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## Contents

1. AIMS AND SCOPE.....	4
2. GENERAL FRAMEWORK .....	5
3. INDUSTRIAL PRODUCTION AND INTERNATIONAL TRADE: DRIVING FORCES BEHIND SEA TRANSPORT AND PORT TRAFFIC .....	7
4. PORT COMPETITIVENESS AND WELFARE IMPACT .....	12
5. PORT ACCESSIBILITY AND HINTERLAND CONNECTIONS .....	17
6. PORTS: A MULTI-ACTOR PLAYING FIELD.....	20
7. A RENEWED ROLE FOR PORT AUTHORITIES?.....	22
8. CONCLUSION .....	25
9. BIBLIOGRAPHY .....	26

## 1. AIMS AND SCOPE

The aim of this study is to identify and analyze a number of critical issues in the port and maritime business for the future decades. It is clear that the sector is facing a number of big challenges, emanating from worldwide economic changes, social evolutions and environmental awareness. These changes stem from inside as well as from outside the sector. It is important to get grip on what these changing characteristics are, how structural they are, how important their impact is, and what factors are causing or triggering them.

Research in the frame of this paper has led to six future key issues:

- The changing relationship between maritime and port activity and international trade
- The role of actor strategies and interests in port competitiveness
- The increasing stress on port hinterland connections
- The growing interconnection and integration of maritime and port-related companies
- Concessions as remaining port authority tools
- Increasing opportunities and potential of inter-port co-operation

These different topics are elaborated in the subsequent sections of this report.

### *Target Stakeholders*

This study has relevance to the following groups:

1. Transport professionals interested in the holistic view of the port market.
2. Port strategy managers
3. Policy makers at a European and National level (e.g. ministries within EU countries in addition to affiliated countries, EU Policy makers) analysing policy strategies.
4. Consultants and analysts, in constructing reports and in developing research material.

## 2. GENERAL FRAMEWORK

In past years, concepts like globalization and liberalization have positively impacted on international trade, with long-lasting and relatively high economic growth as a consequence. The transport sector was implied in a double way in this evolution. Globalization was possible since among others transport was relatively cheap, as a consequence of far-reaching scale increase in the maritime and port sector. This scale increase became possible through fast growing international trade. Clearly, a simultaneous process is involved between international trade on the one hand, and the transport sector on the other hand.

Mutual influencing in a strongly negatively evolving market always goes in line with a dynamic evolution. That is also valid for the port and maritime sector. Within the transport sector, increasingly, the reasoning and decision-making takes place in terms of logistics chains. Competition therefore is no longer considered at the level of individual ports or individual shippers, but at the level of logistics chains between origin and destination.

**A port's success is determined by the success of the logistics chains which it is a part of.**

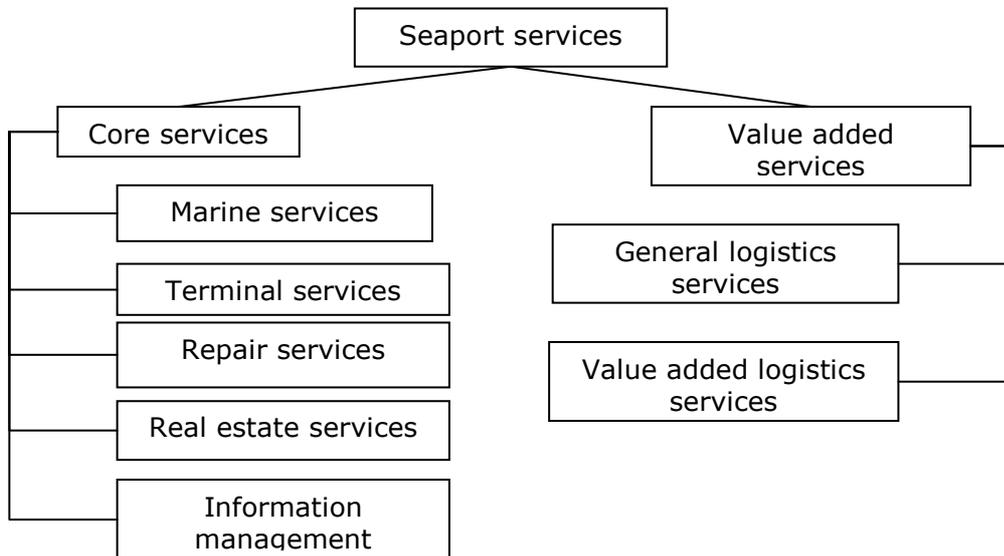
Successful logistics chains are like well oiled machines, whereby all chains and nodes match each other perfectly. Modern seaports within international logistics chains and linked networks act like crucial nodes. The success of logistics chains is a function of the competitive power of the seaports that are included, while the success of a seaport is a function of the competitive power of the logistics chains that pass by the port.

This way, it becomes clear that the competitive power of a port not only depends on its own infrastructure and organization. At the same time, many external market powers act on that port. That implies also that a successful seaport policy cannot be solely directed towards the individual ports on their own, but needs to be framed in an international logistics context. This policy paper wants to deal with this issue. A number of challenges and recommendations for the port and maritime sector are given. The focus is on seaports, which are ports where seagoing vessels can call, that serve a relatively large hinterland, and where terminal facilities and ship services are offered.

