JOINT TRANSPORT RESEARCH CENTRE

Discussion Paper No. 2009-2
January 2009

Market Power and Vertical and Horizontal Integration in the Maritime Shipping and Port Industry

Eddy VAN DE VOORDE and Thierry VANELSLANDER
Department of Transport and Regional Economics
University of Antwerp
BELGIUM

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

International Transport Forum

JOINT TRANSPORT RESEARCH CENTRE

Discussion Paper No. 2009-2

Prepared for the Round Table of 5-6 February 2009 on

Vertical Relations between Transport

and Logistics Businesses

MARKET POWER AND VERTICAL AND HORIZONTAL INTEGRATION IN THE MARITIME SHIPPING AND PORT INDUSTRY

Eddy VAN DE VOORDE and Thierry VANELSLANDER
Department of Transport and Regional Economics
University of Antwerp
BELGIUM

December 2008

TABLE OF CONTENTS

1. INTRODUCTION

The maritime sector is undergoing constant change, as is particularly apparent in the shift in competition that has unfolded in recent years. Whereas in the past shipowners and ports used to compete with one another, the competitive struggle is now increasingly unfolding at the level of logistics chains. Today, market players are selected not so much for their stand-alone competitiveness, but on the basis of whether or not they belong to a successful maritime logistics chain. This explains why certain market players are continuously trying to gain greater control over these chains, including through vertical and horizontal alliances, mergers and acquisitions.

This contribution considers in greater detail these concerted efforts to increase market power through extensive integration. First, we deal with the competitive shifts that have occurred in the port and maritime arena. Subsequently, we look at the strategic behaviour exhibited by the main market players (shipowners, terminal operating companies, port authorities, logistics service providers, etc) and analyse their objectives. Finally, we assess the consequences of the strategies pursued in the context of the anticipated future scenarios.

2. THE COMPLEXITY OF THE MARITIME LOGISTICS CHAIN

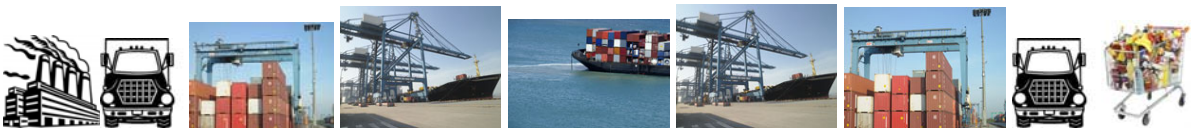
The nature of competition in the maritime and port industry has changed in recent years from a competitive struggle between individual shipping companies and ports to one involving maritime logistics chains (Suykens and Van de Voorde, 1998; Meersman, Van de Voorde and Vanelslander, 2008). In other words, competition is no longer unfolding at the level of individual ports or shipowners but rather at that of logistics chains connecting origin and destination.

Successful maritime logistics chains are like well-oiled machines in which every nut and bolt is perfectly attuned. Consider the case of seaports. Modern seaports are crucially important nodes in international logistics chains and their associated networks. The success of the logistics chain as a whole depends on the competitive strength of the seaports belonging to that chain and vice versa. A similar reasoning applies to the other maritime transport players, including shipowners, port undertakings and hinterland transport providers.

Clearly, then, the competitive strength of a port or any other maritime player does not depend exclusively on the own infrastructure and organisation; it is also affected by a variety of other market forces.[1]

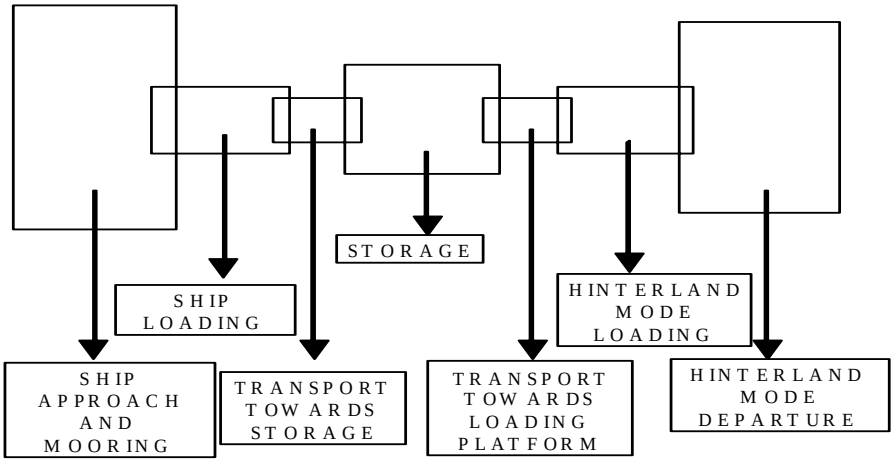
Roughly speaking, a maritime logistics chain consists of three large sections: the purely maritime activities, goods handling in the port and hinterland transport services. The formation of chains depends on three important elements: the maritime connections, the goods-handling operations (usually involving large volumes), and the distribution towards the hinterland. Figure 1 provides a schematic overview of such a logistics chain. Depending on the goods category concerned and the type of chain management applied, this structure may become more complex and possibly involve different ports of call.

Figure 1. **A typology of the maritime logistics chain**



If we home in on the port-related activities in the above overview, we notice that one of the most important roles of ports lies in the transfer of goods from ship to shore and from ship to ship. Jansson and Shneerson (1982) distinguish the following aspects:

Figure 2. **The main activities of a seaport according to Jansson and Shneerson**



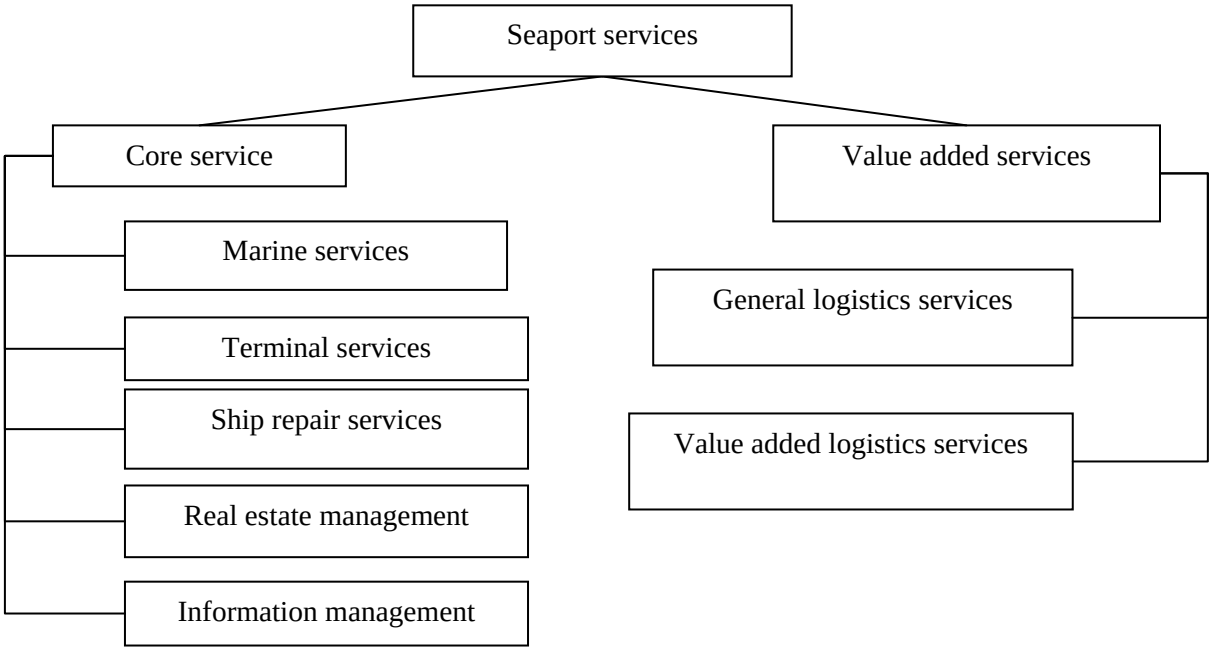
Source: Own diagram on the basis of Jansson and Shneerson (1982).

