportale.it/toe/articolo.php?id=491&num=46&mese=OTTOBRE&anno=2001 &id num=37
- 148. CARBONE, Valentina and Marcella DE MARTINO (2003), The Integration of Port Operators in the Automotive Supply Chain: Le Havre-Renault, paper presented 31 March 2003, 28 p., http://www.inrets.fr/services/manif/Seminaire-EMAR/Carbone-Martino.pdf
- 149. CARDING, Tony and Linda LYNTON (1998), "Ports on Both Sides of Atlantic Vie for Status As 'European Gateway'", Global Logistics & Supply Chain Strategies, March edition, http://www.glscs.com/archives/3.98.hubs.htm?adcode=9 0
- 150. CARGO NEWS ASIA (1997b), PSA adopts a softly, softly Approach, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna3152.html
- 151. CARGO NEWS ASIA (1997c), Maersk, PSA join Forces at Dalian, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna3090.html
- 152. CARGO NEWS ASIA (1997d), PSA fosters China Ties to secure Cargo, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna2529.html
- 153. CARGO NEWS ASIA (1997e), PSA signs MOU at Cigading port, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna2335.html
- 154. CARGO NEWS ASIA (1998), Japan money in Bauan port, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna3647.html
- 155. CARGO NEWS ASIA (1998b), PSA spins off logistics arm, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna3254.html
- 156. CARGO NEWS ASIA (2001), PSA takes major Guangzhou stake, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna6107.html
- 157. CARGO NEWS ASIA. (1996), ICTSI/APL finally sign Karachi Deal, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna1762.html
- 158. CARGO NEWS ASIA. (1997), ICTSI in Bid to Diversify,

http://www.cargonewsasia.com/timesnet/data/cna/docs/cna2660.html

- 159. CARGO NEWS ASIA. (1999), ICTSI in Surabaya Port Bid, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna4166.html
- 160. CARGO NEWS ASIA. (1999b), New container Giant up and running, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna4673.html
- 161. CARGO NEWS ASIA. (2001), ICTSI plans Brazil Boost, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna6342.html
- 162. CARGO SERVICES FAR EAST Ltd. (2005), About us, http://www16.cargofe.com
- 163. CARIBBEAN SHIPPING ASSOCIATION (2002), New Management Contract signed for Kingston Container Terminal, http://www.caribbeanshipping.org/archway/news/kingston-signs.htm
- 164. CARIOU, Pierre (2000), Les alliances stratégiques dans le transport maritime de lignes régulières : Efficacité ou Pouvoir de Marché, Doctoral thesis, 325 p.
- 165. CARIOU, Pierre (2001), « Les enjeux de la consolidation des opérateurs de manutention portuaire sur l'analyse de la concurrence », Location of Economic Activity, Regional Development and the Global Economy: European and East Asian Experience, International Conference Faculty des Affaires Internationales, September 26-27
- 166. CARIOU, Pierre (2001b), Les stratégies des opérateurs de terminaux à conteneurs en Europe du Nord, 5 p., http://bonjorn.sc-eco.univ-nantes.fr/~pcariou/Publi/r%E9sum%E9jmm.pdf
- 167. CARIOU, Pierre (2002), Strategic alliances in liner shipping: an analysis of operational synergies, paper presented at IAME Conference, 13-15 November 2002, Panama, http://www.eclac.cl/transporte/perfil/iame_papers/proceedings/Cariou.doc
- 168. CARLTON, Dennis W. (1992), "The Economics of Cooperation and Competition in Electronic Services Network Industries" in WILDMAN, Steven (Ed.), Economics of Electronic Service Networks, Praeger Press
- 169. CARLTON, Dennis W. and Robert GERTNER (1989), "Market Power and Mergers in Durable-Good Industries", Journal of Law & Economics, Vol. 32, Issue 2, pp. S203-S226
- 170. CASS, Sid (2001), "A light that never goes out", Cargo Systems, October edition
- 171. CASS, Sid (2002), "Testing times ahead", Cargo Systems, April edition
- 172. CASS, Sidney (1996), Port Privatisation: Process, Players and Progress, London, Cargo Systems, 182 p.
- 173. CASS, Sydney (1999), World Port Privatisation: Finance, Funding and Ownership, London, Cargo Systems, 258 p. + annexes
- 174. CATALANI, Mauro (1998), Port Competition and Handling Optimisation Planning Options for a Container Terminal Port, Naples, Naval University, 14 p.
- 175. CAVES, Douglas W., Laurits R. CHRISTENSEN and Michael M. TRETHEWAY (1984), "Economies of density versus economies of scale: why trunk and local service airline costs differ", The RAND Journal of Economics, Vol. 15, Issue 4, pp. 471-489
- 176. CAVES, R.E. and M.E. PORTER (1977), "From entry barriers to mobility barriers: conjectural decisions and contrived deterrence to new competition", The Quarterly Journal of Economics, Vol. 91, n° 2, pp. 241-261
- 177. CAVES, Richard E. (1999), Multinational Enterprise and Economic Analysis, Cambridge, Cambridge University Press, 322 p.

- 178. CCI (CHAMBRE DE COMMERCE ET D'INDUSTRIE SUD ALSACE MULHOUSE, 2003), Rapport d'activité 2002, http://www.mulhouse.cci.fr
- 179. CHAMBERS, Sam (2001), "Battle for the North who will be the top box port in north China?", Lloyd's List Maritime Asia, November edition, pp. 13 15, http://www.csxworldterminals.com/News/mc20011100.pdf
- 180. CHARLES RIVER ASSOCIATES (2002), Port Companies and Market Power a Qualitative Analysis Final Report, 117 p., http://www.transport.govt.nz/downloads/ports-report-29-april-2002-final.pdf
- 181. CHEN, Tao (1999), "Yard operations in the container terminal a study in the 'unproductive' moves", Maritime Policy and Management, Vo. 26, n°1, pp. 27-38
- 182. CHILD, J. and D. FAULKNER (1998), Strategies of Cooperation: Managing Alliances, Networks and Joint Ventures, Oxford University Press, Oxford
- 183. CHINA DAILY (2002), Shanghai to build container port, http://beijing.lehmanlaw.com/newsletter/maritime/20020906.htm
- 184. CHINA ECONOMIC INFORMATION NETWORK (2003), Shenzen Port Running at Full Capacity, http://ce.cei.gov.cn/enew/new_h1/fp00haa9.htm
- 185. CHINA MERCHANT HOLDINGS (INTERNATIONAL) COMPANY Ltd. (CMHIC, 2005), Business Areas, http://www.cmhico.com/webappen/link.html
- 186. CHOI, Y.S. and W.Y. YUN (2000), Simulator for Port Container Terminal: Using an Object-oriented Approach, 17 p.
- 187. CHONG, Ton Soon, Jimmy LIANG and Peter M. DARLEY (1999), "Crane modernisation: why and how part 1?", Port Technology International, Edition 8, pp. 57 63
- 188. CHONG, Ton Soon, Jimmy LIANG and Peter M. DARLEY (1999b), "Crane modernisation: why and how part 2?", Port Technology International, Edition 9, pp. 41 47
- 189. CHOULY, Ariane (2002), Comparatieve Analyse: Luchthavens en zeehavens, doctoral thesis,
 69 p.,

http://www.few.eur.nl/few/people/roos/publications/presentations%202002/achouly.pdf

- 190. CHOULY, Arianne. and Peter. W. DE LANGEN (2003), An Institutional Economic Analysis of Seaports, 17 p.
- 191. CHURCH, Jeffrey and Roger WARE (2000), Industrial Organization, Boston, Irwin McGrawHill, 926p.
- 192. CIAS (CHANGI INTERNATIONAL AIRPORT SERVICES PTE LTD, 2005), About us, http://www.cias.com.sg/coporate_information/aboutus.shtm
- 193. CIRTWILL, Charles, Brian Lee CROWLEY and James FROST (2001), Port-Ability: A Private Sector Strategy for the Port of Halifax, 60p., http://www.aims.ca/library/port.pdf
- 194. CITY OF GÖTEBORG (2001), Göteborg Kommuns Bolag, http://www.goteborg.se/prod/G-

info/kskfhandl.nsf/0/2417fd70553570b1c1256cd8002c59ec/\$FILE/Bilaga%20C.doc

- 195. CITY OF LONG BEACH (2002), The Port of Long Beach: Post 9/11 Effects and Enhanced Security Development, 18 p.
- 196. CITY OF SAN DIEGO (2004), Port District, San Diego Unified (Board of Commissioners), http://www.sannet.gov/city-clerk/boards-commissions/810520d.shtml
- 197. CLARK, Jeffrey A. (1984), "Estimation of economies of scale in banking using a generalized functional form", Journal of Money, Credit and Banking, Vol. 16, pp. 53-68

- 198. CLARK, Jeffrey A. (1988), "Economies of scale and scope at depository financial institutions: a review of the literature", Economic Review of Federal Reserve Bank of Kansas City, September issue, pp. 16-3
- 199. CLARK, Ximena, David DOLLAR and Alejandro MICCO (2004), Port Efficiency, Maritime Transport Costs and Bilateral Trade, 46 p., http://www.nber.org/papers/w10353.pdf
- 200. CLEMENZ, Gerhard and Klaus GUGLER (2002), Locational choice and price competition: Some empirical results for the Austrian retail gasoline market, 31 p., http://mailbox.univie.ac.at/Papers.Econ/RePEc/vie/viennp/vie0206.pdf
- 201. CMB (COMPAGNIE MARITIME BELGE, 2002), Annual Report 2001, http://www.holding.cmb.be/pdf/2002/CMB%20AR%2031-12-2001.pdf
- 202. CMB (COMPAGNIE MARITIME BELGE, 2003), Annual Report 2002, http://www.holding.cmb.be/pdf/2003/CMB%20AR%2031-12-2002.pdf
- 203. CMB (COMPAGNIE MARITIME BELGE, 2005), History, http://www.holding.cmb.be/history/history_cont.htm
- 204. CNDC (2003), Dictamen 225, http://www.mecon.gov.ar/download/cndc/dictamenes/maersk resumen.pdf
- 205. COECK, Chris, Elvira HAEZENDONCK, Marc HUYBRECHTS, Hilde MEERSMAN, Francesca MOGLIA, Theo NOTTEBOOM, Chantal STEENSSENS, Eddy VAN DE VOORDE, Eric VAN HOOYDONCK, Alain VERBEKE and Willy WINKELMANS (1999), Aspecten van Havencompetitiviteit - Finaal Onderzoeksrapport, project Bijzonder Onderzoeksfonds - Geconcerteerde Onderzoeksactie (1995 - 1998), Antwerp, UA, 420 p + appendix
- 206. COLANGELO, Giuseppe (1995), "Vertical vs. horizontal integration: pre-emptive merging", Journal of Industrial Economics, Vol. 43, n° 3, pp. 323-337
- 207. collection and distribution of goods", Transport Policy, Vol. 3, n° 1-2, pp. 3-11
- 208. COMMITTEE ON PRODUCTIVITY OF MARINE TERMINALS, MARINE BOARD, COMMISSION ON ENGINEERING AND TECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL (1999), Improving Productivity in U.S. Marine Container Terminals, http://books.nap.edu/books/0309036941/html/R1.html
- 209. COMPUTERWOCHE (1982), Die Bremischen Häfen verstärken ihr Dienstleistungsangebot: Neues Service-Centrum Logistik, http://www1.computerwoche.de/heftarchiv/1982/19820326/a55878.html
- 210. CONSILIUM SERVICES Inc.(2002), Modern Shipper Concepts and Practices in International Trade Logistics, 14 p., http://www.itsip.com/Trade%20Logistics.pdf
- 211. CONSONNI, Barbara (2001), PORTI: Scommettiamo che i porti del Mediterraneo ..., http://www.trasportale.it/toe/articolo.php?id=418&num=42&mese=giugno&anno=2001&id_ num=34
- 212. CONSORTIUM ARISTOTLE UNIVERSITY OF THESSALONIKI, UNIVERSITY OF CARDIFF, NETHERLANDS ECONOMIC INSTITUTE, GERHARDT-MERCATOR UNIVERSITY OF DUISBURG, VTT AUTOMATION, CHALMERS UNIVERSITY OF TECHNOLOGY, and PORT AND TRANSPORT CONSULTING BREMEN (2000), WORKPORT Project Final Report, DG VII/WA-97-SC-2213. R-EU 981130, 128p.
- 213. CONSULAAT-GENERAAL VAN HET KONINKRIJK DER NEDERLANDEN (2003), Shanghai Port Authority, http://www.cgshanghai.org/pages/EA/Overheid/c_port.html

- 214. CONTAINER CONTACTS (2003), 25 years E.H.Harms Autoterminal Bremerhaven, http://www.container-contacts.net/cc content newsdetail.asp?id=1108
- 215. CONTAINERISATION INTERNATIONAL ONLINE (2005), Doehle Group buys out Swan Container Line, http://www.informare.it/news/review/2005/b270405.asp
- 216. CONTAINERManagement (2003), Continued investment at CSXWT, http://www.csxwtpuertocabello.com/News/MCDetail.asp?c=480
- 217. CONTAINERManagement (2003b), Eurogate: no let-up in investment, http://www.csxwcs.com/News/CSXWT%20terminal%20and%20barge%20investment.pdf
- 218. CONTAINERManagement (2003c), Maximising the Opportunities, http://www.csxwcs.com/News/MCDetail.asp?c=481
- 219. CONTRACTOR, Farok .J. and Peter. LORANGE (1988), "Why should firms cooperate? The strategy and economics basis for cooperative ventures" in CONTRACTOR, Farok F. and Peter LORANGE (Eds.), Cooperative Strategies in International Business – Joint Ventures and Technology Partnerships between Firms, Massachusetts, Lexington Books, 513p.
- 220. CONTRACTOR, Farok .J. and Peter. LORANGE (1998), "Competition vs. co-operation: a benefit/cost framework for choosing between fully-owned investments and co-operative relationships" in BEAMISH, Paul W. (Ed.), Strategic Alliances, Cheltenham, Elgar, 561 p.

221. CONTSHIP CONTAINERLINES Ltd. (2005), History, http://www.contship.com

- 222. CONTSHIP ITALIA GROUP (1998), Services, http://www.contshipitalia.com/services/service body.jsp
- 223. COPELAND, Tom, Tim KOLLER and Jack MURRIN (2000), Valuation Measuring and Managing the Value of Companies, 3rd edition, John Wiley & Sons Inc., New York, 490 p.
- 224. CORCHÓN, Luis C. and Ramon FAULÍ-OLLER (1999), To Merge or Not to Merge: That is the Question, CEPR Discussion Papers, 35 p.
- 225. CORDTS, Markus (2001), BALTICOM Deliverable 3.3 The Effect of Technological and Organizational Innovation in the European Logistics Sector on Port Economic Areas Recommendations for Spatial and Regional Planning, 41 p., http://www.balticom.org/download/reports/Deliverable 3 3.pdf
- 226. COSCO Group (China Ocean Shipping Company Group (2005), Container Business, http://www.cosco.com.hk/en/business/container/home.asp
- 227. COSMOS nv (2005), Milestones, http://www.cosmos.be/
- 228. COTTERILL, Ronald W. (1986), "Market Power in the Retail Food Industry: Evidence from Vermont", Review of Economics and Statistics, pp. 379 386
- 229. COUR DES COMPTES (2005), La Politique Portuaire française, http://www.ccomptes.fr/Cour-des-comptes/publications/rapports/politiqueportuaire/pportuaire29.htm
- 230. CP SHIPS (2005), Contship Containerlines, http://www.cpships.com/
- 231. CRASTON, Andrew (2000), Eurogate, http:// www.craston.de/specimen/eurogate/eurogatefinal.pdf
- 232. CREEL, Harold J. (2001), Remarks before Containerisation International's 4th Annual Conference, http://www.fmc.gov/Speeches/Creel/london-Mar27.htm
- 233. CRITICAL INTERFACE TECHNOLOGIES WORKING GROUP (1999), High Speed

Sealift	Technology	Workshop,	13
http://www.ccdott.or	rg/hss volume2/08	critical ship & port	interface.pdf

234. CROOK, Gary (2002), Infrastructures Framework for Trade, 18p

- 235. CROWELL, Don (2005), e-mail contact, 14 July
- 236. CROWELL, John (2005), Port of Jacksonville, e-mail contact
- 237. CSX CORPORATION (2005), History, http://www.csx.com
- 238. CSX TRANSPORTATION (2005), History, http://www.csxt.com
- 239. CSX WORLD TERMINALS HONG KONG Ltd. (2004), Products and Services, http://www.csxwthk.com
- 240. CTO (COMBINED TERMINAL OPERATORS, 2005), History, http://www.cto.be
- 241. CWT DISTRIBUTION LIMITED (2001), CWT seeks alliance in push to go global, http://www.cwt.com.sg/mediareport CWTAlliancesInPushToGoGlobal.html
- 242. CWT DISTRIBUTION LIMITED (2003), Third Quarter 2003 Financial Statement, http://www.cwt.com.sg/info/3QFS20031.htm
- 243. CWT DISTRIBUTION LIMITED (2003b), CWT divests its Interest in Cambodia-CWT dry Port Corporation, http://www.cwt.com.sg/info/CambodiaDryPort.htm
- 244. D'HONDT, Erik (2002), The Impact of Increasing Vessel Size on The Workload on Container Terminals, 5 p., paper presented at International Union of Marine Insurance Conference, New York, 15-19 September 2002, http://www.iumi.com/Conferences/2002_newyork/CargoLossPreventionWorkshop/ErikDHo ndt ImpactIncreasingVesselSize.doc
- 245. DAGANZO, Carlos F. (2002), "Crane productivity and ship delay in ports", Transportation Research Record, n° 1251, pp. 1-9
- 246. DAMAS, Philip (2001), "Transship or direct: a real choice?", The American Shipper Journal of International Logistics, June 2001, pp. 56-61
- 247. DAMAS, Philip (2002), "Global Terminal Operators Rule", The American Shipper Journal of International Logistics, February 2002, pp. 67-76
- 248. DAMAS, Philip and Robert MOTTLEY (2003), "Big port groups, big volumes", The American Shipper Journal of International Logistics, May 2003, pp. 18-22
- 249. DAMAS, Philip and Robert MOTTLEY (2003b), "Where will extra port capacity come from?", The American Shipper Journal of International Logistics, May 2003, pp. 18-22
- 250. DARDANI, Bruno (1999), http://www.transportonline.com/sole24/ras99-00/27-00.htm
- 251. DARDANI, Bruno (1999b), http://www.transportonline.com/sole24/ras99-00/26-00.htm
- 252. DATALOG GmbH (2005), Profile, http://www.datalog.de
- 253. de Contenedores Como Ayuda a la Toma de Decisiones, paper presented at XXIII Jornadas de Automática,
- 254. DE FINANCIEEL ECONOMISCHE TIJD (2002), EU-gerecht kraakt fusieverbod Schneider-Legrand – Fusieonderzoek van Europese Commissie ligt onder vuur, edition 23 October, p. 1 and 10
- 255. DE LEMBRE, Erik and Inge BIESEMANS DE DEKEN (1992), Praktijkgids Waardebepaling en Strategische Reorganisaties, Zaventem, Kluwer
- 256. DE LLOYD (1998), Hutchison Whampoa devient le Partenaire Stratégique d'ECT, edition 17 October, p. 1
- 257. DE LLOYD (2000), PSA signs Terminal Management Contract for Muara Container

р.,

Terminal in Negara Brunei Darussalam, edition 31 October, p. 3

- 258. DE LLOYD (2001), PSA Corp: + 24,1% eind mei Cosco mikt op Participatie, edition 6 June, p. 1 and 2
- 259. DE LLOYD (2001b), PSA's Portnet.com in Partnership with Sinport Sinergie Portuali, edition 24 January, p. 3
- 260. DE LLOYD (2002), Barcelona in Logistics Leap in China, edition 24 May, p. 3
- 261. DE LLOYD (2002b), PSA has a lock on 75% of volumes, edition 23 and 24 August, p. 3
- 262. DE LLOYD (2002c), Hutchison may sell more Stakes in Terminals to Shipping Lines, edition 9 March, p. 3
- 263. DE LLOYD (2002d), Klang terminals urged to meet competitive Challenges, edition 9 April, p. 4
- 264. DE LLOYD (2002e), Zuid-Korea verlaagt Havenkosten voor Transitgoederen, edition 10 September, p. 4
- 265. DE LLOYD (2002f), NYK Line wil uitgroeien tot geïntegreerde Logistieke Dienstverlener, edition 26 September, p. 1
- 266. DE LLOYD (2002g), PSA zou Voet aan Wal willen krijgen in Noord-Amerika Groep toont Interesse voor grote Terminal in Puerto Rico, edition 26 September, p. 1
- 267. DE LLOYD (2002h), ERS Railways maakt Rederijen tot Spoorvervoerders Jointventure tussen Maersk Sealand en P&O Nedlloyd werkt ook voor derden, edition 25 October, p. 1
- 268. DE LLOYD (2003), Nog lang geen oligopolie in Europese logistiek, edition 18 March, p. 1 and 3
- 269. DE LLOYD (2004), Cosco Pacific to triple Port Investment, edition 3 February, p. 1
- 270. DE LLOYD (2004b), Modern Terminals boosts Port Investment in Suzhou, edition 3 February, p. 1
- 271. DE LLOYD (2004c), PSA krijgt voorlopig geen voet aan de grond in Hongkong, edition 23 November, p. 1
- 272. DE LLOYD (2004d), Partnership in de maak tussen Tanjung Pelepas en PSA?, edition 26 August, p. 1
- 273. DE LLOYD (2004e), Congestieproblemen op Antwerpse Terminals: "Daar wordt aan gewerkt, edition 2 September, p. 1
- 274. DE LLOYD (2005), Eerste scanner voor Havanna, edition 18 January, p. 3
- DE LLOYD (2005aa), Port of Long Beach wants to reduce Pick-up Free Time, edition 19 May, p. 11
- 276. DE LLOYD (2005ab), Russische Spoorwegen investeren in Havens, edition 21 May, p. 5
- 277. DE LLOYD (2005ab), VK blijft kampen met Dossier Containerterminals, edition 21 May, p. 3
- 278. DE LLOYD (2005ac), Australian Federal Government may take Charge of Ports, edition 24 May, p. 7
- 279. DE LLOYD (2005ad), Ports of LA and Long Beach to tackle congestion, edition 28 May, p. 11
- 280. DE LLOYD (2005ae), Trade Unions oppose Privatisation of Indian Ports, edition 28 May, p. 11
- 281. DE LLOYD (2005af), India to get four new Container Terminals, edition 9 June, p. 11

- 282. DE LLOYD (2005ag), PSA neemt 20% in HIT, edition 9 June, p. 11
- 283. DE LLOYD (2005ah), APM Terminals buys 50% Stake in Teconvi, edition 11 June, p. 7
- 284. DE LLOYD (2005ai), ICTSI wins Madagascar Port Deal, edition 11 June, p. 7
- 285. DE LLOYD (2005b), Hutchison breidt uit in Egypte, edition 17 March, p. 3
- 286. DE LLOYD (2005c), APM Terminals set to win Nigeria Port Concession, edition 17 March, p. 11
- 287. DE LLOYD (2005d), Cotonou and Las Palmas to enhance Port Co-operation, edition 17 March, p. 11
- 288. DE LLOYD (2005e), Kalmar to deliver 29 RTGs to GTI in India, edition 26 March, p. 11
- 289. DE LLOYD (2005f), Maersk buys further 30% stake in Pipavav port, edition 31 March, p. 11
- 290. DE LLOYD (2005g), California Port Tariffs to rise 5%, edition 2 April, p. 11
- 291. DE LLOYD (2005h), Haveninspecties splijtzwam Europese Raad en Parlement, edition 9 April, p. 1
- 292. DE LLOYD (2005i), Wegontsluiting Zeebrugge prioritair, edition 19 April, p. 1
- 293. DE LLOYD (2005j), P&ONL sluit Joint-Venture met Voltri, edition 19 April, p. 3
- 294. DE LLOYD (2005k), Havens Brussel, Luik Rijsel en Parijs sluiten Partnerschap, edition 19 April, p. 3
- 295. DE LLOYD (2005l), Europese Havens besteden meer Zorg aan Milieubeheer, edition 19 April, p. 3
- 296. DE LLOYD (2005m), Major Port proposed for Mexico, edition 19 April, p. 7
- 297. DE LLOYD (2005n), Gent gaat met Boma samenwerken, edition 21 April, p. 3
- 298. DE LLOYD (2005o), PSA China Terminals improve Performance in 2004, edition 26 April, p. 7
- 299. DE LLOYD (2005p), Savi Technology and HPH create new RFID company, edition 28 April, p. 10
- 300. DE LLOYD (2005q), Hong Kong Terminal Operators want Security Fees, edition 28 April, p. 11
- 301. DE LLOYD (2005r), APM plans new Terminal in Virginia, edition 3 May, p. 7
- 302. DE LLOYD (2005s), Staking Wegvervoerders in Haven Casablanca, edition 3 May, p. XXX
- 303. DE LLOYD (2005t), Anti-terror Measures pay Cargo Crime Dividend, edition 10 May, p.
 6
- 304. DE LLOYD (2005u), Vancouver struggling to keep up with Asia-Pacific Trade, edition 10 May, p. 7
- 305. DE LLOYD (2005v), Felixstowe wil Spoor uitbreiden, edition 12 May, p. 5
- 306. DE LLOYD (2005w), Shippers protest against Delays at Mombasa Port, edition 17 May, p. 11
- 307. DE LLOYD (2005x), Indonesia to limit number of International Ports, edition 17 May, p. 11
- 308. DE LLOYD (2005y), ICTSI eyes five international Ports, edition 11 May, p. 17
- 309. DE LLOYD (2005z), Vaste Scanner officieel ingehuldigd in Antwerpen, edition 19 May, p. 6
- 310. DE LOMBAERDE, P. and A. VERBEKE (1989), "Assessing international seaport

competition: a tool for strategic decision making", International Journal of Transport Economics, vol. XVI, 1989, n° 2, pp. 175 - 192

- 311. DE STANDAARD (2002), Meerderheid Hesse-Noordnatie nu in handen van PSA, Edition 29 March 2002
- 312. DE STANDAARD (2005), Scanner licht jaarlijks 45.000 Containers door, Edition 19 May, p. 10
- 313. DE, Prabir (2003), "Competition, the Chinese Way", Times Shipping Journal, http://www.etshipping.com/may2003/port.html
- 314. DECLERCQ, Eddy en Alain VERBEKE (1994), Strategic Alliances in the Global Telecommunication Industry, Antwerpen, Centre for International Management and Development, 44 p.
- 315. DEKKER, Neil (2002), "All systems go", Containerisation International, March 2002
- 316. DEKKERS (1998), Intermodal Policy and the Role of European Port Operators, paper presented at Intermodal 98 Conference, Rotterdam, 5 p.
- 317. DELLEPIANE, Filippo (2005), Contrepair, e-mail contact
- 318. DELLINGER, Jean-Claude and Ludgera KLINGE-HABERMANN (2002), ITIP Deliverable 3 – Best Practices Handbook, 39 p., http://www.portmod.org/INDUSTRY%20INFO/Transportation.htm
- 319. DENTON, Jake (2004), Hub Ports anchor Maersk's Network of Services, http://www.insidebiz.com/output.cfm?ID=2963628
- 320. DEPUTATI D'ULIVO (2002), Atto di concessione demaniale tra il Consorzio Autonomo per il porto di Civitavecchia e la SINPORT S.r.l, http://www.deputatids.it/Controllo/Atto.asp?Id=1532
- 321. DESMET, Lieven (2003), "In goede en kwade dagen", De Tijd, edition 3 October, p. 1
- 322. DESRUELLE, Dominique, Gérard GAUDET and Yves RICHELLE (1992), "Complementarity, coordination and compatibility: the role of fixed costs in the economics of systems", Cahiers de recherche du Département des sciences économiques, UQAM 9209, Université du Québec à Montréal, Département des sciences économiques, 21 p.
- 323. DEUTSCHE BAHN AG (2005), Competition Report 2005), http://www.db.de/site/shared/en/file_attachements/reports/competition_report_2005.pdf
- 324. DEUTSCHE LOGISTIK-ZEITUNG (2004), Eurokombi: Hamburger Terminal wird 2006 erweitert, n°85, http://www1.computerwoche.de/heftarchiv/1982/19820326/a55878.html
- 325. DEVINE, P.J., N. LEE, R.M. JONES and W.J. TYSON (1985), An Introduction to Industrial Economics, London, George Allen & Unwin, 528 p.
- 326. DEVLIN, G and Mark BLEACKLEY (1988), "Strategic alliances: guidelines for success", Long Range Planning, Oxford, Pergamon press, Vol. 21, n° 5, p.18-23
- 327. DEVOS, Greta, Gustaaf ASAERT and Fernand SUYKENS (2004), De Antwerpse Naties, Antwerp, Lannoo, 376 p.
- 328. DFTECB (DALIAN FOREIGN TRADE AND ECONOMIC COOPERATION BUREAU, 2005), Dalian Container Terminal Co.,Ltd., http://www.dalian-gov.net/chinese/2000qiye/zhu/dljzhxmt/dljzhxmt_len.htm
- 329. DIALOG DISTRIBUTION AND AUTOMOBILE LOGISTICS GMBH (2005), Unternehmen, http://www.dialog-logistik.de
- 330. DOMBOIS, Rainer and Holger WOHLLEBEN (2000), Change of work and industrial

relations in German seaports - the case of Bremen, working paper, 23 p., http://www.maritim.uni-bremen.de/ports/global/RAINER2.pdf

- 331. DORTMUNDER HAFEN AG AG (2004), Daten und Fakten, http://www.dortmunderhafen.de/
- 332. DOUGLAS, George W. and James C. MILLER (1974), "Quality competition, industry equilibrium, and efficiency in the price-constrained airline market", The American Economic Review, Volume 64, n° 4, pp. 657-666
- 333. DOUGLAS, R.A.P. (1990), Port Administration a Review of the Structural and Legal Aspects, The World Bank, Washington, D.C., U.S., 80 p.
- 334. DOWD, Thomas J. and Thomas M. LESCHINE (1986), Container Terminal Productvity: a Perspective, Seattle, Washington Sea Grant, 6 p.
- 335. DPA (DUBAI PORTS AUTHORITY, 2003b), Core Services, http://www.dpa.co.ae
- 336. DPA (DUBAI PORTS AUTHORITY, 2004), DPA Performance Container Cargo, http://www.dpa.co.ae
- 337. DPA (DUBAI PORTS AUTHORITY, 2004b), Marine Port Rashid, http://www.dpa.co.ae
- 338. DPA (DUBAI PORTS AUTHORITY, 2005), History, http://www.dpa.co.ae
- 339. DRAKE, Jeff (1999), "What makes for a successful transshipment hub?", Port Technology International, Edition 9, pp. 167-169
- 340. DREWE, Paul and Ben JANSSEN (2001), Seaports and Airports in Europe Where do we go from here?, 27 p., http://www.bk.tudelft.nl/afstudeerateliers/networkcity/pdf/pub09.pdf
- 341. DREWRY SHIPPING CONSULTANTS (1998), World Container Terminals Global Growth and Private Profit, 132 p.
- 342. DREWRY SHIPPING CONSULTANTS (2002), Global Container Terminals Profit, Performance and Prospects, 280 p.
- 343. DREWRY SHIPPING CONSULTANTS (2003), Annual Review of Global Container Terminal Operators, 81p.
- 344. DRIESKENS, Geert (1998), Fusies en Samenwerkingsverbanden in de Maritieme- en Havensector, Antwerpen, 116 p.
- 345. DTMPL (MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS ET DU LOGEMENT DIRECTION DU TRANSPORT MARITIME, DES PORTS ET DU LITTORAL, 2002), Les Impacts sur les Ports de l'Evolution du Transport Maritime, 4 p., http://www.ac-nancy-metz.fr/enseign/TransportsLP
- 346. DTMPL (MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS ET DU LOGEMENT – DIRECTION DU TRANSPORT MARITIME, DES PORTS ET DU LITTORAL, 2002b), Les Gens du Port, 12 p., http://www.ac-nancymetz.fr/enseign/TransportsLP/
- 347. DUBAI CUSTOMS (2005), PCFC target international Opportunities through 'Dubai International', http://www.dxbcustoms.gov.ae/news/show.asp?ID=88
- 348. DUBAI PORTS INTERNATIONAL (2005), Dubai Ports International completes Acquisition of CSX World Terminals, http://www.finanznachrichten.de/nachrichten-2005-02/artikel-4468633.asp
- 349. DUNELM (2002), Kalmar Industries and APM Terminals sign terminal tractor services contract, http://www.dunelmpr.co.uk/Kalmar-APMTerminalsagreementPR.htm

- 350. DUNELM (2003), New joint venture between Lloyd Triestino and Zim, http://www.dunelmpr.co.uk/LT-ZimAUX-PR.htm
- 351. DUNELM (2004), Rotterdam Short Sea Terminals sticks with Kalmar, http://www.dunelmpr.co.uk/Kalmar-RSTSTSOrdersPR-NEW.html
- 352. DUQUENNE, Pascal (2002), Kostenvergelijking tussen de Verschillende Wijzen van Goederenbehandeling gekoppeld aan de vervoermodus, Antwerp, University of Antwerp, 140 p.
- 353. DURKIN, Thomas A. and Gregory E. ELLIEHAUSEN (1998), "The cost structure of the consumer finance industry", Journal of Financial Services Research, Vol. 13, n° 1, pp. 71-86
- 354. DYNAMAR B.V. (2004), Weekly News Summary, Analysis and Commentary on Liner Shipping, 8 p., http://www.dynamar.com
- 355. DYNAMAR B.V. (2003), Terminal Handling Charges (THC): a Bone of Contention, Alkmaar, Dynamar B.V., 57 p.
- 356. E.H. HARMS (2004), Beteiligung am Auto-Terminal Neuss perfekt, http://www.ehharms.de/news/2004/nov04 de.html
- 357. EBRD (1999), Ventspils Port Multi-Purpose/Intermodal Terminal, http://www.ebrd.com/projects/psd/psd1999/5920.htm
- 358. ECKBO, B. Espen (1985), "Mergers and the Market Concentration Doctrine: Evidence from the Capital Markets", Journal of Business, Juli 1985, pp. 325-349
- 359. ECLAC (UNITED NATIONS ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 1998), Concentration in Liner Shipping – Its Causes and Impacts for Ports and Shipping Services in Developing Regions, 101 p., http://www.eclac.cl/publicaciones/Transporte/7/LCG2027/LC G.2027.pdf
- 360. ECLAC (UNITED NATIONS ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, 1999), Port Modernization: A pyramid of interrelated challenges, 56 p., http://www.eclac.cl/publicaciones/Transporte/1/LCG2031/lcg2031.pdf
- 361. ECONOMIDES, Nicholas (1996), "The economics of networks", International Journal of Industrial Organization, Vol. 14, n° 2, pp. 673-700
- 362. ECONOMIDES, Nicholas and Andrzej SKRZYPACZ (2003), Standards Coalitions Formation and Market Structure in Network Industries, research paper, 31 p., http://econwpa.wustl.edu:80/eps/mic/papers/0407/0407008.pdf
- 363. ECONOMIDES, Nicholas and Charles HIMMELBERG (1995), Critical Mass and Network Size with Application to the US Fax Market, Discussion Paper no. EC-95-11, Stern School of Business, N.Y.U.
- 364. ECT B.V. (EUROPE CONTAINER TERMINALS B.V., 2005), History, http://www.ect.nl/
- 365. EGGERS, Evelyn (2001), BALTICOM Deliverable 4.4 Effects on Users and Clients, Regional Impacts, 43 p., http://www.balticom.org/download/reports/Deliverable_4_4.pdf
- 366. EISENBAHNBETRIEBE MITTLERER NECKAR GMBH (2005), Projekte, http://www.e-mn.de
- 367. ELZINGA, K.G. and T.F. HOGARTY (1973), "The problem of geographic market delineation in antimerger suits", The Antitrust Bulletin, Vol. 18, pp. 45-81
- 368. EMPRESAS ICA, S.A. (2001), ICA sells ICAVE and Torre Mayor Investments, http://www.ica.com.mx/ica_eng/relacion_inversioneng/detaileng.asp?id=1

- 369. ENCAOUA, David (1991), "Liberalizing European airlines cost and factor productivity evidence", International Journal of Industrial Organization, Vol. 9, pp. 109-124
- 370. ESCAPE ARTIST (2000b), Things are better on Grand Bahama, http://www.escapeartist.com/efam4/Grand_Bahama.html
- 371. ESPO (EUROPEAN SEA PORT ORGANISATION, 2004), National Statistics for 2001, 16 p.
- 372. ESTACHE, Antonio and José CARBAJO (1996), "Competing private ports lessons from Argentina", Public Policy for the Private Sector, The World Bank Group, note n° 100, 4 p.
- 373. ESTACHE, Antonio, Marianela GONZALEZ and Lourdes TRUJILLO (2001), Technical Efficiency Gains from Port Reform: The Potential for Yardstick Competition in Mexico, 20 p., http://econ.worldbank.org/files/2316 wps2637.pdf
- 374. EUROGATE (2001), Annual Report 2000
- 375. EUROGATE (2005), Unternehmen, http://www.eurogate.de
- 376. EUROKAI KGaA (2002), Annual Report 2001, http://www.eurokai.de/generated html/jahresbericht2001 en.pdf
- 377. EUROKAI KGaA (2005), Firmengeschichte, http://www.eurokai.de
- 378. EUROKAI KGaA (2005b), Eurokai im Detail, http://www.eurokai.de
- 379. EUROKAI KGaA (2005c), Gesellschaftsstruktur, http://www.eurokai.de
- 380. EUROKAI KGaA (2005d), Jahresbericht 2003, http://www.eurokai.de
- 381. EUROPE CONTAINER TERMINALS (2004), About ECT, http://www.ect.nl/
- 382. EUROPEAN COMMISSION (1997), Green Paper of 10 December 1997 on Seaports and Maritime Infrastructure, COM (97) 678 final, 33 p.
- 383. EUROPEAN COMMISSION (2001), White Paper: European Transport Policy for 2010: Time to Decide, COM (2001) 0370, 119 p., http://europa.eu.int
- 384. EUROPEAN COMMISSION (2001b), Case No COMP/JV.55 Hutchison/RCPM/ECT, 52 p., http://europa.eu.int/comm/competition/mergers/cases/decisions/jv55 en.pdf
- 385. EUROPEAN COMMISSION (2001c), Assessment Criteria for distinguishing between Competitive and Dominant Oligopolies in Merger Control, Enterprise Papers n°6, http://europa.eu.int/comm/enterprise/library/enterprisepapers/pdf/enterprise paper 06 2001.pdf
- 386. EUROPEAN COMMISSION (2003), Case No COMP/M.3097 MAERSK DATA / EUROGATE IT / GLOBAL TRANSPORT SOLUTIONS JV, http://www.worldlii.org/eu/cases/ECComm/2003/7.html
- 387. EUROPEAN COMMISSION (2004), Short Sea Shipping Success Stories (2nd Half 2003), http://europa.eu.int/comm/transport/maritime/sss/doc/success story 7 en.pdf
- 388. EUROPEAN COMMISSION (2005), Interreg IIIb Northern Periphery Programme, http://europa.eu.int/comm/ten/transport/2005_03_31_tent_consultation/doc/stakeholders_cont ributions/uk/scotland_interreg_3b_northern_maritime_corridor.pdf
- 389. EUROPEAN COMMISSION. (2001d), Case No COMP/JV.56 Hutchison/ECT, http://europa.eu.int/comm/competition/mergers/cases/index/by_nr_jv_1.html
- 390. EUROPEAN COMMISSION. (2002), Case No COMP/M.2859 -DEUTSCHE BAHN CARGO / CONTSHIP ITALIA / JV, http://europa.eu.int/comm/competition/mergers/cases/decisions/m2859_en.pdf