For a long time, cargo transfer was the most important seaport function. Loading and unloading operations are a derived effect of the trade function that seaports feature since their existence. During the fifties, many seaports, besides trade and cargo transfer, got an extra function. Due to agglomeration economies, mainly consisting of scale economies, location economies and urbanization economies, seaports appeared to be excellent location sites for certain industrial activities. This way, seaports not only became part of the commercial and transport chain, but they also became an important element of the industrial chain.

Recent scientific work shows that a lot more sub-activities take place in seaports. Next to the core activities, there are more and more so called 'value added activities', that mainly deal with logistics services (figure 1). By that, a seaport's picture gets all the more complex.

Figure 1: Main seaport activities according to World Bank



Source: own reprocessing, based on World Bank, 2001

Seaport policy needs to take account of this complexity and of the position of seaports in international logistics chains where goods are transiting from origin to destination, and where a large number of parties are involved (figure 2). Starting point for port activity is sea transport, which is steered by international trade and economic activity. Insight into the potential evolution of international trade flows gives the necessary information on the future demand for shipping capacity, preferably split out according to trade route, freight category, appearance and shipment size. On the supply side, future ship developments play a crucial role. Not only scale increases, but also technological developments which will make ship handling more efficient, will have important effects on ports.

Within the port context itself, three separate elements are dealt with. First, there is the potential port development, driven by the joint interplay of technological and economic developments. Further on, hinterland transport is dealt with, since, within a logistics chain, a seaport's success also depends on the competitive power of connecting hinterland transport connections and modes. Finally, there is the need for insight into the future of the economic web in and around the ports (forwarders, agents, service suppliers,...). The latter also involves looking at the future role of port managers and governments.

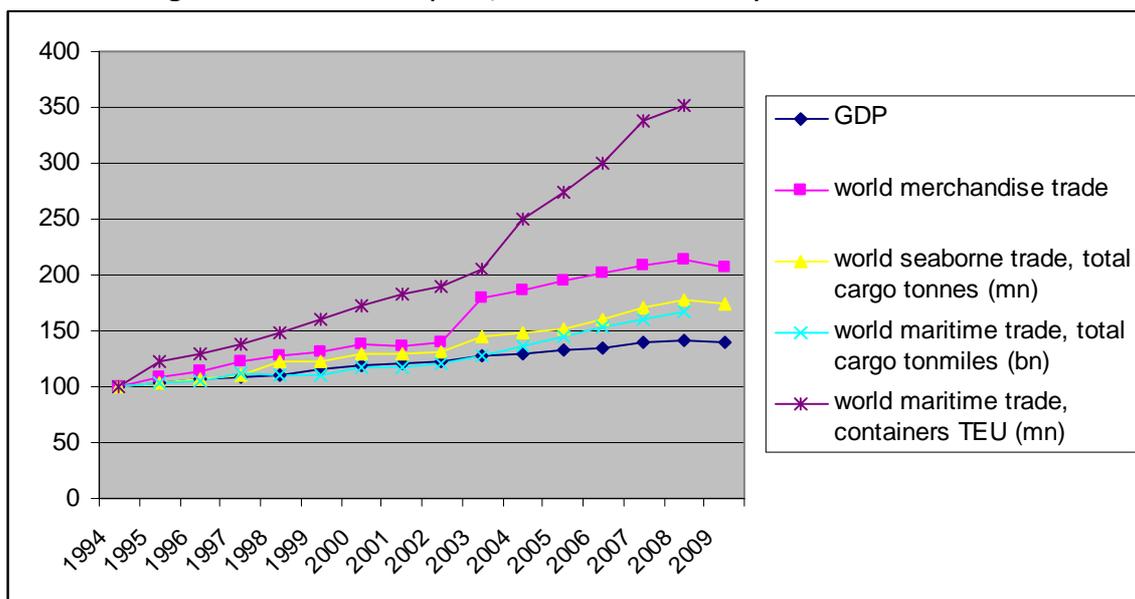
### 3. INDUSTRIAL PRODUCTION AND INTERNATIONAL TRADE: DRIVING FORCES BEHIND SEA TRANSPORT AND PORT TRAFFIC

Demand for freight is a derived demand. This implies that freight transport is only needed since goods are produced and consumed at different locations (Blauwens et al., 2010). Hence, the need for a thorough knowledge of the relationship between economic activities and transport activity. Thereby, economic activities are split out into on the one hand actual industrial production, with on and off-carriage of raw materials, semi-processed and processed materials, and on the other hand international trade (Meersman and Van de Voorde, 2005).

**There is still a strong relationship between on the one hand sea transport, and on the other hand economic activity and international trade.**

Figure 2 gives an overview of the growth of economic activity, international trade and maritime transport. Over the period 1996-2000, the volume of merchandise that was traded by sea grew significantly stronger than international trade. On the other hand, it turns out to be more sensitive to economic climate shifts.