Strikingly, the distribution function is prominent in seaports, as they usually serve an extensive hinterland.[2]

In the course of the 1950s, many seaports acquired a further function, in addition to trade and throughput. Because of certain agglomeration effects – consisting mainly in economies of scale, location effects and urbanisation benefits – ports were found to be excellent locations for certain types of industrial activity. Consequently, in addition to their role in trade and transport chains, they also became significant links in the industrial chain.

In more recent research, one distinguishes even more clearly between the various subactivities in seaports. Increasingly, these are so-called value-added activities, as shown in figure 3 below. This evolution is indicative of the increasingly complex nature of seaports.

Figure 3. **Principal seaport activities according to the World Bank**



Source: Own diagram on the basis of World Bank (2001).

The implication is that the competitive strength of seaports has become dependent on a great many variables. Vanelslander (2005) identifies 89 such variables, which may be classified as policy-related, scope-related, chain-related and terminal-specific. Some have an undeniable impact on the costs to the user and hence to the competitive position of the port. We summarise in Table 1 below.

Table 1. **Seaports' main distinguishing factors**

Factor	Possible states
Activity scope	Complete – limited
Lay-out	Tidal - non-tidal; basins - no basins
Location	Coastal – river; large - small population hinterland
Organization	Land lord – limited operating – operating
Security	High – moderate – low
Traffic	High – moderate – small; mixed – containers only – bulk only

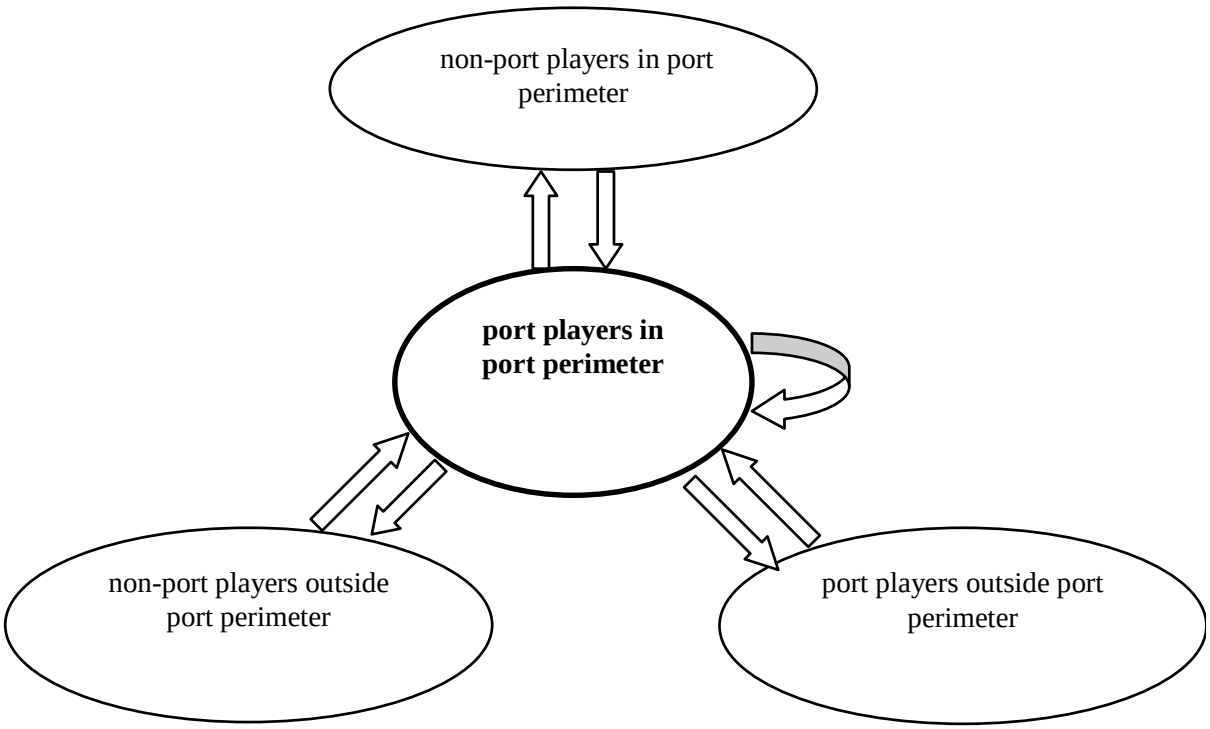
Most combinations of variables values are possible, although some combinations occur more frequently than others. Each combination is, in principle, tied to a different cost structure.

However, that is not the end of it. Seaports are, after all, made up of a variety of links. Often these are controlled or managed by different players, but some activities are also integrated across links. Each aggregated decision will therefore give rise to a chain reaction. This may in turn result in bottlenecks that are not immediately apparent.

A port encompasses more than the port authority as the governing body, the shipping companies as its principal customer and terminal operating companies (TOCs) as the main suppliers of throughput services. There are numerous other, often smaller players to take into account. Yet, hitherto, there has been a lack of insight into the relative importance, the negotiating strength and the market power of each of these players. What is required is a genuine understanding of the mutual relationships, the financial participations, and, as the case may be, forms of managerial control.

A study by Coppens *et al* (2007) considers these issues in greater depth. It takes a bottom-up approach, and consists in a sector analysis based on a regional input-output table linked to microeconomic data. In this manner, the principal clients and suppliers of all port players are identified (cf. figure 4).

Figure 4. **Relationships between port players**

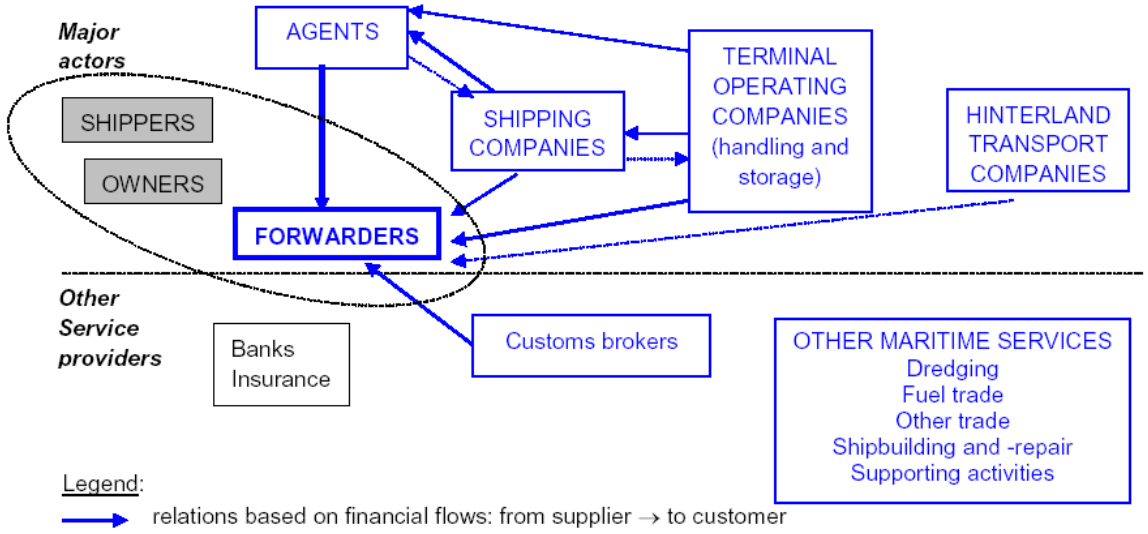


Source: Coppens *et al.*, 2007

The empirical research by Coppens *et al.* (2007) focuses on the port of Antwerp. By way of illustration, Figure 5 provides an overview of the financial flows between the various players. In the case of Antwerp, the significance and, even more so, the sensitivity of the forwarders are very apparent: many of the financial flows are generated through mediation of this activity. Substantial cargo flows reach Antwerp through consolidation. Shipping companies base their decisions regarding shipping routes and schedules on the volume of cargo. Obviously, the role of a number of other port players should not be underestimated either.[3]