391. EUROPEAN COMMISSION. (2002b), Prior Notification of a Concentration (Case COMP/M.2632 ó Deutsche Bahn/ECT International/United Depots) (2002/C 15/04), http://europa.eu.int/eur-

lex/lex/LexUriServ/LexUriServ.do?uri=OJ:C:2002:015:0003:0003:EN:PDF

- 392. EUROPEAN FEDERATION OF INLAND PORTS (2004), Ports, http://www.inlandports.be/
- 393. EUROPEAN PARLIAMENT AND COUNCIL (1996), "Decision n° 1692/96/EC of July, 23rd 1996 Community guidelines for the development of the trans-European transport network", in Official Journal L 228, 09/09/1996, p. 0001 – 0103, http://europa.eu.int
- EUROPEAN PARLIAMENT AND COUNCIL (2001), Communication from the 394. Commission to the European Parliament and the Council: Reinforcing Quality Service in Sea Ports: A Key for European Transport - Proposal for a Directive of the European Parliament of the Council: On Market Access to Port Services, and 35 p., http://www.europa.eu.int/comm/transport/library/propdir-en.pdf
- 395. EVANGELISTA, Pietro and Alfonso MORVILLO (2000), Logistical integration and cooperative strategies in liner shipping: some empirical evidence, "International Journal of Maritime Economics", Vol. II, No 1, January-March, pp. 1-16.
- 396. EVANS, Stephen and Maria HUDSON (1993), Standardised Packages Individually Wrapped? : a Study of the Introduction and Operation of Personal Contracts in the Port Transport and Electricity Supply Industries, University of Warwick, 30 p.
- 397. EXPORT 911 (2004), Shipping Department, http://www.export911.com
- 398. FAGERHOLT, Kjetil (2000), "Evaluating the trade-off between the level of customer service and transportation costs in a ship scheduling problem", Maritime Policy and Management, Vol.27, Issue 2, pp. 145-153
- 399. FAIRPLAY (2002), Singapore grab for Mermaid Marine, Edition 30 August
- 400. FAIRPLAY (2003), Bizarre Holiday Romance Merger makes no sense, Edition 14 August, p.5
- 401. FAIRPLAY (2005), Containers' competitive Conundrum, Edition 21 April, p.2
- 402. FAIRPLAY (2005b), Switching to Suez, Edition 21 April, p.7
- 403. FAIRPLAY (2005c), EC Measures will 'destabilise' Shipping, Edition 21 April, p.8
- 404. FAIRPLAY (2005d), Indonesian Ports battle for Rights, Edition 10 February, p.8-9
- 405. FAIRPLAY (2005e), Environmentalists get soft Target, Edition 10 February, p.11
- 406. FARRELL, Joseph and Carl SHAPIRO (2000), "Scale economies and synergies in horizontal merger analysis", Antitrust Law Journal, Vol. 68, n° 3, pp. 685-710
- 407. FASTSHIP, Inc. (2004), Strategic Partners, http://www.fastshipatlantic.com
- 408. FAT KEE STEVEDORES Ltd. (2004), Container Transport, http://www.fkstev.com/
- 409. FAULHABER, Gerald R. and Christiaan HOGENDORN (2000), "The market structure of broadband telecommunications", Journal of Industrial Economics, Vol. 48, n° 3, pp. 305-330
- 410. FAULÍ-OLLER, Ramon (1997), "On merger profitability in a Cournot setting", Economic Letters, Vol. 54, n° 1, pp. 75-79
- 411. FAULÍ-OLLER, Ramon (2000), "Takeover waves", Journal of Economics & Management Strategy, Vol. 9, n° 2, pp. 189-210
- 412. FAULI-OLLER, Ramon (2002), "Mergers between Asymmetric Firms: Profitability and

Welfare", The Manchester School, Vol. 70, pp. 77-87

- 413. FAULÍ-OLLER, Ramon and Massimo MOTTA (1996), "Managerial incentives for takeovers", Journal of Economics and Management Strategy, Vol. 5, n° 4, pp. 497-514
- 414. FEDIAEV, Sergey (2002), "Giving Preference to Container Cargo", Transport Weekly, http://www.transportweekly.com/spc_articles/indexe.php?x=3&id=13617507863f608273a2b 11
- 415. FELTKAMP, Vincent (1995), Co-operation in Controlled Network Structures, KUB, Netherlands, 165 p..
- 416. FEPORT (FEDERATION OF EUROPEAN PRIVATE PORT OPERATORS, 2004), Members, http://www.feport.be/
- 417. FERRARI, Claudio and Marco BENACCHIO (2000), Market structure in container terminal operators and port services, paper presented at IAME Conference "The Maritime Industry into Millennium: the Interaction of Theory and Practice ", Napoli 13-15 September 2000, http://www.informare.it/news/iget/2000/iame2000.asp
- 418. FIAT (1998), Sinport in agreement with PSA Corporation of Singapore, http://www.madeinfiat.com/janfeb98/newsh.htm
- 419. FLEISCHER, G.A. (2000), Economic Models of Agile Port and Intermodal Transfer Configuration, 24 p., http://www.ccdott.org/Deliverables/1997/USC125/USC125%2010.0.pdf
- 420. FLERE, W.A. (1967), Port Economics, London, The Dock & Harbour Authority, 208 p.
- 421. FOMBRUN, Charles and W. Graham ASTLEY (1983), "Strategies of collective action: the case of the financial services industry", Advances in Strategic Management, JAI Press, pp. 125-139
- 422. FORESTAL, P. (2002), "Haven Barcelona vestigt 'dry port' nabij Toulouse Initiatief mikt onder meer op via Antwerpen behandelde trafieken", De Lloyd, edition 24 October, p. 2
- 423. FORGEAUD, Patrick (2000), Measuring Port Performance, World Bank, 18 p.
- 424. FORUM DE CONCERTATION SUR LE TRANSPORT MARITIME (2003), Rapport sur le Réseau Portuaire Stratégique, http://www.mtg.gouv.gc.ca/fr/publications/modes/maritime/reseau portuaire.pdf
- 425. FOURGEAUD, Patrick (2000), Measuring Port Performance, 18 p., http://www.worldbank.org/transport/ports/con_docs/fourgeau.pdf
- 426. FRANCESETTI, D. Cazzaniga and Alga D. FOSCHI (2001), Networks, Mergers and Economy of Scale: Three Aspects of the Same Strategy, http://papers.ssrn.com/sol3/Delivery.cfm/ssrn.com_idSSRN_ID275154_code010703510.pdf? abstractid=275154&mirid=1
- 427. FREIE HANSESTADT BREMEN (2004), Beteiligungsbericht 2003, http://www2.bremen.de/finanzsenator/Kap3/pdf/Beteiligungsbericht2003.pdf
- 428. FREIE HANSESTADT BREMEN (2005), Europas modernster Kreuzfahrt-Terminal in Bremerhaven eingeweiht, http://www2.bremen.de/web/owa/p_anz_presse_mitteilung?pi_mid=79700&pi_back=p_press e%3Fpi_bereich%3DS%26pi_archiv%3D1
- 429. FREIGHTGATE (2000), PSA and P&O buy stake in P-Serv, http://www.freightgate.com/shippingnews/shippingnews.tet?action=viewOnly&db id=167
- 430. FREIGHTGATE (2002), RTG cranes delivered to HDP, http://www.freightgate.com/shippingnews/shippingnews.tet?db id=4279&action=viewOnly
- 431. FRIEDMAN, James W. (1967), "An experimental study of co-operative duopoly", Econometrica, Vol. 35, n° 3-4, pp. 379-397
- 432. FRIEDMAN, James W. (1968), "Reaction functions and the theory of duopoly", The Review of Economic Studies, Vol. 35, n° 3, pp. 201-208
- 433. FRIEDMAN, James W. (1969), "On experimental research in oligopoly", The Review of Economic Studies, Vol. 36, n° 4, pp. 399-415
- 434. FRIEDMAN, James W. (1971), "A noncooperative view of duopoly", International Economic Review, Vol. 12, pp. 106-122
- 435. FRIGOSCANDIA DISTRIBUTION (2005), The Frigoscandia Story, http://www.frigoscandiadistribution.com
- 436. FUNG, Michael K., Leonard K. CHENG and Larry D. QIU (2003), "The impact of terminal handling charges on overall shipping charges: an empirical study", Transportation Research A, Vol. 37, pp. 703 – 716
- 437. FUSILLO, Mike (2003), "Excess Capacity and Entry Deterrence: The Case of Ocean Liner Shipping Markets", Maritime Economics and Logistics, n° 5, pp. 100 115
- 438. GALE, Bradley T. and Ben S. BRANCH (1982), "Concentration versus market Share: which determines performance and why does it matter?", The Antitrust Bulletin, pp. 83-105
- 439. GAMBARDELLA, Luca and Andrea RIZZOLI (2000), The Role of Simulation and Optimisation in Intermodal Container Terminals, 6 p., http://www.idsia.ch/~luca/ess2000.pdf
- 440. GAMBARDELLA, Luca, Andrea RIZZOLI and Marco ZAFFALON (1998), Simulation and Planning of an Intermodal Container Terminal, 10 p., http://www.idsia.ch/~zaffalon/papers/sim marsim.pdf
- 441. GAMBARDELLA, Luca, Gianluca BONTEMPI, Eric TAILLARD, Davide ROMANENGO, Guido RASO and Pietro PIERMARI (1997), Simulation and Forecasting in Intermodal Container Terminal, 5 p., http://www.idsia.ch/~luca/ess96.pdf
- 442. GAN, Denise (2005), PSA Marine, e-mail contact
- 443. GARCIA, Blair (2004), Efficient Marine Terminal Full Scale Demonstration, paper presented at TRB Session 657, 14 januari 2004, 45 p., http://www.transystems.com/presentations/2004/Pres 01 14 04/image001.htm
- 444. GAUDET, Gérard and Stephen W. SALANT (1992), "Towards a theory of horizontal mergers", in NORMAN, George and Manfredi LA MANNA (Eds.), The New Industrial Economics Recent Developments in Industrial Organization, Oligopoly and Game Theory, Edward Elgar Publishing Ltd., Aldershot, England, pp. 137-158
- 445. GAUDET, Gérard and Stephen W. SALANT (1992), The Limits of Monopolization through Acquisition: Further Results, CREST working paper 92-03, 6 p.
- 446. GAVIRNENI, Srinagesh (2001), "Benefits of co-operation in a production distribution environment", European Journal of Operational Research, Vol. 130, n° 3, pp. 612-622
- 447. GELENS, Carine (2005), PSA-HesseNoordNatie, e-mail contact
- 448. GERINGER, J. Michael and Colette A. FRAYNE (1993), "The joint venture partner selection process" in Peter LORANGE, Bala CHAKRAVARTHY, Johan ROOS and Andrew VAN DE VEN (Eds.), Implementing Strategic Processes Change, Learning and Cooperation, Cornwall, T.J. Press Ltd, pp. 253-272
- 449. GEVELCO TRANSPORTGROEP bv (2004), Activiteiten, http://www.gevelco.nl
- 450. GIANNETTI, Alfred C. (2004), Surviving in the Competitive Marine Terminal Industry,

2004, 27 p., http://www.aapa-

ports.org/programs/seminar_presentations/TMT_'04/Giannetti,%20Al.pdf

- 451. GILBERT, Graham (1988), "Containerisation and the Industrial System: An Insider's View", Proceedings of a Conference of the H.R. Nicholls Society at Newcastle 19-21 February 1988, http://www.hrnicholls.com.au/nicholls/nichvol4/vol47con.htm
- 452. GILLEN, David and Douglas COOPER (1995), "Public versus private ownership and operation of airports and seaports in Canada", in PALDA, Filip (Ed.), Essays in Canadian Surface Transportation, The Fraser Institute, http://oldfraser.lexi.net/publications/books/essays/
- 453. GILLIGAN, Thomas, Michael SMIRLOCK and William MARSHALL (1984), "Scale and scope economies in the multi-product banking firm", Journal of Monetary Economics, Volume 13, pp. 393 – 405
- 454. GLADIATOR, Dirk (2000), BALTICOM Deliverable 7.1b Visualization of the Dangerous Goods Locations in the Port of Stockholm, 20 p., http://www.balticom.org/download/reports/Deliverable 7 1b.pdf
- 455. GLOBAL TERMINAL & CONTAINER SERVICES INC. (2003), Global Terminal, http://www.global-terminal.com/
- 456. GLOBAL TERMINAL AND CONTAINER SERVICES INC. (2004), Global Terminal, http://www.global-terminal.com/
- 457. GLOBALSECURITY.ORG (2005), Mina Jebel Ali, http://www.globalsecurity.org/military/facility/jebel-ali.htm
- 458. GOM (REGIONAL DEVELOPMENT AUTHORITY FOR THE PROVINCE OF ANTWERP, 2002), The Port of Antwerp, 72 p., http://www.gomantwerpen.be/
- 459. GOSS, Richard and Henrik STEVENS (2001), "Marginal Cost Pricing in Seaports", International Journal of Maritime Economics, Vol. 3, n°2, pp. 128-138
- 460. GOSS, Richard O (1993), "The consumer's view of port efficiency", in BLAUWENS, Gust, Guido DE BRABANDER en EDDY Van de Voorde (1993), De Dynamiek van een Haven, Pelckmans, Kapellen, pp. 197 209
- 461. GOSS, Richard O. (1979), A Comparative Study of Seaport Management and Administration, London, Government Economic Service, 2 volumes
- 462. GÖTTING, Hans-Heinrich (2001), "Automation and steering of vehicles in ports", Port Technology International, Edition 10, pp. 101 108
- 463. GRAMKE, Lutz (1998), Port Alliances An Assessment of their Feasibility and their Impact on the Transportation Chain, ITMMA, Antwerp, 45 p.
- 464. GRAND BAHAMA ISLAND TOURISM BOARD (2005), Business in Grand Bahama Island, http://www.escapeartist.com/efam4/Grand_Bahama.html
- 465. GREATER HOUSTON PORT BUREAU (2000), "Americana Ships, Stevedoring Services of America and Texas City Get Together to Develop Shoal Point", The Bulletin, April 2000,
- 466. GREEN, Edward J. and Robert H. PORTER (1984), "Noncooperative collusion under imperfect price information", Econometrica, Vol. 52, n° 1, pp. 57-101
- 467. GREMMECKE, Rainer (2000), BALTICOM Deliverable 10.1 Overview of VTS in the Finish Gulf, 20 p., http://www.balticom.org/download/reports/Deliverable_7_1b.pdf

- 468. GRENZEBACK, Lance R., Christina S. CASGAR and M. John VICKERMAN (2001), Building Freight Capacity through Better Operations: Defining the National Agenda, July 26-27, 2001, Long Beach – CA, http://ops.fhwa.dot.gov/freight/freight analysis/freight ops strategies/proceedings.htm
- 469. GRIFFTITS, Tom (2002), U.S. Maritime Security Efforts, 31 p., paper presented at International Union of Marine Insurance Conference, Singapore, 12 15 September 2004, http://www.iumi.com/conferences/2004_Singapore/1509/LTComdTomGriffitts.pps
- 470. GUGLER, Klaus, Dennis C. MUELLER and, B. Burcin YURTOGLU (2002), The Determinants of Merger Waves, University of Vienna, working paper, 45 p.
- 471. GUGLER, Klaus, Dennis C. MUELLER, B. Burcin YURTOGLU and Christine ZULEHNER (2001), The Effects of Mergers: An International Comparison, University of Vienna, Austria, 35 p.
- 472. GÜTH, Werner and Hartmut KLIEMT (1993), Competition or Co-operation?, Tilburg, CentER for Economic Research, 39 p.
- 473. HAARMEYER, David and Peter YORKE (1993), Port Privitization: an International Perspective, Los Angeles, Reason Foundation, 21 p.
- 474. HABIB, Osama (2002), "Chinese firm wins \$21.5m Lebanese crane deal", Khaleej Times, http://www.khaleejtimes.co.ae/ktarchive/180802/finance.htm
- 475. HAFEN FRANKFURT AM MAIN (2004), Daten und Fakten, http://www.hafenfrankfurt.de
- 476. HAFEN HEILBRONN (2004), Stadt Heilbronn 2, http://www.ifb.uni-stuttgart.de
- 477. HAFEN LUDWIGSHAFEN
- 478. HAFEN MANNHEIM (2004), Wasserseitiger Güterumschlag, http://www.hafenmannheim.de
- 479. HÄFEN UND GÜTERVERKEHR KÖLN AG (2003), Zahlen und Fakten, http://www.hgk.de/
- 480. HAGEDOORN, John. (1993), "Understanding the rationale of strategic technology partnering: interorganizational modes of cooperation and sectoral differences", Strategic Management Journal, n°14, pp. 371-385
- 481. HAGEDOORN, Jos en Jos SCHAKENRAAD (1990), Alliances and Partnerships in Biotechnology and Information Technologies, Den Haag, Directie Algemeen Technologiebeleid - Ministerie van Economische Zaken, 66 p.
- 482. HAMBURGER ABENDBLATT (2003), E.H. Harms wird 25, Edition 9 September
- 483. HANDELSKAMMER BREMEN (2003), BLG neuer Gesellschafter bei Dettmer Container Packing, Wirtschaft in Bremen, n°2, p. 5
- 484. HANJIN (2004), U.S.A (Trans-Pacific / Latin America), http://www.hanjin.com
- 485. HANNAH, L. and J.A. KAY (1977), Concentration in modern industry: theory, measurement and the UK experience, London, McMillan, 144 p.
- 486. HANNAN, Timothy H. and Stephen A. RHOADES (1998), "Acquisition targets and motives: the case of the banking industry", Journal of Reprints for Antitrust Law and Economics, Vol. 27, n° 1, pp. 159-168
- 487. HANNO ROTTERDAM (2004), About Hanno Rotterdam bv, http://www.hannorotterdam.nl
- 488. HANNO ROTTERDAM B.V. (2004), ECT acquires Hanno Container Terminal,

http://www.hannorotterdam.nl/hanno/internet/news/NewsPressReleaseEct.asp

- 489. HANSMANN, Henry (1996), The Ownership of Enterprise, Harvard University Press, London, 372 p.
- 490. HARALAMBIDES (2002), "Competition, excess capacity and the pricing of port infrastructure", International Journal of Maritime Economics, n° 4, pp. 323 347
- 491. HARALAMBIDES, Hercules E., Alain VERBEKE, Enrico MUSSO and Marco BENACCHIO (2001), "Port Financing and Pricing in the European Union: Theory, Politics and Reality", International Journal of Maritime Economics, Vol. 3, n°4, pp. 368-386
- 492. HARALAMBIDES, Hercules E., Pierre CARIOU and Marco BENACCHIO (2002), "Costs, benefits and pricing of dedicated container terminals", International Journal of Maritime Economics, n°4, pp. 21 - 34
- 493. HARRELD, Heather (2001), Inventory stockpiling takes supply-chain spotlight, http://archive.infoworld.com/articles/hn/xml/01/10/15/011015hninventory.xml
- 494. HARRIGAN, K.R. (1988), "Joint ventures and competitive strategy", Strategic Management Journal, Chichester, Wiley, Vol. 9, n° 2, p.141-158
- 495. HARRIS (1998), Inland Challenges facing Deep Sea Carriers in Europe, paper presented at Intermodal 98 Conference, Rotterdam, 14 p.
- 496. HARRISON, Robert, Miguel A. FIGLIOZZI and C. Michael WALTON (1999), Mega-Containerships and Mega-Containerports in the Gulf of Mexico: A Litterature Review and Annotated Bibliography, 119 p., http://www.utexas.edu/research/ctr/pdf reports/1833 1.pdf
- 497. HARTMANN, Sönke (2004), "Generating Scenarios for Simulation and Optimization of Container Terminal Logistics", OR Spectrum, Vol. 26, pp. 171-192
- 498. HASPESLAGH, Philippe C. and David B. JEMISON (1991), Managing Acquisitions Creating Value through Corporate Renewal, New York, The Free Press, 416 p.
- 499. HASSAN, Y. Aly, Richard GRABOWSKI, Carl PASURKA and Nanda RANGAN (1990), "Technical, scale, and allocative efficiencies in U.S. banking: an empirical investigation", Review of Economics and Statistics, May, pp. 211-218
- 500. HAUSMAN, Jerry A., Gregory K. LEONARD and Christopher A. VELLTURO (1968), "Market definition under price discrimination", Antitrust Law Journal, Vol. 64, pp. 367-386
- 501. HAWAWINI, Gabriel A. and Itzhak SWARY (1990), Mergers and Acquisitions in the US Banking Industry, Amsterdam, North Holland, 221 p.
- 502. HAYUTH, Yehuda and Douglas K. FLEMING (1994), "Concepts of strategic commercial location: the case of container ports", Maritime Policy and Management, Vol. 21, n°3, pp. 187 193
- 503. HEAVER, Trevor (1995), "The împlications of increased competition among ports for port policy and management", Maritime Policy and Management, Vol. 22, n°2, pp. 125 133
- 504. HEAVER, Trevor (2001), "The evolving roles of shipping lines in international logistics", International Journal of Maritime Economics, Vol. 4, n°4, pp. 210-230
- 505. HEAVER, Trevor (2003), Changing Relationships in International Maritime Logistics, 15p.
- 506. HEAVER, Trevor D. (1993), "Shipping and the market for port services", in BLAUWENS, Gust, Guido DE BRABANDER and Eddy VAN DE VOORDE (Eds.), De Dynamiek van een Haven, Kapellen, Pelckmans, pp. 227 248
- 507. HEAVER, Trevor, Hilde MEERSMAN and Eddy VAN DE VOORDE (2001), "Co-

operation and competition in international container transport: strategies for ports", Maritime Policy and Management, vol. 28, n° 3, pp. 293 - 306

508. HEAVER, Trevor, MEERSMAN, Hilde, MOGLIA, Francesca and Eddy VAN DE VOORDE (2000), "Do mergers and alliances influence European shipping and port competition?", Maritime Policy and Management, vol. 27, n° 4, pp. 363 - 374

- 509. HEINICKE, P.K. (2005), WELOG GmbH und Combitrans amazonas Ltda, e-mail contact
- 510. HELMICK, John (2002), Port and Intermodal Security: The Post 9/11 Environment, 16 p., paper presented at International Union of Marine Insurance Conference, New York, 15-19 September
 2002,

http://www.iumi.com/Conferences/2002_newyork/CargoCommittee/JonHelmick_PortInterm odalSecurity.pps

- 511. HELMUT, Frank (2005), Trimodal Logistik, e-mail contact
- 512. HENESEY, Larry., Fredrik WERNSTEDT and Paul DAVIDSSON (2002), A Market-Based Approach to Container Port Terminal Management, working paper, 6 p., http://www.assert.bth.se/publications/Marketv1.pdf
- 513. HENK, Russell (2003), "Safe and efficient shipping joint research creates a guidebook for inland port developers", Texas Transportation Researcher, Vol. 39, n°1, p. 13
- 514. HENNART, Jean-François (1988), "A transaction costs theory of equity joint ventures", Strategic Management Journal, Vol. 9, pp. 361-374
- 515. HERRERO, José Luis Navarro, Raúl Simarro FERNÁNDEZ, Carlos Ricolfe VIALA and José Luis Poza LUJÁN (2002), Simulador de una Terminal
- 516. HESELER, HEINER (1999), New strategies of port enterprises and their effects on the structures in the seaports, working paper, 18 p., http://www.maritim.uni-bremen.de/ports/global/HESELER1.pdf
- 517. HESELER, Heiner (2000), Development Trends in the Ports of Bremen, working paper, 6 p., http://www.maritim.uni-bremen.de/ports/global/HESELER2.pdf
- 518. HESSENATIE LOGISTICS nv (2005), History, http://www.heslog.be/
- 519. HHLA (2004), HPC assumes building supervision for Dubai Ports Authority, http://www.hamburgportconsulting.de/Press/Dubai_15-9-04-e.pdf
- 520. HHLA (HAMBURGER HAFEN UND LAGERHAUS AG, 2000), Informationssysteme in der Container-Terminal-Logistik, http://www.bwl.unihildesheim.de/aglogistik/vortrag hamburg/Steenken.pdf
- 521. HIGGINS, Thomas, Randolph HALL and Maged DESSOUKY (1999), Comparison of Attributes and Characteristics of Strategic Ports to Agile Port Models, 27 p., http://www.ccdott.org/Deliverables/1997/USC124/comparison.pdf
- 522. HILSKA, Lassi (2001), Market Structure of Port Services in Certain European Ports, 39 p. + annexes,

http://www.mintc.fi/www/sivut/dokumentit/julkaisu/julkaisusarja/2001/ju111201532fin.htm

- 523. HKCTOAL (HONG KONG CONTAINER TERMINAL OPERATORS ASSOCIATION LIMITED, 2003), Port Facilities, http://www.hkctoa.com
- 524. HOEFT, Lisette (2005), BLG Technical Services, e-mail contact
- 525. HOFFMANN, Jan (2001), "Latin american ports: results and determinants of private sector participation", International Journal of Maritime Economics, n° 3, pp. 221 241
- 526. HOFMAN, Paul F. M. (1999), "Trends and developments in skeletal trailers", Port

Technology International, Edition 9, pp. 97 – 99

- 527. HOI KONG CONTAINER SERVICES CO. Ltd. (2004), Scope of Services, http://www.hoi-kong.com.hk
- 528. HOLGUÍN-VERAS, José and Sergio JARA-DÍAZ (1999), "Optimal pricing for priority service and space allocation in container ports", Transportation Research B, Vol. 33, pp. 81-106
- 529. HOLLAND, Tony (1999), Ports for the Future: Private Sector Concessions and Innovation, paper presented at conference Transport for People in the New Millennium, 21 p., http://www.worldbank.org/transport/expopres/holland.ppt
- 530. HOLLMANN (2005), Pushing the Limits, Edition 31 March, p.14-19
- 531. HONG KONG GENERAL CHAMBER OF COMMERCE (HKGCC, 2003), The Chamber Business Website,

http://www.chamber.org.hk/hkdir/r_detail.asp?single=true&cb=HKM0155

- 532. HONG KONG INTERNATIONAL TERMINALS (HIT, 2005), About HIT, http://www.hit.com.hk
- 533. HONG KONG SALVAGE AND TOWAGE (2005), About us, http://www.hktug.com/
- 534. HONG KONG SHIPPERS' COUNCIL (1999), Acquisitions: Maersk-SeaLand marks a Milestone, http://www.tdctrade.com/shippers/vol22_5/vol22_5_sea1.htm
- 535. HONG KONG SHIPPERS' COUNCIL (1999), Rotterdam ECT's new ownership, http://www.tdctrade.com/shippers/vol23_1/vol23_1_ports3.htm
- 536. HONG KONG SHIPPERS' COUNCIL (2000), CT9 project financing pushes through, http://www.tdctrade.com/shippers/vol23_2/vol23_2_ports.htm
- 537. HONG KONG SHIPPERS' COUNCIL (2001), Cargo Transport E-connectivity, http://www.tdctrade.com/shippers/vol24_3/vol24_3_logistics_e06.htm
- 538. HONG KONG SHIPPERS' COUNCIL (2001), CSX World Terminals in Pusan Newport Project, http://www.tdctrade.com/shippers/vol24_5/vol24_5_ports07.htm
- 539. HONG KONG SHIPPERS' COUNCIL (2001b), Name change for Sea-Land Orient, Tianjin, http://www.tdctrade.com/shippers/vol24_5/vol24_5_ports06.htm
- 540. HONG KONG SHIPPERS' COUNCIL (2001c), CSX World Terminals business unit name changes, http://www.tdctrade.com/shippers/vol24_2/vol24_2_port07.htm
- 541. HONG KONG SHIPPERS' COUNCIL (2002), CSX sells stake in Finnish terminal, http://www.tdctrade.com/shippers/vol25_1/vol25_1_seafr11.htm
- 542. HONG KONG SHIPPERS' COUNCIL (2003), Hong Kong Container Throughput, http://www.hkshippers.org.hk
- 543. HONG KONG SHIPPERS' COUNCIL (2003b), China Shipping, Modern Terminals to jointly develop Yang Shan in Shanghai, http://www.tdctrade.com/shippers/vol26 5/vol26 5 ports05.htm
- 544. HONG KONG SHIPPERS' COUNCIL (2003c), CSX World Terminals enter Joint Venture to operate Yantai Port Container Terminal, http://www.tdctrade.com/shippers/vol26 2/vol26 2 ports01.htm
- 545. HOYLE, Brian (1999), "Port concentration, inter-port competition and revitalization: the case of Mombasa, Kenya", Maritime Policy and Management, 1999, vol. 2, n° 2, pp 161-174
- 546. HPH (HUTCHISON PORT HOLDINGS, 2002), Contractor Named for Port of Felixstowe Expansion, http://www.hph.com.hk/news/news/archive/2002/pfl-16dec02.htm

- 547. HPH (HUTCHISON PORT HOLDINGS, 2002b), Capacity Boost for the Port of Felixstowe, http://www.hph.com.hk/news/news_archive/2002/pof-12dec02.htm
- 548. HPH (HUTCHISON PORT HOLDINGS, 2002c), Highest Ever Container Moves at The Port of Balboa, http://www.hph.com.hk/news/news_archive/2002/ppc-17oct02.htm
- 549. HPH (HUTCHISON PORT HOLDINGS, 2002c), Port of Felixstowe Announces Plans for Extra Deep-Water Container Berths, http://www.hph.com.hk/news/news archive/2002/pof-4dec02.htm
- 550. HPH (HUTCHISON PORT HOLDINGS, 2003), OnePort to Strengthen Hong Kong's Competitive Edge, http://www.hph.com.hk/news/news archive/2003/hit-24feb03.htm
- 551. HPH (HUTCHISON PORT HOLDINGS, 2004), HPH develops six Container Terminals in Thailand, http://www.irasia.com/listco/hk/hutchison/press/p041006a.htm
- 552. HPH (HUTCHISON PORT HOLDINGS, 2005), History of HPH, http://www.hph.com.hk
- 553. HUANG, Wen-Chih and Chin-Yuan CHU (2004), "A selection model for in-terminal container handling systems", Journal of Marine Science and Technology, Vol. 12, n°3, pp. 159-170
- 554. HUGHES (2003), "The perils of the level playing field", The Business Times online edition, published July, 17th
- 555. HUMBER FORUM (2004), Humber/Rotterdam Alliance, http://www.humberforum.co.uk/newsstory.asp?id=155
- 556. HUSSAIN, Thomas. (1999), "PSA doubles Stake in Aden Terminal", Cargo News Asia, http://www.cargonewsasia.com/timesnet/data/cna/docs/cna4110.html
- 557. HUSSAIN, Tom (2005), "Dubai shakes up the Global Ports Industry", Fairplay, Edition 13 January, pp. 14-16
- 558. HUTCHISON DELTA PORTS Ltd. (2005), River Ports / Coastal Ports for Asia and Beyond, http://www.hdp.com.hk/
- 559. HUTCHISON WHAMPOA Ltd. (1997), Annual Report 1996 Ports, http://www.irasia.com/listco/hk/hutchison/annual/96/ports1996.htm
- 560. HUTCHISON WHAMPOA Ltd. (1998), Annual Report 1997 Ports, http://www.irasia.com/listco/hk/hutchison/annual/97/ports1997.htm
- 561. HUTCHISON WHAMPOA Ltd. (1999), Annual Report 1998 Ports, http://202.66.146.82/listco/hk/hutchison/annual/98/principa.pdf
- 562. HUTCHISON WHAMPOA Ltd. (2000), Annual Report 1999, http://www.irasia.com/listco/hk/hutchisonweb/eng/investor/annual/annual.htm#ar01
- 563. HUTCHISON WHAMPOA Ltd. (2000b), M.V. "CSCL Xiamen" christened at XICT, http://www.irasia.com/listco/hk/hutchison/press/p001124a.htm
- 564. HUTCHISON WHAMPOA Ltd. (2001), Annual Report 2000, http://202.66.146.82/listco/hk/hutchison/annual/2000/ar2000.pdf
- 565. HUTCHISON WHAMPOA Ltd. (2001), HPH signs agreement to develop Yantian Phase III, http://www.irasia.com/listco/hk/hutchison/press/p011126.htm
- 566. HUTCHISON WHAMPOA Ltd. (2001b), Hutchison Port Holdings and Ningbo Port Authority sign deal to jointly operate and develop Ningbo Beilun Port Phase II http://www.irasia.com/listco/hk/hutchison/press/p010608.htm
- 567. HUTCHISON WHAMPOA Ltd. (2002), Annual Report 2001,

http://202.66.146.82/listco/hk/hutchison/annual/2001/ar2001.pdf

- 568. HUTCHISON WHAMPOA Ltd. (2003), Annual Report 2002, http://www.irasia.com/listco/hk/hutchisonweb/eng/investor/annual.htm#ar02
- 569. HUTCHISON WHAMPOA Ltd. (2003), Annual Review 2002, http://202.66.146.82/listco/hk/hutchison/annual/2002/ports.pdf
- 570. HUTCHISON WHAMPOA Ltd. (2004), Operations Review Ports and Related Services, http://202.66.146.82/listco/hk/hutchison/annual/2002/ports.pdf
- 571. HUTCHISON WHAMPOA Ltd. (2005), Ports and Related Services Overview, http://www.hutchison-whampoa.com/eng/ports/overview.htm
- 572. HUTCHISON WHAMPOA Ltd. (2005b), ZICT(G) commences construction of Phase II project, http://www.irasia.com/listco/hk/hutchison/press/p050428.htm
- 573. HYUNDAI MERCHANT MARINE Co. Ltd. (2002), Voluntary Disclosure regarding Selling of HMM's Domestic Marine Container Terminals, http://www.hmm21.com/hmm/jsp/eng/ir/management/dview/index.jsp?news_id=169
- 574. ICTSI (2002), International Container Terminal Services Inc ("IIHC"), https://server.capgroup.com/capgroup/action/getContent/file/PE/Funds/CIPEF_III/ICTSI_des c.html
- 575. ICTSI (2003), ICTSI Unit buys Marine Terminal Cargo Management Software, http://www.ictsi.com/www/cgi-bin/newsletter/display.asp?newsid=22
- 576. ICTSI (2005), Private Operator takes over operations of the container terminal, http://www.psrctz.com/Press%20Releases/Private%20Operator Container%20terminal1.htm
- 577. ICTSI (2005b), About us, http://www.ictsi.com/
- 578. IFC (INTERNATIONAL FINANCE CORPORATION, 2005), Ocean Sparkle, INFORMARE (2005b), Inaugurato l'MSC Home Terminal del Porto di Anversa, http://www.informare.it/news/gennews/2005/20051106.asp
- 579. INCHCAPE SHIPPING SERVICES (2005), Hutchison wins Thailand's Six-Berth Port Project, http://iss-shipping.com/news/item.asp?niid=1655
- 580. INDIAN EXPRESS NEWSPAPERS (BOMBAY) LTD. (1999), P&O set to bag Contract for Kandla Container Terminal, http://expressindia.com/fe/daily/19990125/02555585.html
- 581. INFOMARINE (2004), Mawan port in China, http://www.infomarine.gr
- 582. INFORMA MARITIME & TRANSPORT (2005), TOC 2005 Newsletter, edition 23 May, http://isg.toc-

events.com/NASApp/cs/ContentServer?pagename=mtevents/home&mtevent=eurotoc05&pag e=news

- 583. INFORMARE (1997), Accordo PSA COSCO per lo Sviluppo del Porto di Taicang (Shanghai), http://www.informare.it/news/gennews/1997/im0130.asp
- 584. INFORMARE (1999), Concessione trentennale di un container terminal nel porto di Pusan all'Evergreen, http://www.informare.it/news/gennews/1999/99-0291.asp
- 585. INFORMARE (1999b), Quattro Gru a Portale della ZPMC di Shanghai per la North Sea Terminal Bremerhaven, http://www.isr.informare.it/news/1999/99-1351.asp
- 586. INFORMARE (1999c), L'alleanza PSA Sinport Interporto di Padova realizzerà un nuovo distripark nel porto di Venezia, http://www.informare.it/news/gennews/1999/99-0131.asp
- 587. INFORMARE (1999d), Progress and Technology,

http://www.informare.it/news/cisco/1999/0599fuk.asp

- 588. INFORMARE (1999e), Studi e ricerche, http://www.informare.it/news/gennews/1999/99-1409.asp
- 589. INFORMARE (1999f), Lo sviluppo dell'E.C.T., http://www.informare.it/news/cisco/1999/0499auk.asp
- 590. INFORMARE (2001), China Shipping e Marine Terminal Corporation costituiranno la società terminalista New Century Terminal Services, http://www.informare.it/news/gennews/2001/20011178.asp
- 591. INFORMARE (2001b), Due milioni di container movimentati dalla Zhuhai International Container Terminals (gruppo Hutchison Port Holdings), http://www.informare.it/news/gennews/2001/20011610.asp
- 592. INFORMARE (2002), P&O Ports entrerà nel mercato terminalistico francese grazie ad un'intesa con CMA CGM, http://www.informare.it/news/gennews/2002/20022257.asp
- 593. INFORMARE (2002b), Un container terminal esclusivo per l'Evergreen nel porto di Oakland, http://www.informare.it/news/gennews/2002/20020959.asp
- 594. INFORMARE (2002c), P&O Ports, China Merchant, Swire Pacific e Modern Terminals danno il via all'ampliamento del container terminal di Shekou, http://www.informare.it/news/gennews/2002/20021422.asp
- 595. INFORMARE (2002d), Nel primo semestre il gruppo Hutchison Port Holdings ha movimentato 16,3 milioni di teu (+31%), http://www.informare.it/news/gennews/2002/20021638.asp
- 596. INFORMARE (2003), China Merchants Holdings (International) ha acquisito da una consociata il terreno su cui sarà costruita la terza fase del Shekou Container Terminals, http://www.informare.it/news/gennews/2003/20031518.asp
- 597. INFORMARE (2003b), A Laem Chabang International Terminal la gestione del container terminal C3 del porto di Laem Chabang, http://www.informare.it/news/gennews/2003/20030645.asp
- 598. INFORMARE (2004), Shipping Conferences, http://www.informare.it/dbase/conferuk.htm
- 599. INFORMARE (2004b), L'Incheon Container Terminal è stato toccato dalla prima nave, http://www.informare.it/news/gennews/2004/20041224.asp
- 600. INFORMARE (2004c), PSA exits Pipavav Port, http://www.informare.it/news/review/2004/b060704.asp
- 601. INFORMARE (2004d), Trasporto intermodale, http://www.informare.it/news/cisco/2004/200408cuk.asp
- 602. INFORMARE (2004e), Studi e ricerche, http://www.informare.it/news/cisco/2004/200411duk.asp
- 603. INFORMARE (2005), Porto di Livorno, http://www.informare.it/harbs/italy/livorno.htm
- 604. INFORMARE (2005b), Inaugurato l'MSC Home Terminal del Porto di Anversa, http://www.informare.it/news/gennews/2005/20051106.asp
- 605. INFORMARE. (1996), 218 Miliardi di Contributi per nove Interporti , http://www.informare.it/news/gennews/sb140.asp
- 606. INFORMARE. (1996b), Aumento del capitale di contship italia da 65 a 81 miliardi di lire, http://www.informare.it/news/gennews/1997/sb127.asp

- 607. INFORMARE. (1997), Il Container Terminal di Gioia Tauro attira l'Attenzione della PSA, http://www.informare.it/news/gennews/1997/sb924.asp
- 608. INFORMARE. (1997b), Giuseppe canepa nuovo amministratore delegato di medexpress italia , http://www.informare.it/news/gennews/1997/im0383.asp
- 609. INFORMARE. (1998), Fusione di Medexpress Italia, Mediterranean Feeders e Camou Marine, http://www.informare.it/news/gennews/1998/im2021.asp
- 610. INFORMATIE.BINNENVAART.NL (2005), Container Terminal Venlo, http://informatie.binnenvaart.nl/info bedrijven.php?idnr=65
- 611. INSTITUTE OF SHIPPING LOGISTICS (ISL, 2004), ISL Shipping Statistics and Market Review 2003,

http://www.isl.org/products_services/publications/samples/cargo.shtml.en

- 612. INTELS (2002), Port Facilities, http://www.intels.co.uk
- 613. INTERFIN TRADE (2004), NLMK in Talks to Buy two Large Terminals of Saint-Petersburg Seaport, http://interfintrade.com/main/news/company_news?n_id=596
- 614. INTERNATIONAL BUSINESS DATA (2001b), Shanghai Container Dock Co., Ltd, http://www.newsmax.com/archives/articles/2001/6/12/210339.shtml
- 615. INTERNATIONAL PORT SERVICES CO Ltd.. (2005), The Company, http://www.ipscol.com
- 616. INTRACO Ltd. (2002), Divestment of Shares in CWT Distribution Limited, http://www.myintraco.com.sg/corp_news/dsp_article.cfm?target=7051690
- 617. IOANNOU, P.A., E.B. KOSMATOPOULOS, H. JULA, A. COLLINGE, C.-I. LIU, A. ASEF-VAZIRI and Ed Jr. DOUGHERTY (2001), Cargo Handling Technologies Final Report, 147 p.,

http://www.usc.edu/dept/ee/catt/2002/jula/Marine/FinalReport_CCDoTT_97.pdf

- 618. IRPT (INLAND RIVERS PORTS AND TERMINALS, 2004), About the waterways, http://www.irpt.net
- 619. JAFZA (JEBEL ALI FREE ZONE AUTHORITY, 2005), History, http://www.jafza.co.ae
- 620. JAMES, Arhur P., John M. HOWARD, John P. BASILOTTO and Heather HARBOTTLE (1999), Megaports and Load Centers of the Future with the Port of Houston as the Baseline Port, Research Report 467404-1, 203 p., http://swutc.tamu.edu/Reports/467404-1.pdf
- 621. JAMISON, Mark A. (2000), Market Concentration and Incentives to Discriminate Against Rivals in Network Industries, University of Florida, 30 p.
- 622. JANSSON, Jan Owen and Dan SHNEERSON (1982), Port Economics, Cambridge (Massachusetts), M.I.T. Press, 183 p.
- 623. JARA-DÍAZ, Sergio, Eduardo MARTÍNEZ-BUDRÍA, Cristián E. CORTÉS and Leonardo BASSO (2002), "A multioutput cost function for the services of Spanish ports' infrastructure", Transportation, Vol. 29, n°4, pp. 419-437
- 624. JAU, Irvin Lim FANG (2002), Not Yet All Aboard ... But Already All at Sea Over the Container Security Initiative, http://www.homelandsecurity.org/journal/articles/jau.html
- 625. JBIC (JAPAN BANK FOR INTERNATIONAL CO-OPERATION, 1999), Shenzen Dapeng Bay Yantian Port 1st Phase Project, 3 p., http://www.jbic.go.jp/english/oec/post/1999/pdf/20.pdf
- 626. JESPERS, Patrick (1991), Samenwerkingsverbanden tussen ondernemingen: strategische

implicaties, Antwerpen, 201 p.