Figure 2: Sea transport, economic activity and world trade



Source: own processing based on UNCTAD, 1997 till 2009, WTO, Trade Statistics, and Worldbank World Development Indicators

The spectacular growth of transport in its entirety, freight transport in particular, and the link with economic activities already show the economic importance of the transport sector.<sup>1</sup> This strong transport growth also creates serious estimation problems and a severe pressure on society. Typical examples are port congestion and environmental problems, linked to demand for further terminal and port

<sup>1</sup> Till present, this contribution deals with the relationship between economic activities and the derived freight transport. In the past, too little attention was given to the reverse relationship, i.e. the impact of transport activities on economic development and growth. The development of the transport industry unequivocally has had an outspoken effect on economic growth and the expansion of international trade relationships.

capacity, and the optimal planning of such investments. Here lies partly the origin of the important question whether also in the future, further economic growth, even a moderate one, will lead to larger transport demand.

The future growth and localization of economic activities therefore lies at the origin of the evolution of freight flows in general and of maritime trade and port activity in particular. A good insight in this future evolution is a necessary condition to get an idea of potential port traffic. But also a sound translation of trade flows to maritime flows and port transit is a condition for acceptable predictions of port activity.

For estimating the importance of the link between transport and economic activity, empirical work brings to the front several variables. The most evident ones without any doubt are Gross Domestic Product (GDP), employment, industrial production, import and export. Previous empirical work (Meersman en Van de Voorde, 1999) shows that, within Europe, until beginning of the nineties, not GDP growth but the rise of industrial production was the driving force behind growing freight transport. Both parameters do not always evolve in parallel, especially because in a number of Western European countries, economic growth is especially stimulated by the service sector, and industrial production itself got somewhat pushed aside<sup>2</sup>.

All stands or falls with economic activity prognoses and freight flows. A number of evolutions of the past years will most likely continue in the future. It is obvious that transport growth will be different per commodity category, per form of appearance and for sure also per geographical connection. At short notice, for sure, shifts will appear in intercontinental transport patterns. On a number of maritime axes, transport will grow faster than on other axes, for instance on connections between Asia and Europe, and between Africa and Europe. This raises the opportunity of 'new markets', like for instance the BRIC countries, that regain economic growth.

Large uncertainty remains about a number of factors that can impact on the world economy:

- Will globalization continue at the same rate, or will international trade feature a new 'regionalism'?
- Will the trade policy of the main economic blocs be directed towards a further liberalization of world trade, or will a protectionist behaviour remain, or will it even increase? Economic crises like the one we had may reinforce this focus on the own, local economy.
- Will the emerging countries be able to release themselves from the North, or will the world economy in the future still be dominated by the United States?
- Will disequilibria in freight flows in the future decrease or become stronger?
- How will Europe cope with its ageing problems?
- What will be the role of the government and the public sector, not only in relation to port policy and port infrastructure, but also in general in relation to the social sector.
- How will oil and raw material prices evolve?
- What are the previsions for the poorest countries?

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<sup>2</sup> All signs seem to indicate that the concordance from the eighties between freight transport and economic activities, is a clear underestimation from the concordance from the nineties. This can be a consequence of different factors. At first, mondialisation increased. Next to that, during the nineties, a strong move could be observed towards more deregulation, privatization and liberalization of the transport market. This undeniably has contributed to lower transport prices. Next to that, there were a development in the direction of Eastern Europe and technical evolutions like the modified stock and logistics policy in many companies.

These open questions will impact on the growth of the economy at world and regional scale, and on the size and direction of trade flows of the different commodities. It is thus necessary that predictions of sea transport and port activities in one way or another take into account uncertainty about the evolution of the world economy. This can be done in different ways.

**The large uncertainty about the long term evolution of the world economy and international trade can best be approached by means of scenarios.**

Another means to take account of the uncertainty about the evolution of the world economy, is to use scenarios. They offer the advantage that uncertainties can be mapped and that policy can match the potential, divergent outcomes of the scenarios. The Dutch government applied this for long term projections in different domains of the economy and of transport. The predictions are based on four scenarios about potential evolution in Europe and are described in detail in de Mooij and Tang (2003) and summarized in table 1. This gives for each scenario the annual growth that is to be expected till 2040.

Table 1: Expected annual world trade and GDP growth till 2040 for four future scenarios for Europe

	<b>Strong Europe</b>	<b>Global Economy</b>	<b>Transatlantic Market</b>	<b>Regional Communities</b>
World Trade	4,5%	5,6%	3,7%	2,4%
World GDP	2,5%	3,1%	2,3%	1,7%
Non-OEC GDP	4,6%	5,0%	3,2%	3,6%
EU15 GDP	1,6%	2,5%	1,9%	0,6%

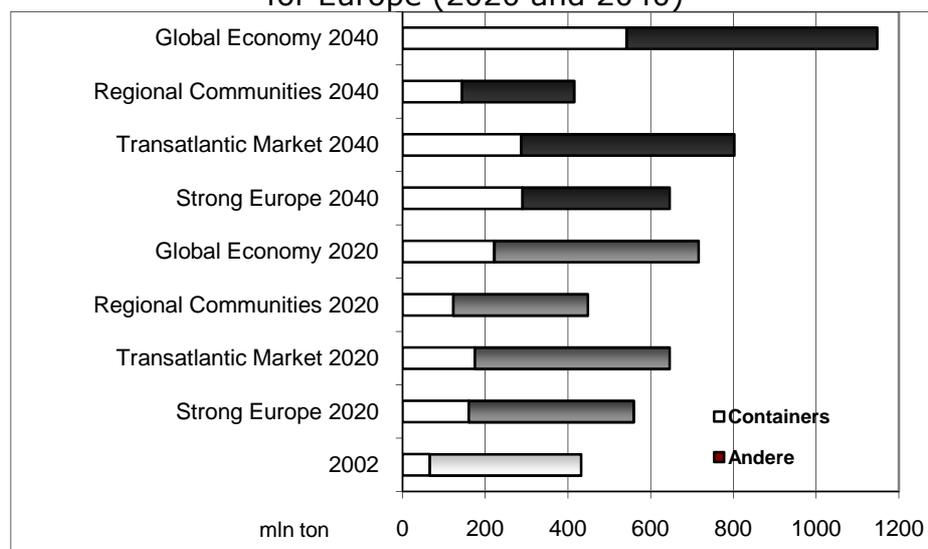
Source: Levinga, Rozemeijer and Francke, 2006.