Typical examples of such players are fuel trading and dredging. The former plays a big role in ship operations, whereas the latter has its role in the construction of shipping and port facilities. The availability of efficient fuel provision can convince a shipping company to call at a port which is at the margin, or to make it a longer stay, in both cases resulting in more cargo loading and unloading capacity. Dredging activities are an important element of capacity creation and maintenance.

Figure 5. **Interactions between port-related players and their size**



Source: Coppens *et al.*, 2007.

Taking a look at value added generated by smaller players, fuel trading, forwarding and hinterland transport take the biggest share, next to terminal operating activities, which has the largest share. The same ranking applies to employment, where fuel trading is replaced by supporting activities.

This kind of disaggregated analysis can help explain how the largest players (i.e. shipping companies, terminal operating companies…) will, in the longer term, try to increase their control over logistics chains, e.g. through acquisitions of smaller but strategically important players. There have already been examples of agents who became takeover targets, and terminal operators, too, may be expected to undergo or actively seek further integration with, for example, shipping companies. However, this integration will be more flexible than it has been in the past: horizontal integration, i.e.

integration between companies belonging to the same industry, shall be achieved through alliances rather than through mergers, while vertical integration, i.e. forms of closer cooperation between parties across the logistics chain, shall tend to consist in joint ventures and dedicated handling.

The potential involvement of non-port groups or even non-transport groups should not be overlooked either: they may wish to acquire control over certain activities within seaports with a view to short-term financial gain rather than the sustainability of the activities as such. It is for this purpose that activities are selected for inclusion in the portfolios of financial groups on the basis of risk and potential return, as well as the extent to which they generate value added that may be turned into profit.

3. FORMS OF INTEGRATION IN THE MARITIME LOGISTICS CHAIN

Let us now consider the consequences of cooperation between the various maritime and port players in the context of the competitive environment in which they operate. We shall take as our starting-point the following synthesis (based on, among others, Meersman, Van de Voorde and Vanelslander, 2008).

- The global economy obviously continues to be the motor of the maritime sector (Meersman and Van de Voorde, 2001; Meersman and Van de Voorde, 2006). However, that economy is also undergoing rapid change: recent years have seen enormous growth in international trade and consequently also in sea-bound trade, a process characterised by an international redistribution of labour and capital and an integration and globalisation of the markets. In the second half of 2008, however, recession set in.

- Shipping companies are strategically important clients of ports. On the one hand they attract traffic and industrial activity to the port, while on the other they are attracted by such industrial activity. Freight passes through the ports, after which drayage may be taken care of either by the ocean carrier (i.e. 'carrier haulage') or the shipper (i.e. 'merchant haulage'). We have also witnessed substantial scale increases on the part of shipping companies in recent times. This has been achieved first and foremost through horizontal cooperation and/or mergers and takeovers. Additionally, shipping companies have set their sights on terminal operators and inland transport services, as operations are increasingly approached from the perspective of complex logistics chains, whereby each link must contribute to the constant optimisation of the chain as a whole. This has altered the competitive balance in the market, as shipping companies have gained in power through their overall control of logistics chains.

- We have also witnessed important structural evolutions within ports. Traditional stevedoring firms have evolved towards more complex *terminal operating companies* (TOCs), more often than not because a shortage of working capital necessitated mergers, takeovers and externally financed expansion projects. In some cases, the external capital was provided by shipping companies, many of which have established their own terminal operating branch. These may operate as *dedicated* terminals for the shipping company itself (e.g. Cosco Pacific), or they

may pursue a more independent course (e.g. APM Terminals), possibly as a multi-user terminal in order to improve the utilisation rate. Port and public authorities, for their part, initially stood by rather passively.

Clearly, then, the port and maritime industry has undergone a dynamic evolution in recent years. In this context, we refer explicitly to Heaver *et al* (2001), where the various forms of cooperation and concentration in the industry are discussed in greater detail. The proposed configuration continues to apply today, even though some players seek partnerships more actively than others do. Table 2 provides an updated overview of the great variety that exists in types of cooperation in the port and maritime industry. We restrict ourselves to shipping companies, TOCs, port authorities and hinterland operators.

As table 2 shows, there is indeed great variety in forms of cooperation within and between the different categories of players. In the next sections, we analyse a number of specific situations in detail: horizontal cooperation between TOCs, horizontal cooperation between shipping companies, vertical cooperation between shipping companies and TOCs.

Table 2. **Strategic cooperation in the maritime sector (with examples)**

Players	Shipping companies	Terminal operating companies	Port authorities	Hinterland operators
Shipping companies	* **Vessel sharing agreements** (e.g. CMA-CGM FAL4 and China Shipping AEX 3 on North Europe - Far East from August 2008) * **Joint-ventures** (e.g. Swire Shipping, Ahrenkiel and MOL on Tasman Orient Line between Far East and Darwin from May 2008) * **Consortia** (e.g. Hamburg Süd and Hapag Lloyd on Europe - Caribbean/WCSA) * **Alliances** (e.g. Grand Alliance: Hapag Lloyd, MISC, NYK and OOCL) * **Mergers/acquistions** (e.g. CSAV bought remaining 25% in Companhia Libra de Navegaçao in July 2008) * **Conferences** (e.g. ESPMC-WITASS Conference: Container Cargo Lines, CMA CGM, CSAV, Hapag-Lloyd, Hamburg Süd and "K" Line, to be liquidated October 2008)			
Stevedores	* **Joint-ventures** (e.g. CHKY Alliance carriers (Coscon, Hanjin, "K" Line, Yang Ming) and ECT (Hutchison) at Rotterdam Euromax from September 2008) * **Dedicated terminals** (e.g. MSC at Antwerp Delwaidedok, operated by joint venture MSC and PSA-HNN) * **Share** (e.g. Tangier Med Gate: 50% Eurogate Tanger (itself 20% CoMaNav, 40% Contship Italia, 40% Eurogate) and 20% CMA CGM, 10% CMA CGM subsidiary CoMaNav, as well as 20% MSC from May 2008) * **Consortia** (e.g. Pacific International Lines (PIL) and Container and Terminal Services (CTS) at Chittagong Container Terminal (CCT) from July 2008)	* **Mergers/acquisitions** (e.g. MSC 51% from NYK Ceres Terminals in New Orleans Terminals) * **Joint-venture** (e.g. National Container Company (NCC, 80%) and Eurogate (20%) at Baltic Container Terminal, open 2009)		
Port authorities	**Concessions for dedicated terminals** (e.g. APM Terminals at Lazaro Cardenas from 2008).	* **Concessions** (vb. Antwerp Deurganckdock by PSA and DP World since 2004) * * **Joint-ventures** (e.g. Ningbo Port Authority and HPH in Ningbo Beilun Port Phase II since 2001)	* **Alliances** (e.g. Port of Rotterdam and Humber Trade Zone since 2004)	
Hinterland operators	* **Block trains and capacity sharing** (e.g. NYK between Rotterdam and Duisburg) * **Acquisitions** (e.g. Maersk acquired Roadways in UK)	* **Joint-ventures** (ECT in Duisburg Inland Port, with own rail and inland navigation shuttles between Rotterdam and Duisburg		* **Alliance** (e.g. Railion (DB's freight section) signed a cooperation agreement with EW&S for traffic from the Benelux countries, Germany, and Eastern Europe.)