- 627. JIN, Zhang and Jiang WEI (2005), Maersk banking on booming Economy, http://english.runsky.com/homepage/english/news/biz/userobject1ai531494.html
- 628. JINKS, Beth (2003), "Shenzen Port's Box Throughput soars 40%", Shipping Times, http://business-times.asia1.com.sg/sub/shippingtimes/story/0,4574,90255,00.html
- 629. JINKS, Beth (2003b), "Laem Chabang tender given to P&O Ports-led group", Shipping Times, http://business-times.com.sg/sub/shippingtimes/story/0,4574,76748,00.html
- 630. JOHNSON, LIZ (2005), Port of Houston Authority, e-mail contact
- 631. JOSEPH, Anto T. (2003), "Stars on Indian Horizon", Times Shipping Journal, http://www.etshipping.com/feb2003/spotlight02.html
- 632. JOSEPH, Anto T. (2004), "Dubai Ports highest bidder for Cochin container terminal", The Economic Times Online, http://economictimes.indiatimes.com/articleshow/582536.cms
- 633. JOSEPH, Anto T. (2004b), "Dubai Ports eyes more terminals in India", The Economic Times Online, http://economictimes.indiatimes.com/articleshow/msid-964485,prtpage-1.cms
- 634. JOURNAL OF COMMERCE ONLINE (2003), Award for APM's Jamica Terminal, November 18
- 635. JTC CORPORATION (2002), Press Release 31 January 2002, http://www.jtc.gov.sg/corporate/media+room/31jan2002.asp
- 636. JUHEL, Marc H. (2001), "Globalisation, Privatisation and Restructuring of Ports", International Journal of Maritime Economics, Vol. 3, n°2, pp. 139-174
- 637. JWD GROUP (2003), U.S. Container Terminal Throughput Density, http://www.portofhouston.com/pdf/genifo/POHA-BayportCapacity.pdf
- 638. KADER, Basheer Hassan Abdul (2001), Northport Future Growth Plans, http://www.porttechnology.org/journals/ed14/pdfs/pt14 27.pdf
- 639. KÄLLSTRÖM, Lars en Christiane WARNECKE (1998), Competitiveness of Port Terminals: Findings of the EU-sponsored Project Euroborder, Hamburg, 10 p.
- 640. KALMAR INDUSTRIES (2004), Kalmar state-of-the-art RTGs to handle growing Red Sea Container Volumes, http://www.kalmarind.com/show.php?id=16884
- 641. KAMIEN, Morton I. And Israel ZANG (1990), "The limits of monopolization through acquisition", Quarterly Journal of Economics, Vol. 105, May, pp. 465-499
- 642. KANTARELIS, D. and E.C.H. VEENDORP (1988), Live and let live type behavior in a multimarket setting with demand fluctuations, Journal of Economic Behavior and Organization, Vol. 10, n°2, pp. 235-244
- 643. KARACHI PORT TRUST (2005), K.P.T. Projects, http://www.kpt.gov.pk/Projects/Proj.html
- 644. KCTA (2003), Port of Pusan Container Throughput (2003.4.), http://www.kca.or.kr/eng/statis/data/eng02/eng02 200304.xls
- 645. KCTA (KOREA CONTAINER TERMINAL AUTHORITY, 2003), Duties and Business, http://www.kca.or.kr
- 646. KENT, Paul E. and Anatoly HOCHSTEIN (1998), "Port reform and privatization in conditions of limited competition: the experience in Colombia, Costa Rica and Nicaragua", Maritime Policy and Management, Vol. 25, n°4, pp. 313-333
- 647. KESSELL, Clive W. (2001), Par & Fowey Ports Information, 14 p., http://www.foweyharbour.co.uk/pdf/parandfoweyinformation.pdf

- 648. KHAN, Fazilette (2002), "Removing barriers", Cargo Systems, February 2002
- 649. KIA, M., E. SHAYAN and F. GHOTB (2002), "Investigation of port capacity under a new approach by computer simulation", Computers and Industrial Engineering, Vol. 42, pp. 533-540
- 650. KIEFER, Britt (2005), Eurogate, e-mail contact
- 651. KIERAN, Peter(2003), World Trends in Shipping and Port Reform, paper presented at Port Reform Seminar, South Africa, 22-23 January 2003, 28 p., http://www.dpe.gov.za/resourceLib/Peter%20Kieran_World%20Trends%20in%20Shipping% 20and%20Port%20Reform.pdf
- 652. KIM, Hak-So (2003), The Strategy of Developing a N.E. Asia Logistics Hub in Korea, paper presented at Workshop on Shipping and Port Development Policy, 30 March 20 April 2003, Seoul, http://www.kmi.re.kr/english/public/html/koica/2003/2.PDF
- 653. KIM, Moshe and Arie SACHISH (2004), "The structure of production, technical change and productivity in a port", The Journal of Industrial Economics, Vol. 35, n°2, pp. 209-223
- 654. KING, D. Harry (1999), "Computer Simulation of Ports and Terminals", Port Technology International, Edition 8, pp. 227 229
- 655. KING, Stephen P. (1998), "Short of a merger: the competitive effects of horizontal joint ventures", Competition and Consumer Law Journal, n° 6, pp. 227-245
- 656. KKNA (KAMER VAN KOOPHANDEL EN NIJVERHEID VAN ANTWERPEN-WAASLAND, 2005), "Dossier Waaslandhaven", Ondernemers, pp. 3-26
- 657. KLAPWIJK-RAPIDE bv (2004), Terminal Operators and Stevedores, http://www.klapwijk-rapide.nl/
- 658. KLEIN, Michael (1996), Competition in Network Industries, Washington, The World Bank Private Sector Development Department, 31 p.
- 659. KLETTE, Tor Jakob (1999), "Market Power, Scale Economies and Productivity: Estimates From a Panel of Establishment Data", Journal of Industrial Economics, Volume 47, n°4, pp. 451-476
- 660. KLINGER, Peter (2004), "Greeks eye tanker operator", Times Online, http://business.timesonline.co.uk/article/0,,9077-1185359,00.html
- 661. KLINGMAN, D. and J.M. MULVEY (1981), Network Models and Associated Applications, Holland Publishing Company, Amsterdam, 176 p.
- 662. KNV GOEDERENVERVOER (2001), SNCF Participations neemt Féron over om Havenambities te onderbouwen, http://keurmerk.knv.nl/goederenvervoer/Actueel/Info's%202000/info's%20december%20200 0/info's%201-12-2000.htm
- 663. KOCH, Peter (1999), "Very Heavy Cable Trolley Energy Supply Systems for Super Container", Port Technology International, Edition 9, pp. 49 52
- 664. KOGUT, Bruce (1988), "Joint ventures: theoretical and empirical perspectives", Strategic Management Journal, Vol. 9, n° 4, pp. 319-332
- 665. KOK, Janny (2001), "Maersk Sealand heeft belangstelling voor eigen terminal in Antwerpen – Douanecontroles volgens het boekje werken vertragend in Rotterdam", De Lloyd, edition 18 January, p. 3
- 666. KOK, Janny (2001b), "Hutchison Whampoa wil meerderheid in ECT situatie Rotterdamse markt heeft zich gewijzigd", De Lloyd, edition 16 October, p. 1

- 667. KOK, Janny (2003), "E-seal' wordt essentiële Schakel in Veiligheidsnetwerk voor Containerlogistiek", De Lloyd, edition 22 May, p. 3
- 668. KOK, Janny (2004), "Alarm over growing EU Port Congestion", Fairplay, edition 12 August, p. 14
- 669. KONINGS (1996), "Integrated centres for the transshipment, storage,
- 670. KORFF, Lueder (2005), Bremerhavener Kühlhäuser GmbH, e-mail contact
- 671. KOZAN, E. (2000), "Optimising Container Transfers at Multimodal Terminals", Mathematical and Computer Modelling, Vol. 31, pp. 235 – 243
- 672. KRAFT, Stefan (2005), PHH Personaldienstleistung Hafen Hamburg GmbH, e-mail contact
- 673. KURANE, Supriya (2004), "Beyond the hubbub. An old plan is revived. But will it fare any better this time?", Businessworld, http://www.businessworldindia.com/july2604/indepth06.asp
- 674. KURSTJENS, S.T.G.L., R. DEKKER, N.P. DELLAERT, M.B. DUINKERKEN, J.A. OTTJES and J.J.M. EVERS (1996), Simulation Studies on Inter Terminal Transport at the Maasvlakte, 21 p., paper presented at 2nd TRAIL Ph.D. Congress, May 1996, Rotterdam, http://www.ocp.tudelft.nl/tt/users/duinkerk/papers/rot9605a.pdf
- 675. KUSZEJ, J. (2005), ATS Autoterminal Slask Logistic sp. z oo, e-mail contact
- 676. KWAST, Myron L., Martha STARR-MCCLUER and John D. WOLKEN (1997), "Market definition and the analysis of antitrust in banking", Antitrust Bulletin, 42 (Winter), pp. 973-995
- 677. KWOKA, John E. (1992), "The output and profit effects of horizontal joint ventures", The Journal of Industrial Economics, Vol. 40, n° 3, pp. 325-338
- 678. La Laguna, 9-11 September 2002, http://www.ceaifac.es/actividades/jornadas/XXIII/documentos/ja02_062.pdf
- 679. LAASER, Claus.-Friedrich, Henning SICHELSCHMIDT, Rüdiger SOLTWEDEL and H. WOLF (2000). Global Strategic Alliances in Scheduled Air Transport Implications for Competition Policy. Kieler Diskussions-beiträge, 370, Kiel, Institut für Weltwirtschaft, October
- 680. LACOSTE, Romuald and Nicolas TERRASSIER (2001), La Manutention Portuaire Conteneurs: les Opérateurs Internationaux – Perspectives européennes, ISEMAR, synthèse n° 39, 4 p., http://www.isemar.asso.fr/syntheses/pdf/39.pdf
- 681. LADDUWAHETTY, RAVI (2003), "P&O to market Colombo among best regional ports", Daily News, http://origin.dailynews.lk/2002/08/22/bus01.html
- 682. LAM, Alan (2004), Active In Acquiring Terminals In Oversea and Mainland, 4 p., http://www.gtja.com.hk/english/2zxhq/yjbg/ShowNews.asp?newsid=198&newscateid=2
- 683. LANDES, William M. and Richard A. POSNER (1981), "Market power in antitrust cases", Harvard Law Review, Vol. 94, n° 5, pp. 937-996
- 684. LANDESHAUPTSTADT DÜSSELDORF (2003), Neue Gesellschaft geht an den Start/Drittgrößter deutscher Binnenhafen, http://www.duesseldorf.de
- 685. LÄPPLE, Dieter (2000), The Port of Hamburg: Containerfloodgate or Logistic Service Centre?, working paper, 18 p., http://www.maritim.uni-bremen.de/ports/global/LAEPPLE.pdf
- 686. LE LLOYD (2000), Quelle place pour la SNCB dans la HesseNoord Natie?, edition 7 December

687. LEE, Der-Horng and Living SONG (2003), Optimizing Security Operations in Seaports using Genetic Algorithms, http://www.isye.gatech.edu/setra/reports/security_NUS.pdf

688. LEGIFRANCE (2003), Décrets, arrêtés, circulaires, http://www.legifrance.gouv.fr/WAspad/UnTexteDeJorf?numjo=EQUK0300238A

- 689. LEGLAY, Alain (2004), "Inter Ferry Boats in 2004 uit rode cijfers", De Lloyd, edition 2 September, p. 1
- 690. LEMMENS, Filip (1991), Samenwerkingsvormen tussen Luchtvaartmaatschappijen eindverhandeling, Antwerpen, UFSIA, 161 p.
- 691. LENG, Goh Yew, Leong Kim HOCK, Shu Tai YONG and Paul WONG (2002), Kaohsiung's Port Strategic Plan for Growth, 71 p., http://www.nanyangmba.ntu.edu.sg/bsm/Taiwan Taipei%20PDF/Group%2003.pdf
- 692. LEONARS, Joris (1996), Produktiviteit van Containerbehandeling Integratie in de Totale Transportketen, Universiteit Antwerpen, 11 p. + annexes
- 693. LEWIS, Brian (2002), Background Information Regarding the Port of Singapore and the Port of Savannah, 20p., http://www.isye.gatech.edu/research/files/white-2002-01.pdf
- 694. LEWIS, Brian (2002b), Background Information Regarding the Port of Rotterdam, 8 p., http://www.isye.gatech.edu/research/files/white-2002-06.pdf
- 695. LEWIS, Brian (2002c), Port Security: Container Inspection Technology, http://www.isye.gatech.edu/research/files/white-2002-02.pdf
- 696. LEWIS, Brian M., Alan L. ERERA and Chelsea C. WHITE III (2002), Efficient Container Security Operations at Transshipment Seaports, http://www.isye.gatech.edu/setra/reports/IEEE Aug 16.pdf
- 697. LI KA SHING FOUNDATION Ltd. (2005), About us, http://www.lksf.org/eng/about/likashing/index.shtml
- 698. LING-SAN, Lin (2003), Port of Kaohsiung, The Baltic Asia-Pacific Shipping 2003, http://www.stroudgate.net/aps/articles/069.html
- 699. LINN, Richard J. (2003), Container Yard Management, 5 p., http://faculty.eng.fiu.edu/~linn/Ein5346/Container Yard management.ppt
- 700. LIU, Chin-I, Hossein JULA and Petros A. IOANNOU (2002), "Design, simulation, and evaluation of automated container terminals", EE Transactions on Intelligent Transportation Systems, Vol.3, n°1, pp. 12 – 26
- 701. LLOYD'S LIST (2003)
- 702. LOBO, Antonio and Vivek JAIN (2003), Port Users' Perspective of the Container Transhipment Business - Hierarchy of Service Quality Attributes and Dimensions, http://www.singaporemaritimeportal.com/SMP_jour_abstract2002.htm#PortUsers
- 703. LOGISTICS PILOT (2001), EUROGATE 2000: Terminals achieve record in container handling and results, http://www.logistics-pilot.de/en/article_show.php?article=81
- 704. LOGISTICS PILOT (2001b), Contship Italia goes North, http://www.logisticspilot.de/en/news.php?monat=2001-06&option=more
- 705. LOGISTICS PILOT (2001c), BLG LOGISTICS GROUP with Record Results, http://www.logistics-pilot.de/en/article_show.php?article=89
- 706. LOGISTICS PILOT (2002), EUROGATE welcomes decision in favour of Gioia Tauro, http://www.logistics-pilot.de/en/news.php?monat=2002-01&option=more
- 707. LOGISTICS PILOT (2002b), Neues Rekordergebnis im Seegüterumschlag,

http://www.logistics-pilot.de/de/article show.php%3Farticle%3D159&e=9707

- 708. LOGISTICS PILOT (2002c), Das Lebenswerk von E. H. Harms, http://www.logisticspilot.de/de/article_show.php?article=227
- 709. LOGISTICS PILOT (2003), Eurogate peilt 10 Mio.-TEU-Marke an, http://www.logisticspilot.de/de/article show.php?article=301
- 710. LOGISTICS PILOT (2004), Innovation as the driving force behind development, http://www.logistics-pilot.de/en/news.php?monat=2002-02&option=more and http://www.zeitsprung.blg.de/innovation de/innovatx1 en.html
- 711. LOKUGE, Prassana, Damminda ALLAHAKOON and Parakrama DISSANAYAKE (2003), Intelligent Scheduling and Monitoring of Electronic Data Transfers in Container Terminal Operations in Sea Port, 6 p., http://www.cssl.lk/conferences/prasanna%20lokuge%20letter%20size.doc
- 712. LÜHRSSEN, Angelika (2005), EH Harms Automobil-Transporte, e-mail contact
- 713. LUIKNATIE GROUP (2004), Port Operations Logistics, http://www.luiknatie.be/
- 714. LUO, Meifeng and Thomas A. GRIGALUNAS (2002), "A spatial-economic multimodal transportation simulation model for US coastal container ports", Maritime Economics and Logistics, Vol. 5, n° 2, pp. 158-178
- 715. LUXNER NEWS INC. (2000), Caribbean: Rivalry for Transshipnt Business, http://www.luxner.com/cgi-bin/view_article.cgi?articleID=749
- 716. LUYKX, Pieter (2002), Het Containertransport van de Oostkust van de V.S. naar West-Afrika, Antwerpen, Universiteit Antwerpen, 123p. + annexes
- 717. LYNK, William J. (1995), "Nonprofit hospital mergers and the exercise of market power", The Journal of Law and Economics, Vol. 38, n° 2, pp. 437-461
- 718. MAERSK (2000), Annual Accounts 1999, http://www.maersk.com/pdf/UK/prelim_1999.pdf
- 719. MAERSK (2004), A.P Moller Maersk Group Invests in Xiamen Port, http://www.maersk.com
- 720. MAERSK (2005), History, http://www.maersk.com
- 721. MALCHOV, Matthew and Adib KANAFANI (2001), "A disaggregate analysis of factors influencing port selection", Maritime Policy and Management, Vol. 28, n° 3, pp. 265 – 277
- 722. MALTA TODAY (2001), Malta Freeport under Threat from Sardinia Facility, http://www.maltatoday.com.mt/2001/0617/local6.html
- 723. MANGAN, John, Chandra LALWANI and Bernard GARDNER (2001), "Identifying Relevant Variables and Modelling the Choice Process in Freight Transportation", International Journal of Maritime Economics, Vol. 3, pp. 278-297
- 724. MANOJ, P. (2004), "Dubai Port Intl's acquisition of CSX World Terminals A box of benefits for Kochi ICTT", The Hindu Business Line, http://www.thehindubusinessline.com/2004/12/20/stories/2004122000190600.htm
- 725. MANOJ, P. (2004b), "Dubai Ports set to win bid to build ICTT at Kochi", The Hindu Business

http://www.thehindubusinessline.com/2004/03/26/stories/2004032601860600.htm

726. MARCHESE, Ugo, Claudio FERRARI and Marco BENACCHIO (2000), L'efficienza Tecnica delle Imprese Terminaliste dedicate alla Movimentazione di Container: un Approccio

DEA (Data Envelopment Analysis), http://www.informare.it/news/iget/2000/dea.asp

- 727. MARCUS, Henry S. and Costas BARDJIS (2003), The Role of Competitive Strategies in the International Liner Industry, 28 p.
- 728. MARDEP (GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION OF THE PEOPLE'S REPUBLIC OF CHINA MARINE DEPARTMENT, 2003), Welcome Message, http://www.mardep.gov.hk
- 729. MARDEP (GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION OF THE PEOPLE'S REPUBLIC OF CHINA MARINE DEPARTMENT, 2004), The Shipping Directory of Hong Kong the place to do business, http://www.mardep.gov.hk
- 730. MARGES, Kees (2002), Privatisation of the Seaports as a Challenge for Trade Unions, working paper, 24 p., http://www.maritim.uni-bremen.de/ports/global/MARGES1.pdf
- 731. MARGES, Kees (2002b), Eurogate stelt Plannen voor Uitbreiding in Rusland uit, http://www.fnvrotterdam.info/wh10.htm
- 732. MARGES, Kees (2004), "Aanpassing Management Structuur van de Singaporese Network Terminal Operator", Wereldhavens, http://www.fnvrotterdam.info/wh71.htm
- 733. MARÍN, Pedro L. (1995), "Competition in European aviation: pricing policy and market structure", Journal of Industrial Economics, Vol. 43, n° 2, pp. 141-159
- 734. MARINE DIGEST (2003), High Tech Systems Expand at U.S. Box Terminals, Marine Digest Cargo Business News, July 2003, http://www.marinedigest.com
- 735. MARITIME AND PORT AUTHORITY OF SINGAPORE (2003a), Roles of MPA, http://www.mpa.gov.sg/
- 736. MARITIME AND PORT AUTHORITY OF SINGAPORE (2003b), "Port Development Plans", Singapore Maritime Portal, http://www.mpa.gov.sg/
- 737. MARITIME GLOBAL.NET (2001), "PSA signs up with Guangzhou", Hong Kong Shipping News International, Issue 183, p. 2
- 738. MARLOW, Peter and Ana Cristina PAIXAO (2002), Measuring Lean Ports Performance, 33 p., paper presented at IAME Conference, 13-15 November 2002, Panama, http://www.eclac.cl/transporte/perfil/iame_papers/proceedings/Marlow_et_al.doc
- 739. MARTIN, Jeffrey and Brian J. THOMAS (2001), 'The container terminal community', Maritime Policy and Management, vol. 28, n°3, pp. 279-292
- 740. MARTIN, Stephen (1994), Industrial Economics Economic Analysis and Public Policy, New York, Macmillan, 623 p.
- 741. MARTIN, Stephen (2001), Advanced Industrial Economics, Oxford, Blackwell Publishing Ltd., 552 p.
- 742. MARYLAND PORT ADMINISTRATION (2002), Nick Taro on APM Terminals, http://www.mpa.state.md.us/news/pobmag/POB%20June%20Taro%20Inter.pdf
- 743. MARYLAND PORT ADMINISTRATION (2005), Facilities, http://www.mpa.state.md.us/facil/index.htm
- 744. MAS-COLELL, Andreu, Michael D. WHINSTON and Jerry R. GREEN (1995), Microeconomic Theory, Oxford, Oxford University Press, 981 p.
- 745. MASSAC, G (1998), "Le transport maritime par conteneurs : concentrations et globalisation", AGM-ITA Revue, n°43, April 1998, http://www.amicale-ensta.org/revue/TA43/Le_transport_maritime_par_conteneurs.html
- 746. MASSCHELIER, William (2004), informal meeting

- 747. MASTROLILLI, Monaldo., Nicoletta FORNARA, Luca GAMBARDELLA, Andrea RIZZOLI, Marco ZAFFALON (2000), "Simulation for policy evaluation, planning and decision support in an intermodal container terminal", in MERKURYEV, Y., A. BRUZZONE and L. NOVITSKY (ed), Proceedings of the International Workshop "Modelling and Simulation within a Maritime Environment", 6-8 September, 1998, Riga, Latvia, pp. 33-38
- 748. MAUDRICH, Eckart (2000), BALTICOM
- 749. MBZ nv (MAATSCHAPPIJ DER BRUGSE ZEEVAARTINRICHTINGEN nv, 2004), Beleidsplan MBZ nv, http://www.zeebruggeport.be/N/beleidsplan.doc
- 750. MC GRAW HILL CONSTRUCTION (2002), Beijing approves 3rd phase of Shenzhen's Yantian port project, http://www.construction.com/beijing2008/2002/12/02/xn/0000-6097-KEYWORD.Missing.asp
- 751. MCAFEE, R. Preston, Joseph J. SIMONS and Michael A. WILLIAMS (1992), "Horizontal mergers in spatially differentiated non-cooperative markets", The Journal of Industrial Economics, Vol. 40, n° 4, pp. 349-358
- 752. MCCALL, Alan S. (1980), "Economies of scale, operating efficiencies and the operational structure of commercial banks, Journal of Bank Research, Vol. 11, pp. 95-100
- 753. MCCALLUM, J. (1995), "National borders matter: Canada-US regional trade patterns", American Economic Review, Vol. 85, pp. 615-623
- 754. MEERSMAN, Hilde en Eddy VAN DE VOORDE (2001), "International logistics: a continuous search for competitiveness", in BREWER, A.M. (edit), Handbook of Logistics and Supply-Chain Management, Oxford, Pergamon, pp. 61 77
- 755. MEERSMAN, Hilde, Eddy VAN DE VOORDE and Thierry VANELSLANDER (2003), The Industrial Economic Structure of the Port and Maritime Sector: an Attempt at Quantification, paper presented at NAV 2003 conference, Palermo, 25th april 2003
- 756. MEERSMANS, Patrick J.M. and Rommert DEKKER (2001), Operations Research supports container handling, Economic Institute Report EI 2001-22, 22 p., http://www.eur.nl/WebDOC/doc/econometrie/feweco20011102151222.pdf
- 757. MEYER, Ingo (2005), E. H. Harms GmbH & Co. KG Automob il-Transporte Niederlassung Wallenhorst, e-mail contact
- 758. MEYER, Sabine (2005), NTT 2000, e-mail contact
- 759. MEZEK, Karl (2005), Binnenschiffe, http://www.binnenschifferheinruhr.de/schiffe/binnenschiffe i.php
- 760. MICCO, Alejandro J. and Natalia PEREZ. (2001), "Puertos y transporte", Economic and Social Progress in Latin America, http://www.iadb.org/res/publications/pubfiles/pubB-2001S 1684.pdf
- 761. MIGLIOR, Aldo, Gian Paulo RITOSSA, Fausta CADONI and Cristiano DIAZ (2003), A Multi-purpose, Flexible Model of Wharf Productivity for Container Terminals, 10 p., paper presented at NAV 2003, International Conference on Ship and Shipping Research
- 762. MILLINGTON, Julie and George DOCWRA (1998), The Economic Performance of Bulk Port Terminals: An Empirical Analysis of Coal Export Terminals, paper presented at WCTR 8, Antwerp, 12-16 July 1998, 18p.
- 763. MIN, Chua Hui (2002), "PSA extends Reach overseas through Portnet.com Unit", Business Times, http://it.asia1.com.sg/newsdaily/news007_20020603.html

- 764. MIN, Hokey and Zijian GUO (2004), "The location of hub-seaports in the global supply chain network using a cooperative competition strategy", International Journal of Integrated Supply Management, Vol. 1, n°1, pp. 51-63
- 765. MINISTRY OF MARITIME AFFAIRS AND FISHERIES (2003), Private Investment, http://www.momaf.go.kr
- 766. MINTIENS, Guy (2001), "Toegang van 'vliegende naties' tot haventerminals blijft probleempunt AGHA-resolutie opnieuw onder de loep", De Lloyd, edition 16 October, p. 2
- 767. MINTIENS, Guy (2002), "Verdere aanpassing port package blijft crucial" ESPO en Feport in gezamenlijke reactie op tweede ontwerp havenrichtlijn", De Lloyd, edition 19 March, p. 1 and 3
- 768. MITSUI ENGINEERING & SHIPBUILDING CO., LTD (2003), Container Crane Ordered by Naha Port Authority, Okinawa - Specially Designed Crane for Naha Port Conditions, http://www.mes.co.jp/english/press/2003/20031008.html
- 769. MITSUI OSK LINES (2004), Beibu Gulf Towing Company Starts Operation, http://www.mol.co.jp/pr-e/2004/e-pr-2402.html
- 770. MLIT (2005), Ministry of Land, Infrastructure and Transport Government of Japan, http://www.mlit.go.jp/english/white-paper/unyu-whitepaper/1996/1996000008.html
- 771. MODERN TERMINALS (2003), "Modern Terminals and China Shipping Terminal form Partnership to develop Yang Shan Deepwater Port", http://www.modernterminals.com/eng/news/press/030815.htm
- 772. MODERN TERMINALS Ltd. (2004), The Company in brief, http://www.modernterminals.com
- 773. MOGLIA, Francesca (2004), Organisational Structures of the Port Authorities, paper presented at seminarAutorità Portuale di Genova.
- MONGELLUZZO, Bill (2002), "Starting from scratch", The Journal of Commerce, Vol. 3, Issue 27, July 8-14, p. 30 31
- 775. MONGELLUZZO, Bill (2003), "Eight is Enough Special Report International Port and Terminal Operators", The Journal of Commerce, 24-30 March 2003
- 776. MULLET, Randy, Alejandra PALMA, Anusha SENEVIRATNE and Marco RODRIGUEZ (2004), Intermodal Container Security in the Post 9/11 Era, 58 p.
- 777. MURTY, KattaG., Jiyin LIU, Yat-wah WAN and Richard LINN (2003), "A DSS (Decision Support System) for Operations in a Container Terminal", to appear in Decision Support Systems, http://www-personal.engin.umich.edu/~murty/DSSpaper.pdf
- 778. MUSSO, Enrico (1998), "I porti: costi interni ed esterni, pianificazione del territorio, ruolo dei sistemi locali", European Transport/Trasporti Europei, Issue 8-9
- 779. MUSSO, Enrico (2004), Ports: Competition and Competitiveness, Course of Maritime and Port Economics 2004-2005, University of Antwerp, 83 p.
- 780. MUSSO, Enrico, Claudio FERRARI and Marco BENACCHIO (1998), "Port terminal sizing and its consequences on maritime transport efficiency", in SCIUTTO, G. and C.A. BREBBIA (eds.), Maritime Engineering and Ports, Boston-Southampton, WIT-Press – Computational Mechanics Publications, pp. 325 - 336
- 781. MUSSO, Enrico, Claudio FERRARI and Marco BENACCHIO (2001), Co-operation in Maritime and Port Industry and its Effects on Market Structure, paper presented at WCTR 9, Seoul, 20 p.

- 782. MUSSO, Enrico, Marco BENACCHIO and Claudio FERRARI (2000), The Economic Impact of Ports on Local Economics, working paper, 36 p., http://www.maritim.uni-bremen.de/ports/global/BENACC2.pdf
- 783. MY LOGISTICS (2005), EUROKOMBI-Bahnhof für kombinierten Ladungsverkehr geht am 1. Juli in Betrieb, http://www.mylogistics.net/de/news/themen/key/news30645/jsp
- 784. NAFED (NATIONAL AGENCY FOR EXPORT DEVELOPMENT, 1996), JICT plans International-standard Seaport, http://www.nafed.go.id/news/index.php?artc=750
- 785. NAIR, VIPIN V. AND C.J. PUNNATHARA (2005), "Concor to hold 15% Stake in Dubai Ports' India Gateway", The Hindu Business Line, http://www.thehindubusinessline.com/2005/02/17/stories/2005021700780700.htm
- 786. NAM, Ki-Chan (1999), "Determination of handling systems at Pusan new port", Port Technology International, Edition 8, pp. 85 87
- 787. NAM, Ki-Chan and Won-Ik HA (2001), "Evaluation of handling systems for container terminals", Journal of Waterway, Port, Coastal and Ocean Engineering, Volume 127, n°3, pp. 171-175
- 788. NATIONAL BANK OF BELGIUM (2003), Economisch Belang van de Zeehavens Haven van Antwerpen, 69 p.
- 789. NATIONAL BANK OF BELGIUM (2004), Economisch Belang van de Vlaamse Zeehavens Verslag 2002, 172 p.
- 790. NAUMENKO, Norbert (2005), Hansa Marine Transport, e-mail contact
- 791. NAVINGO (2003), Hutchison vergroot Belang in ECT, http://www.maritiemnieuws.nl/artikel.php?cat=havens&id=1602
- 792. NAVIS (2003), "One of the world's most innovative container terminals to implement Navis software", Navis What's New Press Releases, http://www.navis.com
- 793. NAWAS, Mike Eugene (1995), Management van Fusie en Integratie: de Vorming van ABN-AMRO, Tilburg, Tilburg University Press, 326 p.
- 794. NEDERLANDS MINISTERIE VAN VERKEER EN WATERSTAAT (2004), Zeehavens, Ankers van de Economie, 104 p., http://www.minvenw.nl/cend/bsg/brieven/data/1099406716.pdf
- 795. NEVA (2003), Vostochny International Container Service, http://www.setcorp.ru/exb/index.phtml?Ex=n05&ID=553&language=english&pagenum=5
- 796. NEW JERSEY (2004), Portway Extensions Concept Development Study, http://www.state.nj.us/transportation/works/portway/FR Section 7.pdf
- 797. NEW ZEALAND MINISTRY OF ECONOMIC DEVELOPMENT (2002), Review of Port Companies' Market Power,
- http://www.med.govt.nz/buslt/bus_pol/portsreview/index.html 798. NEYTS, Frank (2005), "Zeebrugge kreeg een nieuwe kraan, Antwerpen een banaan", De
- Lloyd, edition 15 January, p. 4
- 799. NIEUWSBANK (1999), Aandeelhouders verwachten Oereenstemming over verkoop ECT, http://www.nieuwsbank.nl/inp/1999/08/0805F026.htm
- 800. NIEUWSBANK (1999b), Vopak vergroot Aandeel Singapore tot 69,5%, http://www.nieuwsbank.nl/ payment/order/1893801936/inp/1999/11/1130A013.htm
- 801. NIEUWSBLAD TRANSPORT (2005), Asians sign Major Alliance, http://www.portofrotterdam.com/news/UK/Newsservice/Articles/NT_22062005_22.asp?lng=

UK

- 802. NILSSEN, Tore and Lars SÖRGARD (1998), "Sequential horizontal mergers", European Economic Review, n° 42, pp. 1683-1702
- 803. NOOTEBOOM, Bart (1999), Inter-firm Alliances Analysis and Design, New York, Routledge, 239 p.
- 804. NORMAN, George (1979), Economies of Scale, Transport Costs and Location, Boston, Martinus Nijhoff Publishing, 205 p.
- 805. NORMAN, George and Lynne PEPALL (1999), "Horizontal mergers in spatially differentiated non-cooperative markets: a comment", Journal of Industrial Economics, electronic edition, 18 p.
- 806. NORTHPORT (MALAYSIA) BHD (2003), TeamNorthPort, June, Bulletin 1, http://www.northport.com.my
- 807. NORTHPORT (MALAYSIA) BHD (2003b), Northport Container Services Equipment and Facilities, June, Bulletin 1, http://www.northport.com.my
- 808. NORTHPORT (MALAYSIA) BHD (2003c), "Northport Boost for Port Klang Status", TeamNorthPort, March, Bulletin 1, http://www.northport.com.my
- 809. NOTTEBOOM (2004), "Container Shipping And Ports: An Overview", The Review of Network Economics, Vol. 3, n°2, pp. 86-106
- 810. NOTTEBOOM, Theo (2000), The peripheral port challenge in container port systems, 24 p., paper presented at IAME Conference, 13-15 September 2000, Naples
- 811. NOTTEBOOM, Theo (2001), "Hoe stabiel zijn Strategische Allianties in de Containerlijnvaart?", De Lloyd, edition 24 January, p. 4
- 812. NOTTEBOOM, Theo and Willy WINKELMANS (2003), "Dealing with stakeholders in the port planning process", in DULLAERT, Wout, Bart A.M. JOURQUIN and Jacob B. POLAK (Eds), Across the Border Building upon a Quarter Century of Transport Research in the Benelux, De Boeck, Antwerp, 316 p.
- 813. NSA (NEPTUNE SHIPPING AGENCY, 2005), Interreg IIIb Northern Periphery Programme, http://www.nsa.com/enews/2005april.htm#Section1
- 814. NV ZEEKANAAL EN WATERGEBONDEN GRONDBEHEER VLAANDEREN (2003), Bedrijven Algemeen, http://www.zeekanaal.be
- 815. NWS HOLDINGS Ltd., Project Key Facts and Figures, http://www.nwsh.com.hk/eng/pdf/AR2004/EWF128.pdf
- 816. NYCEDC (NEW YORK CITY ECONOMIC DEVELOPMENT CORPORATION , 2003), EDC Issues Request for Proposals for South Brooklyn Marine Terminal Redevelopment,

http://www.newyorkbiz.com/About_Us/getPressReleasePreview2000_detail48.htm

- 817. NYE, Larry (2001), "Mega-terminals, trends and issues", Port Technology International, Edition 11, pp. 197 200
- 818. O'BRIEN, Thomas (2004), Quality of Life and Port Operations: Challenges, Success and Future, paper presented at Sixth Annual CITT State of the Trade and Transportation Industry Town Hall Meeting, 30 August 2004, 32 p.
- 819. O'MAHONY, Hugh (2005), "Kalmar ready to revolutionize port operations with new crane", Lloyd's List,, Monday January 17, p. 14
- 820. OCEAN SHIPPING CONSULTANTS (2000), The Global Containerport Market to 2015,

Chertsey, UK, 275 p.