**Dutch Central Planning Bureau (CPB) expects annual container tonnage throughput growth of between 3.5% and 6.9% between 2002 and 2020 for Dutch ports.**

For the Dutch ports, CPB came up with 2040 projections of between 400 million tonnes for the scenario Regional Communities, and 1.150 tonnes for the scenario Global Economy. The growth of container throughput in the period 2002-2020 varies between 3.5% and 6.9% annually, and in the period 2021-2040 between 0.8% and 4.6% per year (Besseling, Francke en Nistal, 2006). Notable differences that do not immediately invite impulse decisions in the field of investments in additional port infrastructure.<sup>3</sup> Note that the recent economic and financial crisis without any doubt has an impact on the proposed figures. No recent update of the analysis was made after the crisis, but the Dutch government assumes that the projected growth will remain within the stated bandwidth, be it that the actual growth curve might shift a little over time, so that it may take a couple of years more before the actual throughput figures are reached. In the longer run, for instance 2040, the effect should be minimal.

<sup>3</sup> Each of the scenarios can be subject to rightful questioning. To what degree were specific elements, among others in the field of environmental aspects, shifts in average distance traveled, so-called 'trading services', etc. It becomes clear that elaborating and especially estimating scenarios requires availability of three elements: and instrument (model), an observatory, and a correct interpretation of quantitative results. With the latter, it should not be forgotten that in the rest of the world, port capacity is being built. In some countries even under the slogan 'build capacity ahead of demand'.

Figure 3: Projections of port throughput for Dutch ports for the four future scenarios for Europe (2020 and 2040)



Source: Levinga, Rozemeijer and Francke, 2006

**Good prognoses of economic growth and world trade are a first pre-requisite of good port traffic predictions and estimation of ancillary capacity needs. Next to that, a port's competitive position is crucial.**

Predicting port traffic, for sure at longer term, remains hard, since uncertainty is too big. One can try, in a scientific way, to estimate and channel that uncertainty. Working with models and related scenarios can offer value added. One learns from the past, without omitting the dynamic character of the processes involved.

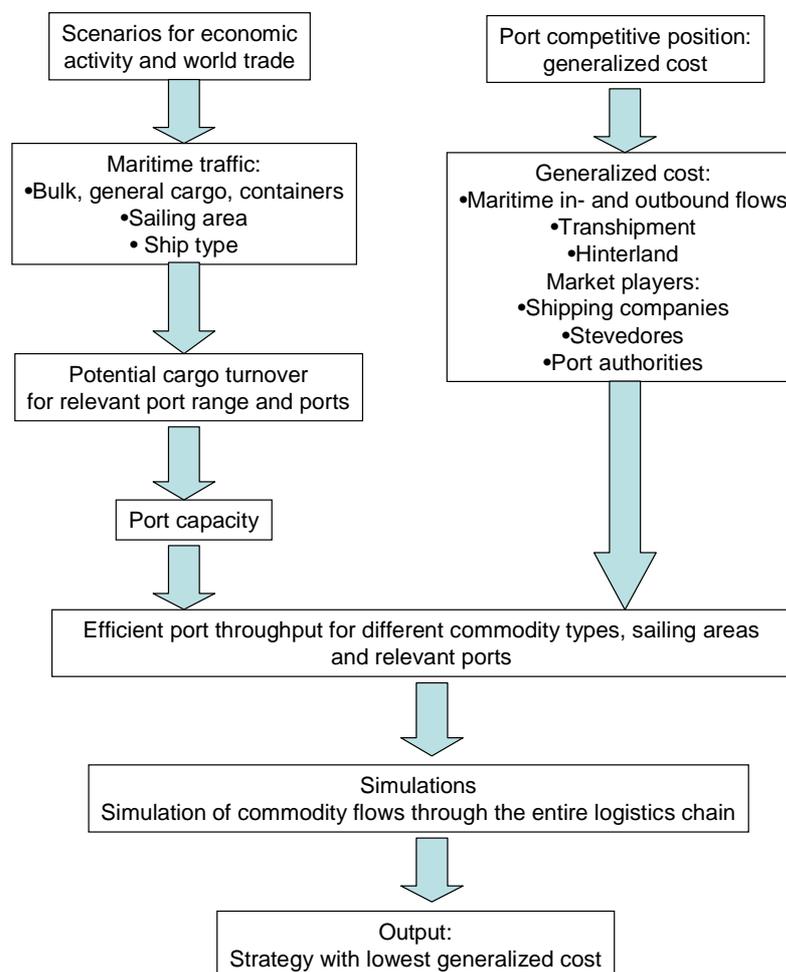
One of the problems is that the evolution of maritime trade, especially over a longer period, cannot be steered by port authorities and port operators. They do for instance not determine what the international trade policy of a country will be, they do not steer economic cycles, and they do not determine what exchange rates will be. These exogenous factors will however strongly determine what the potential freight flows to and from ports will be. Which volume of these potential flows will then actually be handled at these ports, will depend highly on the port's competitive position.