Source: own processing of data from various shipping companies, stevedoring firms and port authorities; based on Heaver *et al*. (2001)

4. IN-DEPTH ANALYSIS OF HORIZONTAL AND VERTICAL CO-OPERATION AMONG SHIPPING COMPANIES AND TOCS

This section tries to identify recent trends in the kind of horizontal and vertical agreements among shipping companies and TOCs.

To begin with, mergers and acquisitions among TOCs are assessed. As Figure 6 shows, the concentration drive, which was particularly strong during the late 1990s, has lost momentum. The most recent transaction of consequence was the takeover of P&O Ports by Dubai Ports Authority, after which the company was renamed DP World. At this very moment, Spanish operator Dragados, which was previously part of a construction group, is involved in takeover talks with various operators, including HPH and DP World. It would appear, then, that preference is now given to new start-ups, be it under a joint venture or as a solo investment.

Among shipping companies, too, the takeover drive seems to have come to a relative halt too. As shown in Figure 7, the only new moves to have been registered since 2000 are the takeover of Delmas by CMA-CGM in 2005, the acquisition of P&O Nedlloyd by AP Moeller in 2006, the purchase of CP Ships by Hapag Lloyd in 2007. Alliances and vessel-sharing agreements are presently the preferred option, most probably because of the inherent flexibility offered by this type of deal.

It would appear that vertical co-operation is now applied a lot more commonly by shipping companies as a means of gaining control over port capacity. An example that comes to mind is that of dedicated operating contracts. Table 3 provides an overview of the dedicated terminal agreements involving the top-5 container shipping companies. Each of these firms is involved in a number of such agreements, most of which were reached only recently. Dedicated terminals are in many cases also linked to financial stakes being taken by the shipping line under consideration.

It is furthermore striking that eight of the top-15 TOCs are subsidiaries of shipping companies, with a varying degree of independence in decision-making. This again illustrates the importance that shipping companies attach to being involved in the terminal operating business, not so much for the sake of diversification, but rather to ensure that sufficient port capacity is available. However, the relationship between such terminal subsidiaries and their parent companies is often not equivocal or problem free, APM Terminals being a case in point. Originally a dedicated terminal subsidiary of the AP Moeller Group, under the then name of Maersk Terminals, the business unit acquired relative independence in 2002. To underline this autonomy, the headquarters were moved from Copenhagen to The Hague (Scheepvaartnieuws, 2007). At the present moment, APM Terminals still has a preferred supplier relationship with its parent company, even though it is free to – and indeed does – negotiate (dedicated) terminal handling capacity, mainly on the condition that sufficient port capacity is reserved for the parent company. The multi-user decision also depends on the strength of any other shipping companies, their shares in total port throughput and the stakes they might take in any joint ventures. It should be added that AP Moeller's interest in the overall chain is not restricted to port terminals. Maersk is also active in road and rail and was till 2005 active in the air transport business.

Figure 6. **Mergers and takeovers between terminal operating companies**

	1996	2001	2003	2006	2008
1	PSA	HPH	HPH	HPH	HPH
2	HPH	PSA	PSA	PSA	PSA
3	P&O Ports	APM Terminals	APM Terminals	APM Terminals	APM Terminals
4	Maersk	P&O Ports	P&O Ports	DP World	DP World
5	Sea-Land	Eurogate	Eurogate	Cosco Pacific	Cosco Pacific
6	Eurokai	DPA	Cosco	Eurogate	Eurogate
7	DPA	Evergreen	Evergreen	SSA Marine	SSA Marine
8	ICTSI	Cosco	DPA	APL/NOL	APL/NOL
9	SSA	Hanjin	SSA	HHLA	HHLA
10	Hamburger Hafen und Lagerhaus Aktiengesellschaft (HHLA)	SSA	APL/NOL	? Hanjin	Hanjin
11	Pacific Ports Co.	HHLA	HHLA	MSC	MSC
12	Ceres Terminals Inc.	APL/NOL	Hanjin	NYK	NYK
13	Europe Combined	NYK	MSC	OOCL	OOCL
14	Bremer Lagerhaus Gesellschaft	Hyundai	NYK	CSXWT	CSXWT
15	NYK	CSXWT	OOCL	Mitsui OSK Lines	Mitsui OSK Lines
16	APL/NOL	Mitsui OSK Lines	CSXWT	Dragados	K Line
17	OOCL	OOCL	Mitsui OSK Lines	K Line	TCB
18	Hanjin	K Line	Dragados	TCB	ICTSI
19	Mitsui	Dragados	K Line	ICTSI	
20	Evergreen	TCB	TCB		
21	K Line	MSC	ICTSI		
22	Cosco	ICTSI	P&O Nedlloyd		
23	CSXWT	Yang Ming Line			
24	Terminal Contenedores de Barcelona (TCB)				
25	Yang Ming Line				
…	Hyundai				
…	Hessenatie	Hessenatie			
…	Noord Natie	Noord Natie			
…	Contship Italia sa				
…	Sinport Sinergie Portuali				
…	Egis Ports	Egis Ports			

Source: company annual reports.

Figure 7. **Mergers and takeovers between shipping companies**

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Maersk Line	Maersk Line	Maersk Sealand	Maersk-SeaLand	Maersk Sealand	Maersk Line	Maersk Line	Maersk Line	Maersk Line	Maersk Line
2	Evergreen	Evergreen	Evergreen Line/Uniglo	P&O Nedlloyd	P&O Nedlloyd	MSC	MSC	MSC	MSC	MSC
3	P&O Nedlloyd	P&O Nedlloyd	P&O Nedlloyd	Evergreen	Evergreen	P&O Nedlloyd	Evergreen	Evergreen	P&O Nedlloyd	CMA-CGM
4	Sea-Land	MSC	Hanjin/DSR-Senator	Hanjin/DSR-Senator	Hanjin/DSR-Senator	Evergreen	P&O Nedlloyd	P&O Nedlloyd	Evergreen	Hapag Lloyd
5	COSCO	Hanjin	MSC	MSC	MSC	Hanjin/DSR-Senator	CMA-CGM	CMA-CGM	CMA-CGM	COSCO
6	Hanjin	Sea-Land	COSCO	NOL/APL	NOL/APL	COSCO	Hanjin/DSR-Senator	NOL/APL	NOL/APL	CSCL
7	MSC	COSCO	NOL/APL	COSCO	COSCO	NOL/APL	COSCO	Hanjin/DSR-Senator	CSCL	Evergreen
8	MOL	NOL/APL	NYK	NYK	CMA-CGM	CMA-CGM	NOL/APL	NYK	COSCO	NOL/APL
9	NYK	NYK	CMA/CGM/ANL	CP Ships	NYK	MOL	NYK	COSCO	Hanjin/DSR-Senator	Hanjin
10	HMM	MOL	CP Ships	CMA-CGM	CP Ships	CP Ships	MOL	CSCL	NYK	NYK
11	Zim	HMM	Zim	MOL	K Line	NYK	CP Ships	OOCL	OOCL	MOL
12	Yangming	Zim	MOL	K Line	OOCL	K Line	K Line	MOL	CSAV	OOCL
13	CMA-CGM	CP Ships	K Line	Zim	MOL	Zim	OOCL	Zim	MOL	K Line
14	OOCL	CMA/CGM	HMM	OOCL	HMM	OOCL	Zim	CP Ships	K Line	Yang Ming
15	NOL	Hapag-Lloyd	OOCL	Hapag-Lloyd	CSCL	CSCL	Hapag Lloyd	K Line	Hapag Lloyd	Zim
16	CP Ships	OOCL	Yangming	Yang Ming	Yang Ming	Hapag Lloyd	Yang Ming	CSAV	Zim	Hamburg Süd
17	K Line	K Line	Hapag-Lloyd	CSCL	Zim	HMM	CSCL	Hapag Lloyd	Hamburg-Süd	HMM
18	APL	Yangming	UASC	HMM	Hapag Lloyd	Yang Ming	Hyundai	Yang Ming	Yang Ming	PIL
19	Hapag-Lloyd	UASC	CSAV	CSAV	CSAV	PIL	CSAV	HMM	CP Ships	CSAV
20	Cho Yang	Safmarine	Cho Yang	Hamburg-Süd	Hamburg-Süd	CSAV	PIL	Hamburg Süd	HMM	Wan Hai
		Uniglory						Delmas		
		Lloyd Triestino								
		DSR Senator								