- 821. OCEAN SHIPPING CONSULTANTS (2003), World Containerport Outlook to 2015, Chertsey, UK, 281 p.
- 822. OECD (Organisation for Economic Co-operation and Development, 1999), Glossary of Industrial Organisation Economics and Competition Law, 90 p.
- 823. OECD (Organisation for Economic Co-operation and Development, 2003), Security in Maritime Transport: Risk Factors and Economic Impact, 62 p.
- 824. OFFICE OF THE REGULATOR-GENERAL, VICTORIA (1999), Review of Port Services Price Regulation – Final Report, 148 p., http://www.reggen.vic.gov.au/apps/page/user/pdf/portsfi.pdf
- 825. OFFICE OF THE REGULATOR-GENERAL, VICTORIA (1999b), Beyond Price Regulation: Market Structure, Competition and Efficiency in Victoria's Ports, 36 p., http://archive.esc.vic.gov.au/1999/ports_wpports.pdf
- 826. ONG CHIN, Soon, Gary YEO WEI QIANG and Barry CHIA HAN SIAN (2004), How Technologies work: Container Shipping, Project n° UPC2203, 20 p., http://staff.science.nus.edu.sg/~parwani/htw/htwproject3/shipping.doc
- 827. OP DE BEECK, Roland (1999), Port Operation and Governance Systems a Comparative Approach, Antwerp Port Engineering and Consulting (APEC), International Course in Port Management and Harbour Administration, 86 p.
- 828. ORR, Dale (1974), "An index of entry barriers and its application to the market structure performance relationship", Journal of Industrial Economics, Vol. 23, n°1, pp. 39 49
- 829. OSBORN, Richard N. and C. Christopher BAUGHN (1990), "Forms of Interorganizational Governance for Multinational Alliances", The Academy of Management Journal, Vol. 33, n°3, pp. 503 – 519
- 830. OT AFRICA LINE (2002), OTAL-Belgium, http://www.otal.com/europe/belgium.htm
- 831. OUM, Tae Hoon, Jong-Hun PARK and Anming ZHANG (1996), "The effects of airline codesharing agreements on firm conduct and international air fares", Journal of Transport Economics and Policy, Vol. 30, n°2, pp. 187-202
- 832. OUM, Tae Hoon, Jong-Hun PARK and Anming ZHANG (2000), Globalization and Strategic Alliances: the Case of the Airline Industry, Amsterdam, Pergamon, 229 p.
- 833. OUM, Tae, Anming ZHANG and Yimin ZHANG (2000), "Socially optimal capacity and capital structure in oligopoly", Journal of Transport Economics and Policy, Vol. 34, pp. 55-68
- 834. OVERTON, Rob, Joe DISCENZA and Tony SIMKUS (2001), "Increasing container loading productivity through crane automation", Port Technology International, Edition 10, pp. 65-67, http://www.porttechnology.org/journals/ed10/download/PT10-03 3.pdf
- 835. P&O FERRIES (2002), P&O and CMA-CGM joint venture to become largest Container Terminal Operator in France, http://www.prnewswire.co.uk/cgi/news/release?id=94173
- 836. P&O GROUP (2000), P&O Ports and P&O Nedlloyd sign Lease for Port Newark Container

http://www.findarticles.com/cf_dls/m4PRN/2000_Nov_1/66578057/p1/article.jhtml 837. P&O GROUP (2002), P&O trading update: July to September 2002, http://www.prnewswire.co.uk/cgi/news/release?id=94083

838. P&O Group (2002), Shekou Container Terminal Expansion, http://portal.pohub.com/pls/pogprtl/url/ITEM/DFDD3C41DABA0526E0340003BA2CA8EA

- 839. P&O GROUP (2002b), US\$1 billion investment will make Qingdao one of the World's top 10 Container Terminals, http://www.prnewswire.co.uk/cgi/news/release?id=105619
- 840. P&O GROUP (2003), P&O acquires a new Container Port in India for \$195 million, http://portal.pohub.com/pls/pogprtl/url/ITEM/BF5C25492FD442A8E0340003BA0B0F09
- 841. P&O GROUP (2004), Annual Report 2003, http://www.competition-commission.org.uk/inquiries/completed/2005/bai/joint_submission_annex_3.pdf
- 842. P&O GROUP (2005), History, http://portal.pohub.com/portal/page?_pageid=71,44964& dad=pogprtl& schema=POGPRTL
- 843. P&O GROUP (2005b), P&O Ports Extends Into Supply Chain, http://portal.pohub.com/pls/pogprtl/url/ITEM/DFD8F0C131896050E0340003BA2CA8EA
- 844. P&O NEDLLOYD (2000), P&O Nedlloyd and P&O Ports sign lease for Port Newark terminal,

http://www.ponl.com/topic/home_page/language_en/newsroom/news/latest_news?action=ite m&usetemplate=archive_news_item&resourceitem_no=3893

- 845. P&O Nedlloyd (2004), Container Type Index, http://www.ponl.com
- 846. P&O Ports (2003), Efficient Port Operation using Electronic Commerce Systems, paper presented at APEC Symposium, 58 p., http://www.apec-tptwg.org.tw/TPT/tpt-main/apec.ppt
- 847. P&O PORTS (2003), P&O trading update: July to September 2003, http://www.prnewswire.co.uk/cgi/news/release?id=111910
- 848. P&O PORTS (2003b), P&O trading update: January to March 2003, http://portal.pohub.com/pls/pogprtl/url/ITEM/BD2212C32B633201E0340003BA0B0F09
- 849. P&O Ports (2004), P&O invests in Major New Container Terminal in Antwerp, Press Release
 21 april, 2 p.,
- http://portal.pohub.com/pls/pogprtl/url/ITEM/DFDD6796D6B8068BE0340003BA2CA8EA 850. P&O PORTS (2005), History,
- http://portal.pohub.com/portal/page?_pageid=36,1,36_31151:36_32105&_dad=pogprtl&_sch ema=POGPRTL
- 851. PACHAKIS, Dimitris and Anne S. KIREMIDJAN (2003), "Ship Traffic Modelling Methodology for Ports", Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 129, n° 5, pp. 193-202
- 852. PAELINCK, Honoré (2001), Glossary of Terms, ITMMA, 138 p.
- 853. PAELINCK, Honoré (2002), meeting concerning round table Flemish Logistics Institute
- 854. PANAYIDES, Photis M. and Kevin CULLINANE (2002), "Competitive Advantage in Liner Shipping: A Review and Research Agenda", International Journal of Maritime Economics, Vol. 4, n° 2, pp. 189-209
- 855. PANYNJ (PORT AUTHORITY OF NEW YORK / NEW JERSEY , 2003b), "Redevelopment moves ahead", PortViews, http://www.airtrainnewark.com/commerce/portviews.2002.01.02.pdf
- 856. PANYNJ (PORT AUTHORITY OF NEW YORK / NEW JERSEY, 2003), Facts/History, http://www.panynj.gov
- 857. PANYNJ (PORT AUTHORITY OF NEW YORK / NEW JERSEY, 2003c), Facility Facts, http://www.panynj.gov
- 858. PANYNJ (PORT AUTHORITY OF NEW YORK / NEW JERSEY, 2004), Summary of 2002 Statistics, Comparison with 2001, http://www.panynj.gov

859. PARK HOTEL BREMEN GmbH (2005), Geschichte, http://www.park-hotel-bremen.de/

- 860. PARK, Jong-Hun and Anming ZHANG (1998), "Strategic airline alliances: complementary vs. parallel alliances" in MEERSMAN, Hilde, Eddy VAN DE VOORDE and Willy WINKELMANS, Selected Proceedings of the 8th World Conference on Transportation Research, Vol. 1 (Transport Modes and Systems), pp. 181-195, Elsevier Pergamon, Oxford.
- 861. PARK, Jong-Hun and Anming ZHANG (2000), "An empirical analysis of global airline alliances: cases in North Atlantic markets", Review of Industrial Organization, Vol. 16, pp. 367-384
- 862. PATZELT, W. (2005), EH Harms GmbH & Co. KG Automobil-Umschlag Cuxhaven, email contact
- 863. PAWLIK, Thomas (2003), Containerterminals, 4 p., http://www.wirtschaft.fhkiel.de/seeverkehrswirtschaft/downloads/terminals.pdf
- 864. PELTZMAN, Sam (1977), "The gains and losses from industrial concentration", Journal of Law and Economics, Vol. 20, n° 2, pp. 229-264
- 865. PENFOLD, Andrew (2002), The Effect of Global Changes on Asian Container Trades, paper presented at 1st Asia Maritime and Logistics Conference, October 2002, 28 p., http://www.osclimited.com/releases/1stasia2.PDF
- 866. PERRY, Martin K. and Robert H. PORTER (1985), "Oligopoly and the incentive for horizontal merger", American Economic Review, Vol. 75, n° 1, pp. 219-227
- 867. PESTON, M. H. and R. H. REES (1971), Port Costs and the Demand for Port Facilities, National Ports Council, London, 52 p.
- 868. PETERLINI (2000), ITIP Deliverable 1 Annex 1: Survey on intermodal transfer technologies, 86 p., http://www.eutp.org/download/itip/D1/Annex1.pdf
- 869. PETERLINI (2000), ITIP Deliverable 1 Annex 3: Maritime Technologies for Intermodal Transport, 34 p., http://www.eutp.org/download/itip/D1/Annex3.pdf
- 870. PETERS, Craig (2003), Evaluating the Performance of Merger Simulation: Evidence from the U.S. Airline Industry, The Center for the Study of Industrial Organization at Northwestern University, Working paper n° 0032, 53 p., http://www.csio.econ.northwestern.edu/Papers/2003/CSIO-WP-0033.pdf
- 871. PETERS, Hans J. F. (1995), "Private sector involvement in east and southeast asian ports an overview of contractual arrangements", Infrastructure Notes, Transport N° PS-10, March 1995, http://www.worldbank.org/transport/publicat/td-ps10.htm
- 872. PETERS, Hans J. F. (2001), "Developments in global seatrade and container shipping markets: their effects on the port industry and private sector involvement", International Journal of Maritime Economics, Vol. 3, pp. 3-26
- 873. PHILIPPINES PORT AUTHORITY (2005), Port of Singapore Authority, http://www.ppa.com.ph/apa-2002/apa_members/apa_sing/apa_psa.htm
- 874. PILSCH, Martin C. (2001), "Port productivity: management and technology", Harbor Facilities Guide, Pacific Maritime, October 2001, pp. 2 3, http://www.portmod.org
- 875. PILSCH, Martin C. (2001b), "Port productivity: the human element", Harbor Facilities Guide, Pacific Maritime, September 2001, pp. 2 3, http://www.portmod.org
- 876. PILSCH, Martin C. (2004), Strategies to enhance Terminal Productivity Advances in Cargo Handling Technology, http://www.aapaports.org/programs/seminar presentations/TMT '04/Pilsh,%20Martin.pdf

- 877. PIODI, Franco (1999), European Sea Port Policy, Working Paper, European Parliament Directorate General for Research, 64 p.
- 878. PIRAEUS PORT AUTHORITY (2004), Passenger Terminal, http://www.olp.gr
- 879. PIZZOLANTE, José Alfredo Sabatino (1999), Los Puertos y su Rol para el Nuevo Milenio, http://www.sabatinop.com/articulos/art26.html
- 880. PMAESA (PORT MANAGEMENT ASSOCIATION OF EASTERN AND SOUTHERN AFRICA, 2000), Newsletter January 2004, http://www.pmaesa.org/Newsletter/Newsletter04.html
- 881. PMAESA (PORT MANAGEMENT ASSOCIATION OF EASTERN AND SOUTHERN AFRICA, 2003), Portos e Caminhos de Ferro de Moçambique, http://www.pmaesa.org/mozambique.html
- 882. PMAESA (PORT MANAGEMENT ASSOCIATION OF EASTERN AND SOUTHERN AFRICA, 2003b), November 2002 to June 2003, http://www.pmaesa.org/Newsletter/Newsletter13.htm
- 883. PMAESA (PORT MANAGEMENT ASSOCIATION OF EASTERN AND SOUTHERN AFRICA, 2005), June 2004 to March 2005, http://www.pmaesa.org/Newsletter/Newsletter16.htm
- 884. PNCT (PORT NEWARK CONTAINER TERMINAL, 2004), Facilities, http://www.pnct.net/
- 885. PORT AUTHORITY OF JAMAICA (2003), Services, http://www.seaportsofjamaica.com/skcp.htm
- 886. PORT AUTONOME DE LIEGE (2004), Le PAL en chiffres, http://www.liege.portautonome.be
- 887. PORT DE CAEN-QUISTREHAM (2003), Nouveau Bassin, http://www.caen.port.fr
- 888. PORT EVERGLADES (2005), History, http://www.porteverglades.org/
- 889. PORT KEMBLA (2003), Trade Data, http://www.kemblaport.com.au/
- 890. PORT KLANG AUTHORITY, (2003), Organisation, http://www.lpk.gov.my
- 891. PORT KLANG AUTHORITY, (2003b), Background Information, http://www.lpk.gov.my
- 892. PORT KLANG AUTHORITY, (2003c), Containerised Cargo, http://www.lpk.gov.my
- 893. PORT OF ANTWERP (2000), Hessenatie and Nova join forces, http://www.portofantwerp.be/asp/news_detail.asp?id=268
- 894. PORT OF ANTWERP (2003), Mainport brochure, http://www.portofantwerp.be/html/05_PORTBROCHURES/AGHApdfNEW/mainport_broch ure_nl.pdf
- 895. PORT OF ANTWERP (2003), Port Organisation, http://www.portofantwerp.be
- 896. PORT OF ANTWERP (2003b), Public Sector, http://www.portofantwerp.be
- 897. PORT OF ANTWERP (2003c), Companies by Activity Cargo Handling, http://www.portofantwerp.be
- 898. PORT OF ANTWERP (2003d), 5 million TEU in the Port of Antwerp, http://www.portofantwerp.be/asp/news_detail.asp?id=391
- 899. PORT OF ANTWERP (2004), Hesse-noord Natie granted Deurganckdok West Concession, http://www.portofantwerp.be/asp/news_detail.asp?id=414
- 900. PORT OF BUSAN (2003), History, http://www.pusan.momaf.go.kr

901. PORT OF BUSAN (2003a), Foreword, http://www.pusan.momaf.go.kr 902. PORT OF BUSAN (2003b), Berth Facilities, http://www.pusan.momaf.go.kr 903 PORT OF BUSAN (2004), Pier Information, http://www.pusan.momaf.go.kr 904. PORT OF **BUSAN** (2005).Port of Shanghai, http://www.portbusan.or.kr/english/m1/s9/s9 6.asp 905. PORT OF DUISBURG (2004), Zahlen und Fakten, http://www.duisport.de 906. PORT OF GÖTEBORG (2004), Port of Göteborg – Annual Report 2003, http://www.portgot.se/prod/hamnen/ghab/dalis2.nsf/vyFilArkiv/GHAB 03 ENG.pdf/\$file/G HAB 03 ENG.pdf 907. PORT OF HAMBURG (2003), Intermodal Hub, http://www.hafen-hamburg.de 908 PORT OF HAMBURG (2003), Port Authority, http://www.hafen-hamburg.de 909. PORT OF HAMBURG (2003b), Public-Sector Infrastructure, http://www.hafenhamburg.de 910. PORT OF HAMBURG (2003c), Containerand Multi-purpose Terminals, http://www.hafen-hamburg.de 911. PORT OF HAMBURG (2003d), "Container Cargoes", Port Handbook, http://www.hafenhamburg.de/html-engl/handbook/begin.html PORT OF KAOHSIUNG (2003), Comprehensive and Future Development Plan, 912. http://www.khb.gov.tw 913. PORT OF LONG BEACH (2003), About the Port, http://www.polb.com 914. PORT OF LONG BEACH (2003b), Cargo/Tenants, http://www.polb.com 915. PORT OF LOS ANGELES (2003), About, http://www.portoflosangeles.org 916. PORT OF ANGELES (2003b), Container Terminals, LOS http://www.portoflosangeles.org PORT OF MARSEILLE (2003), Zone Industrielle, http://www.marseille-port.fr 917. 918. PORT OF MIAMI (2004), Port Tariff, http://www.co.miami-dade.fl.us/portofmiami/ 919. PORT OF MORMUGAO (2003), Traffic Performance, http://www.mptgoa.com/ 920. PORT OF PARIS (2003), Croissance soutenue des trafics voie d'eau en Ile-de-France, http://www.paris-ports.fr 921. PORT OF PORTLAND (2003), Fast Facts, http://www.portofportland.com 922. PORT OF ROTTERDAM (2003), Company Profile, http://www.portofrotterdam.com 923. PORT OF (2003b), Lease and Contract ROTTERDAM Management, http://www.portofrotterdam.com 924. PORT OF ROTTERDAM (2003c), RMPM becomes Havenbedrijf Rotterdam N.V., http://www.portofrotterdam.com 925. PORT OF ROTTERDAM (2003d), Port Industry, http://www.portofrotterdam.com PORT OF SAN DIEGO (2004), Tariff, http://www.portofsandiego.org 926. 927. PORT OF SEATTLE (2003), How the Port works, http://www.portseattle.org PORT OF SINGAPORE AUTHORITY (2003), GTOs and the Global Port Industry, 928. http://www.npa.co.za/PDF%20Documents/IAPH%20Speaker%20Papers/Tuesday%2027%20 May%2003/Michael%20Chia GTOs%20&%20the%20Global%20Port%20Industry.pdf 929. PORT OF SINGAPORE AUTHORITY (2003), http://www.psa.com.sg 930. PORT OF SINGAPORE AUTHORITY (2003), MSC seals long-term service agreement with PSA, http://www.singaporepsa.com/html/portview/pv0312/thenewsupdate07.pdf

- 931. PORT OF SINGAPORE AUTHORITY (2004), Hesse-Noord Natie granted Deurganckdok West Concession, http://www.internationalpsa.com/news/nr040213.pdf
- 932. PORT OF SINGAPORE AUTHORITY (2004), Multi-purpose Terminal, http://www.psa.com.sg/
- 933. PORT OF SINGAPORE AUTHORITY (2004b), PSA Global Footprint, http://www.internationalpsa.com/general/ar2002/pg16.pdf
- 934. PORT OF SINGAPORE AUTHORITY (2005), History, http://www.psa.com.sg/
- 935. PORT OF SINGAPORE AUTHORITY (2005b), Facilities, http://www.psa.com.sg/
- 936. PORT OF SOUTH LOUISIANA (2003), Port Overview, http://www.portsl.com
- 937. PORT OF STRASBOURG (2003), Le port en bref, http://www.strasbourg.port.fr
- 938. PORT OF SWINOUJSCIE (2003), Traffic, http://www.phs.com.pl/
- 939. PORT OF TACOMA (2003), About us, http://www.portoftacoma.com
- 940. PORT OF TEXAS CITY & TEXAS CITY TERMINAL RAILWAY COMPANY (2003), Progress built on Vision, http://www.railporttc.com
- 941. PORT TECHNOLOGY (2003), Kaohsiung Port Expansion, Taiwan, http://www.port-technology.com/projects/kaohsiung/
- 942. PORT TECHNOLOGY INTERNATIONAL (2001), JTC Corporation unveils plans for newly corporatised Jurong port, http://www.porttechnology.org/industry.news/2001/01.03.shtml
- 943. PORT TECHNOLOGY INTERNATIONAL (2004), Dubai Ports International team at Kochi to finalise container project, http://www.porttechnology.org/industry.news/2004/23.11.04.html
- 944. PORT TECHNOLOGY INTERNATIONAL (2005), Industry Projects, http://www.port-technology.com/projects/
- 945. PORTEK (2005), Financials, http://www.listedcompany.com/ir/portek/web/show.cgi?content=financials&
- 946. PORTER, M.E. (1980), Competitive Strategy: Techniques for Analyzing Industries and Competitors, New York, Free Press, 396 p.
- 947. PORTION WIDE Ltd. (2004), Services, http://www.portionwide.com.hk/
- 948. PORTNET (2004), Facilities and Services in PSA, http://www.portnet.com
- 949. PORTNET.COM (2001), Press Release 7 August 2001, http://www.portnet.com/02news/07082001.htm
- 950. POSSAJENNIKOV, Alex (2001), "Equilibrium selection in a merger game", Economic Letters, Vol. 72, n° 2, pp. 255-261
- 951. POYAGO-THEOTOKY, Joanna (1995), "Equilibrium and optimal size of a research joint venture in an oligopoly with spillovers", Journal of Industrial Economics, Vol. 43, n° 2, pp. 209-226
- 952. PRAGER, Robin A. and Timothy H. HANNAN (1998), "Do substantial mergers generate significant price effects? Evidence from the banking industry", Journal of Industrial Economics, Vol. 46, n° 4, pp. 433-452
- 953. PSA INTERNATIONAL (2001), Annual Report, http://www.internationalpsa.com/general/ar2004/AnnualReport04.htm
- 954. PSA MUARA CONTAINER TERMINAL SDN BHD (2005), Partnership, http://www.psamuara.com.bn

- 955. QQCT (QINGDAO QIANWAN CONTAINER TERMINAL, 2005), Introduction, http://www.qqct.com.cn
- 956. RAILFAN (2005), Die Privatbahnen im Bundesland Nordrhein-Westfalen, http://www.railfan.de
- 957. RANKINE, Gordon (2004), Benchmarking Container Terminal Performance, 18 p., paper presented at ContainerPort Conference Rotterdam 2003, http://www.brponline.co.uk/Benchmarking%20container%20terminal%20performance.PDF
- 958. RAO, Ramadas (2004), "Temasek swoop could split up NOL", Fairplay, edition 12 August, p. 6
- 959. RAO, Ramadas (2004b), "Singapore tries to keep up with container boom", Fairplay, edition 12 August, p. 14
- 960. RAVEN, John (2001), Trade and Transport Facilitation A Toolkit for Audit, Analysis, and Remedial Action, World Bank Discussion Paper n° 427, 86 p.
- 961. REALUBIT, Job T. (2001), ICTSI sells overseas Stakes to Bankroll Operations in RP, http://www.philstar.com/philstar/show content.asp?article=203
- 962. REBOLLO, Miguel, Vicente JULIAN, Carlos CARRASCOSA and Vicente BOTTI (2000), A Multi-Agent System for the Automation of a Port Container Terminal, 6 p., http://www.dsic.upv.es/~vinglada/download/agentw.pdf
- 963. REEKIE, W. Duncan (1989), Industrial Economics A Critical Introduction to Corporate Enterprise in Europe and America, Edward Elgar Publishing Ltd., Aldershot, England, 240 p.
- 964. REITMAN, David (1994), "Partial ownership arrangements and the potential for collusion", Journal of Industrial Economics, Vol. 42, n° 3, pp. 313-322
- 965. RHB STEVEDORING AND WAREHOUSING (2004), Stevedoring, http://www.rhb.nl/
- 966. RHEINHÄFEN KARLSRUHE (2004), Wasserseitige Umschlagzahlen der Rheinhäfen Karlsruhe, http://www.rheinhafen.de
- 967. RHOADES, Stephen A. (1985), "Market share as a source of market power", Journal of Economics and Business, Vol. 37, n°4, pp. 343-363
- 968. RIVER TRADE TERMINAL Co. Ltd.(2004), Terminal Services, http://www.rttc.com.hk
- 969. RIZVI, Zia (2003), The Containership: how big? A Port Authority's Dilemma, http://www.npa.co.za/PDF%20Documents/IAPH%20Speaker%20Papers/Tuesday%2027%20 May%2003/Zia%20Rizvi%20-%20Durban-PP-Presentation-Revised.ppt
- 970. ROBINSON, Brian (2002), "Terminal planning of mice and men", Cargo Systems, November, pp. 29-31
- 971. ROBINSON, Brian (2003), "Ship-to-shore cranes getting bigger and faster", Cargo Systems, July/August, pp. 31-34
- 972. RODRIGUES, Vasco (2002), Merger Waves, paper presented at EARIE 29, Madrid 2002, 16p.
- 973. ROOS, Hugo B. (2002), Mainport Developments in Europe from a Logistics Perspective, paper presented at International Conference on Supply Chain Management, Shanghai, 18-20 September 2002, 12 p., http://www.few.eur.nl/few/people/roos/publications/presentations%202002/chinatxtroos.doc
- 974. ROOT, Franklin R. (1988), "Some taxonomies of International Cooperative Arrangements", in CONTRACTOR, Farok F. and Peter LORANGE (Eds.), Cooperative Strategies in International Business Joint Ventures and Technology Partnerships between

Firms, Massachusetts, Lexington Books, 513p.

- 975. ROSON, Roberto and Jeroen C.J.M. VAN DEN BERGH (2000), "Network markets and the structure of networks", The Annals of Regional Science, Vol. 34, n° 2, pp. 197-211
- 976. ROTH, David (1992), A Computational Algorithm for Optimal Collusion in Dynamic Cournot Oligopoly, Michigan, Center for Research on Economic & Social Theory, 20 p.
- 977. ROYAL VOPAK (1999), Vopak increases its Stake in Singapore to 69.5%, http://www.jurongisland.com/Companies/Information.asp?Company=Vopak+Terminals+Sin gapore+Pte+Ltd&Type=AboutUs
- 978. ROYAL VOPAK (1999), Vopak increases its Stake in Singapore to 69.5%, http://www.jurongisland.com/Companies/Information.asp?Company=Vopak+Terminals+Sin gapore+Pte+Ltd&Type=AboutUs
- 979. RPPC (ROTTERDAM PORT PROMOTION COUNCIL, 2004), HT Holland Termoinals bv, http://www.rppc.nl/nl/nlplaza/profiel/hollandterminals.htm
- 980. RUDOLF, C. Davis (1999), "Crane Procurement: buying the big ones", Port Technology International, Edition 8, pp. 51 54
- 981. RYAN, Nora K. (1998), The Future of Maritime Facility Designs and Operations, Proceedings of the 1998 Winter Simulation Conference, pp. 1223-1227, http://www.informscs.org/wsc98papers/167.PDF
- 982. SAAVEDRA, Jorge Pecci (2002), Cargo Theft in Latin America, 16 p., paper presented at International Union of Marine Insurance Conference, New York, 15-19 September 2002, http://www.iumi.com/Conferences/2002_newyork/CargoLossPreventionCommittee/JorgePec ciSaavedra CargoTheftLatinAmerica.pps
- 983. SACHITANAND, N. N. (2003), "Mundra Port sets new benchmarks", The Hindu, http://www.hinduonnet.com/thehindu/thscrip/print.pl?file=2002102800190200.htm&date=20 02/10/28/&prd=biz&
- 984. SALANT, Stephen and Greg SCHAFFER (1997), Optimal Asymmetric Strategies in Research Joint Ventures, Department of Economics Working Paper Series, 17p.
- 985. SALANT, Stephen W., Sheldon SWITZER and Robert J. REYNOLDS (1983), "Losses from Horizontal Merger: The effects of an exogenous change in industry structure on Cournot-Nash equilibrium", Quarterly Journal of Economics, Vol. 98, p.185-199
- 986. SAN, Wong Joon (1997), "In a League of its Own", Transportation and Communications, http://www.tdctrade.com/prodmag/transport/r9701e.htm#2
- 987. SÁNCHEZ, Ricardo J., Jan HOFFMANN, Alejandro MICCO, Georgina V. PIZZOLITTO, Martín SGUT and Gordon WILMSMEIER (2003), "Port Efficiency and International Trade: Port Efficiency as a Determinant of Maritime Transport Costs", Maritime Economics & Logistics, Vol. 5, n°2, pp. 199-218
- 988. SANDMANN, Fernando (2001), "Container cranes a highway of inputs and outputs", Port Technology International, Edition 12, pp. 18 20
- 989. SANYAL, Satanu (2004), "Container terminal operators An armada in full sai"l, The Hindu Business Line, http://www.blonnet.com/2004/04/05/stories/2004040500050600.htm
- 990. SAR (GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION OF THE PEOPLE'S REPUBLIC OF CHINA, 2004), Annex D : Current and Planned Handling Capacities of Shenzhen Ports, http://www.info.gov.hk/hk2030/hk2030content/wpapers/wpaper 4/AnnexD text e.htm

991. SAVACOOL, Ed, Ed DOUGHERTY and Bryant YOUNG (1999), Port Operations in Remote Areas, 136 p., http://www.ccdott.org/Deliverables/1997/Stanley16/Stanley16.pdf

992. SCHEDNET (2000), Millionth Mazda arrives in Antwerp, http://mailgate.supereva.com/misc/misc.transport.air-industry.cargo/msg00103.html

993. SCHELDE INFORMATIE CENTRUM (2004), Hesse-Noord Natie breidt uit in Zeebrugge,

http://www.scheldenet.nl/main.php?lg=nl&url=/nl/nieuws/actualiteit_pagina&story=616&hig hlight=Ocean%7CContainerterminal%7CHessenatie#zoek

- 994. SCHIFFER, Emanuell (2000), Entwicklung der Container Terminals, http://www.tisgdv.de/tis/tagungen/workshop/cs/schiffer/schiffer.htm
- 995. SCHOLTEN (2002), "Global logistics needs scale, scope and care", Student Business Review, summer 2002, p. 18 19
- 996. SCHUTTEVAER (1998), ECT stapt in het Terminalproject van RCT Verbeke in Willebroek, http://www.schuttevaer.nl/Berichten/1298/ect terminalproject.htm
- 997. SEA-LAND ALUMNI (2005), Timeline History of Sea-Land, http://www.mpa.state.md.us/news/pobmag/POB%20June%20Taro%20Inter.pdf
- 998. SEA-RO TERMINAL nv (2004), The Sea-Ro Group in the Port of Zeebrugge, http://www.searo.be/content/pdf/SEA-RO brochure.pdf
- 999. SEA-RO TERMINAL nv (2005), Inleiding en Historiek, http://schoolweb.argo.be/ka/blankenberge/pascale/inleiding en historiek.htm
- 1000. SEATRADE MIDDLE EAST MARITIME (2004), DPI sharpens up Djibouti's Edge, http://www.seatrade-middleeast.com/report 2004/ezine 2004/ezine5.htm
- 1001. SELIGER, U. (2005), BLG Automobile Logistics GmbH, e-mail contact
- 1002. SHABAYEK. A.A. and W.W. YEUNG (2002), "A simulation model for the Kwai Chung container terminals in Hong Kong", European Journal of Operational Research, Vol. 140, n°, pp. 1-11
- 1003. SHAFFER, Sherrill (1997), Network Diseconomies and Optimal Structure, Working Paper n° 97-19, 38 p., http://www.phil.frb.org/files/wps/1997/wp97-19.pdf
- 1004. SHANGHAI INDUSTRIAL HOLDINGS Ltd. (2004), Infrastructure and Mordern Logistics, http://www.sihl.com.hk/sihl/logistics_e.htm
- 1005. SHANGHAI PORT CONTAINER CO. LTD (2005), Development Course, http://www.spcco.com/en/introduce deve.asp
- 1006. SHAPIRO, Carl (1999), "Exclusivity in network industries", George Mason Law Review, Vol. 7, n°3, p. 1-11
- 1007. SHENZEN YANTIAN DISTRICT (2003), Yantian Port, http://www.yantian.gov.cn/ENGLISH/port/port-index.htm
- 1008. SHERMAN, Rexford B. (2001), Seaport Governance in the United States and Canada, American Association of Port Authorites, 12 p., http://www.aapaports.org/pdf/governance_uscan.PDF
- 1009. SHRIEVES, R.E. (1978), 'Geographic markets and market structure in the bituminous coal industry", The Antitrust Bulletin, Vol. 23, pp. 589-625
- 1010. SHY, Oz (2001), The Economics of Network Industries, Cambridge University Press, 313 p.
- 1011. SIDERIS, Alexios C., Maria P. BOILÉ and Lazar N. SPASOVIC (2002), Using On-Line

Information To Estimate Container Movements For Day-To-Day Marine Terminal Operations, 26 p., http://www.transportation.njit.edu/nctip/publications/forecastTRB.pdf

1012. SINGAPORE GOVERNMENT (2005), Fact Sheet, http://www.pub.gov.sg/downloads/doc/FACT%20SHEET rev2.doc

- 1013. SINGAPORE MIRROR (2005), BES Technology Pte Ltd., http://www.singaporemirror.com.sg/co bestech.htm
- 1014. SINGAPORE MIRROR (2005b), Sterile Services (S) Pte Ltd., http://www.singaporemirror.com.sg/co_sterile.htm
- 1015. SINGAPORE TIMES (2001), PSA, Partners set to finalise Structure of Hibiki Project, http://www.marinerthai.com/webboard/view.php?No=727
- 1016. SLEUWAEGEN, Leo and Isabelle DE VOLDERE (2001), Globalisation and the definition of the relevant geographic market in antitrust practice, Vlerick Leuven Gent Management School Working Paper Series, 38 p.
- 1017. SMITH, L.S. (2005), APM Terminals Charleston, e-mail contact
- 1018. SOMMER, Dirk (1999), "Private participation in port facilities recent trends", Public Policy for the Private Sector, The World Bank Group, note n° 193, 8 p.
- 1019. SONG, Dong-Wook (2001), A Cooperative Strategy for Container Ports: The Case of Hong Kong and South China, paper presented at WCTR 9, Seoul, 22-27 July 2001, 19 p.
- 1020. SONG, Dong-Wook (2003), "Port co-opetition in concept and practice", Maritime Policy and Management, Vol. 30, n°1, pp. 29-44
- 1021. SONG, Dong-Wook and Chul-Hwan HAN (2004), "An Econometric Approach to Performance Determinants of Asian Container Terminals", International Journal of Transport Economics, Vol. 31, n°1, pp. 39-52
- 1022. SONG, Dong-Wook and Photis M. PANAYIDES (2002), "A conceptual application of cooperative game theory to liner shipping strategic alliances", Maritime Policy and Management, Vo. 29, n°3, p. 285 – 301
- 1023. SOUTH AFRICAN PROPERTY OWNER ASSOCIATION (SAPOA, 2005), Costs at Coega mounting, http://www.sapoaonline.co.za/news/article.aspx?idArticle=222
- 1024. SPECS CONSULTANTS PTE LTD (2005), Corporate Profile, http://www.specscon.com/specs/corporat.html
- 1025. SPG MEDIA PLC (2005), Industry Projects, http://www.port-technology.com/projects
- 1026. SPINETTI, Clara (2003), Tecniche di funzionamento e gestione dei piazzali portuali, http://etd.adm.unipi.it/theses/available/etd-05212003-110116/
- 1027. SPULBER, Daniel F. (1995), "Bertrand competition when rival's costs are unknown", Journal of Industrial Economics, Vol. 43, n° 1, pp. 1-12
- 1028. SROKA, Michael (2002), "Oceangate: a Gateway to Logistics and Information Management", Transport Weekly, http://www.transportweekly.com/spc_articles/indexe.php?x=3&id=17942251803f60857e96f7 e
- 1029. SSAMARINE (2003), SSA Marine Company / History, http://www.ssamarine.com
- 1030. STEENKEN, Dirk, Stefan VOSS and Robert STAHLBOCK (2004), Container Terminal Operation and Operations Research a classification and literature review, n° 26, pp. 3 49
- 1031. STEFFENS, A. (2005), EH Harms Automobil-Transporte, e-mail contact
- 1032. STEWART, John F., Robert S. HARRIS and Willard T. CARLTON (1984), "The role of

market structure in merger behaviour", The Journal of Industrial Economics, Vol. 32, n° 3, pp. 293-312

- 1033. STIGLER, George J. (1950), "Monopoly and oligopoly by merger", American Economic Review, Vol. 50, pp. 23-34
- 1034. STOPFORD, Martin (2002), Is the Drive for Ever Bigger Containerships Irresistible?, paper presented at CI Shipping Forecasting Conference, 25 April 2002.
- 1035. STOPFORD, Martin (2002), Maritime Economics, Routledge, London, 562 p.
- 1036. STUDIENGESELLSCHAFT FÜR DEN KOMBINIERTEN VERKEHR E.V. (2001), Rundschreiben 2001,

http://www.sgkv.de/deutsch/Publikationen/Rundschreiben%202001_%20Inhalt.pdf

- 1037. STUMM, Marielle, John KIDD and Thomas DEGRE (2004), Mechanisms of Diffusion and Managing Information Flows associated with the Physical Freight Flows in Ports: a Case Study of the Ports of Le Havre, Marseilles and Genoa, paper presented at WCTR 10, 5-8 July 2004
- 1038. SUPREME COURT OF APPEALS OF WEST VIRGINIA. (1997), Case n° 24117, http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=wv&vol=fall97%5C24117&invol=1
- 1039. SUYKENS, Fernand (1995a), Controlling your Port's Future the Role of the Private Sector, Government and the Port Authority, American Association of Port Authorities – Annual Convention – 18 October 1995, New Orleans, 21 p.
- 1040. SUYKENS, Fernand (1995b), Is Europe moving towards a "Centrally Planned" Port Economy, TOC Asia 24 April 1995, Singapore, 8p.
- 1041. SUYKENS, Fernand (2000), The Transformation of the Seaport of Antwerp, working paper, 7 p., http://www.maritim.uni-bremen.de/ports/global/SUYKENS.pdf
- 1042. SUYKENS, Fernand and Eddy VAN DE VOORDE (1998), "A Quarter of a Century of Port Management in Europe: Objectives and Tools", Maritime Policy and Management, vol. 25, n° 3, pp. 251 - 261
- 1043. SUZUE-PSA COLD STORAGE PTE LTD (2005), About us, http://suzuepsa.com.sg/about.html
- 1044. SWAHN, Henrik (2002), Marginal Cost Pricing in the Maritime Sector: Cost Calculation, Acceptance and Swedish Infrastructure Charging Practice, 23 p., paper presented at IMPRINT-EUROPE Thematic Network "Implementing Reform on Transport Pricing: Constraints and Solutions: Learning from Best Practice", Brussels, 23 and 24 October 2002, http://www.imprint-eu.org/public/Papers/Imprint3_Swahn.pdf
- 1045. SWENNEN, Bart (2004), Corporate Governance en Havens: een Economische Analyse, 123 p.
- 1046. SWIRE PACIFIC LTD. (2003), The Swire Group, http://www.swire.com/activities/china/index1.htm
- 1047. SWIRE PACIFIC LTD. (2005), Company History, http://www.swire.com
- 1048. TAI WAH SEA/LAND HEAVY TRANSPORTATION Ltd. (2004), Services, http://www.taiwahhk.com
- 1049. TAIKOO MARITIME SERVICES Ltd. (2004), Taikoo Maritime Stevedoring, Midstream Terminal, http://www.swirelogistics.com.hk
- 1050. TALLEY, Wayne K. (2000), "Ocean container shipping: impacts of a technological improvement", Journal of Economic Issues, Vol. 34, Issue 4, pp. 933-948

- 1051. TALLEY, Wayne K. (2004), "Wage Differentials of Intermodal Transportation Carriers and Ports: Deregulation Versus Regulation", Review of Network Economics, Vol.3, Issue 2, pp. 207-227
- 1052. TALLMAN, Stephen B. and Oded SHENKAR (1998), "A managerial decision model of international co-operative venture formation" in BEAMISH, Paul W. (Ed.), Strategic Alliances, Cheltenham, Elgar, 561 p.
- 1053. TBBC (TAIWAN BRITAIN BUSINESS COUNCIL, 2003), Port Development and Projects, 4 p., http://www.taiwanbritain.com/SITE/UPLOAD/DOCUMENT/PORT DEVELOPMENT IN TAIWAN.doc
- 1054. TECKLENBURG, Jutta (2005), DCP Dettmer Container Packing GmbH & Co. KG, email contact
- 1055. TEILLET, Bernard (1996), "Intermodal traffic in international sea trade", in BEKEMANS, Léonce et al. (1996), Ports of Europe, Brussels, European Interuniversity Press
- 1056. TEMASEK HOLDINGS (2004), Temasek Review 2004, http://www.temasekholdings.com.sg/2004review/c5.pdf
- 1057. TERMINALES RIO DE LA PLATA SA (1998), New Investor buys into P&O Container Terminal, http://www.prnewswire.co.uk/cgi/news/release?id=41390
- 1058. TERRASSIER, Nicolas and Romuald LACOSTE (2001), Cargo Handling in Ports: Actors and Strategies - The Integration of Port Cargo Handling in Port and Industrial Networks, paper presented at WCTR 9, Seoul, 22-27 July 2001, 15 p.
- 1059. THARAKAN, Joseph (2003), "Out of India: Snapshots of five leading Container
Terminals",CargoNewsAsia,

http://www.cargonewsasia.com/timesnet/data/CNA/docs/CNAREPO030106_002.html

- 1060. THE ECONOMIC TIMES (2004), Maersk to buy out Sea King in Pipavav Port, http://www.ciae.org/asp/news/sa4E1A.htm
- 1061. THE HINDU BUSINESS LINE (2003), Vizag Box Terminal set to Scale new Peak in Traffic, http://www.blonnet.com/2003/06/27/stories/2003062701610600.htm
- 1062. THE HINDU ONLINE (2004), Election Commission's clearance sought for Vallarpadam project, http://www.hindu.com/2004/04/09/stories/2004040905190300.htm
- 1063. THE MANILA TIMES (2005), ICTSI bids for 2 foreign Ports, sets Sights on 3 Others, http://www.manilatimes.net/national/2005/apr/22/yehey/business/20050422bus6.html
- 1064. THE NORTH AFRICA JOURNAL (1998), Infrastructure, Housing and Telecom, http://www.gis.net/~journal/latest/april98.pdf
- 1065. THE UNITED KINGDOM PARLIAMENT (1999), A New Deal for Transport; Better for Everyone,

http://www.publications.parliament.uk/pa/cm199899/cmselect/cmenvtra/32ii/3255.htm