At this moment, one does not have a scientifically founded instrument which enables simulating the impact of policy instruments and strategies on port traffic. This is due partly to lack of reliable information and data, but mainly also to the complexity of port selection behavior. The latter requires strategic market share models that allow simulating the behaviour of all parties involved in port selection, with the aid of game theory. Of course, at longer notice, all actors concerned will attempt to maximize their profit. However, the complexity of the choice behaviour is mainly due to the different strategies that the market players can put into practice to make their long-term goals materialize.

In order to predict the longer term port activity, one can best use a twofold structure, whereby first potential traffic is predicted, based on scenarios for the future evolution of economic activity and world trade. In a next phase, it is analysed what volume of this potential traffic a port can actually turn into practice. Figure 4 gives the proposed structure of a model to predict port traffic, including all relevant decision variables and related parties.

The first level of the model shows the potential of maritime throughput from a macro-economic angle. With the second level, the port competition model, one tries to gain insight into the effective traffic that can be caught, taking into account the positioning of competing ports and logistics chains. The contribution to and of an industrial-economic policy should ensure anchoring maritime flows, in both directions.

Figure 4: General structure of a model to predict port traffic



It is also important to timely estimate the effect of political decisions in the area of transport and environment. Policymakers more and more strive towards sustainable transport, which one attempts to translate into a number of measurable indicators: an increase of transport growth, an evolution towards environmentally more friendly modes, internalization of external costs, de-coupling of transport and economic growth<sup>4</sup>. The European White Paper (European Commission, 2001) further deepens this issue.

<sup>4</sup> Economic growth in most cases is measured through GDP at constant prices.

Decoupling the evolution of freight transport demand entirely from economic activity and international trade is utopia. Moreover, it is questionable whether this is desirable, since the coupling works in two directions. The functioning of freight transport in a more equitable, more efficient and less impacting way is feasible.<sup>5</sup> But no matter the policy that is conducted, there will be important consequences for maritime logistics flows and port operations. A good port policy requires a good estimation of possible scenarios and related consequences.

#### 4. PORT COMPETITIVENESS AND WELFARE IMPACT

Successful ports do continuously act on a number of technical and organizational innovations that also in the past were the driving forces behind the market structure of the port industry. Musso (2008) summarizes these forces as follows:

- vessels growing ever bigger, as a consequence of the search for scale, scope and density effects;
- vessel specialization, linked to the increased use of unit loads (among others containers); striving towards higher productivity must avoid that scale effects of bigger ships get lost through port transfer;
- increased vertical integration within intermodal chains, driven by a striving for decreased transport time and diminished stocks;
- the development of transshipment in order to make substantial scale and density advantages materialize by grouping cargo in hubs; at the same time, one achieves better connectivity of small and regional ports.
- the economic and management integration of the transport logistics cycle, steered by capital flows;
- increased outsourcing of logistics activities, again so as to benefit to the maximum of scale and network advantages

#### **More intense port competition expresses into factor shifts.**

Still today, the above trends are progressing, with consequences for ports. Take the field of factor intensity, where this is clearly observable: labour savings, linked to higher capital intensiveness, with increased need of land. Those radical changes in factor intensity do have an important effect on generalized costs, and therefore also on port competition. The overlapping hinterland of the different ports increases, freight flows do get more volatile. By the increased pressure on available land, at the same time, some industry has been moved out of the ports, with consequential shrinking of the captive market.

#### **In case of competition for container traffic, available port capacity turns out to be a crucial factor.**

Where competition between ports exists, in particular in the field of container traffic, available capacity is an important factor in attracting new flows and in maintaining

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<sup>5</sup> The package of measures that the European Commission (2001) proposes in its White Paper, can, at full execution, lead to good results. When the proposed package is not, or only partially, executed, there is a risk of transport chaos, and an aggregation of supplementary bottlenecks. At that moment, even the economic growth that is to be expected, can be touched upon. Hence the urgent need for developing and using scientific instruments that can estimate, among others, the relationship between economic activities and freight transport in a systematic way, in both directions. Eventual negative developments in the freight transport can have negative repercussions on the entire economy.

existing ones. Shipping companies opt for ports without congestion and bottlenecks. They think ahead, choose open space, look for growth potential. That implies that the cargo transfer from sea to port and back needs to be performed in a fluent way, but also that the hinterland connection, including mode choice, is an important factor.

Some remarks are in place here. For one thing, while the aforementioned criteria are undeniably important for the final selection of a port, their relevance varies from player to player within the supply chain. Cost minimisation, for example, is important to every player in the chain, but clearly a shipping company has greater scope than some other players for restricting costs while being able to maintain a price level that guarantees a wide profit margin. Ultimately, though, someone has to foot the bill, namely the (new) owner of the goods.