Source: company annual reports.

Table 3. **Dedicated terminals top-5 container shipping companies**

Shipping company	Terminal	Date of announcement	Terminal operator
Maersk	Rotterdam	1998	APM Terminals
	Bremerhaven	1999	APM Terminals - Eurogate
	Algeciras	2005	APM Terminals
	Lazaro Cardenas	2007	HPH
	Felixstowe	2008	HPH
	Tanger	2008	Maersk - APM Terminals - Akwa Group
MSC	La Spezia	1971	Eurogate - MSC
	Napels	2002	MSC - Cosco
	Bremerhaven	2004	Eurogate
	Antwerp	2005	PSA - MSC
	Valencia	2006	MSC
	Las Palmas	2007	MSC - Dragados
	Le Havre	2007	MSC
	Kumport		Limar Port and Ship Operators SA
CMA-CGM	Le Havre	2006	CMA-CGM - GMP
	Busan	2007	Macquarie - Bouygues - Hyundai - KMCT - BPA - KUKJE - KCTC
Hapag-Lloyd	Hamburg CTA	2001	HHLA - Hapag-Lloyd
Cosco	Singapore	2003	PSA

Source: company annual reports.

5. REASONS FOR INTEGRATION

As each form of cooperation is intended to enhance the players' own competitive position, we have thus far considered them as a whole. Ultimately, though, the industrial economic purpose of respectively horizontal cooperation (e.g. between shipping companies) and vertical cooperation (e.g. between a shipping company and a TOC) is often quite different.

In the case of horizontal cooperation, the companies' optimal shape depends on the benefits of scale and scope. These are present for as long as large-scale production and service provision results in economies. Such scale and scope effects are instrumental to companies' merger and diversification strategies. They also affect pricing, entry and exit behaviour, and whether or not a long-term sustainability of the competitive advantage is feasible.

The source of economies of scale and scope are diverse (Besanko, 2007, p. 78): indivisibilities and the spreading of fixed costs; increased productivity of variable inputs, especially in consequence of specialisation; a reduction of joint stocks; engineering principles associated with the so-called 'cube-square rule'.[4] Other sources relate to joint purchases, marketing, and R&D.

The question arises whether recent horizontal mergers in the maritime and port industry have confirmed the existence of economies of scale and scope. In the past decade, we have witnessed two evolutions: on the one hand, shipping companies have become ever larger through mergers, takeovers and organic growth, which has led to greater concentration; on the other, we have seen evidence of closer cooperation through strategic alliances. In both cases, the purpose is clearly to benefit optimally from economies of scale and scope within the boundaries set by antitrust legislation. By way of

illustration, we refer to one of the major merger operations in shipping history. One of the explicit goals of the merger between Nedlloyd and P&O in 1996 was to achieve scale benefits and thus to reduce costs (Hansen, 1997). However, the operation was not particularly successful, and the proclaimed objective was not attained. This led in turn to the takeover of P&O Nedlloyd by Danish group AP Moeller in 2005. Again, the stated objective was to realise scale benefits and to acquire even greater market power. As far as the latter goal is concerned, the merger has been successful to some extent. It has however been far less successful in achieving the envisaged scale benefits. P&O Nedlloyd gave preference to the Danish group over a number of Asian candidates (incl. NOL and China Shipping) because of its substantial cash stocks and in view of so-called 'cultural similarities' (Neleman, 2005). The extent of the latter was clearly overestimated, as the integration consumed a lot more money and effort than originally anticipated, which impacted substantially on the group's results (USD 568 mn loss in 2006, USD 202 mn loss in 2007). Moreover, the expectations in terms of market share were not achieved either. In fact, on routes to and from the US, the group lost market share (Leach, 2006).

Table 4 shows that in the terminal operating business, merging groups have been more successful in increasing market share and obtaining good financial results. The top company in 2007, HPH, obtained a market share of 14% with a worldwide throughput of more than 66 million TEU, on a total throughput by all operators of 485 million TEU. The top 8 companies together represent 52% of the worldwide market. However, the picture is mixed depending on the company considered. It is striking that HPH has obtained a turnover which is relatively a lot higher than that of PSA, whereas its throughput is not that different. The difference in EBITDA is even smaller. A similar difference between turnover and EBITDA balance kan be found between DP World and APM Terminals.

Table 4. **Top 8 global terminal operators – financial results and market share**

	Turnover Million USD	EBITDA Million USD	Throughput Million TEU	Throughput share
HPH	4,864	1,649	66.3	14
PSA	3,009	1,462	58.9	12
DP World	2,731	1,100	43.3	9
APM Terminals*	2,519	404	31.4	6
HHLA	1,857	597	7.2	1
ICTSI	361	118	3	1
APL Terminals	609	113	4.5	1
Cosco Pacific	51	29	39.8	8
World total			485	

* TEU-figures based on capital share

Source: Containerisation International.

In the case of vertical cooperation, the central question is how the vertical chain can be organised most efficiently. Companies are commonly confronted with a choice between producing and purchasing, in what is known as the 'make-or-buy' decision. The reasons for buying may include scale and scope effects (i.e. restriction of one's activity to the core business) and bureaucratic considerations (i.e. the avoidance of agency and lobbying costs). The choice for 'making' may be inspired by the avoidance of transaction costs, or the prevention of leaks of sensitive corporate information. In reality, the two options are extremes on a continuum of possibilities insofar as degree of vertical integration is

concerned. As table 2 clearly demonstrates, the maritime and port industry is characterised by a variety of forms of vertical cooperation and integration, ranging from controlled market transactions to full vertical integration.

The impact of vertical integration on competition has been the subject of much industrial economic research, and it presents a constant challenge to the regulating authorities. Riordan (2008, p. 145) asserts in this context that "antitrust policy in the United States recognises that a vertical merger can create incentives for anticompetitive foreclosure or facilitate collusion, while remaining mindful that vertical integration can achieve efficiencies".

As far as the maritime and port industry is concerned, insights into the objectives and outcomes of horizontal and vertical cooperation are still rather limited. There is a need for further empirical research into, among other things, the existence of economies of scale and scope. And, if they do exist, it is equally important to determine how far they reach, where their boundaries lie. If they do indeed exist and are found to be substantial enough, then we will undoubtedly see additional mergers and takeovers in years to come. It is also important that we should conduct empirical research into factors affecting scale and scope effects (e.g. coordination costs, the risk of leakage of sensitive corporate information, transaction costs…) and weigh them against each other, under various market conditions. This could help explain differences in vertical integration, including in relation to the speed at which it unfolds.