- 1066. THOMAS, Allen and Scott URBAN (2001), "Automated gate control systems and port productivity", Port Technology International, Edition 13, pp. 15 19
- 1067. THURSTON, Tom and Huosheng HU (2002), Distributed Agent Architecture for Port Automation, 7 p., http://cswww.essex.ac.uk/staff/hhu/Papers/CSA-Oxford2002.pdf
- 1068. TIMES JOURNAL OF CONSTRUCTION DESIGN (2004), Seven Companies in the
Running for a Rs 2,000 Crore Project,
http://www.etconstructionanddesign.com/jan2004/nat.html
- 1069. TIMES SHIPPING JOURNAL (2005), Into big League,

http://www.etshipping.com/Dec2004/cstory02.html

1070. TNT (2000), Acquisition of US-based CTI Logistx further strengthens TPG's leadership in Automotive Logistics,

http://www.tnt.com/country/en_corporate/services/ournews/press/acquisition.html

- 1071. TONGZON, José L. (1993), "The Port of Melbourne Authority's pricing policy: its efficiency and distribution implications", Maritime Policy and Management, Vol. 20, n°3, pp. 197-203
- 1072. TONGZON, José L. (2002), Port Choice Determinants in a Competitive Environment, 23 p., paper presented at IAME Conference, 13-15 November 2002, Panama, http://www.eclac.cl/transporte/perfil/iame_papers/proceedings/Tongzon.doc
- 1073. TORNEY, Bärbel (2005), BLG Automobile Logistics GmbH, e-mail contact
- 1074. TORRES, Ted P. (2005), ICTSI gets 20-year Contract for Madagascar Port, http://www.philstar.com/philstar/News200506150704.htm
- 1075. TOVAR DE LA FE, Beatriz, Sergio JARA-DIAZ and Lourdes TRUJILLO (2003), Economies of Scale and Scope for Cargo Handling Firms in Spanish Ports, 13 p., paper presented at European Transport Conference, 8 – 10 October 2003, Strasbourg
- 1076. TOVAR DE LA FE, Beatriz, Sergio JARA-DIAZ and Lourdes TRUJILLO (2003b), A Multioutput Cost Function for Port Terminals – Some Guidelines for Regulation, World Bank Policy Research Working Paper 3151, 27 p., http://econ.worldbank.org/files/30342 wps3151.pdf
- 1077. TOVAR DE LA FE, Beatriz, Sergio JARA-DIAZ and Lourdes TRUJILLO (2003c), Production and Cost Functions and their Application to the Port Sector – A Literature Survey, World Bank Policy Research Working Paper 3123, 32 p., http://econ.worldbank.org/files/29357 wps3123.pdf
- 1078. TOZER, David and Andrew PENFOLD (2002), Ultra-Large Container Ships (ULCS) Designing to the Limit of Current and Projected Terminal Infrastructure Capabilities, 10 p., http://www.antiport.de/doku/gutachten/ulcs.pdf
- 1079. TRACE, Keith (1998), "Australian shipping and stevedoring", Proceedings of a Conference of the H.R. Nicholls Society at Newcastle 19-21 February 1988, http://www.hrnicholls.com.au/nicholls/nichvol4/vol46aus.htm#Vol 4-6: Australian Shipping and Stevedoring Keith Trace
- 1080. TRACE, Keith (2002), Globalisation of Container Shipping: Implications for the North-South Liner Shipping Trades, paper presented at XIII World Congress of Economic History, Buenos Aires, July 2002
- 1081. TRADE 2000 (2003), Shenzhen Industrial Products and Traffic, http://www.trade2000.com/szep/szepE_other4.htm
- 1082. TRADELINK-eBIZ (2000), Turning Shanghai into an International Shipping Centre, http://www.tradelink-ebiz.com/english/331n08or3m9a51l/newscast/ct_0008.html
- 1083. TRADEWAY (2005), Ports & Terminals, http://www.tradeway.com.au/seaportsterms.cfm
- 1084. TRANSWARD Ltd. (2004), Stevedores, http://www.transward.com
- 1085. TRANSYSTEMS CORPORATION (2001), Port Everglades Master Plan, http://www.broward.org/poi05000.htm
- 1086. TRANSYSTEMS CORPORATION (2002), Pacific Northwest Agile Port System

Analysis,

124

ftp://www.foundation.csulb.edu/CCDoTT/Deliverables/2000/Task%201.9.1/task1.9.1_1.pdf

- 1087. TRENITALIA (2004), Hannibal, la nuova joint venture tra Trenitalia e Sogemar, http://www.cargo.trenitalia.it/MainApp/MainApp/page?id=1095637656231005
- 1088. TRi Maritime Research Group (2003), Container Transhipment and Demand for Container Terminal Capacity in Scotland: Final Report, http://www.scotland.gov.uk/library5/transport/ctdctc-00.asp
- 1089. TRUJILLO, Lourdes and Gustavo NOMBELA (1999), "Privatization and regulation of the seaport industry", in ESTACHE, Antonio and Ginés DE RUS (Eds.), Privatization and Regulation of Transport Infrastructure Guidelines for Policymakers and Regulators, The World Bank Institute
- 1090. TRUJILLO, Lourdes and Gustavo NOMBELA (1999), Privatization and Regulation of the Seaport Industry, 64 p., http://econ.worldbank.org/docs/944.pdf
- 1091. TRUJILLO, Lourdes and Tomas SEREBRISKY (2003), "Market power: ports a case study of postprivatization mergers", Public Policy for the Private Sector, The World Bank Group Private Sector and Infrastructure Network, March 2003, Note Number 260, http://rru.worldbank.org/PapersLinks/Open.aspx?id=2003
- 1092. TURNBULL, P. and S. WESTON (1993), "The British Port Transport Industry: Operational Structure, Investment and Competition", Maritime Policy and Management, 1993, vol. 2, nr. 20, p. 109 120
- 1093. TURNBULL, Peter (2002), Restructuring and Strategies of Seaports and Port companies: The United Kingdom, working paper, 18 p., http://www.maritim.unibremen.de/ports/global/TURNBUL.pdf
- 1094. TURNER, Hugh, Robert WINDLE and Martin DRESNER (2004), "North American containerport productivity: 1984–1997", Transportation Research E, Vol. 40, n°4, pp. 339-356
- 1095. UK BUSINESS PARK (2005), P&O, http://www.ukbusinesspark.co.uk/poaaaaaa.htm
- 1096. UK TRADE & INVESTMENT (2004), Ports & Logistics Industries in India, http://www.trade.uktradeinvest.gov.uk/ports/india/opportunities/opportunities.shtml
- 1097. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 1985), Port Development – A Handbook for Planners in Developing Countries, Geneva, United Nations, 227 p.
- 1098. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 1996), Potentialities for Regional Port Cooperation, 1996, 30 p., http://www.unctad.org/Templates/Download.asp?docid=1821&lang=1&intItemID=1860
- 1099. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 1998), Review of Maritime Transport, 1998, Geneva, 143 p., http://www.unctad.org/en/docs/rmt1998 en.pdf
- 1100. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 2002), Review of Maritime Transport, 2002, Geneva, 137 p., http://www.unctad.org/Templates/Download.asp?docid=2956&lang=1&intItemID=1397
- 1101. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 2003), Review of Maritime Transport, 2000, Geneva, 141 p., http://www.unctad.org/en/docs/rmt2000 en.pdf

p.,

- 1102. UNCTAD (UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, 2003), Review of Maritime Transport, 2003, Geneva, 162 p., http://www.unctad.org/Templates/Download.asp?docid=4126&lang=1&intItemID=1397
- 1103. UNIPORT bv (2004), About Uniport, http://www.uniport.nl
- 1104. UNITED NATIONS (1999), Development of Asia-Europe Rail Container Transport Through Block-Trains: Northern Corridor of the Trans-Asian Railway, United Nations, Geneva, 96 p., http://www.unescap.org/tctd/pubs/tarncfiles/tarnc-fulltext.pdf
- 1105. UNITED NATIONS (2001), Sustainable Transport Pricing and Charges Principles and Issues, United Nations, Geneva, 142 p., http://www.unescap.org/tctd/pubs/pricetoc.htm
- 1106. UNITED NATIONS (2001b), Review of Developments in Transport and Communications in the ESCAP Region 1996-2001, United Nations, Geneva, 143 p., http://www.unescap.org/ttdw/Publications/TPTS_pubs/pub_2157/review2001.pdf
- 1107. UNITED NATIONS (2002), Commercial Development of Regional Ports as Logistics Centres, United Nations, Geneva, 99 p., http://www.unescap.org/publications/detail.asp?id=975
- 1108. UNITED NATIONS (2004), Review of Developments in Transport in the ESCAP Region(2003),UnitedNations,Geneva,208p.,http://www.unescap.org/ttdw/Publications/TPTSpubs/pub2307/pub2307fulltext.pdf
- 1109. UNITED STATES EMBASSY SINGAPORE (2001), Investment Developments July 2001, http://singapore.usembassy.gov/ep/2001/investment-July%202001.html
- 1110. UNITED STATES EMBASSY SINGAPORE (2002), Investment Developments March 2002, http://singapore.usembassy.gov/ep/2002/Investment-March%202002.html
- 1111. US DEPARTMENT OF LABOR (2003), Longshoring and Marine Terminals; Vertical Tandem Lifts; Proposed Rule - 68:54297-54318, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTE R&p id=17972
- 1112. VALENTINE, Vince and Richard GRAY (2002), An Organisational Approach to Port Efficiency, 15 p., paper presented at IAME Conference, 13-15 November 2002, Panama, http://www.eclac.cl/transporte/perfil/iame_papers/proceedings/Valentine_et_al.doc
- 1113. VALKENIERS, Bruno (2003), Container Security: Practical effects on terminals, Container Shipping Security Conference, Antwerp, 9-10 September 2003
- 1114. VAN DE MERBEL, Niek (1998), Cargo Handling Operations Containerflow over the terminal, http://www.vpa.org.vn
- 1115. VAN DE MERBEL, Niek (1998b), Container Handling Equipment, http://www.vpa.org.vn
- 1116. VAN DEN BOSSCHE, Bart (2000), "Ferryways gaat van Oostende Containerhaven maken", De Lloyd, edition 17 October, p. 1 and 3
- 1117. VAN DEN BOSSCHE, Bart (2000b), "P&O Ports bouwt wereldwijd net van containerterminals verder uit 2 mrd USD investeringen voorzien", De Lloyd, edition 17 October, p. 1
- 1118. VAN DEN BOSSCHE, Bart (2001), "PSA-controle over 5 van de 6 Antwerpse getijdenterminals zou tot vertrek Maersk Sealand/Safmarine kunnen leiden Dreiging trafiekverlies van 250.000 TEU tekent zich af", De Lloyd, edition 18 January, p. 1
- 1119. VAN DEN BOSSCHE, Bart (2001b), "IFB France exploiteert staalkade in Duinkerke via

ACIMAR – Containerterminal maakt zich op voor ontvangst van mega-containerschepen van 8.000+ TEU", De Lloyd, edition 24 January, p. 1 and 3

- 1120. VAN DEN BOSSCHE, Bart (2001c), "Hapag-Lloyd neemt 25,1% in nieuwe Altenwerder-terminal Om op termijn voldoende capaciteit te hebben", De Lloyd, edition 14 February, p. 1 and 3
- 1121. VAN DEN BOSSCHE, Bart (2001d), "P&O Ports Antwerpen belast met ontwikkelingen in Europa en Afrika – Vijfde regionaal hoofdkantoor van internationale groep", De Lloyd, edition 18 September, p. 1 and 3
- 1122. VAN DEN BOSSCHE, Bart (2002), "AP Möller plaatst vraagtekens bij dedicated terminals Wegens problemen om capaciteit op trafiek af te stemmen", De Lloyd, edition 15 June, p. 2
- 1123. VAN DEN BOSSCHE, Bart (2002b), "Tandem PSA/HNN zou hoge ogen moeten gooien in Europese havenspel Nieuw logo voorgesteld", De Lloyd, edition 14 May, p. 2
- 1124. VAN DEN BOSSCHE, Bart (2002c), "Concurrentie in Noord-Europese containeroverslag neemt nieuwe vormen aan", De Lloyd, edition 11 June, p. 2
- 1125. VAN DEN BOSSCHE, Bart (2002d), "Burger herstructureert om beter in te spelen op toekomstige ontwikkelingen", De Lloyd, edition 10 September, p. 2
- 1126. VAN DEN BOSSCHE, Bart (2003), "Detthold Aden (BLG: "Logistiekers hebben vooral planbare en betrouwbare transporttijden nodig"", De Lloyd, edition 22 May, p. 1 and 5
- 1127. VAN DEN BOSSCHE, Bart (2003b), "Cosco neemt participatie van 49% in PSAterminal in Singapore", De Lloyd, edition 9 March, p. 1
- 1128. VAN DEN BOSSCHE, Bart (2003c), "Getijdenterminal P&O Ports krijgt jaarcapaciteit van 3,5 mln TEU", De Lloyd, edition 31 October, p. 1 and 3
- 1129. VAN DEN BOSSCHE, Bart (2003d), "Kraanrendement zegt niet alles", De Lloyd, edition 8 July, p. 2
- 1130. VAN DEN BOSSCHE, Bart (2004), "Grote Aziatische containerhavens zetten capaciteitswedloop in", De Lloyd, edition 23 November, p. 1
- 1131. VAN DEN BOSSCHE, Bart (2004b), "Eenheid en verscheidenheid in veiligheidstoeslagen...", De Lloyd, edition 26 August, p. 1
- 1132. VAN DER LINDE, Gido, Sjors ROZEMEIJER and Pauline WORTELBOER (2003), Zeehavens in Europees Perspectief – Verklarende Analyse van de Internationale Havenbenchmark fase 1, 50 p.
- 1133. VAN DOOREN, Philippe (2002), "Added Logistics zet joint-venture op met Toti Trans Voor exploitatie shuttledienst tussen Genk en Midden-Italië", De Lloyd, edition 20 March, p. 1 and 2
- 1134. VAN DOOREN, Philippe (2002b), "Transports Munster (GMI) overweegt beursintroductie Na overname deel Transports Vialle", De Lloyd, edition 14 June, p. 1
- 1135. VAN DOOREN, Philippe (2002c), "Kalmar wil marktleiderspositie bevestigen Met nieuwe generatie reachstackers en middelzware heftrucks", De Lloyd, edition 26 September, p. 2
- 1136. VAN DOOREN, Philippe (2002d), "Geodis neemt logistieke activiteiten van Rhode+Liesenfeld over – Na verkoop overseas-activiteiten in Duitsland", De Lloyd, edition 23 October, p. 2
- 1137. VAN DRIEL, Hugo (1990), Samenwerking in Haven en Vervoer in het Containertijdperk,
Delft, Eburon, 489 p.

- 1138. VAN DRIEL, Hugo (2002), "Innovation and Integration in Mineral Bulk Handling in the Port of Rotterdam, 1886-1923", Business History, Vol. 44, n°3, pp. 63-90
- 1139. VAN KRUNKELSVEN, Guy (2005), informal meeting
- 1140. VANDER VENNET, Rudi (1994), Determinants of EC Bank Takeovers and their Performance Effects an Empirical Analysis, Ghent, University of Ghent, 342 p.
- 1141. VANELSLANDER, Thierry (2000), Haveneconomisch onderzoek: waar schuilen de onderzoeksmogelijkheden?, Antwerpen, UA, Faculteit T.E.W. 2000-017, 80 p.
- 1142. VANGENEUGDEN, Roel (1997), Fusies en Overnames in de Belgische Financiële Sector - Theoretische Benadering en Recente Praktijkervaring, Hasselt, LUC, 127 p. + bijlagen
- 1143. VANLERBERGHE, Peter (1997), Fusies en Overnames in de Banksector van de E.U. Determinanten en Gevolgen, Antwerp, UFSIA, 89 p. + annexes
- 1144. VANLOKEREN, Stefan (1998), Fusies en Overnames in de Banksector, Antwerp, UFSIA, 92 p.
- 1145. VERBAND DEUTSCHER MASCHINEN- UND ANLAGENBAU (VDMA, 2005), Wer baut Maschinen in Deutschland, http://www.vdma-products.com/firma,81310.htm
- 1146. VERHOEFF, Jan Willem (1997), Shore Reception Facilities, http://www.vpa.org.vn
- 1147. VERMEULEN, C.A.P. (1988), "Co-makership, samen ontwikkelen en produceren", Bedrijfskunde: Tijdschrift voor Modern Management, Deventer, Kluwer, Vol. 59, n° 4, p.331-336
- 1148. VEUGELERS, Reinhilde (1993), Alliances and the Pattern of Comparative Advantages: a sectoral Analysis, Leuven, KULeuven, Onderzoeksrapport 9336, 33 p.
- 1149. VEZZOSO, Giovanni (2000), The Restructing of the Port of Genoa, working paper, 13 p., http://www.maritim.uni-bremen.de/ports/global/VEZZOSO.pdf
- 1150. VICKERMAN, John (2003), Understanding National Freight System Dynamics: State of our Port and Intermodal Freight Sytems, 49 p., paper presented at 28th Annual Summer Ports, Waterways, Freight & International Trade Conference, Portland, Oregon, 16 July 2003, http://gulliver.trb.org/conferences/JM/SessionJointVickerman.pdf
- 1151. VICKERMAN, John (2003b), Securing the North American Freight Logistics Supply
Chain, 47 p., 1 April 2003,
http://www.transystems.com/presentations/2003/Pres 04 01 03/Pres 04 01 03.pdf
- 1152. VICKERMAN, John (2003c), Emerging Port Industry Trends in the 21st Trends, 66 p., 2 April 2003,

http://www.transystems.com/presentations/2003/Pres 04 02 03/Pres 04 02 03.pdf

- 1153. VICKERMAN, John (2003d), US Chamber of Commerce Study of Trade and Transportation... The North American Port and Intermodal System, 64 p., 5 March 2003, http://www.transystems.com/presentations/2003/Pres_04_11_03/Pres_04_11_03.pdf
- 1154. VICKERMAN, John (2003e), Planning for Future Transportation Technological Change, 122 p., 15 April 2003, http://www.transystems.com/presentations/2003/Pres 04 15 03/Pres%2004-15-03.pdf
- 1155. VICKERMAN, John (2003f), Agile Port System Program, 52 p., AAPA 2003 Facilities Engineering Seminar, 28 April 2003, http://www.transystems.com/presentations/2003/Pres 04 28 03/Pres%2004-28-03.pdf

- 1156. VICKERMAN, John (2003g), The National Experience: Emerging Trends in North American Intermodal Freight Transportation, 85 p., paper presented 23 May 2003, Forum on Freight Mobility and Economic Prosperity, http://www.transystems.com/presentations/2003/Pres 05 23 03/Pres%2005-23-03.pdf
- 1157. VICKERMAN, John (2003h), America's Ports Falling Further Behind?, 56 p., paper presented 22 September 2003, Council of Logistics Management, http://www.transystems.com/presentations/2003/Pres 09 22 03/image001.htm
- 1158. VICKERMAN, John (2003i), Strategic Maritime and Cargo Logistics Trends and Challenges... (A North-American Perspective), 100 p., 13 November 2003, First Marine Symposium, http://www.transystems.com/presentations//2003/Pres 11 13 03/image001.htm
- 1159. VIEIDER (2004), Malpensa Logistica Europa, http://dc.editricetemi.com/ed_temi/dcFr/articolo.jsp?idArt=69
- 1160. VINH, Nguyen Phuong (2004), Container Inspections, SGP, http://www.vpa.org.vn
- 1161. VINH, Nguyen Phuong (2004b), Terminal Safety, http://www.vpa.org.vn
- 1162. VINOD, Mathew (2001), "A Port-railway Venture on fast Track", The Hindu Business Line,

http://www.thehindubusinessline.com/businessline/logistic/2001/12/17/stories/0917c05a.htm

- 1163. VIS, Iris F.A. and René DE KOSTER (2003), "Transshipment of Containers at a Container Terminal : an Overview", European Journal of Operational Research, n° 147, pp. 1 16
- 1164. VLAAMSE GEMEENSCHAP (1999), AWZ Terugblik 1997-1998, http://www.lin.vlaanderen.be/awz/publi/terugblik9798.pdf
- 1165. VLAAMSE HAVENCOMMISSIE (2004), Jaaroverzicht Vlaamse Havens 2003, http://www.serv.be/Publicaties/611.pdf
- 1166. VOPAK TERMINALS SINGAPORE PTE LTD (2005), About us, http://www.jurongisland.com/Companies/Information.asp?Company=Vopak+Terminals+Sin gapore+Pte+Ltd&Type=AboutUs
- 1167. WAALHAVEN GROUP bv (2004), Company Information, http://www.waalhaven-group.nl
- 1168. WALLIS, Keith (2003), "Mid-stream operators object to trade judgment", The Standard, Edition 11 June,

http://www.thestandard.com.hk/news_detail_frame.cfm?articleid=39445&intcatid=1

- 1169. WANG, James J. and Daniel OLIVIER. (2003), La Gouvernance des Ports et la relation Ville-Port en Chine, http://www.afitl.com/CST/Contenu%20des%20pr%C3%A9c%C3%A9dents%20num%C3% A9ros/N44/WangOliv.pdf
- 1170. WARD, Thomas A. (1999), "Optimising quayside productivity using computer simulation analysis", Port Technology International, Edition 8, pp. 65-68
- 1171. WARD, Thomas A. (2004), Innovative Solutions in Technology "Before, After and Next", paper presented at the AAPA Planning & Research Committee, Spring 2004, http://www.aapa-ports.org/programs/seminar presentations/04 Planning/Ward Tom.pdf
- 1172. WARF, Barney en Louis KLEYN (1989), "Competitive status of US ports in mid 80's", Maritime Policy and Management, 1989, vol. 2, nr. 16, pp. 157 172
- 1173. WATERFRONT ACTION (2005), LWVO Waterfront Study,

http://waterfrontaction.org/learn/league/ch2.htm

- 1174. WATERFRONT COALITION (2005), Industry Information, http://www.portmod.org/INDUSTRY%20INFO/Transportation.htm
- 1175. WAUTHY, Xavier (1996), "Quality choice in models of vertical differentiation", Journal of Industrial Economics, Vol. 44, n° 3, pp. 345-353
- 1176. WEBB-SITE.COM (1999), The Ghost of CT3, http://www.webbsite.com/articles/ct3.htm
- 1177. WEEKE, A. (1998), Container Stuffing and Stripping, Scheepvaart en Transport College, Rotterdam, http://www.vpa.org.vn
- 1178. WEGBERG, M., van (1995), "Mergers and Alliances in the Multimedia Market", Research Memorandum, n° 7, 13 p.
- 1179. WEHNERT, Jürgen (2001), BALTICOM Deliverable 4.4 Findings on the Exchange of Feeder Transport Information with the Swedish portIT System, 43 p., http://www.balticom.org/download/reports/Deliverable_7_1.pdf
- 1180. WEI, Wong Hin (2003), Economic Impacts and Implications of Trade and Maritime Security Initiatives on Malaysia, www.mima.gov.my/mima/htmls/papers/ pdf/whw/whw_econ-impact.pdf
- 1181. WEIL, H.J. (2005), BLG Unterstützungskasse GmbH, e-mail contact
- 1182. WEINSTEIN, David E. and Yishay YAFEH (1995), "Japan's corporate groups: collusive or competitive? An empirical investigation of keiretsu behaviour", Journal of Industrial Economics, Vol. 43, n° 4, pp. 359-376
- 1183. WEISMAN, Dennis L. (2002), A Theory of Mergers in Network Industries, Manhattan, Waters Hall, Kansas State University, 17 p.
- 1184. WERDEN, G.J. (1981), "The use and misuse of shipments data in defining geographic markets", The Antitrust Bulletin, Vol. 26, pp. 719-737
- 1185. WERDEN, Gregory and Luke M. FROEB (1998), "The entry-inducing effects of horizontal mergers: an exploratory analysis", Journal of Industrial Economics, Vol. 46, n° 4, pp. 525-543
- 1186. WEST L.B. PANMURE (2001), Container Terminals, 18p., http://www.westlbpanmure.com/documents/transport/container_terminals.pdf
- 1187. WESTPORT MALAYSIA (2003), Our Services Container, http://www.westportmalaysia.com.my
- 1188. WIEGMANS, Bart W., Peter NIJKAMP and Piet RIETVELD (2001), Container terminals in Europe: their positioning in marketing channel flows, Research Memorandum, n° 5, 22 p.
- 1189. WIEGMANS, Bart, Barry UBBELS, Piet RIETVELD and Peter NIJKAMP (2002), "Investment in container terminals: public private partnerships in Europe", International Journal of Maritime Economics, n°4, pp. 1 – 20
- 1190. WIEZORKE, Christiane (2000), ITIP Deliverable 2 The intermodal terminal and its equipment: An attempt at the definition of success and failure, http://www.eutp.org/download/itip/D2/D2-final.doc
- 1191. WILLIAMSON, Oliver E. and Scott E. MASTEN (1999), The Economics of Transaction Costs, Cheltenham, Edward Elgar, 365p.
- 1192. WILSON, Ian D., Paul A. ROACH and J. Andrew WARE (2001), "Container stowage

pre-planning: using search to generate solutions, a case study", Knowledge-Based Systems, Vol. 14, pp. 137 – 145

- 1193. WILSON, Jim (2005), "Harbour 'Havoc' again", Fairplay, Edition 7 April, p.23 24
- 1194. WINKELMANS, Willy, "Ports as nodal points in a global transport system", in DOLMAN, Antony J. and Jan VAN ETTINGER (1990), Pacem in Maribus VIII Ports as Nodal Points in a Global Transport System, Oxford, Pergamon Press, pp. 65 76
- 1195. WOODBRIDGE, Clive (2002), "The big four", Containerisation International, March Edition, pp. 86-89
- 1196. WORLD BANK (2001), Port Reform Toolkit Module 3: Alternative Port Management Structures and Ownership Models, 78 p., http://rru.worldbank.org/logandopen.aspx?DocumentID=868&URL=http://rru.worldbank.org /Toolkits/Documents/Ports/mod3.pdf
- 1197. WORLD BANK (2001b), Port Reform Toolkit Module 1: Framework for Port Reform, 28

http://rru.worldbank.org/logandopen.aspx?DocumentID=868&URL=http://rru.worldbank.org /Toolkits/Documents/Ports/mod3.pdf

- 1198. WORLD BANK (2001c), Port Reform Toolkit Module 4: Legal Tools for Port Reform, 73 p., http://www.worldbank.org/transport/ports/toolkit/mod4.pdf
- 1199. WORLD CARGO NEWS ONLINE (1998), PSA wins Pipavav, http://www.worldcargonews.com/htm/o8981b.htm
- 1200. WORLD CARGO NEWS ONLINE (1998b), PSA launches Mega Depot Joint Venture, http://www.worldcargonews.com/htm/o79816d.htm
- 1201. WORLD CARGO NEWS ONLINE (1998c), Noord in Ventspils, http://www.worldcargonews.com/htm/o7985b.htm
- 1202. WORLD CARGO NEWS ONLINE (1999), ECT/Maersk win East Port Said, http://www.worldcargonews.com/htm/o998xwcn4b.htm
- 1203. WORLD CARGO NEWS ONLINE (2000), Strong results for Contship Italia, http://www.worldcargonews.com/htm/n20000501.052099.htm
- 1204. WORLD CARGO NEWS ONLINE (2000b), ICTSI in Dar es Salaam Deal, http://www.worldcargonews.com/htm/n20000501.053307.htm
- 1205. WORLD CARGO NEWS ONLINE (2000c), Koper for Trieste?, http://www.worldcargonews.com/htm/n20000901.064495.htm
- 1206. WORLD CARGO NEWS ONLINE (2000d), PSA pulls a Leg, http://www.worldcargonews.com/htm/n20000801.070962.htm
- 1207. WORLD CARGO NEWS ONLINE (2000e), P&O Ports bags Chennai Deal, http://www.worldcargonews.com/htm/n20000701.073308.htm
- 1208. WORLD CARGO NEWS ONLINE (2000f), Terminal moves in the Plate, http://www.worldcargonews.com/htm/n20000901.064635.htm
- 1209. WORLD CARGO NEWS ONLINE (2000g), BACTSSA terminal up for sale?, http://www.worldcargonews.com/htm/n20001001.069832.htm
- 1210. WORLD CARGO NEWS ONLINE (2000h), Århus aims for big league, http://www.worldcargonews.com/htm/n20000901.066629.htm
- 1211. WORLD CARGO NEWS ONLINE (2000i), ...eyeing KMT stake, http://www.worldcargonews.com/htm/n20000901.063767.htm

- 1212. WORLD CARGO NEWS ONLINE (2000j), Maersk takes PTP Stake, http://www.worldcargonews.com/htm/n20000901.064076.htm
- 1213. WORLD CARGO NEWS ONLINE (2000k), ...adding Terminal in Dominican Republic, http://www.worldcargonews.com/htm/n20000701.078154.htm
- 1214. WORLD CARGO NEWS ONLINE (2000l), Attending to unFinnished, http://www.worldcargonews.com/htm/n20001120.044683.htm
- 1215. WORLD CARGO NEWS ONLINE (2000m), Ports in a Sea of Change?, http://www.worldcargonews.com/htm/n20001220.068783.htm
- 1216. WORLD CARGO NEWS ONLINE (2000n), ... and goes Dutch, http://www.worldcargonews.com/htm/n20000101wcn7a.htm
- 1217. WORLD CARGO NEWS ONLINE (2001), CSG into terminals, http://www.worldcargonews.com/htm/n20010618.054528.htm
- 1218. WORLD CARGO NEWS ONLINE (2001b), Enter BLG AutoTec, http://www.worldcargonews.com/htm/n20010716.059420.htm
- 1219. WORLD CARGO NEWS ONLINE (2001c), Look quickly or you might miss it, http://www.worldcargonews.com/htm/n20010701.065407.htm
- 1220. WORLD CARGO NEWS ONLINE (2001d), HPH seeks Xiamen deal..., http://www.worldcargonews.com/htm/n20010920.053898.htm
- 1221. WORLD CARGO NEWS ONLINE (2001e), Shuttles for Euromax?, http://www.worldcargonews.com/htm/n20010101.042042.htm
- 1222. WORLD CARGO NEWS ONLINE (2001f), Leaner, meaner and better?, http://www.worldcargonews.com/htm/n20010610.038754.htm
- 1223. WORLD CARGO NEWS ONLINE (2001g), VTE gets bigger, http://www.worldcargonews.com/htm/n20011001.039340.htm
- 1224. WORLD CARGO NEWS ONLINE (2001h), Sinport Airport formed, http://www.worldcargonews.com/htm/n20010610.037566.htm
- 1225. WORLD CARGO NEWS ONLINE (2001i), Duisburg Merger, http://www.worldcargonews.com/htm/n20010201.052284.htm
- 1226. WORLD CARGO NEWS ONLINE (2001j), CSXWT into S Africa, http://www.worldcargonews.com/htm/n20010101.043416.htm
- 1227. WORLD CARGO NEWS ONLINE (2002), Jurong Port's box bid, http://www.worldcargonews.com/htm/n20020115.044235.htm
- 1228. WORLD CARGO NEWS ONLINE (2002b), Prevention Better than Cure, http://www.worldcargonews.com/htm/n20020115.044235.htm
- 1229. WORLD CARGO NEWS ONLINE (2002bc), PSA out of Aden?, http://www.worldcargonews.com/htm/n20031201.920554.htm
- 1230. WORLD CARGO NEWS ONLINE (2002c), Cosco Pacific to expand Port Portfolio, www.worldcargonews.com/htm/n20020901.293819.htm
- 1231. WORLD CARGO NEWS ONLINE (2002d), Hutchison eyes Bandar Abbas, http://www.worldcargonews.com/htm/n20020201.035866.htm
- 1232. WORLD CARGO NEWS ONLINE (2003), Cosco in Singapore Terminal Joint Venture, http://www.worldcargonews.com/htm/n wcn20030901.017275.htm
- 1233. WORLD CARGO NEWS ONLINE (2003aa), Port Reform Move in Oz, http://www.worldcargonews.com/htm/n20031101.536903.htm

1234. WORLD CARGO NEWS ONLINE (2003ab), Efficiency Incentive, http://www.worldcargonews.com/htm/n20031101.611499.htm

1235. WORLD CARGO NEWS ONLINE (2003ac), Efficiency Incentive, http://www.worldcargonews.com/htm/n20031101.611499.htm

- 1236. WORLD CARGO NEWS ONLINE (2003ad), Box Inspection at Snail's Pace, http://www.worldcargonews.com/htm/nf20031101.373281.htm
- 1237. WORLD CARGO NEWS ONLINE (2003ae), Vibrations in the Cab, http://www.worldcargonews.com/htm/nf20031015.226099.htm
- 1238. WORLD CARGO NEWS ONLINE (2003af), Winning yet more Rubbers, http://www.worldcargonews.com/htm/nf20031015.253630.htm
- 1239. WORLD CARGO NEWS ONLINE (2003ag), Home Spreaders, http://www.worldcargonews.com/htm/nf20031015.484067.htm
- 1240. WORLD CARGO NEWS ONLINE (2003ah), Need for New Definitions, http://www.worldcargonews.com/htm/nf20031015.555892.htm
- 1241. WORLD CARGO NEWS ONLINE (2003ai), Boxed Bulk is in the Bag, http://www.worldcargonews.com/htm/nf20031015.578696.htm
- 1242. WORLD CARGO NEWS ONLINE (2003aj), Capital ups Box Security, http://www.worldcargonews.com/htm/nf20031015.859382.htm
- 1243. WORLD CARGO NEWS ONLINE (2003ak), Security Seals back to Basics?, http://www.worldcargonews.com/htm/nf20031015.520863.htm
- 1244. WORLD CARGO NEWS ONLINE (2003al), Autorack in Gear, http://www.worldcargonews.com/htm/n20031001.056717.htm
- 1245. WORLD CARGO NEWS ONLINE (2003am), Israel ports Strife, http://www.worldcargonews.com/htm/n20031001.089988.htm
- 1246. WORLD CARGO NEWS ONLINE (2003an), Two new Cranes for Pusan, http://www.worldcargonews.com/htm/n20031001.168003.htm
- 1247. WORLD CARGO NEWS ONLINE (2003ao), BEE for Durban, http://www.worldcargonews.com/htm/n20031001.187381.htm
- 1248. WORLD CARGO NEWS ONLINE (2003ap), MSC Deal in Venice, http://www.worldcargonews.com/htm/n20031001.220750.htm
- 1249. WORLD CARGO NEWS ONLINE (2003aq), Hibiki on Track, http://www.worldcargonews.com/htm/n20031001.811006.htm
- 1250. WORLD CARGO NEWS ONLINE (2003ar), Portsynergy boosts French Interests, http://www.worldcargonews.com/htm/n20031001.993569.htm
- 1251. WORLD CARGO NEWS ONLINE (2003as), SA funding in pipeline, http://www.worldcargonews.com/htm/n20030901.049272.htm
- 1252. WORLD CARGO NEWS ONLINE (2003at), More RTGs for ZPMC, http://www.worldcargonews.com/htm/n20030901.339295.htm
- 1253. WORLD CARGO NEWS ONLINE (2003au), New Players in Dalian, http://www.worldcargonews.com/htm/n20030901.430891.htm
- 1254. WORLD CARGO NEWS ONLINE (2003av), Silence in Trinidad, http://www.worldcargonews.com/htm/n20030901.570606.htm
- 1255. WORLD CARGO NEWS ONLINE (2003aw), Pusan setbacks Bolster Shanghai..., http://www.worldcargonews.com/htm/n20030901.775813.htm

- 1256. WORLD CARGO NEWS ONLINE (2003ax), Port Operators waiting on Yangshan plans, http://www.worldcargonews.com/htm/nf20030901.643696.htm
- 1257. WORLD CARGO NEWS ONLINE (2003ay), Gdansk makes progress?, http://www.worldcargonews.com/htm/n20030815.121671.htm
- 1258. WORLD CARGO NEWS ONLINE (2003az), A Tale of two opposing Tales, http://www.worldcargonews.com/htm/n20030815.124633.htm
- 1259. WORLD CARGO NEWS ONLINE (2003b), ICTSI commits US\$80 mill to BCT Gdynia, http://www.worldcargonews.com/htm/n20030601.098306.htm
- 1260. WORLD CARGO NEWS ONLINE (2003ba), Altenwerder comes of Age, http://www.worldcargonews.com/htm/n20030815.495406.htm
- 1261. WORLD CARGO NEWS ONLINE (2003bb), HPH launches new Mexican Wave, http://www.worldcargonews.com/htm/n20030701.373602.htm
- 1262. WORLD CARGO NEWS ONLINE (2003bc), Cosco in Singapore Terminal Joint Venture, http://www.worldcargonews.com/htm/n20030901.017275.htm
- 1263. WORLD CARGO NEWS ONLINE (2003bd), Qingdao port deals cause Confusion, http://www.worldcargonews.com/htm/n20031101.775740.htm
- 1264. WORLD CARGO NEWS ONLINE (2003be), ...CSXWT steps in, http://www.worldcargonews.com/htm/n20030901.566624.htm
- 1265. WORLD CARGO NEWS ONLINE (2003bf), .snub for Vallarpadam, http://www.worldcargonews.com/htm/n20030301.840269.htm
- 1266. WORLD CARGO NEWS ONLINE (2003bg), CSXWT to buy Dragados SPL?, http://www.worldcargonews.com/htm/n20030601.686528.htm
- 1267. WORLD CARGO NEWS ONLINE (2003bh), Change of Owner for CSKD-Intrans, http://www.worldcargonews.com/htm/n20030101.916979.htm
- 1268. WORLD CARGO NEWS ONLINE (2003c), HPH acquires IIHC, http://www.worldcargonews.com/htm/n20010623.042449.htm
- 1269. WORLD CARGO NEWS ONLINE (2003d), PTP Smartens up, http://www.worldcargonews.com/htm/nf20031215.610440.htm
- 1270. WORLD CARGO NEWS ONLINE (2003e), WGQ4 hits Million Mark, http://www.worldcargonews.com/htm/n20031201.311015.htm
- 1271. WORLD CARGO NEWS ONLINE (2003f), Call to Halt UK Box Port Developments, http://www.worldcargonews.com/htm/n20031201.575527.htm
- 1272. WORLD CARGO NEWS ONLINE (2003g), Visakha Additions, http://www.worldcargonews.com/htm/n20031201.844234.htm
- 1273. WORLD CARGO NEWS ONLINE (2003h), More Cranes for Liebherr, http://www.worldcargonews.com/htm/n20031201.859817.htm
- 1274. WORLD CARGO NEWS ONLINE (2003i), Tollerort Expansion, http://www.worldcargonews.com/htm/n20031201.994915.htm
- 1275. WORLD CARGO NEWS ONLINE (2003j), Never mind the Weather..., http://www.worldcargonews.com/htm/nf20031115.699377.htm
- 1276. WORLD CARGO NEWS ONLINE (2003k), Ust-Luga brought forward?, http://www.worldcargonews.com/htm/nf20031115.824054.htm
- 1277. WORLD CARGO NEWS ONLINE (20031), Associated Danish Ports plans ahead, http://www.worldcargonews.com/htm/nf20030915.050967.htm

1278. WORLD CARGO NEWS ONLINE (2003m), Between a Rock and a Hard Place, http://www.worldcargonews.com/htm/nf20030915.569063.htm