Table 2 assesses the importance of each variable to each of the port players involved in the selection of a port of call. While Table 1 provides a fair indication, it essentially remains a reflection of stated preference. Obviously, cost is an important consideration, but precisely how decisive is it? Time management would also appear to be crucial, so that the question arises: how does the trade-off work out between time management and cost? This issue is illustrative of the urgent need for a quantification of all decision variables that present themselves in the context of a supply chain. On the basis of such a toolset, one could take adequate account of the own business strategies of each type of player, irrespective of whether their prime concern is cost minimisation or maximisation of market share or profit. Ultimately, the goal must be to reduce the decision-process to a single variable, namely the generalised cost, while taking adequate account of the cost and value of time, and possibly also of external costs.

Table 2: Decision variables in choosing a port

	<b>Owner / Shipper of goods</b>	<b>Forwarder</b>	<b>Shipping company</b>	<b>Terminal operators</b>
<b>Cost</b>	xx	x	xx	xx
<b>Location</b>	xx	x	xx	xx
<b>Port operations quality and reputation</b>	xx	xx	xx	xx
<b>Speed / time</b>	x	x	x	xx
<b>Infrastructure and facilities availability</b>	x		xx	xx
<b>Efficiency</b>	x	xx	x	xx
<b>Frequency of sailings</b>	x	x	x	
<b>Port information system</b>	x	x	x	xx
<b>Hinterland</b>	x	x	x	xx
<b>Congestion</b>	x	x	x	xx

Source: Based on Aronietis *et al.*, 2010

xx: very important  
x: important

It is important for a port authority to know who the port user is, who makes the choice of port and which factors influence this choice. However, the term 'port user' covers quite a heterogeneous group that includes shipping companies, consignors of goods, owners of goods, goods handlers, ... It is a group whose members would appear to depend on one another, but who are nevertheless often engaged in a fierce competitive struggle. Consequently, it is not always easy to determine who ultimately makes the choice of port. In addition, there is the question of which cost variables are most significant in the decision process (cf. the problem of factor assessment). In this respect, one needs to realise that the cost structure is determined by both exogenous factors (e.g. scale increases in world trade, or rapidly developing cargo-handling equipment) and endogenous factors within the port's direct sphere of influence.

Factors which increases the complexity of logistics chains and of who in the end chooses ports of call, and based on what factors, are the growing globalisation of operators and the higher private involvement. It is clear that the role – and financial power - of public governments and port authorities has shrunk to a large extent, to the advantage of private groups, who often are operating at a world scale, some of them covering operations in all continents. The way and extent of integration determine which interests will lead to what type of port of call and investment decision. Profit maximization for an integrated group, who covers entire logistics chains, should not necessarily imply cost minimization in port operations, if rightly chosen sub-optimization there allows for bigger gains to be reached in other segments of the chain.

Table 3 shows the growth of the biggest global terminal operators over the last few years. It is clear that concentration has been strengthened, even though overall throughput volumes have suffered in 2009 due to the economic crisis. Some of the groups, like PSA International and DP World have public roots, but are now run as private entities.

Table 3: Global container terminal operators (over 10 million TEU)

2010 position	2009 position	Terminal operator	Growth '09/'08	2009 TEU	2008 TEU	2007 TEU
1	1	Hutchison	-3%	65,300,000	67,500,000	66,300,000
2	2	APM Terminals	-7%	61,100,000	65,400,000	60,800,000
3	3	PSA International	-10%	56,900,000	63,200,000	58,850,000
4	5	Cosco Pacific	-5%	43,384,000	45,879,000	39,800,000
5	4	DP World	-8%	43,000,000	46,800,000	43,300,000
6	6	Eurogate	-12%	12,454,000	14,200,000	13,875,000
7	7	SSA Marine	-11%	11,100,000	12,500,000	12,500,000

Note: All figures comprise handlings at all terminals in which an operator is involved, regardless of equity share, numbers in italics are estimates

Source: Dynaliners

Table 4 shows the importance of the biggest container shipping lines, and the market share that they represent. It turns out that world share of the 25 biggest ones amounts to 59% in number of vessels, and even to 86% in TEU volume. Most of these companies are part of consortia, alliances or even integrated groups. Equally, as with the terminal operators from table 2, some of the companies are state-related or state-owned, but all of them run like private companies.

Table 4: The world's largest container shipping companies

	Parent/main	Operated Fleet		Order book	
		Ships	TEU	Ships	TEU
1	Maersk Line	567	2,129	57	361
2	MSC	435	1,755	37	445
3	CMA CGM	395	1,168	32	323
4	Evergreen	162	614	10	88
5	APL	153	613	22	201
6	Hapag-Lloyd	135	594	7	57
7	CSAV	143	539	7	53
8	Coscon	135	528	39	322
9	China Shipping	137	467	16	150
10	Hanjin	101	466	24	235
11	MOL	99	386	15	89
12	NYK	99	375	7	43
13	Hamburg Süd	117	359	10	71
14	OOCL	80	359	6	52
15	ZIM	97	327	16	164
16	K Line	78	323	14	86
17	Yang Ming	77	319	17	109
18	Hyundai	55	282	6	72
19	PIL	136	251	11	45
20	UASC	53	212	9	118
21	Wan Hai	83	176	14	38
22	HDS Lines	31	102	0	0
23	MISC	30	80	2	17
24	TS Lines	37	77	0	0
25	Sea Consortium	51	58	0	0
Total Top 25		3,486	12,560	378	3,138
World liner fleet		5,951	14,566	538	3,654
Share Top 25		59%	86%	70%	86%