Insight is also required into the relationship between developments in the maritime and port industry on the one hand and competitive relationships and market power on the other. After all, antitrust concerns revolve around the definition of markets, the measurement of market power and the identification of that market power.[5] In relation to horizontal mergers or takeovers involving direct competitors (e.g. shipping companies), Werden and Froeb (2008, p. 43) assert that they give rise to unilateral anticompetitive effects if they cause the merged firm to charge a higher price, produce a lower output, or otherwise act less intensively competitive than the merging firms, while non-merging rivals do not alter their strategies. Unilateral effects contrast with coordinated effects arising if a merger induces rivals to alter their strategies, resulting in some form of coordination or reinforcement of ongoing coordination.[6] [7] More specifically, there would appear to be a need for two types of research. The first type is disaggregate research into the industrial and economic behaviour of shipping companies, TOCs and other players in the maritime and port chain. One possible approach is through case studies.[8] Additionally, there is a need for model-based and empirical research, including into the extent that pricing and production volume decisions by a single shipping company or terminal operating company may impact on the price-setting and output of other shipping companies.[9] [10]

6. CASH OR GAMBLE? A LOOK AT SOME POSSIBLE FUTURE SCENARIOS

The question arises how the industry will evolve in the future. How will port and maritime players respond to the economic downturn? How will declining economic growth translate to the maritime sector? To what extent is the slowdown tangible in industrial output rather than in services? Will the above outlined evolution towards scale increases based on horizontal and vertical mergers continue to manifest itself? And what are the likely consequences in terms of vessel size, especially in the container business? What timeframe are shipping companies looking at in their quest for further

cooperation? What strategies will market players other than the shipping companies pursue[11]? How will the maritime industry evolve in the near future? What position should port authorities assume? Will players currently operating within the port perimeter, such as terminal operators, be able to survive independently?

These are crucially important questions to the sector and its players, yet all are shrouded in uncertainty. Moreover, the market is not static, but extremely dynamic. One may therefore reasonably assume that each market player will try to anticipate on likely strategic moves by other players.

6.1. Shipping companies: further reorganisation, mergers and scale increases?

Thus far, there has been a strong integration movement mainly in the container business. Yet, precisely in this dynamic subsector, we make a peculiar observation: despite the fact that shipping companies have been complaining for some time about relatively low freight rates due to overcapacity, they continue to invest steadily in additional capacity. Table 5 provides an overview for May 2008 of the operational fleets of and vessel orders placed by the leading shipping companies.

The underlying strategy of these shipping companies is clear to see: in response to already low freight rates, they are attempting to deploy additional capacity at a lower operational cost per slot. Moreover, they consider a mixed fleet as a means of spreading risks. Additional cost control can be achieved through mergers and takeovers, and the entailed capacity reduction. Strategic and financial considerations by the holdings that control the shipping companies will keep capacity further in check, through strategic alliances, new partnerships, the rerouting of vessels. These evolutions may / will result in shifts in terms of direct port calls, which will in turn affect the volume of freight to be carried to and from the hinterland. On the other hand, it is perfectly conceivable that a port may compensate largely or even wholly for a drop in direct port calls through additional (maritime) feeder services.

Table 5. **Overview of fleet sizes and vessels ordered, 2008**

Owner		Operational fleet				Orders			
		Ships		TEU		Ships		TEU	
No.	Shipping Company	30/5	28/11	30/5	28/11	30/5	28/11	30/5	28/11
1	Maersk Line	550	544	2.006	2,041	71	85	325	421
2	MSC	396	432	1.289	1,437	54	56	578	668
3	CMA CGM	392	387	936	986	76	75	631	615
4	Evergreen	179	175	628	626	10	0	109	0
5	Hapag-Lloyd	139	132	505	496	14	14	123	123
6	Coscon	146	154	454	494	73	67	528	486
7	APL	127	135	428	491	33	25	234	183
8	China Shipping	133	142	421	442	34	31	234	239
9	NYK	121	113	410	417	38	32	213	182
10	Hanjin	87	89	365	373	40	34	315	288

Source: DynaLiners.

This evolution will have important consequences for the rest of the maritime logistics chain, including ports and their hinterland services. In the short to medium term, the pressure of such reorganisations will result in a profound reshuffle of services offered. New alliances will be formed, leading to further mergers and takeovers. On the side of the shipping companies, the market will stabilise, though there will of course be fewer players following the inevitable rationalisation and concentration drive[12].

In the very short run, the overcapacity which is observed in the sector, mainly due to falling demand as a consequence of the current economic and financial crisis, leads to the cancellation or slowdown of orderings of newbuildings where contractually possible, and to modified sailing schemes. Examples of the latter are slow steaming and temporary lay-up of vessels. In the cases where none of these are possible, for whatever contractual reason, shipping companies keep on operating their regular sailing schemes at a loss. Only companies with so-called 'deep pockets' can do this for a rather substantial duration of time. But for none of the companies, such situation is sustainable in the longer run. It can however be expected that the situation may return to 'normal' sooner or later, once the counter-reaction hitting the economy and therefore also the maritime business has been undone.

The further increases in vessel sizes may also have a profound impact in the longer-run evolution.[13] The present state of science suggests that increasing vessel size will lead to a different cost function, among other things because of the necessity of a second engine. Moreover, shipping companies have had some unpleasant experiences with scale increases in tanker shipping, including the imposition of higher port dues. The expectation is therefore that they will not allow themselves to be manoeuvred into a situation where they have no alternative seaport, i.e. where port authorities are all too aware that shipowners' price elasticity is extremely low. Finally, benefits of scale achieved at sea may be lost through higher terminal and hinterland transportation costs due to the greater freight volumes involved.[14]

6.2. Additional capacity and scale increases at landside

The economic benefits shipping companies seek through far-reaching scale increases and the corresponding cost reduction must not be wasted through time and cost bottlenecks on the quay, in the terminal or during connecting in-land transport. Port authorities and TOCs are aware of this, so that they try to maintain sufficient available capacity.

Many Northern European ports intend to further expand in the short to medium term, albeit almost entirely in terms of container throughput capacity. Table 6 provides an overview of these expansion plans. The result is again quite predictable: any substantial growth in capacity will further aggravate overcapacity in the global market and at certain European terminals, where operational quays are already lying idle.[15]

Besides these plans for additional capacity, there is also the issue of the organisation of freight handling at terminals. Here, too, we notice a concentration movement, inspired in part by the growing need for investment capital, which the original owners are often no longer able to supply themselves. This concentration movement has also created a buffer against any attempt at vertical integration on the initiative of the shipping companies.

Obviously, the prospect of even further concentration among terminal operators poses an economic threat to shipping companies, as reduced competition may lead to lower productivity growth, longer vessel-handling times and, perhaps most importantly of all, higher handling rates. The latter evolution is primarily a consequence of the fact that shipping companies no longer have a choice between any number of rival terminal operators, but are increasingly dependent upon large players who operate in different locations and are therefore able to negotiate longer-term package deals for services in those different ports. This way, the focus of port competition is gradually shifting from the level of individual port authorities to that of terminal operators, i.e. large groups that are able to offer regional networks of services.