1279. WORLD CARGO NEWS ONLINE (2003n), Short and Sweet, http://www.worldcargonews.com/htm/nf20030915.929799.htm

- 1280. WORLD CARGO NEWS ONLINE (2003o), Phone Card Diagnostics, http://www.worldcargonews.com/htm/nf20030915.045670.htm
- 1281. WORLD CARGO NEWS ONLINE (2003p), To Davy Jones' Locker with the Jones Act?, http://www.worldcargonews.com/htm/nf20030915.255083.htm
- 1282. WORLD CARGO NEWS ONLINE (2003q), Ports catch a Heavy Cold, http://www.worldcargonews.com/htm/nf20030915.695886.htm
- 1283. WORLD CARGO NEWS ONLINE (2003r), Brazilian Port Privatisation: is Next Gear Reverse?, http://www.worldcargonews.com/htm/nf20030915.753932.htm
- 1284. WORLD CARGO NEWS ONLINE (2003s), New Overheight from Timars, http://www.worldcargonews.com/htm/nf20030915.831338.htm
- 1285. WORLD CARGO NEWS ONLINE (2003t), Kemi Shipping invests, http://www.worldcargonews.com/htm/nf20030915.927452.htm
- 1286. WORLD CARGO NEWS ONLINE (2003u), Gaza Dreaming on, http://www.worldcargonews.com/htm/n20031101.048294.htm
- 1287. WORLD CARGO NEWS ONLINE (2003v), Delays to Nigerian Port Reform?, http://www.worldcargonews.com/htm/n20031101.089229.htm
- 1288. WORLD CARGO NEWS ONLINE (2003w), Bad timing for Everett?, http://www.worldcargonews.com/htm/n20031101.250528.htm
- 1289. WORLD CARGO NEWS ONLINE (2003x), New Mombasa Charges under Fire, http://www.worldcargonews.com/htm/n20031101.388344.htm
- 1290. WORLD CARGO NEWS ONLINE (2003y), Sydney boxed out, http://www.worldcargonews.com/htm/n20031101.418988.htm
- 1291. WORLD CARGO NEWS ONLINE (2003z), Le Havre concerned over Inland Links, http://www.worldcargonews.com/htm/n20031101.425607.htm
- 1292. WORLD CARGO NEWS ONLINE (2004), ...more trouble in Trieste, http://www.worldcargonews.com/htm/n20040801.120068.htm
- 1293. WORLD CARGO NEWS ONLINE (2004aa), London Dredging, http://www.worldcargonews.com/htm/n20041126.073786.htm
- 1294. WORLD CARGO NEWS ONLINE (2004ab), Lines livid over Melbourne Levy, http://www.worldcargonews.com/htm/n20041126.588028.htm
- 1295. WORLD CARGO NEWS ONLINE (2004ac), PSA's new RTGs, http://www.worldcargonews.com/htm/n20041126.898413.htm
- 1296. WORLD CARGO NEWS ONLINE (2004ad), DPI seeks Partners for Vallarpadam, http://www.worldcargonews.com/htm/n20041126.919755.htm
- 1297. WORLD CARGO NEWS ONLINE (2004ae), Do crane operators know the ropes?, http://www.worldcargonews.com/htm/nf20041130.028447.htm
- 1298. WORLD CARGO NEWS ONLINE (2004af), Adding value with portcentric logistics, http://www.worldcargonews.com/htm/nf20041130.395446.htm
- 1299. WORLD CARGO NEWS ONLINE (2004ag), Taxed out of Brazil?..., http://www.worldcargonews.com/htm/n20050113.290520.htm

- 1300. WORLD CARGO NEWS ONLINE (2004ah), Keller Deal kicked Back, http://www.worldcargonews.com/htm/n20050113.366092.htm
- 1301. WORLD CARGO NEWS ONLINE (2004ai), Oryx/ABB Crane Simulator, http://www.worldcargonews.com/htm/n20050113.579767.htm
- 1302. WORLD CARGO NEWS ONLINE (2004aj), Ningbo in a Spin, http://www.worldcargonews.com/htm/n20050113.668837.htm
- 1303. WORLD CARGO NEWS ONLINE (2004ak), Buenos Aires row, http://www.worldcargonews.com/htm/n20050114.270976.htm
- 1304. WORLD CARGO NEWS ONLINE (2004al), Free for all at JNP, http://www.worldcargonews.com/htm/n20050114.360121.htm
- 1305. WORLD CARGO NEWS ONLINE (2004am), Ringing the changes in Kotka, http://www.worldcargonews.com/htm/nf20050114.054331.htm
- 1306. WORLD CARGO NEWS ONLINE (2004an), BCT carries on Regardless, http://www.worldcargonews.com/htm/nf20050114.296048.htm
- 1307. WORLD CARGO NEWS ONLINE (2004ao), Engaging Finland's Western Front, http://www.worldcargonews.com/htm/nf20050114.963342.htm
- 1308. WORLD CARGO NEWS ONLINE (2004ap), Crystal clear Container Management, http://www.worldcargonews.com/htm/nf20050116.486597.htm
- 1309. WORLD CARGO NEWS ONLINE (2004aq), Tackling the environmental impacts, http://www.worldcargonews.com/htm/nf20050116.678153.htm
- 1310. WORLD CARGO NEWS ONLINE (2004ar), "Smart" container put to the Test, http://www.worldcargonews.com/htm/n20050221.062259.htm
- 1311. WORLD CARGO NEWS ONLINE (2004as), US Container Ports get Verticallychallenged, http://www.worldcargonews.com/htm/nf20040715.024682.htm
- 1312. WORLD CARGO NEWS ONLINE (2004at), Shenzhen building Capacity, http://www.worldcargonews.com/htm/nf20040715.249433.htm
- 1313. WORLD CARGO NEWS ONLINE (2004au), New Arck Sensors, http://www.worldcargonews.com/htm/n20040701.132084.htm
- 1314. WORLD CARGO NEWS ONLINE (2004av), Jib Cranes get Thumbs down, http://www.worldcargonews.com/htm/n20040701.132084.htm
- 1315. WORLD CARGO NEWS ONLINE (2004aw), Holding Cranes, http://www.worldcargonews.com/htm/n20040701.473095.htm
- 1316. WORLD CARGO NEWS ONLINE (2004ax), Maher goes West, http://www.worldcargonews.com/htm/n20040701.592550.htm
- 1317. WORLD CARGO NEWS ONLINE (2004ay), Enter the Interceptor, http://www.worldcargonews.com/htm/n20040701.648653.htm
- 1318. WORLD CARGO NEWS ONLINE (2004az), Shannon looks to Boxes, http://www.worldcargonews.com/htm/n20040701.748609.htm
- 1319. WORLD CARGO NEWS ONLINE (2004b), Haldia plans to build on, http://www.worldcargonews.com/htm/n20041119.171247.htm
- 1320. WORLD CARGO NEWS ONLINE (2004ba), APMT for Douala, http://www.worldcargonews.com/htm/n20040701.852819.htm
- 1321. WORLD CARGO NEWS ONLINE (2004bb), Progress to new Emission Rules, http://www.worldcargonews.com/htm/nf20040615.498072.htm

- 1322. WORLD CARGO NEWS ONLINE (2004bc), Global Operations with a Local Touch, http://www.worldcargonews.com/htm/nf20040515.053146.htm
- 1323. WORLD CARGO NEWS ONLINE (2004bd), Terminal XXI handles its first Ship, http://www.worldcargonews.com/htm/nf20040515.330207.htm
- 1324. WORLD CARGO NEWS ONLINE (2004be), Making sure that the Ports Industry goes round, http://www.worldcargonews.com/htm/nf20040515.343773.htm
- 1325. WORLD CARGO NEWS ONLINE (2004bf), Southampton acts to improve Landside, http://www.worldcargonews.com/htm/nf20040515.348854.htm
- 1326. WORLD CARGO NEWS ONLINE (2004bg), Options for Crane Brakes increase, http://www.worldcargonews.com/htm/nf20040515.515894.htm
- 1327. WORLD CARGO NEWS ONLINE (2004bh), Boxed Bulk Boom continues, http://www.worldcargonews.com/htm/nf20040515.973340.htm
- 1328. WORLD CARGO NEWS ONLINE (2004bi), PuriNOx in Houston, http://www.worldcargonews.com/htm/n20040501.292326.htm
- 1329. WORLD CARGO NEWS ONLINE (2004bj), Vizhinjam attracts Interest, http://www.worldcargonews.com/htm/n20040501.383928.htm
- 1330. WORLD CARGO NEWS ONLINE (2004bk), Cosco Pacific moves into the Big League, http://www.worldcargonews.com/htm/n20040501.449286.htm
- 1331. WORLD CARGO NEWS ONLINE (2004bl), Swanson Rethink urged..., http://www.worldcargonews.com/htm/n20040501.497473.htm
- 1332. WORLD CARGO NEWS ONLINE (2004bm), Iraqi Ports planning US\$1 bill Investment, http://www.worldcargonews.com/htm/n20040501.550282.htm
- 1333. WORLD CARGO NEWS ONLINE (2004bn), New World Records?, http://www.worldcargonews.com/htm/n20040501.671042.htm
- 1334. WORLD CARGO NEWS ONLINE (2004bo), Metroport Upgrade, http://www.worldcargonews.com/htm/n20040501.773863.htm
- 1335. WORLD CARGO NEWS ONLINE (2004bp), New routes for Uganda?, http://www.worldcargonews.com/htm/n20040501.876657.htm
- 1336. WORLD CARGO NEWS ONLINE (2004bq), Koblenz expands, http://www.worldcargonews.com/htm/n20040501.879015.htm
- 1337. WORLD CARGO NEWS ONLINE (2004br), YICT ties up Phase III funding Yantai financing complete, http://www.worldcargonews.com/htm/n20040501.899332.htm
- 1338. WORLD CARGO NEWS ONLINE (2004bs), MTL eyes CSXWT HK Terminal..., http://www.worldcargonews.com/htm/n20040401.013043.htm
- 1339. WORLD CARGO NEWS ONLINE (2004bt), Aden calling again, http://www.worldcargonews.com/htm/n20040401.168846.htm
- 1340. WORLD CARGO NEWS ONLINE (2004bu), Nansha plan moves on, http://www.worldcargonews.com/htm/n20040401.210988.htm
- 1341. WORLD CARGO NEWS ONLINE (2004bv), JNP Hub ambitions, http://www.worldcargonews.com/htm/n20040401.381848.htm
- 1342. WORLD CARGO NEWS ONLINE (2004bw), ABP Dibden Bay plan rejected, http://www.worldcargonews.com/htm/n20040401.638107.htm
- 1343. WORLD CARGO NEWS ONLINE (2004bx), Turbo catcher for Diesels, http://www.worldcargonews.com/htm/n20040401.842017.htm

- 1344. WORLD CARGO NEWS ONLINE (2004by), ...as Price War begins, http://www.worldcargonews.com/htm/n20040401.955630.htm
- 1345. WORLD CARGO NEWS ONLINE (2004bz), SAPO's Italian Crane Deal, http://www.worldcargonews.com/htm/nf20040315.061304.htm
- 1346. WORLD CARGO NEWS ONLINE (2004c), Jasper still clinging on, http://www.worldcargonews.com/htm/n20040801.176040.htm
- 1347. WORLD CARGO NEWS ONLINE (2004ca), Auto RTGs, http://www.worldcargonews.com/htm/n20040501.876893.htm
- 1348. WORLD CARGO NEWS ONLINE (2004cb), Fraser River Port Upgrade, http://www.worldcargonews.com/htm/nf20040315.131857.htm
- 1349. WORLD CARGO NEWS ONLINE (2004cc), Towards a new ART form?, http://www.worldcargonews.com/htm/nf20040315.270107.htm
- 1350. WORLD CARGO NEWS ONLINE (2004cd), Yard Crane Automation gathers Pace, http://www.worldcargonews.com/htm/nf20040315.463982.htm
- 1351. WORLD CARGO NEWS ONLINE (2004ce), ...Contecar looks out, http://www.worldcargonews.com/htm/nf20040315.765483.htm
- 1352. WORLD CARGO NEWS ONLINE (2004cf), P&OP goes long at Centerm..., http://www.worldcargonews.com/htm/n20040301.041756.htm
- 1353. WORLD CARGO NEWS ONLINE (2004cg), Exxtor gets bigger, http://www.worldcargonews.com/htm/n20040301.269739.htm
- 1354. WORLD CARGO NEWS ONLINE (2004ch), Pirelli launches new Cable Repair Service, http://www.worldcargonews.com/htm/n20040301.436347.htm
- 1355. WORLD CARGO NEWS ONLINE (2004ci), CSIRO unveils new Container Scanner, http://www.worldcargonews.com/htm/n20040301.785272.htm
- 1356. WORLD CARGO NEWS ONLINE (2004cj), Maersk/ Concor win JNP, http://www.worldcargonews.com/htm/n20040301.994089.htm
- 1357. WORLD CARGO NEWS ONLINE (2004ck), Scanner Vehicle from Shook, http://www.worldcargonews.com/htm/nf20040215.692699.htm
- 1358. WORLD CARGO NEWS ONLINE (2004cl), Hanjin dropping CSXWT HK, http://www.worldcargonews.com/htm/n20040201.184519.htm
- 1359. WORLD CARGO NEWS ONLINE (2004cl), Osaka/Kobe join Forces to cut Costs, http://www.worldcargonews.com/htm/n20040201.325629.htm
- 1360. WORLD CARGO NEWS ONLINE (2004cm), JICT ignores Call to shut down, http://www.worldcargonews.com/htm/n20040201.333036.htm
- 1361. WORLD CARGO NEWS ONLINE (2004cn), Tauranga in Tyre Safety First Claim, http://www.worldcargonews.com/htm/n20040201.517331.htm
- 1362. WORLD CARGO NEWS ONLINE (2004co), UK Ports Debate heats up, http://www.worldcargonews.com/htm/n20040201.553871.htm
- 1363. WORLD CARGO NEWS ONLINE (2004cp), HPH shut out of Beilun Port Deals, http://www.worldcargonews.com/htm/n20040201.655411.htm
- 1364. WORLD CARGO NEWS ONLINE (2004cq), Big Spend in Jeddah, http://www.worldcargonews.com/htm/n20040201.761070.htm
- 1365. WORLD CARGO NEWS ONLINE (2004cr), TCA up and running, http://www.worldcargonews.com/htm/n20040201.766271.htm

- 1366. WORLD CARGO NEWS ONLINE (2004cs), Call for longer leases, http://www.worldcargonews.com/htm/n20040201.851764.htm
- 1367. WORLD CARGO NEWS ONLINE (2004ct), Niches in the North East, http://www.worldcargonews.com/htm/nf20040115.020442.htm
- 1368. WORLD CARGO NEWS ONLINE (2004cu), Long and Short, http://www.worldcargonews.com/htm/nf20040115.027916.htm
- 1369. WORLD CARGO NEWS ONLINE (2004cv), BIFA objects to Charges, http://www.worldcargonews.com/htm/nf20040115.140064.htm
- 1370. WORLD CARGO NEWS ONLINE (2004cw), Policy Void at the Top hurts, http://www.worldcargonews.com/htm/nf20040115.651889.htm
- 1371. WORLD CARGO NEWS ONLINE (2004cx), Four scanners for ICTSI, http://www.worldcargonews.com/htm/n20040501.647045.htm
- 1372. WORLD CARGO NEWS ONLINE (2004cy), La Filippina ICTSI opererà un Container Terminal nel Porto Naha (Okinawa), http://www.informare.it/news/gennews/2004/20042331.asp
- 1373. WORLD CARGO NEWS ONLINE (2004cz), Cosmos buys out of HNN, http://www.worldcargonews.com/htm/n20040101.228392.htm
- 1374. WORLD CARGO NEWS ONLINE (2004d), Saigon relocations approved, http://www.worldcargonews.com/htm/n20040801.224263.htm
- 1375. WORLD CARGO NEWS ONLINE (2004da), Cosco to take HNN stake?, http://www.worldcargonews.com/htm/n20040601.313614.htm
- 1376. WORLD CARGO NEWS ONLINE (2004db), PSA the front Runner for CSXWT terminals, http://www.worldcargonews.com/htm/nf20041128.926903.htm
- 1377. WORLD CARGO NEWS ONLINE (2004e), Ambitious Ilyichevsk, http://www.worldcargonews.com/htm/n20040801.310284.htm
- 1378. WORLD CARGO NEWS ONLINE (2004f), Aqaba deal for APMT, http://www.worldcargonews.com/htm/n20040801.319083.htm
- 1379. WORLD CARGO NEWS ONLINE (2004g), Brunei seeks partner for new box port, http://www.worldcargonews.com/htm/n20040801.319083.htm
- 1380. WORLD CARGO NEWS ONLINE (2004h), Tangier interest running high, http://www.worldcargonews.com/htm/n20040801.645319.htm
- 1381. WORLD CARGO NEWS ONLINE (2004i), More Terberg tractors for Iran, http://www.worldcargonews.com/htm/n20040801.657914.htm
- 1382. WORLD CARGO NEWS ONLINE (2004i), New Beirut concession, http://www.worldcargonews.com/htm/n20040801.647346.htm
- 1383. WORLD CARGO NEWS ONLINE (2004j), AutoRacks enter service, http://www.worldcargonews.com/htm/n20040801.683744.htm
- 1384. WORLD CARGO NEWS ONLINE (2004k), New Modal Shift Initiatives shape up, http://www.worldcargonews.com/htm/nf20040815.269068.htm
- 1385. WORLD CARGO NEWS ONLINE (2004k), Takoradi to undergo major expansion, http://www.worldcargonews.com/htm/n20040801.771173.htm
- 1386. WORLD CARGO NEWS ONLINE (20041), Linking the North Sea with the European Hinterland, http://www.worldcargonews.com/htm/nf20040815.981529.htm
- 1387. WORLD CARGO NEWS ONLINE (20041), New Petrolesport terminal plan,

http://www.worldcargonews.com/htm/n20040801.878580.htm

- 1388. WORLD CARGO NEWS ONLINE (2004m), APS bags Security Contracts, http://www.worldcargonews.com/htm/n20040801.061001.htm
- 1389. WORLD CARGO NEWS ONLINE (2004n), X-ray for Adelaide, http://www.worldcargonews.com/htm/n20040801.722152.htm
- 1390. WORLD CARGO NEWS ONLINE (2004o), P&OP secures Kulpi, http://www.worldcargonews.com/htm/n20040801.994557.htm
- 1391. WORLD CARGO NEWS ONLINE (2004p), ...upping Stake in Pipavav port, http://www.worldcargonews.com/htm/n20041118.015041.htm
- 1392. WORLD CARGO NEWS ONLINE (2004q), PSA/HPH in the Hunt for Gwadarport, http://www.worldcargonews.com/htm/n20041118.067614.htm
- 1393. WORLD CARGO NEWS ONLINE (2004r), East Coast/APM M&R deal, http://www.worldcargonews.com/htm/n20041118.269355.htm
- 1394. WORLD CARGO NEWS ONLINE (2004s), APMT inks Xiamen deal..., http://www.worldcargonews.com/htm/n20041118.694335.htm
- 1395. WORLD CARGO NEWS ONLINE (2004t), Early start for Vallarpadam?, http://www.worldcargonews.com/htm/n20041118.856049.htm
- 1396. WORLD CARGO NEWS ONLINE (2004u), Mombasa Delays..., http://www.worldcargonews.com/htm/n20041118.943597.htm
- 1397. WORLD CARGO NEWS ONLINE (2004v), Shenzhen Terminals hit by Box Charge, http://www.worldcargonews.com/htm/n20041119.610857.htm
- 1398. WORLD CARGO NEWS ONLINE (2004w), No Hoorays for X-rays, http://www.worldcargonews.com/htm/n20041119.886520.htm
- 1399. WORLD CARGO NEWS ONLINE (2004x), NAWC looking for a Decongestant, http://www.worldcargonews.com/htm/nf20041122.778268.htm
- 1400. WORLD CARGO NEWS ONLINE (2004y), Comparing Automated RMG Solutions, http://www.worldcargonews.com/htm/nf20041122.935537.htm
- 1401. WORLD CARGO NEWS ONLINE (2004z), Congestion in Oz Ports Real or Circumstantial?, http://www.worldcargonews.com/htm/nf20041124.295872.htm
- 1402. WORLD CARGO NEWS ONLINE (2005), Van Phong back on, http://www.worldcargonews.com/htm/n20050218.151441.htm
- 1403. WORLD CARGO NEWS ONLINE (2005aa), Green Light for Chennai Terminal, http://www.worldcargonews.com/htm/n20050419.151972.htm
- 1404. WORLD CARGO NEWS ONLINE (2005ab), JNP Deal closed, http://www.worldcargonews.com/htm/n20050419.213140.htm
- 1405. WORLD CARGO NEWS ONLINE (2005ac), P&O Nedlloyd/Trans-Rak in Car carrying Alliance, http://www.worldcargonews.com/htm/n20050419.253530.htm
- 1406. WORLD CARGO NEWS ONLINE (2005ad), New Berths at Naples, http://www.worldcargonews.com/htm/n20050419.320289.htm
- 1407. WORLD CARGO NEWS ONLINE (2005ae), Mindanao Box Port gets going, http://www.worldcargonews.com/htm/n20050419.371783.htm
- 1408. WORLD CARGO NEWS ONLINE (2005af), Waves in the Sea of Azov, http://www.worldcargonews.com/htm/n20050419.376339.htm
- 1409. WORLD CARGO NEWS ONLINE (2005ag), SCCT tops 41 Moves/Crane Hour,

http://www.worldcargonews.com/htm/n20050419.618599.htm

- 1410. WORLD CARGO NEWS ONLINE (2005ah), NSW proffers PB3T Option, http://www.worldcargonews.com/htm/n20050419.952328.htm
- 1411. WORLD CARGO NEWS ONLINE (2005ai), P&ONL's Genoa sting, http://www.worldcargonews.com/htm/n20050520.729399.htm
- 1412. WORLD CARGO NEWS ONLINE (2005aj), PSA Plans thwarted, http://www.worldcargonews.com/htm/n20050218.756887.htm
- 1413. WORLD CARGO NEWS ONLINE (2005ak), Cosco Pacific disposes of Shenzhen Box Port Stake, http://www.worldcargonews.com/htm/n20050520.477414.htm
- 1414. WORLD CARGO NEWS ONLINE (2005al), Grip of steel tightens around ports, http://www.worldcargonews.com/htm/nf20050323.836849.htm
- 1415. WORLD CARGO NEWS ONLINE (2005am), Single Port Body for Tasmania, http://www.worldcargonews.com/htm/n20050318.938741.htm
- 1416. WORLD CARGO NEWS ONLINE (2005b), Boost for Euromax, http://www.worldcargonews.com/htm/n20050218.154269.htm
- 1417. WORLD CARGO NEWS ONLINE (2005c), MTL plans Upgrade, http://www.worldcargonews.com/htm/n20050218.397262.htm
- 1418. WORLD CARGO NEWS ONLINE (2005d), APM astride the Pillars of Hercules, http://www.worldcargonews.com/htm/n20050218.716769.htm
- 1419. WORLD CARGO NEWS ONLINE (2005e), Big Operators join Forces in Tianjin, http://www.worldcargonews.com/htm/n20050218.770465.htm
- 1420. WORLD CARGO NEWS ONLINE (2005f), ZPMC bags NZ order, http://www.worldcargonews.com/htm/n20050218.810272.htm
- 1421. WORLD CARGO NEWS ONLINE (2005g), Doosan books PSA, http://www.worldcargonews.com/htm/n20040701.366407.htm
- 1422. WORLD CARGO NEWS ONLINE (2005h), PTP Expansion continuing, http://www.worldcargonews.com/htm/n20040701.426825.htm
- 1423. WORLD CARGO NEWS ONLINE (2005i), Bayport moves on, http://www.worldcargonews.com/htm/n20040701.461157.htm
- 1424. WORLD CARGO NEWS ONLINE (2005j), More orders for ZPMC Cranes, http://www.worldcargonews.com/htm/n20050317.054840.htm
- 1425. WORLD CARGO NEWS ONLINE (2005k), Nansha underused as Ships stay away, http://www.worldcargonews.com/htm/n20050317.062189.htm
- 1426. WORLD CARGO NEWS ONLINE (20051), DPI inks Vallarpadam Deal, http://www.worldcargonews.com/htm/n20050317.246504.htm
- 1427. WORLD CARGO NEWS ONLINE (2005m), Battle Lines drawn at Voltri..., http://www.worldcargonews.com/htm/n20050317.259470.htm
- 1428. WORLD CARGO NEWS ONLINE (2005n), Hamburg outlines Investment Budget, http://www.worldcargonews.com/htm/n20050317.286978.htm
- 1429. WORLD CARGO NEWS ONLINE (20050), SA ports upgrade, http://www.worldcargonews.com/htm/n20050317.296335.htm
- 1430. WORLD CARGO NEWS ONLINE (2005p), Ningbo set to challenge Shanghai's new Box Port, http://www.worldcargonews.com/htm/n20050317.396062.htm
- 1431. WORLD CARGO NEWS ONLINE (2005q), Mooring adds MoorFender,

http://www.worldcargonews.com/htm/n20050317.450788.htm

- 1432. WORLD CARGO NEWS ONLINE (2005r), Hutchison moves in on Ceres Paragon..., http://www.worldcargonews.com/htm/n20050317.461395.htm
- 1433. WORLD CARGO NEWS ONLINE (2005s), Brunei hits Box Record, http://www.worldcargonews.com/htm/n20050317.528313.htm
- 1434. WORLD CARGO NEWS ONLINE (2005t), SouthPort Plans, http://www.worldcargonews.com/htm/n20050317.613114.htm
- 1435. WORLD CARGO NEWS ONLINE (2005u), India amends Box Terminal Policy, http://www.worldcargonews.com/htm/n20050317.648836.htm
- 1436. WORLD CARGO NEWS ONLINE (2005v), ...adds Berth in Karachi, http://www.worldcargonews.com/htm/n20050317.741675.htm
- 1437. WORLD CARGO NEWS ONLINE (2005v), PSA requests Tuticorin Change, http://www.worldcargonews.com/htm/n20050317.822875.htm
- 1438. WORLD CARGO NEWS ONLINE (2005w), RTT misses Targets, http://www.worldcargonews.com/htm/n20050317.822875.htm
- 1439. WORLD CARGO NEWS ONLINE (2005x), Tacoma to turn Strads green, http://www.worldcargonews.com/htm/n20050317.993768.htm
- 1440. WORLD CARGO NEWS ONLINE (2005y), First Nigerian port tender, http://www.worldcargonews.com/htm/n20050318.843673.htm
- 1441. WORLD CARGO NEWS ONLINE (2005z), Can Logistics pay its Way?, http://www.worldcargonews.com/htm/n20010920.058573.htm
- 1442. WORLD MARITIME NEWS (1996), River Trade Terminal announces contractor, http://www.transport.ru/2_period/wmn/96/13_12_96.htm
- 1443. WORLD MARITIME NEWS (1997), Israeli strike hits Ports, http://www.transport.ru/2_period/wmn/97/3_01_97.htm
- 1444. WORLD MARITIME NEWS (1997b), Rebidding to be held for Subic Bay Container Terminal Operation, http://www.transport.ru/2 period/wmn/97/3 01 97.htm
- 1445. WORLD MARITIME NEWS (1997c), Azores hit by Storms, Port closed, http://www.transport.ru/2_period/wmn/97/3_01_97.htm
- 1446. WORLD MARITIME NEWS (1997d), H.I.T., Yangming to operate five Wharves in Taichung, http://www.transport.ru/2_period/wmn/97/3_01_97.htm
- 1447. WORLD MARITIME NEWS (1997e), German rivers effected by Winter Weather, Main-Danube Section closed, http://www.transport.ru/2_period/wmn/97/3_01_97.htm
- 1448. WORLD MARITIME NEWS (1997f), Hessenatie takes 50 percent of Sea-Ro, http://www.transport.ru/2_period/wmn/97/3_01_97.htm
- 1449. WORLD MARITIME NEWS (1997g), Hessenatie in Control of Zeebrugge Terminal, http://www.transport.ru/2 period/wmn/97/3 01 97.htm
- 1450. WUERMANN, Ronald (2005), BLG IT, e-mail contact
- 1451. YAHALOM, Shmuel (2002), Intermodal Productivity and Goods Movement Land Access to Port and Terminal Gate Operations, University Transportation Research Center, 71 p.
- 1452. YAP, Robert (2001), Logistics and Transportation, Moving People and Products to World Markets, paper presented at Eyefortransport Asia, 13 September 2001, 12 p., http://www.eyefortransport.com/ResArticles/Robert%20Yap.pdf

- 1453. YIKUN, Feng (2003), "Qingdao to build China's largest Container Seaport", China Internet Information Center, edition July, 30th, http://www.china.org.cn/english/2003/Jul/71167.htm
- 1454. YOSHINO, Michael Y. and U. Srinivasa RANGAN (1995), Strategic Alliances An Entrepreneurial Approach to Globalization, Boston, Harvard Business School Press, 259 p.
- 1455. ZENTRALE-DU (2005), Historische Daten aus Duisburg, http://www.zentraledu.de/historydu.htm
- 1456. ZHANG, Anming (2002), Competition between Strategic Alliances, Working Paper, University of British Columbia, 31 p.
- 1457. ZHANG, Chuqian, Yat-Wah WAN, Jiyin LIU and Richard J. LINN (2002), "Dynamic crane deployment in container storage yards", Transportation Research B, Vol. 36, n° 6, pp. 537-555
- 1458. ZHANG, Chuquian, Jiyin LIU, Yat-wah WAN, Katta G. MURTY and Richard G. LINN (2002), Storage space allocation in container terminals, 37 p., http://iesu5.ieem.ust.hk/dfaculty/wan/research/assign_cont4.pdf
- 1459. ZISS, Steffen (1995), "Vertical integration and horizontal mergers", Journal of Industrial Economics, Vol. 43, n° 1, pp. 63-76

APPENDIX

A.1. Appendix A-1: Sea-port definition

Ports in general have over time been defined in a variety of ways. Every particular definition is tributary to the perspective from which one starts. One of these perspectives is cargo handling. In this respect, Flere's (1967, p. 3) definition can be a good start: "A port exists to provide terminal facilities and services for ships, and transfer facilities and services for waterborne goods and/or passengers". The previous definition shows that ports have from the beginning been linked to ship-to-shore or ship-to-ship transfer. Miglior et al. (2003) equally view the port as a node within the maritime transport chain, tied between sea and land.

One of the port types is a sea port. Branch (1986, p. 1) defines these as follows: "A sea port has been defined as a terminal and an area within which ships are loaded with and/or discharged of cargo, and includes the usual places where ships wait for their turn or are ordered or obliged to wait for their turn, no matter the distance from that area. Usually, it has an interface with other forms of transport and in so doing provides connecting services". The last part of the previous definition, the connection with the hinterland, is the new element compared to Flere's general port definition. It adds the distribution function to Flere's definition which focuses on the port's transfer function. It is especially the <u>hinterland size</u> which is a typical characteristic of sea ports: sea ports on average have a larger hinterland than any other type of port.

Take the example of the port of Antwerp. Shipping companies serving this port ship commodities collected from or to be distributed to a hinterland comprising a lot more than just Belgium: the Netherlands, the Rhine-Ruhr area and Northern France are served via inland waterways, 12 international railway links towards a.o. France, Austria, Scandinavia, Germany and Switzerland) have their terminus in Antwerp, 300 regular road liner services are offered covering the entire European continent as well as the Gulf region and Russia, and 100 pipelines connections are made towards Northern France, the Ruhr area and Rotterdam (GOM, 2002). The port of Hamburg's hinterland stretches from Lisbon in the southwest till Glasgow in the northwest, Saint-Petersburg in the northeast and Istanbul in the southeast. It has direct sailings to 39 destinations outside Germany (Port of Hamburg, 2003). Another

example is the port of South Louisiana, which accounts for 15% of all US exports (Port of South Louisiana, 2003).

It is the type of ports from the previous paragraph which this thesis focuses on. They handle the largest share of a region's, nation's or continent's trade. Recently, intermodalism dramatically increased the port's market perspective (Transystems Corporation, 2002). Due to the increase in hinterlands, more ports get into competition with each other, as is also observed by Hughes (2003).

Sea ports are distinguished from inland ports, the latter of which usually do have much smaller hinterlands. There are however two problems with a hinterland-related classification: (i) also among sea ports, hinterlands may vary in size a lot, and (ii) the hinterland of the smaller sea ports may be as large as or even smaller than that of some larger inland ports. To the first problem and how it affects merger/acquisition decisions in cargo handling, CHAPTER III and CHAPTER IV come back. In answer to the second problem, there is another and more clear criterion allowing to distinguish sea ports from inland ports and therefore clarifying the type of ports we focus on: <u>the location of the port</u>: at sea or not.

An inland port is then defined by Henk (2003, p. 13) as "a site located away from traditional land, air and coastal borders. It facilitates and processes international trade through strategic investments in multimodal transportation assets and by promoting value-added services as goods move through the supply-chain". The latter part of the previous definition of course also applies to sea ports. It is the first part that makes the difference: sea ships cannot reach inland ports.

For most ports, the locational criterion allows a clear categorization. Among the 5 major in terms of tonnage throughput European pure inland ports in 2002 identified by the European Federation of Inland Ports¹ (2004), we find the ports of Strasbourg (10,8 mn tonnes (Port of Strasbourg, 2003)), Ludwigshafen (8,1 mn tonnes (Hafen Ludwigshafen, 2004)), Mannheim

¹ The European Federation of Inland Ports (EFIP) groups the inland ports in the EU, Switzerland and central and eastern Europe (involving the countries Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, the Netherlands, Portugal, Romania, Slovak Republic, Sweden and Switzerland).

(7,9 mn tonnes (Hafen Mannheim, 2004)), Karlsruhe (6,3 mn tonnes (Rheinhäfen Karlsruhe, 2004)) and Mulhouse (5,8 mn tonnes (CCI Sud Alsace Mulhouse)).

A number of ports however meeting the conditions of Henk's inland port definition de facto are sea ports: although they are located some distance away from the waterfront, sea-going vessels can reach them. The European Federation of Inland Ports (2004) indicates the ports in Europe showing this mixed nature. Among the largest of them are Duisburg (37,1 mn tonnes (Port of Duisburg, 2004)), Paris (20,1 mn tonnes (Port of Paris, 2003)), Liège (19,5 mn tonnes (Port Autonome de Liège, 2004)), the Zeekanaal ports (9,9 mn tonnes (nv Zeekanaal en Watergebonden Grondbeheer Vlaanderen, 2003)) and Cologne (9,38 mn tonnes (Häfen und Güterverkehr Köln AG, 2003)). A similar distinction can be made for US inland ports (IRPT, 2004). Moreover, a number of ports like the port of Antwerp are far away from coastal borders, but are commonly called sea ports and are without any doubt more than what one would expect to be an inland port in the spirit of Henk's definition.

This thesis focuses on the cargo transfer where sea-going vessels are involved, which primarily implies dealing with pure sea ports as defined by Henk. But as shown in the previous paragraph, also mixed sea-inland ports of the type shown in the previous paragraph can be part of the relevant geographical market for sea transport. Whether they will be part of it depends on the transport chain cost structure: it can turn out that those mixed sea-inland ports are cost-ineffective for port users, namely in case using a pure sea port and a hinterland mode for reaching the final destination (or in reverse direction) is cheaper than the mixed sea-inland ports solution. So probably the best criterion for discerning sea ports from inland ports is the <u>nature of the vessels entering the port</u>: if sea vessels can reach the ports, they are to be considered as sea ports.

Still, at world scale, the major ports in terms of tonnage used for sea transport turn out to be ports termed as pure sea ports by Henk, as shown by the data from Table A-1. To the specific effects of port location on cargo-handling mergers and/or acquisitions, CHAPTER III and CHAPTER IV hark back. The same will be done for vessel nature, since sea-going vessels are still very diverse in size and structure.

Port	Cargo turnover 2002 (metric tonnes)
Rotterdam	322.107.000
Singapore	251.386.925
Hong Kong	192.500.000
Antwerp	131.271.471
Kaohsiung	118.110.666
Houston	109.399.877
Shanghai	105.716.200
Qingdao	100.586.268
Hamburg	96.448.159
Busan	96.066.000

Table A-1: Major 10 world cargo ports (in tonnes)

Source: Lloyd's list, 2003

A.2. Appendix A-2: Cargo-handling limitation

Cargo handling at a sea port requires a number of activities to take place at the sea port. Different systems are used to classify these activities. Systems are different in scope: some of them only consider the operational sea-port activities, others also include preparatory activities such as infra- and superstructure provision, EDI-facilitation, etc. The most relevant systems are presented here.

In the group of classification systems with an operational focus, Jansson and Shneerson (1982) break up the sea-port transfer process into seven sequential activities, which are presented in Figure A-1. The figure takes the perspective of inbound cargo handling. Of course, a similar representation can be made for outbound streams.



Figure A-1: Sea-port activities according to Jansson and Shneerson

Source: Jansson and Shneerson, 1982, p. 10

Jansson and Shneerson state that capacity constraints of one element may have implications on other elements' efficiency and/or effectiveness. This is marked by the overlap between the various blocks in the chain structure, and especially by the different size of the blocks: usually, not all elements in the sea port have similar capacities. Van de Merbel (1998) applies a variation to Jansson and Shneerson's system: he distinguishes among 5 kinds of activities in 5 different physical zones, as shown in Figure A-2. New compared to Jansson and Shneerson are Container Freight Station (CFS) operations.

Figure A-2: Sea-port activities according to Van de Merbel



Source: own composition based on Van de Merbel, 1998, p. 2

Brennan (2001), in a similar way as Jansson and Shneerson presents a pipeline-like sea-port activities structure, stressing again the different capacities between the activities (see Figure A-3). In line with the activity groups (and corresponding sea port zones) which he distinguishes, Brennan sees as critical factors to sea-port capacity:

- vessel access capacity (passage through approach channel and berth access);
- terminal capacity;
- port-inland interfaces capacity (rail and truck);
- inland transport capacity (rail and truck, linehaul and destinations).



Figure A-3: Balancing pipelines in sea ports according to Brennan

Source: Brennan, 2001, p. 8

Yahalom (2002) discerns three sequential sub-systems in sea ports, to which he assigns the sea-port activities. Some activities can be found in more than one sub-system, as can be seen in Figure A-4.



Figure A-4: Sea-port activities according to Yahalom

Source: own composition based on Yahalom, 2002

Miglior *et al.* (2002) also work with sea-port sub-systems in a series: (i) the wharf system, (ii) the stacking system and (iii) the land-side system. They consider one overall system, the transfer system, which connects the three sub-systems. No particular activities are referred to. Henesey *et al.* (2002) as well as Holguín-Veras and Jara-Díaz (1999) consider 4 terminal sub-systems: (i) the ship-to-shore cycle, (ii) the transfer (between shore and storage area) cycle, (iii) the storage cycle, and (iv) the delivery / receipt cycle. Again, no detail of corresponding cargo handling activities is given.

Steenken *et al.* (2004) describe a terminal as "*an open system of material flow with two external interfaces*", where the interfaces are quay-side (or waterside, with (un-)loading of ships) and land-side (or hinterland, with (un-)loading of trucks and trains), and where containers are stored in stacks. This system can have the structure presented in Figure A-5.



Figure A-5: Sea-port activities according to Steenken et al.

Source: Steenken et al., 2004, p. 6

To the second group of classification systems belongs the system of Trujillo and Nombela (1999, p. 4), who refer to some preparatory activities needed at the sea port: "An efficient sea port requires, besides infrastructure, superstructure and equipment, adequate connections to other transport modes, a motivated management, and sufficiently qualified employees." They categorize sea-port activities as in Figure A-6. It can be noticed that for this second group of systems, the sequence of activities which was typical for the first group has disappeared: some activities are preparatory to cargo handling operations, but also need operation during cargo-handling operations. Locks for instance need to be installed but also operated.



Figure A-6: Sea-port activities according to Trujillo and Nombela

Source: own composition based on Trujillo and Nombela, 1999, p. 19-23

United Nations (2001), who consider four main activities taking place in sea ports for enabling the cargo-handling process, mention a number of additional activities as a condition sine qua non for ship arrival/departure, and also detail the quayside ship operations:

- ship arrival / departure, which requires provision of:
 - o navigational aids;
 - \circ approach channels;
 - o pilotage from outside the port;
 - o locks;
 - o protected waters;
 - o port pilotage;
 - o towage;
 - o berthing and unberthing services;
- quayside operations, which comprises:

- o opening / closing of hatches;
- o breaking out / stowage;
- o cargo handling;
- cargo/container transfer to/from quay;
- cargo arrival / departure.