Source: Dynaliners

Anyway, expanding port capacity in most cases requires very large investments, that often are irreversible and only profitable at the very long term. For financing, one has to rely on scarce public means that can also be used for other purposes. On top of that, increased social responsibility about the sustainable character of port activities features. A much heard argument is that the environmental impact of ports increases with the dramatic upsurge of throughput, even if it is admitted that the external cost per ton of throughput decreases. Moreover, technological evolutions and innovations make that this increase in transfer volume not necessarily translates into an increase of employment and value added, or in other advantages. (Meersman *et al.*, 2008)

The ensuing dilemma is then whether ports must or can still be considered to be profitable, and, if that is the case, at what level: locally, nation-wide or globally? What is the result of a careful analysis of local versus general costs and benefits, in the environmental as well as the economic domain? What is the link between the micro-economic role of ports as a node in the logistics chain, and their macro-economic role? The increasing port competition requires a continuous ex-ante anticipation of new developments. That will only be possible with sufficient social acceptability, which in turn requires knowledge and transparency.

## **It is important to show the real value added of seaports, and to avoid NIMBY<sup>6</sup> effects**

Knowledge and transparency imply the need for a quantitative insight into all costs and benefits related to port activities, at disaggregate level. Port performance namely is not only measured in terms of throughput and tonnage. Making available the results of this knowledge creation is the basis of a transparent policy and can contribute to local support for port modifications and an eventual further extension.

Through continued globalisation, port at world scale become relatively important, but by local groups, they are often considered a threat rather than generators of value added. This is the well-known NIMBY syndrome, fed by possible conflicts around land use, congestion and pollution. Here too, transparency is requested, not only on the procedures that are linked to port exploitation, but especially about possible compensation schemes.

## **Pricing is the most important instrument for optimizing capacity utilization**

Pricing is a powerful instrument where the link with the value of certain activities is involved. There is a need for further studying possible pricing schemes, among others in the field of differentiated pricing as a function of the advantage for the local community. Such pricing can be linked to promotion of better jobs in a sustainable port industry, targeting an increase in value added per unit of throughput. That requires selectivity in attracting port activity, building long-lasting relationships with shipping companies, and increased chain thinking in the direction of logistics and distribution. Automatically, this will lead to optimal use of available land. The most important problem however is that determining and imposing an honest and efficient price is not easy.

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<sup>6</sup> Not In My Back Yard: the paradoxical phenomenon where people probably are unanimous on the need of certain infrastructure, but by all means avoid to have too close to their own property.

## 5. PORT ACCESSIBILITY AND HINTERLAND CONNECTIONS

The problem of port hinterland connections and landside accessibility is enormously sensitive within the logistics chain thinking. The main reason is that a productive port and the shipping companies and terminal operators operating it, cannot afford having bad hinterland connections that destroy benefits reaped elsewhere. That is a real danger. Port congestion more and more appears landside, linked to bottlenecks there. Hence the continuous battle for improved connections between ports and hinterland, and for abandoning potential bottlenecks.

**Good hinterland connections reinforce a port's competitive position, but at this stage, they are hard to control by port and maritime actors.**

The biggest problem is that port nor maritime actors do have a lot of decision making power over the organization, coordination and efficiency of port hinterland connections. Such investments are often linked to responsibilities and the prioritization of a government (national, regional or local) and also a function of the availability of investment capital<sup>7</sup>. Macário and Viegas (2008) in this respect state: "Transport infrastructure can be considered as a production function for a region or a country and it is difficult to take into account the network properties, or the lack of, in the production function. Not less important is the spatial spill-over effect caused by the infrastructure impact that always transcends the spatial boundaries of its implementation".

It is clear that an improvement of hinterland transport infrastructure leads to more capacity, and hence gives chance to the materialization of scale and density effects. This has an effect on direct costs, but also on the choice by shippers of goods on the route, including the port of call, the mode, the location of distribution centres, in brief the entire logistics strategy. The degree of development of the transport system in the hinterland therefore clearly has an impact on the competitive position of a port. Improved accessibility means lower generalized costs, whereby the captive hinterland grows bigger. Landside accessibility has, in that respect, become one of the most important criteria of a port.

**In the future, port strategies will more and more be aimed at the hinterland side. The port community will therefore be more implied into a broad regional development.**

This observation has also changed port strategy. Where, in the past, traditional ports solely focused on shipping companies as most important clients, one now observes a shift of attention towards cargo owners and/or shippers. An important consequence is that, in the future, seaport development strategies will not only be more directed towards the water side, but as well or even more towards the hinterland.

<sup>7</sup> An additional problem thereby often is the division in decision responsibility between national, regional and local administrations. That often leads to conflict situations.

According to Macário and Viegas (2008), the port community will become a more implied party in regional development. Therefore, it is evident that a match is needed between the strategic objectives of a port, and the long-run objectives in the area of territorial development of the hinterland that is linked to a port. It is for the functioning of a port important that investments are being conducted in an infrastructure stock that in the transit towards and from ports avoids bottlenecks and therefore time loss, and in that way optimizes production and distribution systems, taking into account the prevailing environmental restrictions.