We may assume with a high degree of certainty that shipping companies will not be prepared to (continue to) undergo this evolution. As their relative market power is at stake, it seems logical that they should put greater effort into acquiring so-called dedicated terminals, be it under joint ventures with locally active terminal operators or otherwise. This needs not be detrimental to the port authorities' cause, as it will at least make shipping companies less footloose, in the sense that a long-term relationship is forged that makes them less likely to relocate (Heaver *et al*., 2001). In the short term, such dedicated terminals may however lead to lower utilisation rates of available capacity.

Table 6. **Recent and planned expansion of container capacity in the Hamburg–Le Havre range**

Haven	Terminal	Unused capacity / Planned increases
Amsterdam	no structurally idle capacity, no concrete plans	
Antwerpen	Deurganckdok terminals Saeftinghedok terminals?	2008: 4,000,000 TEU idle 2014? 7,000,000 TEU additional
Bremen	CT 4	2008: 1,900,000 TEU idle
Hamburg	Eurogate Container Terminal Hamburg CTH HHLA Container Terminal Burchardkai CTB HHLA Container Terminal Altenwerder CTA HHLA Container Terminal Tollerort GmbH CTT	2010: 1,900,000 TEU additional 2010: 2,400,000 TEU additional 2010: 600,000 TEU additional 2010: 1,050,000 TEU additional
Le Havre	Port 2000	Phase 2: 2 quay walls in a tidal terminal (2008-2009), 500,000 TEU increase Phase 3: 6 quay walls in a tidal terminal (?),500,000 TEU increase
Rotterdam	EUROMAX terminal Maasvlakte 2	2009: 2,300,000 TEU 2013: 17,000,000 TEU
Vlissingen	Westerschelde Container Terminal	2,000,000 TEU, no specified date
Wilhelmshaven	Jadeweserport	2009: 2,900,000 TEU additional
Zeebrugge	no structurally idle capacity, no concrete plans	

Source: own table based on data from various port authorities.

6.3. A relative decline in market power for the port authorities?

The involvement of port authorities in commercial activities within the logistics chain is declining. Consequently, the market power of those port authorities and, as the case may be, the public authorities that control them is also decreasing[16]. In other words, managerial control over the maritime logistics chain now lies only partly with the ports and the undertakings located in those ports

In the current negotiation game between shipping companies and terminal operators, those same port authorities do however hold a strong trump card: they have the power to grant concessions and to determine their duration. Once a long-term concession has been awarded, they lose much of their market power, though. It has, for example, hitherto proven very hard to penalise concession holders who fail to achieve the objectives of their business plan. Consequently, there is an economic incentive for port authorities to award long-term concessions (e.g. 30 years), but in conjunction with mandatory interim objectives agreed upon beforehand with the concession holder[17].

7. CONCLUSIONS

However, the previously outlined trends point at certain elements that can help us reduce this uncertainty to some extent. Let us briefly summarise.

We may reasonably assume that the economy and international trade will continue to grow substantially in the future, despite the current economic and financial slowdown. This trend will also manifest itself in maritime trade. There are no indications of increasing profit margins in maritime transport. This is in itself rather surprising, as ocean carriage involves a risk for which investors may reasonably expect a premium. Moreover, demand for vessel capacity is expected to rise further. Consequently, at the level of individual shipping companies, shareholders will exert constant pressure on management to improve business results. Management will in turn continue to pressurise other links in the logistics chain, including the port, the terminal operating companies and the hinterland modes, which will give rise to further verticalisation.

Some shipping companies have, in recent years, taken a number of important long-term decisions, including in relation to fleet expansion. At aggregate level, this holds a real danger of overcapacity, which would inevitably lead to further rationalisation and cost reduction through partnerships, takeovers and mergers. Such movements may, or will, result in changes in terms of shipping companies' ports of call, loops and frequency of service.

In the short to medium term, overcapacity will result in lower freight rates and lower ROI, putting additional pressure on market players elsewhere along the logistics chain. Over a slightly longer time horizon, a lack of working capital may give rise to cooperation agreements that go beyond the level of dedicated terminals.

Shipping companies will no doubt retain a degree of dominance. In the case where a shipping company, through vertical integration, has gained control of the container terminal where its vessels are loaded and unloaded, that company will of course find it relatively easy to determine in which links of the chain the greatest cost savings may be achieved by distributing resources differently so

that the productivity level of the different links is modified. What is then required is for the various links to be geared to one another in such a way that productivity gains are maximised in links where the greatest cost reduction is achieved. This way, the shipping company is able to increase the productivity of the chain as a whole. In the case where a shipping company has not achieved vertical control, the impact of each action depends on the prevailing relationship between shipping lines and terminal operators. Shipping companies will, in any case, try to keep the tightest possible control over the generalised cost of a given port call. And if this should prove difficult, they will no doubt look out for the most appropriate solutions, i.e. an alternative port that is able to contribute to the lowest generalised cost.

The most likely scenarios, which therefore deserve to be studied in depth, are more or less known. However, the speed at which the various market players within the maritime logistics chain will take specific initiatives shall depend on a battery of exogenous and endogenous variables. As is the case with pricing in the maritime sector, and with successfully covering oneself against price fluctuations and other risks, timing is what ultimately determines who will emerge a winner.

All parties belonging to a given maritime logistics chain have one interest in common: to ensure that their chain is the most attractive, i.e. that it is the most efficient and the cheapest. The user, who depending on the contract is the forwarder or the destinee of the cargo, will after all consider the total cost of the chain. In order to gain insight into this aspect, additional model-based and empirical research is absolutely indispensable.

NOTES

1. Take the example of seaports. As ports are an integral part of a logistics chain, it does not necessarily make sense to consider the productivity of a terminal or port as an isolated entity. Resolving a bottleneck in one link may, after all, simply transfer the problem to another link, so that this in turn will not function optimally. In other words, an increase in productivity in one link may impose higher costs on another (Valleri and Van de Voorde, 1996, p. 127). An increase in the capacity of ships , for example, will spread the fixed cost of sailing over more containers, but it also requires a greater handling capacity, or else the bottleneck on the maritime route may be transferred to the port or hinterland services.

2. Consider the example of the Port of Hamburg. Its hinterland extends from Lisbon in the southwest to Glasgow in the northwest, St. Petersburg in the northeast and Istanbul in the southeast. There are direct departures to thirty nine destinations outside Germany (Port of Hamburg, 2008).

3. This holds even more so for other ports, as Antwerp is typically a forwarder-driven ports. Coppens *et al.* (2007) compares the situation in Antwerp with that in a number of other ports, resulting in a typology which distinguishes between forwarder-driven, agent-driven and transhipment-driven ports.

4. According to Besanko (2007, p. 85), this rule "states that as we increase the volume of the vessel by a given proportion, the surface area increases by less than this proportion".

5. Baker and Bresnahan (2008, p. 15) define market power as the ability of firms to raise prices above the competitive level for a sustained period. Market power may be identified in different ways, incl. on the basis of rotation in demand, variation in observable cost components, a comparison with the conduct of competitive firms, and unusual movements in price (Baker and Bresnahan, 2008, p. 19).

6. The term 'unilateral' is used because the merged firm and its rivals both pursue their unilateral self-interest (Werden and Froeb, 2008, p. 43).

7. Container shipping companies continue to complain about relatively low profit margins. For example, on 2 October 2008, the going rate for a 20-foot container on the Asia-Europe route was USD 350, compared to USD 1,400 just a year before (RZD partner). This may be indicative of a very competitive market. Moreover, the EU is no longer tolerating the conference system which has existed since 1875. From this perspective, the current wave of mergers and alliances may be seen as an attempt to achieve lower average cost through scale increases, which will yield a higher return if prices remain stable.