World Bank (2001b, p. 9) takes a different approach and regroups the list of sea-port activities in two groups: core and value-added services, as in Figure A-7. Marine services here also include provision of access infrastructure, and terminal services include provision of terminal infra- and superstructure. It can however be questioned whether ship repair services should indeed be classified as core services to cargo handling. Indeed, ship repair services will usually be performed in sea ports where ships enter for cargo (un-)loading, but not all ships use this service.



Figure A-7: Sea-port activities by World Bank

Source: own composition based on World Bank, 2001b, p. 9

Op de Beeck (1999, p. 4 - 7) presents an approach of classifying sea-port activities, which copes with most problems or disadvantages of the classification systems presented higher. For

this reason, it is well fit as a guide through the activities taking place at a sea port and impacting on cargo handling costs and revenues. Op de Beeck categorizes in:

- regulatory activities;
- operational activities;
- logistical activities.

The term 'regulatory activities' comprises both what Alderton (1999, p. 6) calls 'administrative activities', which is probably most related to regulation in the strict sense, as well as 'civil engineering activities'. Also Alderton's contribution is used in this section.

Combination of both complementary approaches leads to the classification of sea-port activities given in Figure A-8.



Figure A-8: Sea-port activities based on Op de Beeck and Alderton

Source: own composition based on Op de Beeck (1999, p. 4 – 7) and Alderton (1999, p. 6)

The structure of Figure A-8 is detailed into activities by the two authors. Civil engineering activities then comprise infrastructure provision and maintenance. Administration includes estate management, providing safety and security, collection of charges, promotion, and providing the ship and its crew with stores, water, medical aid, telephone, bunkers, repairs and waste disposal. Operational activities are (un-)loading, storage, intermodal receipt / delivery and (E)DI. Logistical activities finally include consolidation, (un-)stuffing, bagging,

stockpiling, packing, parcelling, tallying, marking, weighing, controlling quality and sampling.

A.3. Appendix A-3: Major container-handling operators' co-operation track record

This appendix presents the six major container-handling companies' track record, company by company. The sequence for each operator is chronological. If a current operator has roots in or affiliations with another (current or former) operator, that other operator's track record is also included, after that of the main operator.

Acquisitions and mergers are marked with arrow lines, start-ups are marked with full lines, and attempts to acquire, merge or start up are in dotted lines. When a company or terminal name is framed red, this means that the exact date of acquisition, merger or start-up is not known. Following color codes are used: blue represents terminals or terminal-operating companies, green represents holding companies, in brown are logistics companies, in red maritime companies, and black finally shows companies not belonging to any of the previous categories.

A.3.1. Hutchison Port Holdings

Figure A-9 represents HPH's track record.

Sources:

HPH (2003 and 2004), HIT (2004), Cargo Services Far East Ltd. (2005), Hutchison Whampoa Ltd. (1997, 1998, 1999, 2000b, 2001, 2001b, 2002, 2003bh, 2005 and 2005b), Hutchison Delta Ports Ltd. (2005), Escape Artist (2000b), Grand Bahama Island Tourism Board (2005), Luxner News Inc. (2000), Brennan (2001b), International Business Data (2005), Shanghai Port Container Co. Ltd (2005), Mc Graw Hill Construction (2002), Informare (2001b), Freightgate (2002), Hong Kong Salvage and Towage (2005), Swire Pacific Ltd. (2005), Asian Economic News (2000), The United Kingdom and Parliament (1999), Cirtwill et al. (2001), World Maritime News (1996), Nafed (1996), Hong Kong Shippers' Council (1999), Nieuwsbank (1999), De Lloyd (1998), Van Driel (2002), European Commission (1999, 2001 and 2002b), Kok, 2001b, Realubit (2001), Bennett (2002), Hyundai Merchant Marine Co. Ltd. (2002), San (1997), Peters (1995), Tradelink-eBiz (2000), World Cargo News Online (1999, 2000e, 2000c, 2000m, 2001e, 2001f, 2001i, 2002d, 2003bb, 2003be, 2004q, 2004bc, 2004ce, 2004cp and 2005r), ECT B.V. (2005), United Nations (2002), Navingo (2003), Informare (1999f and 2002d), Hanno Rotterdam B.V. (2004), Asia Times (2005), Inchcape Shipping Services (2005), Li Ka Shing Foundation Ltd. (2005), American Chamber of Commerce in Egypt (2005), SPG Media PLC (2005), Dardani (1999b), Informatie.Binnenvaart.Nl (2005), Zentrale-Du (2005), Schuttevaer (1998)

ICTSI (2002, 2003 and 2005b), Buenos Aires Port (2001), Empresas ICA S.A., Cargo News Asia (1996, 1997 and 1999), American Defense Council (2003), World Cargo News Online (2000b, 2001f, 2002d, 2003b, 2003av, 2004cx and 2004cy), Cargo News Asia (1998 and 2001), Micco, Pérez (2001), Torres (2005) and De Lloyd (2005ai and 2005y), Pmaesa (2003b), Informare (1999e), Peters (1995)

Figure A-9: HPH's track record

•	▲	1	500/ stortur		♠	
1	Zhuhai Internationa Terminals Jiuzh	al Container 50% nou Ltd. startuj		Zhuhai	Port Enterprises Group	
1992	Zhuhai Internationa Terminals Goa	al Container 50% lan Ltd. startuj	50% startup	Zhuha Group	Zhuhai S.E.Z. Fuhua Group Company Ltd	
	Nanhai Inte Container Ter	minals Ltd. startu	nals Ltd. startup Co		Nanhai Municipal Transport Instruction Investment Company	
1991	Hong Kong Interna Terminals CT	ational 100% startu	▲ 100% acquisition Port of Felixstowe			
	50% COSCO- startup	-HIT Terminals	50%		COSCO	
	100% Hong Ko startup Terr	ng International ninals CT7	startup			
1989	1		Moder	n Terminals Ltd	<u>100%</u> acquisition	
1985	100%Hong KongstartupTermin	International nals CT6	50% Hongkong Salvage and startup Towage Company Ltd.			
1979	100% acquisition Like Shine Foundation Ltd					
1977	Hutchison Whampoa Ltd. merger Hutchison International Ltd.					
1976	100%Hong KongstartupTermin	100%Hong Kong InternationalstartupTerminals CT2				
1974	100% startup Hong	Kong International Ferminals CT4	Swire Pacific Ltd. 100%			
1972	Hongkong United I	Dockyards startup	Acquisition Hor	ngkong Salvage	and Towage Company	
1969	Hong Kong Interna Terminals	ational 85% startu	p 50% startup)	Taikoo Dockyard	
ac	quisition	startuj)			
1888	Admiralty dock	100% startup	-			
1870	Tai Kok Tsui dock facilities	100% startup				
	Hunghom dock facilit	ties 100% startup	-			
1866		Hong Kong and Wi	ampoa Dock Co	mpany		
















A.3.2. Port of Singapore Authority

Figure A-10 represents HPH's track record.

Sources:

Port of Singapore Authority (2005 and 2005b), DFTECB (2005), Cargo News Asia (1997b, 1997c, 1997d, 1997e, 1998b, 2001 and 2003), UNCTAD (1998), World Cargo News Online (1998, 1998b, 1998c, 2000e, 2000n, 2001g, 2001h, 2003bc, 2005ai, 2004q, 2004bd, 2004bt, 2004cz, 2004db and 2005aj), Philippines Port Authority (2005), Bridge Singapore (2005), Caracciolo (2001), AIVP (2001), Asian Development Bank (2000), Fiat (1998), Vieider (2004), Joseph (2003), Times Journal of Construction Design (2004, Marges (2004), Tharakan (2003), PSA Muara Container Terminal Sdn Bhd (2005), Informare (1999c, 2005 and 2005b), Autorita' Garante della Concorrenza e del Mercato (2002), Deputati d'Olivo (2002), Hussain (1999), Wang and Olivier (2003), Informare (1997), UNCTAD (2002), OT Africa Line (2002), CMB (2002, 2003 and 2005), United States Embassy Singapore (2001 and 2002), De Standaard (2002), Port of Antwerp (2000 and 2003d), Vlaamse Gemeenschap (1999), Port of Antwerp (2003 and 2004), World Maritime News (1997f and 1997g), Vlaamse Havencommissie (2004), MBZ nv (2004), Sea-Ro Terminal nv (2004 and 2005), City of Göteborg (2001), Schelde Informatie Centrum (2004), Port of Göteborg (2004), Hessenatie Logistics nv (2005), KKNA (2005), Cosmos nv (2005), Schednet (2000), Singapore Times (2001), Nieuwsblad Transport (2005), Asia Trade Hub (2005), EBRD (1999), De Lloyd (2004c), Inchcape Shipping Services (2005), Min (2002), CIAS (2005), Suzue-PSA Cold Storage Pte Ltd (2005), JTC Corporation (2002), Intraco Ltd. (2002), Barwil (2005), Vopak Terminals Singapore Pte Ltd (2005), Royal Vopak (1999), Pizzolante (1999), Singapore Government (2005), SPECS Consultants Pte. Ltd (2005), Portnet.com (2001), CTO (2005), Autoscan (2005), CWT Distribution Ltd. (2001, 2003 and 2003b), Singapore Mirror (2005 and 2005b), Freightgate (2000), Fairplay (2002), IFC (2005), Nieuwsbank (1999b), The North Africa Journal (1998)

Figure A-10: PSA's track record



۱			49%	nazhou Containar 7	Form Co I td
2000			startup Gua	Harbour Durson	51%
1999			30% acquis	Royal Pakh	oed startup acquisition
	China Merchants - PSA Logistics Network Co. Ltd.	43.3% startup			
	PSA Logistics Pte Ltd.	100% startup			
	Thai Port Ventures Ltd	100% startup			
	Smilesun Company Ltd	startup			
	Maritime (2002) Pte. Ltd.	startup			
	PSA Marine Pte. Ltd.	100%			
	Dacca Pte. Ltd.	100%			
988	Equi-Lease Pte. Ltd.	100%			
	PSA Italy Pte Ltd	100% startup			
	Singapore Guangzhou Port Investment Pte Ltd	100% startup			
	CWT Pacific Ltd.	27.5% startup	49%	Fuzhou Qingzho	ou
	Sealion Fuzhou Port Invest Pte Ltd	85% startup	startup	Container Termi	nal
P	PSA Tianjin Wu Zhou Pte. Ltd.	100%			
S	Sealion Zhuhai Investments Pte. Ltd.	100% startup	49%	Fuzhou Qingzhou	u Warehousing
L H T	Huanan Rongcheng Warehousing & Fransportation Pte Ltd	85% startup	startup	& Transportation	Co., Ltd.
H	- Huanan Minjiang Investment Pte Ltd	85%	41 7%	Fuzhou Jiangvin	International
[— Fujian Straits Pte Ltd	100%	startup	Container Termin	nal Co.



2004	39% acquisition
	PSA-China Logistics Pte Ltd (from PSA Corp.) X X
	49% startup
	Cosco-PSA Terminal Pvt Ltd Startun Cosco Pacific
	80% Acquisition
2003	startup eLogicity International Pte Ltd Startup bid Thai Port 50%
	acquisition HessenNoordNatie nv
	startun Tuticorin berth 8 stortun Tuticorin Port Trust
ļĻĻ	
	Mermaid Marine Australia
	80% 7.66% acquisition
2002	acquisition HessenNoordNatie nv (from JTC Corp.) CWT Distribution Ltd
	Vopak Terminals Sing. Pte Ltd 4 100% acquisition GATX Terminals Pte Ltd
	Changi Int Airport Services Pte I td
	40% startup CIAS Sinport Airport Services SpA
	Sinport Sinergie Portuali 56% startup
0001	startun Hibiki Container Terminal startun City of Kitakyushu
2001	Startup bid Chennai Container Terminal
	lost <u>Container reminar</u> 60% Laboration 40% Samsung Corporation
	startup Incheon Container Terminal startup
	acquisition P-Serv Technologies Pte Ltd
	80% Negara Brunei Darussalam's
2000	startup PSA Muara Container Terminal startup Archipelago Development Corp. Sdn
	50% ac CLP Sintermar 100% startup Portnet.com Pte Ltd.
	Dalian Jilong Logistics Co. 10.4% acquisition Vopak Terminals Singapore Pte Ltd
	100% startup Since Container Terminal Voltri Terminal Europa
	43% acquisition
	57.5% Startup South India Corporation X% startup
1000	PSA Sical (Agencies) Limited Interporto
1999	61% acquisition Terminals Tuticorin startup Nur Investments di Padova
	Allied Sea- Poh Singapore depot
1998	40% Guiarate Pinavay Port Ltd Container Shore Tion Transport
1770	acquisition 100% Services Transport Choon Supply
	Masahero Ltd. acquisition 30% startup
	Subic bayInvitation to bid Taicang 70% Cosco Int. City
1997	no bid Container Port Startup Development Ltd.
	Port Said - Interest expressed, 100% acquisition
	Damietta Port - Interest expressed, - no bid Roma Terminal Container S.p.A. startup





27.5% Beijing Gelin International startup Forwarders Co., Ltd.						
87% Globelink International Services startup (Qingdao) Co., Ltd.						
87% Globelink International Services startup (Tianjin) Co., Ltd.						
startup CWT Globelink (South China) Pte L	td					
38.28% Globelink Container startup Line (EM) Sdn. Bhd.						
GLS Interfreight Co Ltd	startup					
Globelink WW India Pvt Ltd	startup					
Globelink-Trans (Tianjin) International	startup					
Globelink Pakistan Pvt Ltd						
Globelink Marine (China) Pte Ltd	startup					
Globelink International Pty Ltd 55%						
Globelink Freight Services Inc	startup					
Globelink Express Lines Pte Ltd star						
Globelink Container Line (Phil) Inc	55%					
Sdn. Bhd.	/0% startup					
Globelink Container Line (IB) Sdn Bhd	87%					
75%						
Globelink Container Lines (JB) Sdn Bhd.	startup					
CWT Globelink (Colombo) Pvt Ltd	_51%startup					
1988						

CWT Globelink Pte Ltd





	MSC Home Terminal Antwerp nv	50% startup	
	MSC Terminal Antworp ny	50%	MSC
	Coil Terminal nv	startup	
	Antwerp Associated Stevedoring	startup	250/
	Zeebrugge Transport nv	45%	Failed attempt
	Sea Box nv	50%	51% acquisition
	Bastenaken Terminal	startup <u>00%</u> tartup	Cosmos management
2004	Deurganckdock Terminal st	00%	50% acquisition
2003	Accessory Plant Zeebrugge NV Holland Terminals B.V.	100% startup 00% tartup ional	Combined Terminal Operators Cobelfret 33,33% acquisition
2002	100% Compagnie Maritime acquisition 100% acquisition PSA Internat	e Belge	66,66% acquisition
	40% startup	HessenNoo	rdNatie nv 60% startup
2001	Van Gestel Computer Software Management Operations & Services N.V. Independent Barge Operators	100% startup 100%	merger Noordnatie nv 100% acquisition startup ACPC nv / CARDIC bvba
2001	Intermetional Stavedoring Co.N.V.	X%	X% startup Con Check Terminel my
1999	Westerschelde Container Termin	startup nal startuj	Cosmos management 49% acquisition
1998	Montevideo port X%	startup	X% startup Tangiers new port
1997	Hessenatie Logistics Kortrijk nv Repaircon B.V. Woodpulp Terminal N.V.	startup 100% startup 100% startup	33,33% acquisition

2005			PSA International 4 100% acquisition
2000	International Distribution Partners N.V.	37.4% startup	
1998	Noord Natie Ventspils Terminals LLC	40% startup 60% startup	Ventplac LLC
1997	Noordzeeterminal nv 33,33% startup – N.	66.66% startup	
1987	Norexa nv	100% startup	
1882	Havenbedrijf Noord Natie n	v <u>100%</u> startup Noordn	atie nv

A.3.3. <u>APM Terminals</u>

Figure A-11 represents HPH's track record.

Sources:

Maersk (2000 and 2005), APM Terminals (2001, 2002, 2002b, 2003, 2003bd, 2004, 2004ba, 2005, 2005b, 2005c and 2005d), Hong Kong Shippers' Council (1999), Maryland Port Administration (2002), Sea-Land Alumni (2005), CSX Corporation (2005), ACLSAL (2005), CSX Transportation (2005), American Commercial Lines (2005), American City Business Journals Inc (2004), Supreme Court of Appeals of West Virginia (1997), Hong Kong Shippers' Council (2000 and 2001b), Webb-site.com (1999), TNT (2000), Drewry Shipping Consultants (2002), Maryland Port Administration (2005), Journal of Commerce Online (2003), Crowell (2005c and 2005r), World Cargo News Online (1999, 2000f, 2000g, 2000h, 2000i, 2000j, 2004f, 2004ba, 2004ce, 2005d and 2005ab), Maersk (2004), The Economic Times (2004), Fairplay (2005b), Caribbean Shipping Association (2002), Barav (2005), CNDC (2003), Aktieselskabet Dampskibsselskabet Svendborg (2002 and 2003), Intels (2002), MLIT (2005), SPG Media Plc (2005), Pmaesa (2005), Damas and Mottley (2003b), Peters (1995), Jin and Wei (2005), De Lloyd (2005j), Informare (2004d)

Figure A-11: APM Terminals' track record



	100% Houston Terminal	70% acquisition				
Î	100%	Gabriel Port of Tanjung Pelenas				
2000	Maersk Argentina Holdings SA	30% acquisition Maersk Kobe Terminal				
	100% acquisition	50% North Sea Terminal 50%				
	100% Maarsk Sealand	startup Bremerhaven GmbH startup				
	acquisition Watersk Scaland startup	Bremer Lagerhaus-Gesellschaft AG&Co				
	Suez Canal Container Terminal	100% See Land Clobal Container Shinning				
1000		acquisition				
1999	Cisis Terre Madamter					
	Container Terminal S.p.A.	▲ 100% acquisition Terminal Operations				
		100% acquisition				
	acquisition startur					
1998	100% Maersk Container	Organisator A/S SPS				
	startup Industri Qingdao Ltd	Landbrugets EDB-Center				
1997		Dalian Container Terminal Co				
1996	Maersk Kobe Terminal 100%					
1995	acquisition Maersk Contractors 100%	100% LCB Container Terminal 1 Ltd				
1994	100% Kaohsiung Pier 76/77	Yantian International Container Terminals				
1993		100% acquisition EacBen Container Line Ltd.				
1002	100% startup Kaohsiung Pier 120					
1992	Maersk Taiwan Ltd. 100% start	startup Ar Moner Finance SA acquisition				
1001	100% Maersk Container					
1991	startup Industri AS					
1987		Franco-Belgian Services				
1985	administran Maersk Pacific Ltd. startur	100% acquisition Norfolk Line				
1980	Maersk Singapore Pte Ltd 100%					
	startur	<u>)</u>				
1977	Mercantile 100%					
1975	Tacoma Terminal 100%					
1072	Moorsk Drilling 100%	,				
17/2	startur					
	Maersk Olie & Gas AS 100%					
	startur					
		•				





	L	33.3% s	tartup						
1991	100% Sea-L acquisition Tern	and Orient ninals Ltd	66.6% startup			Ready Cit	y Ltd		
	Seagirt Mari	ne Terminal	100% 						
			<u>startup</u>	X%))				
1988	ECT Delta Termina	Sea-Land- 11 B.V.	X% startup	Starte	чh	Eur Te	ope Conta erminus B	ainer .V.	
1987					<u>100</u>	% ition	CSX Co	orporation	
1985	Tacoma	Terminal	100% startup	20.5% acquisition		Central Dev	velopment	t	
	acquisition RJ Reynol	ds Tobacco I		acquisition	Nev	w World D	Developme	ent	
1981	Startup Asia Terr	minals Ltd			Far E	East Conso	rtium Lin	nited	
1978	Dubai Mina J Termin	lebel Ali al	100% startup						
1975	Algeciras Te	erminal	<u>100%</u> startup						
1973	Elizabeth NJ	Terminal	100% startup						
1972	New Orleans	Terminal	100%						
1970	100% Kwa startup	ai Chung CT	3						
	Sea-Land Or	rient Ltd	startup	1(<u>)0%</u>	Port Eve	erglades T	erminal	
	Que Nhon T	erminal	100% startup	Sta	ւուսբ	L			
	Da Nang Te	erminal	100% startup						
1967	Cam Rahn Bay	Terminal	startup 100%						
1965	Oakland Te	erminal	startup 100%	1					
1962	New York T	erminal	startup 100%						
1057	Jacksonville T	erminal	100%						
175/		•	startup	• •					
1956		Se	ea-Land Se	ervice Inc.					





A.3.4. <u>P&O Ports</u>

Figure A-12 represents HPH's track record.

Sources:

P&O Group (2002, 2002b, 2003, 2004, 2005 and 2005b), P&O Ports (2003, 2003b, 2004 and 2005), Peters (1995), Terminales Rio de la Plata (1998), World Cargo News Online (2000e, 2003bd, 2004cf, 2004o, 2005e, 2005ak and 2005al), Neva (2003), Interfin Trade (2004), Aslam (1998), Informare (2003b), Jinks (2003b), PMaesa (2000 and 2003), Indian Express Newspapers (Bombay) Ltd. (1999), BII (1999), UK Business Park (2005), QQCT (2005), AAPA (2000), Tharakan (2003), P&O Ferries (2002), Cour des Comptes (2005), KNV Goederenvervoer (2001), Sachitanand (2003), ABP (2005), Consonni (2001), Malta Today (2001), Cargo News Asia (1997b), Times Journal of Construction Design (2004), Van den Bossche (2001d), Aslam (1998)

Figure A-12: P&O Ports' track record











A.3.5. Eurogate

Figure A-13 represents HPH's track record.

Sources:

Sroka (2002), Eurokai KGaA (2005), Contship Containerlines Ltd. (2005), European Commission (2002), Informare (1996, 1996b, 1997, 1997b, 1998), Dardani (2000), Logistics Pilot (2001b, 2001c, 2002, 2002b, 2002c, 2003 and 2004), CP Ships (2005), BLG Logistics (2000, 2002 and 2004), World Cargo News Online (2000, 2001b, 2001c, 2005z), Contship Italia Group (1998), Eurokai KGaA (2002), Spinetti (2003), Trenitalia (2004), Bremen Ports (2005), BLG Logistics (2004), BLG Logistics (2002), Eurokai KGaA (2005b), Eurokai KGaA (2005c), Eurokai KGaA (2005d), BLG Logistics (2003), Beneze (2005), Bremische Bürgerschaft (2004), Freie Hansestadt Bremen (2004), Computerwoche (1982), Deutsche Logistik-Zeitung (2004), My Logistics (2005), Informare (1999b), De Lloyd (2005), Eisenbahnbetriebe Mittlerer Neckar GmbH (2005), Railfan (2005), European Commission (2003), Bothmer (2003), Datalog GmbH (2005), VDMA (2005), Frigoscandia Distribution (2005), Freie Hansestadt Bremen (2005), B-Online (2005), Mattauch (2002), Dialog Distribution and Automobile Logistics GmbH (2005), Handelskammer Bremen (2003), Container Contacts (2003), Hamburger Abendblatt (2003), Mezek (2005), Deutsche Bahn AG (2005), Marges (2002b), Cargo News Asia (1999), online conversations with BLG and Eurokai responsibles

Figure A-13: Eurogate's track record







	EUROGATE Landterminal GmbH	100% acquisition					
	EUROGATE City Terminal GmbH	100% acquisition					
		100% acquisition					
1999	acquisition						
ſ	EUROGATE Container Terminal GmbH	66.6% acquisition Contship Italia sa					
100 2000	EUROGATE GmbH & Co KGaA startun						
1998-	PHH Personaldienstleistung Hafen Hamburg GmbH						
1996	a	OCEANGATE Distribution GmbH					
1994	EUROKAI Container 100% startup Terminal KGaA 100% startup						
	100%						
	EUROCARGO Container Freight startup						
1993	Station and Warehouse GmbH						
	► EUROKOMBI Transport KGaA						
	100% acquisition						
	Eurokai Bohemia a.s. X% startup						
	Eurohambi Transport						
1992	GmbH						
1001	Euro Matrona a X% startup						
1771	Euro-Mcuails a.s.						
	Eurotrans GmbH Rostock	A 10% acquisition Carl Tiedemann GmbH & Co.					
1990	100%	Carl Tiedemann					
	acquisition Ewersween Lagerhaus GmbH	GmbH & Co. 100%					
		X% startup 33.45%					
		EUROKAI Contahin North					
1989		International Europe Bv					
		V% startup					
•							

100% acquisition

2003
≜	ff , , , , , , , , , , , , , , , , , ,
ľ	$100\% \rightarrow EUROGATE GmbH & Co KGaA 50\%$
acc	BLG Automobile Logistics
	Italia S.r.l. 51% startup 100% acquisition EUROGATE Technical
1999	BLG Data Services GmbH Services GmbH
	North Sea Terminal 50% startup A P Möller
	13% startup
	40% startup
1008	20% startup BLG IT Services GmbH startup
1990	BLG Automobile Logistics GmbH 100% startup
	BLG Technical Services GmbH startun
	BLG International Logistics GmbH
	BLG Unterstützungskasse GmbH
	ZI B Zentrallager Bremen GmbH
1997	100% BLG Consult GmbH
	100% acquisition BLG Logistics Group AG & Co KG 100% startup
	100% acquisition DLO LOgistics Oldup 718 the Corker 100% startup
	50% startup acquisition
1995	Hansa Marine Logistics GmbH
1991	acquisition Frigoscandia Distribution GmbH
1982	SCL Service-Centrum 100% startup
	Logistik Bremerhaven
107(Port and Transport 100% startup
1976	Consulting Bremen GmbH
1974	Datalog GmbH 50% startup
	Datanbank Bramiasha Häfan 35.7% startup
1973	
ا 1971 ا	Container Terminal 100% Bremerhaven GmbH startup
	Bremerhavener Kühlhäuser GmbH 100%
1056	Bark Hatal Braman Canbu 0.05% startup
1930	
1077	Bremer Lagerhaus-Gesellschaft AG&Co
18//	

100% startup

Kaufleute





†	
1992 -	EH Harms Auto-Terminal 100% Wörth GmbH & Co startup
	E.H. Harms Car Shipping Königsborn 100% 100% E.H. Harms GmbH & Co
1990	startup Automobil-Transporte Jena E.H. Harms Car Shipping Dallgow 100% startup startup
1987	E.H. Harms Auto-Terminal 100% startup Hamburg GmbH & Co 100% startup
1983	100% startup E.H. Harms Auto-Terminal Köln GmbH & Co
1982	50% BV Interrijn EH Harms Automobil- Transporte RoRo Rotterdam
1977	E.H. Harms Car Shipping Kaiserhafen startup
1076	E.H. Harms Auto-Terminal 100% startup Bremerhaven GmbH & Co
1970	100%E.H. Harms GmbH & CostartupAutomobil-Transporte Wallenhorst
1972 -	E.H. Harms PDI Bremen
1970	100%E.H. Harms GmbH & CostartupAutomobil-Transporte Paderborn
-	EH Harms Car Shipping Antwerp startup
1963	EH Harms Car Shipping München startup
	E.H. Harms Car Shipping Stuttgart startup 100%
	E.H. Harms Car Shipping Bremen startup
1959	E.H. Harms GmbH & Co Automobil-Transporte startup
	Egon-Herbert Harms GmbH











A.3.6. Dubai Ports Authority

Figure A-14 represents HPH's track record.

Sources:

Dubai Ports International (2005), Times Shipping Journal (2005), Manoj (2004 and 2004b), Joseph (2004 and 2004b), GlobalSecurity.org (2005), Barwil (2005b), Kalmar Industries (2004), World Cargo News Online (2004t, 2004ad, 2004bj and 2005l), Seatrade Middle East Maritime (2004), AME Info (2004, 2005 and 2005b), Nair and Punnathara (2005), The Hindu Business Line (2003), Dubai Customs (2005), Jafza (2005), SPG Media PLC (2005)

CSXWT

Hong Kong Shippers' Council (2001c and 2003c), Tradeway (2005), Studiengesellschaft für den kombinierten Verkehr e.V. (2001), World Cargo News Online (2000k, 2000l, 2001j, 2003ao, 2003be, 2003bf, 2003bg, 2004bs, 2005al), American City Business Journals Inc (2004b), Neva (2003), Tharakan (2003), Times Shipping Journal (2005)

Figure A-14: DPA' track record















1957	Louisville & 100% Nashville RR
1908	Carolina, Clinchfield & Ohio RR
1873	100%Nashville, Chattanoogaacquisition& St. Louis RR
1870	Western Rail Road 100% Company of Alabama startup
1857	Atlanta and West Point Rail Road Company
1850	100% Louisville & acquisition Nashville RR
1847	Atlantic & LaGrange RR
1845	Nashville and Chattanooga RR
1843	100%Montgomery and WeststartupPoint Rail Road Company
	Western & Atlantic Railroad Company Richmond, Fredericksburg
1834	& Potomac RR Montgomery RR
1833	Georgia RR
1830	Lexington & Ohio Railroad













A.4. Appendix A-4: Ocean Shipping Consultants' (2003) containerhandling geography

Sub-continent	Range	Ports involved	
North-Europe	North continent	Le Havre – Hamburg	
	British Isles	UK / Ireland	
	Nordic/Baltic	Scandinavia, Russia, Baltic States,	
		Poland and Northern Germany	
		Baltic	
Southern Europe / Mediterranean	Atlantic	Portugal, Atlantic Spain, Western	
		France, Canaries, Azores and	
		Madeira	
	West Mediterranean	Mediterranean Spain, Southern	
		France, Morocco and Algeria	
	Central Mediterranean	Italy, Malta, Adriatic countries	
		(Slovenia and Croatia) and Tunesia	
	East Mediterranean / Black Sea	Greece Turkey, Black Sea	
		countries (Bulgaria, Romania,	
		Ukraine, Russia and Georgia),	
		Cyprus, Syria, Lebanon, Israel and	
		Egypt	
Middle East	Arabian Gulf	U.A.E., Eastern Saudi-Arabia, Iran,	
		Kuwait, Bahrain, Qatar and	
		Northeast Oman	
	Red Sea	Saudi Arabia, Jordan, Yemen,	
		South Israel, Eritrea, Sudan,	
		Ethiopia	
	Arabian Sea / Gulf of Aden	Southern Oman, Southern Yemen	
		and Djibouti	
Indian subcontinent		India, Pakistan, Bangladesh, Sri	
		Lanka	
Sub-Saharan Africa	Southern Africa	South-Africa, Namibia,	
		Mozambique	
	West Africa	Ivory Coast, Ghana, Nigeria,	
		Senegal, Guinea, Angola	
	East Africa	Mauritius, Kenya, Tanzania,	
		Reunion	

East Asia	Northeast Asia	South-Korea, Japan, Northern	
		China and Pacific Russia	
	Chinese Region	Taiwan, Hong Kong, Southern and	
		Eastern China	
	Southeast Asia	Singapore, Malaysia, Thailand,	
		Indonesia, Philippines, Brunei,	
		Vietnam and Myanmar	
Australasia and Oceania		Australia	
		New Zealand	
		Oceania (most Papua New Guinea)	
North America	Atlantic	North and South	
	Pacific	North and South	
	Gulf of Mexico		
Caribbean / Latin America	Caribbean	Puerto Rico, Jamaica, Panama,	
		Bahamas, Domenican Republic,	
		Trinidad, Martinique, Cuba	
	Central American Caribbean and	Panama, Mexico, Costa Rica,	
	Gulf Coast	Guatemala, Honduras	
	Central America Atlantic	Venezuela, Colombia	
	Central America Pacific	Mexico, Guatemala, Panama	
	South America Atlantic	Brazil, Argentina, Uruguay	
	South America Pacific	Chile, Peru, Ecuador, Colombia	

Source: Ocean Shipping Consultants (2003)

A.5. Appendix A-5: Agile Port System

APS is a concept used to describe container-handling activities which conform to containerhandling goals and customer requests is the describes such a system as one which combines "an appropriate harbor with adequate draft and ocean access, specialized pier complexes, a large staging area strategically located for the best possible access to the major rail and highway arteries as well as the local industrial complex, inland rail / truck corridors permitting unrestricted access between the pier complexes and the staging area, a buffer zone adjacent to the pier complex to store railcars, and a manager supported by an electronic data processing system." (Transystems Corporation, 2002)

In general, such system generates operational advantages in shifting the storage and CFS activities to an area called for instance Intermodal Interface Center (IIC), which may be some distance away from the container yard, which is then for example called Efficient Marine/Rail Interface Terminal (EMT). A fast connection called for instance Dedicated Freight Corridor (DFC) links IIC and EMT, which avoids landside congestion at the container yard. Applications of APS, like in Garcia (2001), illustrate how container-handling and cargo-handling in general can be successfully organized and how they impact on cargo-handling costs and revenues. Offshore terminals, which among others Baird (2002) deals with, form a similar solution of shifting space-intensive storage and handling activities towards cheaper and amply available inland terminals.

A.6. Container-terminal scope

Sea port	Terminal	Cargo-unit type	Container throughput
_			(2002, TEU/year)
Hong Kong (1)	Kwai Chung Container Terminal (1-9)	Containers (including reefers)	11.890.000
	Midstream Terminal – Fat Kee Stevedores	Containers and project cargo	7.250.000
	Terminal		
	Midstream Terminal - Hoi Kong Container	Containers (including reefers), breakbulk,	
	Services Terminal	uncontainerized cargo, dutiable goods,	
		dangerous goods, and controlled chemical cargo	
	Transward Terminal	Containers and breakbulk	
	Midstream Terminal – Faith & Safe	Containers	
	Transportation Terminal, Floata Consolidation		
	Terminal, Ocean Crown Transportation		
	Terminal, Wide Shine Terminal, Yee Lee Sea /		
	Land Forwarding Terminal		
	Pearl River Delta Terminal	Containers (including reefers) and breakbulk	1.797.000
~ ~ ~ ~		cargo (including dangerous and dutiable cargo)	
Singapore (2)	Tanjong Pagar, Keppel, Brani, Pasir Panjang	Containers (including reefers), uncontainerised	16.940.000
	and Jurong Terminal	cargo and dangerous goods	
	Pasir Panjang Wharves	Multi-purpose containers / ingots / bags / steel	
	(operationally separated from Pasir Panjang	coils / steel sheets / general cargo / steelworks /	
	Terminal)	crawlers / MRT trains	
	Sembawang Wharves	Multi-purpose containers / ingots / bags / steel	
		coils / steel sheets / general cargo / steelworks /	
		crawlers / MRT trains	
Busan (3)	Gamcheon Terminal	Containers	433.000 (figure for 2001)
	Jaseongdae Terminal	Containers	1.272.000 (figure for 2001)
	Shinsundae Terminal	Containers	1.320.000 (figure for 2001)
	Gamman Terminal	Containers	1.923.000 (figure for 2001)

Table A-2: Container-terminal nature according to cargo type at 15 major world container sea ports, October 2003

Sea port	Terminal	Cargo-unit type	Container throughput (2002, TEU/year)
Busan (ctd.)	Singamman Terminal	Containers	-
, ,	Uam Terminal	Containers	447.000 (figure for 2001)
	Piers 3 and 4	Multi-purpose containers and general cargo	1.342.123
	Pier 7	Multi-purpose containers / general cargo / coal /	part of 1.253.119 (which
		scrap iron and ore	counts for remaining
			terminals)
Shanghai (4)	Waigaoqiao Terminals	Containers	1.780.000
	Yangshan Terminal	Containers	1.800.000 (planned capacity)
	Huangpu Terminal	Containers	2.170.000
Kaohsiung (5)	Piers 31, 39, 63, 64, 66, 69, 70, 75, 76, 77, 79,	No data	No data
	80, 81, 115, 116, 117, 118, 119 and 121 (at CT 1-5)		
	CT6	Containers and petrochemical products	4.000.000 (estimated capacity)
	Other Piers	No data	No data
Shenzen (6)	Yantian Phase I	Containers	800.000 (figure for 2000)
		Multi-purpose	
	Yantian Phase II	Containers	
			1.200.000 (figure for 2000)
	Yantian Phase III	Containers	2.000.000 (scheduled
			capacity upon completion)
	Shekou Container Terminal Phase I	Containers	720.000 (figure for 2000)
	Shekou Container Terminal Phase II	Containers	329.000 (figure for 2000)
	Shekou Container Terminal Phase III	Containers	No data
	Chiwan Kaifeng Container Terminal Phase I	Containers	600.000 (figure for 2000)
	Chiwan Kaifeng Container Terminal Phase II	Containers	400.000 (figure for 2000)
Rotterdam (7)	Steinweg Botlek Terminal	Multi-purpose charter cargo / containers / project cargoes / ro/ro	No data

Sea port	Terminal	Cargo-unit type	Container throughput (2002, TEU/year)
Rotterdam (ctd.)	Steinweg Beatrix Terminal	Multi-purpose ferrous and non-ferrous metals / containers	
	Steinweg Seinehaven	Multi-purpose chemicals / containers	
	ECT Home Terminal	Containers	3.500.000
	ECT Delta Terminal	Containers	
	Gevelco Terminal	Multi-purpose general cargo / containers / neo- bulk / steel / non-ferrous products / forest products / high value project cargoes / heavy lift cargo	No data
	Hanno Rotterdam Terminal	Multi-purpose	No data
	HT Holland Terminal	Containers	No data
	Klapwijk-Rapide Terminal	Multi-purpose containers / steel products / tubes and pipes / heavy lifts	No data
	RHB Terminal	Project cargo, non-ferrous metals, steel coils, containers and reefers	No data
	Rotterdam Shortsea Terminals	Containers	No data
	Uniport Terminal	Containers	1.600.000 (projected capacity)
	Barge Center Waalhaven	Containers	200.000 (capacity)
	APM Terminal	Containers	2.200.000 (capacity)
Los Angeles (8)	Berths 121-131, 136-146, 206-209, 212-225, 226-236, 302-305, 401-407	Containers	5.600.000
Hamburg (9)	Burchardkai terminal	Containers	2.150.000
	Eurogate terminal	Containers	1.300.000
	TCT Tollerort terminal	Container (including reefers) and hazardous cargo	600.000 (capacity)
	Unikai container terminal	Containers	140.000
	Buss Hansa terminal, Dradenau terminal, Unikai O'Swaldkai, C. Steinweg Süd-West terminal, Wallmann terminal	Multi-purpose containers / ro/ro / heavy goods / project load and conventional cargo / iron and steel	500.000

Sea port	Terminal	Cargo-unit type	Container throughput (2002, TEU/year)
Antwerp (10)	Berths 466, Berths 119-123, 317, 504, 851-869, , , 466, , 732-748, 242-314, 118, 166,	Containers and ro/ro	1.020.000 (estimated)
	Berths 1223-1231	Multi-purpose steel products / project cargo / unitized cargo / fruit /	
	Berths 474-484	Containers and breakbulk	
	Berths 242-246	Semi-container	
	Berths 248-256 and 300-314	Multi-purpose container / project cargo / homegenous iron and steel consignments / heavy loads	
	Berths 420-428, 702-714, 730, 851-869 and 901-915	Containers	3.967.000 (extrapolated from Apr-Dec figures)
	Berths 380 (Zomerweg Terminal) and 712 (Cirkeldyck Terminal)	Containers	No data
	Berths 345-355	Multi-purpose project cargo / steel products / general cargo (including containers) / chemicals / bulk	No data
	Berhts 416 and 1145	Containers / breakbulk cargo / palletized loads / bagged goods / metals /	No data
Long Beach (11)	Pier E Berths 24-26, Pier T Berths 132-140, Pier J Berths 232-234, Pier F Berths 6, 8 and 10, Pier J Berths 243-247 and 266-270, Pier A Berths 90-94, Pier C Berths 60-62	Containers	3.307.692
Port Klang (12)	NorthPort: CT1 (berths 8-11), CT2 (17-21) and CT3 (12-14)	Containers	2.480.000
	WestPort: berths 7-13 (CT1, CT2 and CT3)	Containers	2.050.000
Dubai (13)	Jebel Ali (Berths and Port Rashid (Berths 33, 34 and 35) Container Terminals	Containers	749.449
New York/New Jersey (14)	Port Elizabeth Maher Terminals (Fleet Street and Tripoli Street)	Containers	1.383.191 (2001)

Seaport	Terminal	Nature	Container throughput (2002, TEU/year)
New York/New	Port Elizabeth Maersk Terminal	Containers	650.065 (2001)
Jersey (ctd.)	Port Newark Container Terminal	Containers	390.017 (2001)
	Port Newark American Stevedoring Terminal	Containers	76.750 (2001)
	Howland Hook Marine Terminal	Containers	498.399 (2001)
	Red Hook Container Terminal	Multi-faceted container / bulk	10.344 (2001)
	Global Marine Terminal	Containers	298.554 (2001)
Qingdao (15)	Qianwan Container Terminal	Containers	3.400.000

Source: (1) MarDep, 2004; Asia Container Terminals, 2004; CSX World Terminals Hong Kong Ltd., 2004; Hong Kong International Terminals, 2004; Modern Terminals Ltd., 2004; River Trade Terminal Co. Ltd., 2004; Fat Kee Stevedores Ltd, 2004; Hoi Kong Container Services Co. Ltd, 2004; Taikoo Maritime Services Ltd., 2004; Portion Wide Ltd., 2004; Tai Wah Sea/Land Heavy Transportation Ltd., 2004; Hutchison Whampoa Ltd., 2003;

(2) Lewis, 2002; Port of Singapore Authority, 2004; Portnet, 2004;

(3) Port of Busan, 2004; OSH, 2004; KCTA, 2003; Wei, 2003;

(4) Hutchison Whampoa Ltd., 2003; Shanghai Industtrial Holdings Ltd., 2004; China Daily, 2002;

(5) Ling-San, 2003; TBBC, 2003;

(6) JBIC, 1999, Irasia, 2001, Swire Pacific Ltd., 2003, China Economic Information Network, 2003, Informare, 2003; Barwil, 2004; Infomarine, 2004; Hong Kong Shippers' Council, 2003; SAR, 2003;

(7) Lewis, 2002b; Port of Rotterdam, 2003d; C. Steinweg Handelsveem bv, 2004;Europe Container Terminals, 2004;Hutchison Whampoa Ltd., 2004;Gevelco Transportgroep bv, 2004;Hanno Rotterdam, 2004;Klapwijk-Rapide bv, 2004;RHB Stevedoring and Warehousing, 2004;Uniport bv, 2004;Waalhaven Group bv, 2004;A.P. Möller Terminals, 2004;

(8) Port of Los Angeles, 2003 and 2003b;

(9) Port of Hamburg, 2003, 2003b, 2003c and 2003d, Buss Ports + Logistics, 2004;

(10) Port of Antwerp, 2003c; Port of Singapore Authority, 2004b; Drewry Shipping Consultants, 2003; Luiknatie Group, 2004;

(11) Port of Long Beach, 2003b;

(12) Kader (2001), NorthPort (Malaysia) Bhd, 2003c; Port Klang Authority, 2003c; WestPort Malaysia, 2003;

(13) DPA, 2004 and 2004b; APL, 2004;

(14) PANYNJ, 2003c and 2004; New Jersey, 2004; American Stevedoring Inc, 2004; PNCT, 2004; Global Terminal and Container Services Inc.,

2004

(15) Yikun (2003)

A.7. Stuffing and stripping planning and process

Planning the stripping activity involves these activities.