8. An option that comes to mind is a detailed analysis of whether or not port players have, in the past, applied so-called entry-deterring strategies (e.g. limit pricing, predatory pricing, capacity expansion).

9. A joint doctoral research programme is underway at the Universities of Ghent and Antwerp into the strategies of container shipping companies. One of the aspects studied is the relationship between market concentration and profitability (Sys, 2007 and 2008).

10. In this context we may also refer to the fact that, at the present moment, the antitrust authorities are focusing mostly on the coordinated effect of mergers: they have to be interpreted as the impact of a merger on the incentives to collude (explicitly or explicitly) (Kühn, 2008, p. 105).

11. In recent years, most port and higher public authorities have concentrated mainly on the container business. The question arises whether this is or has been a wise strategy. After all, not all cargo can be containerised. Moreover, the added value and profits realised in, say, project cargo are usually significantly higher than in containerised cargo.
    Consider the following two (related) examples:
    1) The petrochemical industry is extremely important to the ports of Rotterdam and Antwerp: it provides significant employment and represents substantial added value. It is, moreover, a non-footloose industry that also fulfils an important supply function to other companies and sectors. At the same time, however, it is sensitive to changes in environmental legislation and industrial policy.
    2) The revenue realised by the major ports usually consists in a cyclical and a non-cyclical component. Revenue from concessions (to both industrial concerns and TOCs) are relatively stable in the short to medium term, i.e. they are less sensitive to cyclical fluctuations.

12. As far as the forming of alliances is concerned, there is a certain parallel to be drawn with the air transport industry. The main difference lies in the fact that, in the airline business, all major carriers belong to alliances and only the smaller companies have stayed on the sidelines, while in the maritime sector, some of the large companies have not joined an alliance (see for example MSC and CMA-CGM).

13. Will we see a further evolution towards 10,000 to 12,000 TEU, or even up to Malaccamax-sized vessels of 18,000 TEU? The answer no doubt depends on the context, but certainly there is no denying that the new generation of Maersk vessels, with a capacity of over 13,500 TEU, represent another step in that direction.

14. The question arises how far one can / should go in order to achieve economies of scale and scope. For example, in the deployment of 8,000-plus TEU vessels, the number of calls is restricted to ports handling large volumes (in the order of 1,000 to 2,000 movements). However, the system still relies on ‘hubs’, implying additional handling costs. One may reasonably assume that it will then become interesting for non-mainports to attract smaller ships (e.g. in the order of 1,500 to 2,000 TEU) offering direct origin-to-destination services, without hubbing and associated additional handling and storage costs.

15. Typical examples are Amsterdam, Cagliari, Zeebrugge and Sines.

16. The question of where market power actually resides cannot be answered unequivocally, as the situation varies from port to port. In the case of such mainports as Rotterdam and Antwerp, it is already the case that terminals are given in concession, albeit mostly under a joint venture

between a shipping company and a terminal operator. From this, we draw the following conclusions:

1) The shipping companies and terminal operators involved appear to adhere to the saying 'If you can't beat them, join them'. Rather than engaging in an all-consuming competitive struggle, they prefer to collaborate. The immediate effect is, however, a new decline in the relative power of port and public authorities;
2) Revenues from a dedicated terminal may be higher, but now they need to be divided. In the case of a 50/50 terminal, the operator must, unlike in the past, give up 50% of profits to the shipping company. On the other hand, terminal operators thus acquire greater certainty that freight flows will be retained or may even increase in the future.

17. The proposed strategy is in any case purer than that previously applied by some port authorities in an effort to enhance their competitive position. A case in point was the move by the port authority of Rotterdam in 1999 to acquire a 35% stake in terminal operator ECT. Such action, be it temporary or on a more permanent basis, raises the spectre of conflict of interest, not in the least because the port authority continues to hold power of decision when it comes to the granting of concessions.

BIBLIOGRAPHY

Baker, J. and T. Bresnahan (2008), Economic Evidence in Antitrust: Defining Markets and Measuring Market Power, in Buccirossi, P. (Ed.), Handbook of Antitrust Economics, MIT Press, Cambridge (Mass.)

Besanko, D., Shanley, M. and D. Dranove (2007), Economics of Strategy, John Wiley and Sons

Coppens, F., Lagneaux, F., Meersman, H., Sellekaerts, N., Van de Voorde, E., Van Gastel, G., Vanelslander, T. and A. Verhetsel (2007), Economic impact of port activity: a disaggregate analysis: the case of Antwerp, Working paper document n° 10, Brussels: NBB

Hansen, R.K. (2005), P&O Nedlloyd – Economy of scale, Schip & Werf De Zee, 20-22

Port of Hamburg, http://www.hafen-hamburg.de/

Heaver, T., Meersman, H. and E. Van de Voorde (2001), Co-operation and competition in international container transport: strategies for ports, Maritime Policy and Management, 25(3) 293-306

Jansson, J.O. and D. Shneerson (1982), Port Economics, Cambridge (Massachusetts), M.I.T. Press

Kühn, K-U (2008), Competitive effects of vertical integration, in Buccirossi, P. (Ed.), The Handbook of Antitrust Economics, MIT Press, Cambridge (Mass.)

Leach, P. (2006), Maersk reports disappointing results after P&O Nedlloyd deal, Gulf Shipper

Meersman, H. and Eddy Van de Voorde (2001), International logistics: a continuous search for competitiveness, in Brewer, A.M. (Ed.), Handbook of Logistics and Supply-Chain Management, Oxford, Pergamon, 61-77

Meersman, H. and E. Van de Voorde (2006), Dynamic Ports within a Globalised World, paper presented at 17th International CEMT/OECD Symposium on Transport Economics and Policy, Benefiting from Globalisation – Transport Sector Contribution and Policy Challenges, 25-27 October 2006, Berlin.

Meersman, H., Van de Voorde, E. and T. Vanelslander (2008), Future Challenges for the Port and Shipping Sector, London, Informa

Neleman, J. (2005), P&O Nedlloyd: de Deense verrassing, FEM Business, http://archief.fembusiness.nl/2005/05/21/nummer-20/PO-Nedlloyd-De-Deense-verrassing.htm, consulted 22/11/08

Riordan, M. (2008), Competitive effects of vertical integration, in Buccirossi, P. (Ed.), The Handbook of Antitrust Economics, MIT Press, Cambridge (Mass.)

Scheepvaartnieuws (2007), Overslagbedrijf kiest eigen koers, http://scheepvaartnieuws.punt.nl/index.php?r=1&id=327383&tbl_archief=1, consulted 30/11/2008

Suykens, F. and E. Van de Voorde (1998), A Quarter of a Century of Port Management in Europe: Objectives and Tools, Maritime Policy and Management, 25(3), 251-261

Sys, C. (2008), Is container liner shipping an oligopoly?, paper presented at IFSPA 2008 Conference Hong Kong

Sys, C. (2007), Measuring concentration in the container liner shipping industry, in: Proceedings of the NECTAR Conference, Porto. Proceedings on CD-ROM.

Valleri, M. and E. Van de Voorde (1996), Port productivity: what do we. know about it?, in Valleri; M. (ed.), L'industria portuale: per uno sviluppo sostenibile dei porti, ed., Cacucci, Bari

Vanelslander, T. (2005), The economics behind co-operation and competition in sea-port container handling, PhD, University of Antwerp

Werden, G. J., and L. M. Froeb, Unilateral competitive effects of horizontal mergers, in P. Buccirossi (ed.), Handbook of Antitrust Economics, MIT Press, Cambridge (Mass.)

World Bank, (2001), Port Reform Toolkit – Module 3: Alternative Port Management Structures and Ownership Models, Washington.