- Identifying cargo categories from Container Packing List (CPL).
- Deciding on allocation of lifting and moving equipment.
- Choice of manning level.
- Finding appropriate work value.
- Dividing tonnage by work value to find handling time.
- Repeating calculation for other cargoes to find total handling time.
- Adding allowances to find total job time.
- Calculating start and end times for job, and entering data in work schedule.
- Turning to next packing list.

(Van de Merbel, 1998)

Once planned, the final stage is of course the execution of the container stripping activity itself. Supervision and documents transfer are indispensable side-activities.

- A request to unpack, a packing list, and an SSR-document² are received, and the container move is scheduled.
- Work order and tally list (and EIR) are prepared.
- The container arrives, the work order is issued, and customs are informed.
- The foreman inspects the container.
- The foreman takes gang and equipment to the work location.
- The doors are opened and cargo conditions and resources are assessed.
- Cargo is unpacked, sorted, tallied and palletized where necessary; any discrepancy is reported to the foreman.
- Packages are moved into storage under frequent checks by foreman and supervisor.
- The clerk checks cargo, adds pile tags, and signs the tally list and gives it to the foreman.
- The foreman checks the work location, the container is cleaned and the doors are closed.

² Special Shipping Required, a document which describes the conditions under which commodities should be packed into the container in order to be shipped.

- The work order is signed, documents are returned to the office, and the terminal is asked to collect the container.
- The clerk updates the MIS and requests customs clearance.
- The clerk tells the cargo owner that the cargo is ready for collection.

(Van de Merbel, 1998)

Planning for container packing involves these activities.

- The ship operator's planner sending a Container Loading List (CLL) to CFS.
- The CFS planner confirming that cargoes will fit in the container.
- Discussion with the ship operator of any discrepancy.
- Checking cargoes do not exceed container's permitted payload.
- The planner inspecting whether all cargo was received and cleared.
- Checking packing, strength, compatibility, etc.
- The ship operator sending the container loading plan (CLP).
- The planner starting to prepare a detailed loading plan.
- Calculation of space requirements.
- Making plans for packing sequence and arrangement.

(Van de Merbel, 1998)

The stuffing of the container itself is again subject to a large number of control activities and documents to be transferred

- The administrative supervisor checks data received and the customs clearance.
- The SSR-document is sent to the terminal and an empty is moved to the CFS.
- The CLP, work order and tally list are issued to the foreman.
- The foreman checks the container position and condition, and may fill in the EIR.
- The foreman collects and briefs the packing gang, which sets to work.
- The foreman checks packing, stowage and securing, and seeks advice if needed.
- Packing proceeds to plan, items are tallied and pile tags are collected.
- The clerk completes and signs the tally list and gives it to the foreman.
- The foreman inspects the container and completes the EIR.

- The foreman supervises the clearing up, signs the work order, and returns the documents to the office.
- The administrative supervisor reports completion for having the container returned.
- Clerks update the MIS, complete documentation and invoicing.
- The administrative supervisor oversees the documentary procedures.

(Van de Merbel, 1998)

As a sidenote to stuffing / unstuffing operations, Export 911 (2004) mentions the need of (forced) ventilation in order to team up with heat and humidity, which may cause inconvenience to workers stuffing or stripping the container, and also to cargo being transported.

Before stuffing the container, the vehicle supplying the commodities of course has to be unloaded at the CFS, which requires following activities

- The CFS receiving the booking list from the ship operator.
- The planner estimating the workload for the acceptance period.
- Calculation of the proportion of exports likely to arrive each day.
- Adding daily estimates for all vessels.
- Assessing vehicle, wagon or bargo cargo from usual transport split.
- Estimating the number of road vehicles, wagons and barges.
- Preparing a rough work schedule.
- Calculation of cargo deliveries accurately, using the vehicle appointment scheme.
- Preparing a detailed and firm work schedule.

(Van de Merbel, 1998)

Actual receipt through a road vehicle of outbound commodities ready for stuffing requires the following physical and documentary activities.

- The driver arriving and presenting the shipping note.
- The clerk checking details against the consignment record; if details differ, a supervisor checks.
- The clerk selecting the door / bay.

- The door / bay number being written on the shed instruction.
- The driver returning to the vehicle and driving to the door / bay.
- The clerk informing the supervisor, making up the work order and completing the tally list.
- Issuing work order and tally list, and the foreman taking the gang to the unloading position.
- The foreman checking vehicle conditions and working content.
- The gang being briefed and setting to work.
- The cargo being unloaded, and sorted and tallied by the tally clerk; in case of discrepancy, a foreman is called and action is taken.
- The clerk checking storage, attaching pile tags and signing the tally list.
- The foreman checking list and storage, and signing the driver's documents, after which the driver leaves.
- The foreman checking the work site and returning the signed documents to the office, which allows to update the MIS.

(Van de Merbel, 1998)

When dealing with rail instead of road, the main differences during receipt are these.

- There are several consignments per wagon (which increases the work content).
- The rail foreman / supervisor is at wagon position, supervising the unloading.
- Cargoes are tallied both by the rail company and by CFS as they are unloaded.

If barge transport is involved, this sequence occurs.

- Cargo quantities per barge are again higher than per road vehicle.
- The CFS / terminal foreman is at the barge berth, supervising the discharge.
- The quay transfer operation is necessary.
- Cargoes are tallied at berth and at CFS (at its entry and before storage).

(Van de Merbel, 1998)

Also after stripping the container, interaction with the hinterland mode is required, which involves following steps
- The vehicle arrives and the driver presents the collection order.
- A clerk checks the details in the MIS, and any discrepancies are referred to the supervisor; the clerk also checks the driver's identity and authorization.
- The clerk selects the door or bay, issues a shed instruction, and the driver takes the vehicle to the door or bay.
- The supervisor issues the work order and the tally list to the foreman.
- The foreman takes the gang to the loading site, and checks vehicle position and condition.
- Loading proceeds, the clerk checks and tallies.
- When work is complete, the tally clerk and the driver check, the clerk signs the tally list, ad gives it together with the pile tags to the foreman.
- The foreman signs the shed instruction and the vehicle leaves.
- The foreman supervises the clearing up and returns the documents to the office.
- The clerks update the MIS, and complete documentation and invoicing.

(Van de Merbel, 1998)

When dealing with rail for collecting inbound, unstuffed commodities, the main differences with road are these.

- Collection orders are sent in advance or travel on train.
- Two foremen are required: one foreman, the rail foreman, supervises wagon movement and loading, while the other , the CFS foreman, supervises unstacking and transfer to the wagon.
- Two tallies are involved: a CFS tally clerk stands at the door, while a rail clerk stands at the wagon.
- A rail advice note is prepared and sent to the rail company.

Inland waterway transport compared to road transport implies that

- Collection orders are sent in advance or travel on barge.
- Like with rail, 2 foremen are involved: a barge berth foreman and a CFS foreman
- A quay transfer operation may be required.
- Two tallies are involved, like with rail again: one at the CFS and one at the barge berth. (Van de Merbel, 1998)

A.8. Sea-port organization: examples

In CHAPTER IV, decisional and financial independence on the one hand and unicity of command and integrated commercial management on the other hand are the main dimensions to distinguish among port organizational types with an impact on container handling supply and demand.

With respect to <u>decisional and financial independence</u>, five port organizational types are distinguished: sea-port authority bodies under direct national jurisdiction, sea-port authority bodies under sub-national jurisdiction, self-governing public sea-port authority bodies, privately owned and operated sea-port authority bodies, and corporate sea-port authority bodies.

Examples of sea-port authority bodies under direct national jurisdiction are these.

- Singapore, where the Maritime and Port Authority of Singapore reports to the Ministry of Transport (Maritime and Port Authority of Singapore, 2003a).
- Busan, with the Maritime Affairs and Fisheries Administration being one of the eleven authorities under the Ministry of Maritime Affairs and Fisheries (Port of Busan, 2003), and the administration being in control of the Korea Container Terminal Authority (KCTA, 2003).
- Kaohsiung, where the Harbour Bureau operates under the sole responsibility of the Ministry of Transport and Communications (Port of Kaohsiung, 2003).
- Klang, with the Board Chairman appointed by the King, and the 10 directors appointed by the Minister of Transport (Port Klang Authority, 2003).
- Qingdao, where the Ministry of Transport and Communication still decides on investments, but it intends to bring the Qingdao Port Company, as it will do for 7 other ports, under local administration (Yikun, 2003).

<u>Sea-port authority bodies under sub-national jurisdiction</u> comprise among others the following examples in <u>federated states</u>.

- A federal state, like for example in Dubai, where the Dubai Ports Authority (DPA) was formerly directed by the Emirate's Sheikh and was reformed into a government agency (DPA, 2005).
- A multi-state agency, like in New York / New Jersey, where the sea-port authority was formed as a bi-state agency in 1921 in order to settle a dispute between the states of New York and New Jersey (PANYNJ, 2003).
- A city-state, of which, among the major world container ports, Hamburg is an example: the city-state undertakes the public functions in the port (Port of Hamburg, 2003 and Läpple, 2000).
- A county, like e.g in Portland (Or., USA), where the authority is a regional government comprising Clackamas, Multnomah and Washington counties (Port of Portland, 2003);
- A special district, like e.g. in Hong Kong, through the Marine Department of the Hong Kong Special Administrative Region (MarDep, 2003).
- A municipal or area-wide district, like in Seattle, where municipal corporation board members are elected by voters of King County, giving them unique authority in the seaport area (Port of Seattle, 2003), or like in Tacoma, with the port being an independent, municipal corporation that operates under state-enabling legislation and being classified as a special purpose district, like all ports in the state of Washington.
- A federal state together with a municipality, like in Shanghai, where the Shanghai Port Authority falls under the Chinese Ministry of Communications, but also under Municipal Government (Consulaat-Generaal van het Koninkrijk der Nederlanden, 2003); this situation is about to change to entirely local administration, like in the case of Qingdao (Yikun, 2003).
- A municipality itself, like in Los Angeles, with the Los Angeles Harbour Department being a city department (Port of Los Angeles, 2003).

In non-federated states, examples of ports with lower-level governments in charge are these.

- A province, as in Canada, where 32 former state ports situated in New Brunswick, Newfoundland and Ontario have been transferred to provincial governments in 1999 (Sherman, 2001);
- A municipality, an example of which was the port Rotterdam till January 2004, where the Rotterdam Municipal Port Management was authorized by the Municipality of Rotterdam to manage the port zone (Port of Rotterdam, 2003).

An example of a <u>self-governing public port</u> is Long Beach, with its Board of Harbour Commissioners, whose members are appointed by the mayor and confirmed by the City Council. Commissioners appoint the Executive Director to head the Harbour Department, which carries out port policies and overviews port development (Port of Long Beach, 2003).

An example of a <u>privately owned and operated sea-port authority body</u> which is a subsidiary of some type of industrial company, is found at the Port of Par (UK), which is owned by Imerys and run by the latter's Port and Transport section, this section also acting as stevedore (Kessell, 2001). Other examples are the ports of Mailiao and Kuan Tang, the former being owned by Formosa Plastics Group (TBBC, 2003). An example of a company exploiting a complementary mode of transport is found in the port of Texas City, which is onwed by two railway companies, Union Pacific and Burlington Northern Santa Fe.

The Port of Antwerp, where the shares of the Municipal Autonomous Port Company are owned by the city, is an example of a <u>corporate sea port authority</u> (Port of Antwerp, 2003 and Suykens, 2000). From January 2004 onwards, also the port of Rotterdam has adopted this structure (Port of Rotterdam, 2003c).

With respect to <u>unicity of command and integrated commercial management</u>, three port organizational types are distinguished: land-lord sea-port authority bodies, limited-operating sea-port authorities, and comprehensive (or service, or operating) port authorities.

Land-lord sea-port authority bodies can be land leases, leases to operate and manage or leases to build. Examples of <u>land leases</u> are found for example in Antwerp (Port of Antwerp, 2003 and 2003b), Singapore (Maritime and Port Authority of Singapore, 2003a), Busan (among others at its Gamman terminal, see Informare, 1999), Rotterdam (Port of Rotterdam, 2003b), Los Angeles (Port of Los Angeles, 2003), Hamburg (Port of Hamburg, 2003b), Long Beach (Port of Long Beach, 2003), Klang (Port Klang Authority, 2003b) and New York (at Port Newark / Elizabeth Marine Terminal, see PANYNJ (2003b) and Dunelm (2002)).

A <u>lease-to-operate-and-manage</u> construction was set up in This construction was set up in Kingston (Jamaica), where the Kingston Container Terminal is owned by the Port Authority, but managed by APM Terminals (Port Authority of Jamaica, 2003).

The port of Hong Kong for instance applies the <u>lease-to-build</u> contract type among others at the Kwai Chung Terminal (HKCTOAL, 2003). Also at Busan, a lease-to-build contract is used for the development of the New Port Project (Hong Kong Shippers' Council, 2001). At Kaohsiung, part of container terminal n°5 was leased out through BOT (Build-Operate-Transfer) (Port Technology, 2003). The Yantian International Container Terminal development at Shenzen is equally performed under such BOT regime (Woodbridge, 2002). In New York, the Global Marine Terminal was privately developed (Global Terminal & Container Services Inc., 2003), and the South Brooklyn Terminal is to be developed under the 'lease to build' system (NYCEDC, 2003).

<u>Limited-operating sea-port authorities</u> can take the forms of a permit to operate a public utility, a permit to operate a private utility or a joint-venture contract

- A <u>permit to operate a public utility</u> is in place for instance in Brest, where the Chambre de Commerce et d'Industrie granted a permit to three operators (Legrifrance, 2003 and Brest Port, 2003).
- A <u>permit to operate a private utility</u> exists for instance in Caen, where Combustibles de Normandie operates a terminal under such regime (Port de Caen-Quistreham, 2003).
- A joint-venture contract is applied for example in Qingdao, for creating the new Qingdao Qianwan Container Port Cy Ltd. (Yikun, 2003).

One example of a <u>comprehensive (or service, or operating)</u> type of port authority is Dubai where the Port Authority is assuming all functions from infrastructure provision to (un-)loading (Dubai Ports Authority, 2003b).

Theoretically, each cell from Table IV-4 in CHAPTER IV: can be an existing combination, but in practice sea-port organizational forms often cluster around a limited number of cells. This is what Trujillo and Nombela (1999) indicate: land-lord and limited-operating sea-port

authority institutions will typically be public, whereas operating sea-port authority institutions are often in private hands.

Historical, geographical, political as well as cultural influences can cause a particular country of region to show concentrations of certain port organizational types. The ample supply of examples in Cass (1996, p. 29 - 31) show the particularities of each region or each country. Suykens (1995b, p. 3) makes a broad distinction between three traditional systems: the Hanseatic tradition, the Latin tradition, and the Anglo-Saxon tradition. The first two are typical for the European continent. They distinguish themselves from the Anglo-Saxon system in that they allow public supervision and execute only part of the functions a sea-port authority body could perform. Therefore, they comprise more or less the upper left section of Table IV-4 in CHAPTER IV: (Suykens and Van de Voorde, 1998, p. 255).

Latin-type sea ports conform best to type I, since the central government is the public level which is most involved. Nevertheless, comparisons among sea ports merit sufficient caution, even when sea ports are of the same type, since each individual sea port shows its peculiarities. In France, Spain, Portugal as well as Italy for instance, state ownership of many sea ports is laid down in the constitution. Nevertheless, in France, profit-making was for a fairly long time impossible since sea ports were called in for budgetary policy measures. This situation was not encountered in Spain for example.

Hanseatic sea ports best conform to type II. The variety of local levels responsible for supervision again makes this a very diverse category. In Germany alone for instance, federal states, city-states, municipalities or hybrid authorities composed of the former each have control over a number of sea ports (Op de Beeck, 1999).

The Anglo-Saxon system is often called a total sea-port system. Through its characteristics it best matches the lower right types of Table IV-4 in CHAPTER IV: (Suykens and Van de Voorde, 1998, p. 255). Anglo-Saxon ports are most likely type XV sea ports. Even here though, public influence is not excluded, since shareholders can still be municipalities, as in Manchester for instance, or the central government, of which Liverpool is an example (Op de Beeck, 1999).

It should not be forgotten that sea-port categorization is not static: over time, sea ports shift over the categories of Suykens and Van de Voorde (1998). The typical national preferences often disappear so that sea-port type dispersion is getting larger: countries traditionally applying one of the systems above, have often introduced different structures for newly developed ports, often for budgetary reasons. The Latin type for instance used to be applied in all countries denominated as 'Latin' in culture, which are generally southern-European countries. Some of these have lessened central control. In six major French sea ports for example an autonomous authority of type III was installed in 1965, while 11 other sea ports remained under national supervision (type VI), and still others were under local control (type VII). In Canada, 353 of the 549 harbours and sea ports saw their facilities change status in 1999: 32 sites were transferred to provincial governments (type VII in most cases), 31 to local interests (type VII also), and 64 sites to Fisheries and Oceans Canada (type XI). In Belgium, there was a notable shift from municipal port departments (type II) towards autonomous port authorities (type III) for instance in Ghent and Ostend, and even to corporatised ports (type V) for example in Antwerp and Zeebruges). These dynamics make the traditional comparisons among countries much more complex than before (Op de Beeck, 1999).

What has changed too over time, is that the sea-port authority institution is often no longer of one type to all terminals on its territory: For some historic terminals for instance, a sea-port authority can remain an operating body, whereas for newly developed terminals, it can assume for instance a land-lord role.

A.9. Sea-port organization at major world container ports

Seaport	Terminal	Organizational type		
Hong Kong (1)	Kwai Chung Container Terminal (Terminals 1-9), Pearl River Delta Terminal and Midstream Terminal	II (Special Administrative District since 1997, lease to build)		
Singapore (2)	Tanjong Pagar, Keppel, Brani, Pasir Panjang and Jurong Terminal	I (Maritime and Port Authority of Singapore since 1996, land lease)		
Busan (3)	Jaseongdae Terminal	I (Maritime and Fisheries Administration, land lease since 1999, before: comprehensive)		
	Uam, Gamman and Shinsundae Terminals	I (Maritime and Fisheries Administration, land lease)		
	New Port Project	I (Maritime and Fisheries Administration, lease to build)		
Shanghai (4)	Waigaoqiao Terminals	VII (local administration (before: combined with national), joint-venture (before: comprehensive))		
	Yangshan and Huangpu Project	VII (local administration, joint-venture)		
Kaohsiung (5)	Piers 31, 39, 63, 64, 66, 69, 70, 75, 76, 77, 79, 80, 81, 115, 116, 117, 118, 119 and 121 (at CT 1-5) and CT6	I (Harbour Bureau under national administration, BOT-lease) and VI (Harbour Bureau, joint-venture)		
	Other Piers	XI (Harbour Bureau under national administration, no private		
		participation yet)		
Shenzen (6)	Yantian Phase I	II (local administration (before: combined with national), land lease)		
	Yantian Phase II	II (local administration (before: combined with national), lease to build)		
	Yantian Phase III	VII (local administration, joint-venture)		
	Shekou Phase I	II (local administration (before: combined with national), lease to operate)		
	Shekou Phase II	II (local administration, land lease)		
	Shekou Phase III	II (local administration, lease to build)		
	Chiwan Container Terminal	II (local administration, lease to build)		
Rotterdam (7)	ECT Delta Terminal, ECT Home Terminal, and	V (government corporation from January 2004 onwards (before:		
	APM Terminal	municipal service), land lease)		
Los Angeles (8)	Berths 121-131, 136-146, 212-225, 226-236, 302-305, 401-407	II (municipal supervision, land lease)		
	Berths 206-209	XII (municipal supervision, operating Harbour Department)		
Hamburg (9)	Burchardkai terminal, Eurogate terminal, TCT Tollerort, Unikai	II (city-state of Hamburg, land lease)		

Table A-3: Organizational types at 15 major world container ports, October 2003

	container terminal, Buss Hansa terminal, Dradenau terminal, Unikai	
	O'Swaldkai, C. Steinweg Süd-West terminal, Wallmann terminal	
Seaport	Terminal	Organizational type
Antwerp (10)	Berths 119-123, 317, 504, 855-869, 702-730, 420-428, 901-915, 732-	V (corporate with shares owned by municipality, land lease)
	748, 242-314, 118, 166	
Long Beach (11)	Pier E Berths 24-26, Pier T Berths 132-140, Pier J Berths 232-234,	III (self-governing under the municipality, land lease)
	Pier F Berths 6, 8 and 10, Pier J Berths 243-247 and 266-270, Pier A	
	Berths 90-94, Pier C Berths 60-62	
Port Klang (12)	NorthPort: CT1 (berths 8-11), CT2 (17-21) and CT3 (12-14);	I (Harbour composed by King and Minister of Transport, land lease by
	WestPort: berths 7-13	the Harbour Board)
Dubai (13)	Jebel Ali and Port Rashid Container Terminals	XII (owned and operated by government agency)
New York/New	Port Newark/Elizabeth – Port Authority Marine Terminal Complex,	II (under bi-state supervision of New York / New Jersey, land lease)
Jersey (14)	Red Hook Container Terminal and Howland Hook Marine Terminal	
	Global Marine Terminal	II (under bi-state supervision of New York / New Jersey, lease to build)
Qingdao (15)	Qianwan Container Terminal	VII (local administration (before: national administration), joint-venture
		(Qingdao Port Company for 2 nd phase (1 partner) and 3 rd phase (3
		partners))

Source: (1) HKCTOAL, 2003; Hong Kong Shippers' Council, 2003;

(2) Lewis, 2002; Maritime and Port Authority of Singapore, 2003a and b; Port of Singapore Authority, 2003; World Cargo News Online, 2002; Port Technology International, 2001;

(3) Port of Busan, 2003a, b and c; Informare, 1999; Ministry of Maritime Affairs and Fisheries, 2003; Hong Kong Shippers' Council, 2001;

(4) Consulaat –Generaal van het Koninkrijk der Nederlanden, 2003; Yikun, 2003; Baizhang, 2003;

(5) Port of Kaoshiung, 2003; Port Technology, 2003; Ling-San, 2003; TBBC, 2003; Leng a.o., 2003;

(6) Shenzen Yantian District, 2003; British Embassy Bejing, 2001; JBIC, 1999; Irasia, 2001; Trade 2000, 2003; Swire Pacific Ltd., 2003; China Economic

Information Network, 2003; HKGCC, 2003; Informare, 2003; De, 2003; Barwil, 2004; Infomarine, 2004;

(7) Lewis, 2002b; Port of Rotterdam, 2003, 2003b, 2003c and 2003d;

(8) Port of Los Angeles, 2003 and 2003b;

(9) Port of Hamburg, 2003, 2003b, 2003c and 2003d;

(10) Port of Antwerp, 2003c;

(11) Port of Long Beach, 2003b;

(12) Kader, 2001; NorthPort (Malaysia) Bhd, 2003 and 2003b; Port Klang Authority, 2003, 2003b and 2003c; WestPort Malaysia, 2003;

(13) Dubai Ports Authority, 2003, 2003b and 2004b;

(14) PANYNJ, 2003c; (15) Yikun, 2003

A.10. Shipping company integration in terminals: examples

Examples of shipping companies taking a stake in existing or new terminals are these.

- COSCO together with PSA in Singapore since 2003 (World Cargo News Online, 2003).
- COSCO together with Stevedoring Services of America (SSA) in Long Beach since 2001 (SSAMarine, 2003).
- P&O Nedlloyd and Evergreen together with 6 other partners in SAGT (Sri Lanka) since 1999 (Ladduwahetty, 2003).
- Neptune Orient Lines (NOL) together with P&O Ports in Laem Chabang since 2003 (Informare, 2003b).
- P&O Nedlloyd in Port Newark in 2000 (P&O Nedlloyd, 2000).
- Evergreen in Oakland in 2002 (Informare, 2002b).
- Maersk Sealand in Gioia Tauro (BLG Logistics, 2004).
- Hapag-Lloyd in Hamburg in 2001 (Navis, 2003).
- Americana Ships (itself a daughter of CP Ships) which decided in 2000 to develop the Shoal container complex in Galveston (Greater Houston Port Bureau, 2000).

Examples of shipping companies taking a stake in existing terminal groups are these.

- CMA CGM, which, through a joint-venture with P&O Ports, acquired 80% of Egis Ports form Egis Group (Informare, 2002).
- China Shipping Group (CSG), setting up New Century Terminal Services in 2001, in a joint-venture with Marine Terminal Corporation (Informare, 2001).

An example of a shipping company <u>setting up a terminal division of their own</u> is CSG, starting China Terminal Development Company (CTDC) in 2001 (Modern Terminals, 2003).

A.11. Passenger traffic

Demand and supply of passenger transport by sea and therefore also passenger handling at sea ports are driven by factors which are totally different from factors encountered in maritime cargo transport and handling. As a consequence, sea ports where demand for cargo handling is high, need not show high passenger traffic figures in the same time. This is what shows up in Table A-4.

Passenger traffic (,000 units)
57,212
50,166
37,791
31,817
31,458
-

Table A-4: Major 5 European passenger handling countries, 2001

Source: ESPO, 2004

Comparison is not 100% possible from these figures, since countries rather than individual ports are ranked here. Nevertheless, it is clear that none of the above countries had sea ports on their territory ranked among the major world sea ports. Moreover, passenger handling terminals show no comparison with their cargo equals, and are preferably located on a safe and comfortable distance away from cargo-handling sites.

A.12. Drewry Shipping Consultants' (2003) cost figures reprocessed

This section summarizes Drewry Shipping Consultants' (2003) cost figures like they are reprocessed in this thesis, as well as the cost figures derived from those figures.

Table A-5: Aggregate labour	cost figures calculated from	Drewry Shipping Consultants
	(1998)	

manpower	management	general	1997	USD	per unit	186,000.00
		engineering	1997	USD	per unit	120,000.00
		terminal	1997	USD	per unit	120,000.00
		accountant	1997	USD	per unit	37,000.00
		IT	1997	USD	per unit	55,000.00
		operations	1997	USD	per unit	35,000.00
		control	1997	USD	per unit	37,000.00
		maintenance	1997	USD	per unit	30,500.00
		maintenance	1997	USD	per unit	30,500.00
		secretariat	1997	USD	per unit	11,000.00
	administration	payroll	1997	USD	per unit	11,000.00
		billing	1997	USD	per unit	11,000.00
		cashier	1997	USD	per unit	10,000.00
		purchasing	1997	USD	per unit	10,000.00
	operations	ship / yard supervisors	1997	USD	per unit	34,000.00
		quay crane operators	1997	USD	per unit	20,750.00
		forklift and other drivers	1997	USD	per unit	13,500.00
		tractor / trailer	1997	USD	per unit	13,500.00
		stowage / wharf clerks	1997	USD	per unit	14,500.00
		ship / yard clerks	1997	USD	per unit	14,500.00
		control clerks	1997	USD	per unit	14,500.00
		computer clerks	1997	USD	per unit	14,500.00
		gate clerks	1997	USD	per unit	14,500.00
		personnel officer	1997	USD	per unit	18,000.00
		roster clerk	1997	USD	per unit	13,500.00
		senior depot clerk	1997	USD	per unit	13,500.00
		depot clerk	1997	USD	per unit	12,000.00
	maintenance	technician	1997	USD	per unit	17,000.00
		mechanics	1997	USD	per unit	17,000.00
		electricians	1997	USD	per unit	17,000.00
		trade assistants	1997	USD	per unit	10,000.00
		welders	1997	USD	per unit	10,000.00
		store clerk	1997	USD	per unit	10,500.00
		storemen	1997	USD	per unit	9,000.00
		pumpmen	1997	USD	per unit	6,000.00
		tyreman	1997	USD	per unit	6,000.00

maintenance	container-handling	quay cranes	1997	USD	per unit	106,400.00
	equipment new	yard gantries	1997	USD	per unit	35,400.00
		straddle carriers	1997	USD	per unit	
		rail-mounted gantries	1997	USD	per unit	
		tractors / trailers	1997	USD	per unit	8,400.00
		reach stackers	1997	USD	per unit	40,250.00
		forklift trucks	1997	USD	per unit	19,250.00
		engineering service vehicles	1997	USD	per unit	700.00
		other vehicles	1997	USD	per unit	14,000.00
	computer and commication equipment new		1997	USD	per unit	11,000.00
	buildings and other supply new		1997	USD	per unit	
	other equipment new		1997	USD	per unit	
	container-handling	quay cranes	1997	USD	per unit	152,000.00
	equipment	yard gantries	1997	USD	per unit	47,200.00
		straddle carriers	1997	USD	per unit	
		rail-mounted gantries	1997	USD	per unit	
		tractors / trailers	1997	USD	per unit	9,600.00
		reach stackers	1997	USD	per unit	51,750.00
		forklift trucks	1997	USD	per unit	24,750.00
		engineering service vehicles	1997	USD	per unit	
		other vehicles	1997	USD	per unit	
	computer and commit	computer and commication equipment		USD	per unit	
	buildings and other su	ipply	1997	USD	per unit	
	other equipment		1997	USD	per unit	

Table A-6: Aggregate first-generation crane scenario maintenance cost figures calculated from Drewry Shipping Consultants (1998)

maintenance	container-handling	quay cranes	1997	USD per unit	173,600.00
	equipment new	yard gantries	1997	USD per unit	35,400.00
		straddle carriers	1997	USD per unit	
		rail-mounted gantries	1997	USD per unit	
		tractors / trailers	1997	USD per unit	8,400.00
		reach stackers	1997	USD per unit	40,250.00
		forklift trucks	1997	USD per unit	19,250.00
		engineering service vehicles	1997	USD per unit	700.00
		other vehicles	1997	USD per unit	14,000.00
	computer and commication equipment new		1997	USD per unit	11,000.00
	buildings and other supply new		1997	USD per unit	
	other equipment new	1997	USD per unit		
	container-handling	quay cranes	1997	USD per unit	248,000.00
	equipment	yard gantries	1997	USD per unit	47 ,200.00
		straddle carriers	1997	USD per unit	
		rail-mounted gantries	1997	USD per unit	
		tractors / trailers	1997	USD per unit	9,600.00
		reach stackers	1997	USD per unit	51,750.00
		forklift trucks	1997	USD per unit	24,750.00
		engineering service vehicles	1997	USD per unit	
		other vehicles	1997	USD per unit	
	computer and commi	computer and commication equipment		USD per unit	
	buildings and other su	Ipply	1997	USD per unit	
	other equipment		1997	USD per unit	

Table A-7: Aggregate panamax-generation crane scenario maintenance cost figures calculated from Drewry Shipping Consultants (1998)

Table A-8: Aggregate	post-panamax cran	e scenario mainte	nance cost	figures	calculated
	from Drewry Shipp	oing Consultants ((1998)		

maintenance	container-handling	quay cranes	1997	USD	per unit	210,000.00
	equipment new	yard gantries	1997	USD	per unit	35,400.00
		straddle carriers	1997	USD	per unit	
		rail-mounted gantries	1997	USD	per unit	
		tractors / trailers	1997	USD	per unit	8,400.00
		reach stackers	1997	USD	per unit	40,250.00
		forklift trucks	1997	USD	per unit	19,250.00
		engineering service vehicles	1997	USD	per unit	700.00
		other vehicles	1997	USD	per unit	14,000.00
	computer and commication equipment new		1997	USD	per unit	11,000.00
	buildings and other supply new		1997	USD	per unit	109.01
	other equipment new	1997	USD	per unit	0.00	
	container-handling	quay cranes	1997	USD	per unit	300,000.00
	equipment	yard gantries	1997	USD	per unit	47 ,200.00
		straddle carriers	1997	USD	per unit	
		rail-mounted gantries	1997	USD	per unit	
		tractors / trailers	1997	USD	per unit	9,600.00
		reach stackers	1997	USD	per unit	51,750.00
		forklift trucks	1997	USD	per unit	24,750.00
		engineering service vehicles	1997	USD	per unit	
		other vehicles	1997	USD	per unit	
	computer and commication equipment		1997	USD	per unit	
	buildings and other sup	ply	1997	USD	per unit	
	other equipment		1997	USD	per unit	

maintenance	container-handling	quay cranes	1997	USD per unit	210,000.00
	equipment new	yard gantries	1997	USD per unit	35,400.00
		straddle carriers	1997	USD per unit	
		rail-mounted gantries	1997	USD per unit	
		tractors / trailers	1997	USD per unit	8,400.00
		reach stackers	1997	USD per unit	40,250.00
		forklift trucks	1997	USD per unit	19,250.00
		engineering service vehicles	1997	USD per unit	700.00
		other vehicles	1997	USD per unit	14,000.00
	computer and commication equipment new		1997	USD per unit	11,000.00
	buildings and other supply new		1997	USD per unit	109.01
	other equipment new	1997	USD per unit	0.00	
	container-handling	quay cranes	1997	USD per unit	300,000.00
	equipment	yard gantries	1997	USD per unit	47 ,200.00
		straddle carriers	1997	USD per unit	
		rail-mounted gantries	1997	USD per unit	
		tractors / trailers	1997	USD per unit	9,600.00
		reach stackers	1997	USD per unit	51,750.00
		forklift trucks	1997	USD per unit	24,750.00
		engineering service vehicles	1997	USD per unit	
		other vehicles	1997	USD per unit	
	computer and commic	computer and commication equipment		USD per unit	
	buildings and other su	pply	1997	USD per unit	
	other equipment		1997	USD per unit	

Table A-9: Aggregate other operating cost figures calculated from Drewry Shipping Consultants (1998)



Figure A-15: Total operating cost scenarios with first-generation quay cranes and new equipment.

Figure A-16: Average operating cost scenarios with first-generation quay cranes and new equipment.





Figure A-17: Total operating cost scenarios with first-generation quay cranes and used equipment.

Figure A-18: Average operating cost scenarios with first-generation quay cranes and used equipment.





Figure A-19: Total operating cost scenarios with panamax-generation quay cranes and new equipment.

Figure A-20: Average operating cost scenarios with panamax-generation quay cranes and new equipment.





Figure A-21: Total operating cost scenarios with panamax-generation quay cranes and used equipment.

Figure A-22: Average operating cost scenarios with panamax-generation quay cranes and used equipment.





Figure A-23: Total operating cost scenarios with post-panamax-generation quay cranes and new equipment.

Figure A-24: Average operating cost scenarios with post-panamax-generation quay cranes and new equipment.





Figure A-25: Total operating cost scenarios with post-panamax-generation quay cranes and used equipment.

Figure A-26: Average operating cost scenarios with post-panamax-generation quay cranes and used equipment.



land and terminal	mobilisation					
	dredging and earthwork	dredging without restrictions	1997	USD	per m3	2.25
		dredging confined space	1997	USD	per m3	7.50
	quay structure		1997	USD	per m	54,000.00
	container yard		1997	USD	per m2	63.80
	open storage yard		1997	USD	per m2	55.00
	sheds		1997	USD	per m2	375.00
	buildings					
	other civil works					
	lease	land lease	1997	USD	per m per year	7,300.00
equipment	container handling new	quay crane	1997	USD	per crane	3,800,000.00
		spreader	1997	USD	per unit	125,000.00
		yard gantry	1997	USD	per unit	1,180,000.00
		reach stacker	1997	USD	per unit	575,000.00
		forklift truck	1997	USD	per unit	275,000.00
		tractor / trailer	1997	USD	per unit	120,000.00
		generator	1997	USD	per unit	600,000.00
		radio / communication	1997	USD	per unit	350,000.00
		work vehicle	1997	USD	per unit	14,000.00
		computer hardware / software	1997	USD	per unit	1,200,000.00
		other	1997	USD	per unit	280,000.00
	computer and commication equipment new		1997	USD	per year	220,000.00
	power, water and fuel supply equipment new					
	other equipment new					
	container handling	quay crane	1997	USD	per crane	3,800,000.00
		spreader	1997	USD	per unit	125,000.00
		yard gantry	1997	USD	per unit	1,180,000.00
		reach stacker	1997	USD	per unit	575,000.00
		forklift truck	1997	USD	per unit	275,000.00
		tractor / trailer	1997	USD	per unit	120,000.00
		generator	1997	USD	per unit	600,000.00
		radio / communication	1997	USD	per unit	350,000.00
		work vehicle	1997	USD	per unit	14,000.00
		computer hardware / software	1997	USD	per unit	1,200,000.00
		other	1997	USD	per unit	280,000.00
	computer and commicat	ion equipment	1997	USD	per year	220,000.00
	power, water and fuel su	pply equipment				
	other equipment					

Table A-10: Aggregate first-generation crane scenario capital cost figures calculated from Drewry Shipping Consultants (1998)

With panamax cranes, quay crane cost is at 6,200,000 USD, with post-panamax cranes at 7,500,000 USD.