Important in the planning of investments in hinterland connections is that one can discover in a timely manner eventual threatening bottlenecks. This can be done through setting up an information system that for all ports allows a continuous market monitoring of hinterland transport, in order to see ex ante whether and to what extent bottlenecks are emerging.

Bottlenecks in the connections with the hinterland can often partly be resolved through a more efficient use of existing infrastructure. This can be achieved through a well suit pricing system that takes care, through charges, of a better spread of traffic and a more equitable division between the different modes of transport. When this is not sufficient, expansion of the infrastructure will be necessary.

Expanding hinterland connections most likely will not be possible without extensive investments, that moreover are mostly financed with public means. The scarcity of these means make prioritizing possible new infrastructure projects for port hinterland connections, necessary. This should be done in a uniform way, with a similar methodology, like for instance social cost-benefit analysis. For each proposed investment, a minimum rate of return needs to be reached. This prioritization happens within existing investment budgets, taking into account the analyzed investment's impact on the entire logistics chain.

An important aspect in the relation between the port and its hinterland, and the integration in logistics chains, is the introduction of efficient technologies and port community systems that allow for a fluent exchange of data and documents. Automation and improving technologies are crucial factors that impact on port competitiveness, through time gains that they allow for. In any of the cases, a trade-off has to be made between the flexibility of systems with some manual staff involvement, and the standardization and routine productivity that automatic systems allow for.

Gevaers, Van de Voorde and Vanelslander (2007) give a good overview of the state-of-the art of technological and process innovations that have been implemented in recent years in and around ports. A lot of attention has gone to investments that focus on safety, security, intermodality and environmental issues. Particular points of innovation dealt with inland navigation connections, Motorways of the Sea, customs services and payment systems. Far less attention seems to have been drawn to the application of technological innovations like GPRS systems, bottleneck elimination in the link with the hinterland, value added services, and the changing needs through increased containerization.

Port community systems in particular have an important role in eliminating bottlenecks. Very often, physical goods flows are running rather smoothly, but the exchange of documents cannot follow. As the speed of a chain is always determined by its weakest segment, slow information exchange slows down the entire trading process. Ports and governments can therefore play an important role in making sure

that such systems do exist, and in particular that they allow for easy standardization or exchange of data. Lack of standardization and uniformity implies the need for translation of data, with related risk of failures or mistakes.

**Investments in port and related infrastructure can in the future be troublesome when they can only be financed through public means.**

The construction of additional port capacity requires enormous investments. In maritime shipping, investing companies assume risk, but the starting point are mobile assets that can still be sold afterwards. This is not the case when investing in infrastructure: hinterland investments, just like port docks, locks and terminals, are physically non-movable, in most cases irreversible, and de facto sunk costs.

Till now, investments in port and terminal infrastructure were mainly government-driven. This evidence will disappear in the future. First of all, most countries feature a clear lack of sufficient financial government means to satisfy all investment plans submitted by port authorities in the short or middle run. Second, shrinking investment funds will imply that such port investments will be traded off against other important social needs, for instance in the field of education, health and/or ageing. In fact, this boils down to making choices in port investments, whether or not after prioritizing proposed projects, or looking for alternative sources of funding. The latter always involves larger port authority involvement, other actors that are directly or indirectly concerned parties (terminal operators, shipping companies, agencies), or even external funders.

Optimizing capital flows can be done through so-called financial engineering, whereby a continuous assessment of all financing techniques in the broader infrastructure investment sector is necessary. Next to that, it is necessary to stimulate possible forms of alternative financing. Such exercise also deals with distributional effects, for instance which actors experience what costs and benefits. There is a link with the generation of capital, pricing, and the control of both investments and infrastructure management.

Furthermore, decisions about large investment projects in ports or related infrastructure projects that are financed through public means, often use certain future port traffic projections. When the project materializes, an ex-post analysis can help evaluating whether, but especially also why the proposed returns are or are not generated. This can be an important learning base, especially towards future, large investment projects.

## 6. PORTS: A MULTI-ACTOR PLAYING FIELD

A port is a cluster of different companies that to a larger or lesser extent contribute to a port's success, but that, directly or indirectly, are subject to evolutions in a port's strategic position. Each decision by an important port player will generate a chain reaction within the port structure. At a lower level, this can lead to bottlenecks which are not directly visible, but that in the end do have consequences for a port's competitive position.

Hence the importance of analyzing more and more in detail the companies that directly or indirectly are involved in a port. A port namely not only consists of the port authority, shipping companies as their most important customers and terminal operating companies (TOC's) as most important cargo transfer service providers. Next to that, there are still many smaller operators. Till now, one was insufficiently aware of the relative importance of the negotiating and market power of each actor, because one had insufficient insight into the mutual relationships, the financial participations and eventual forms of management control.

**Company-intertwine inside and outside the port perimeter can lead to substantial *spill-over* effects.**

In Meersman *et al.* (2008), the port internal structure is being analyzed. It is checked how the relationships between the different port actors can be quantified, which is the evolution that is to be expected for each port actor, and how comparable port structures can be identified, starting from empirical research into one particular port.

Relationships between different port actors can be quantified by coupling a regional input-output table to micro-economic data, like in Coppens *et al.* (2007) for the Port of Antwerp. The most prominent customers and suppliers of all port actors are being identified in that way. It is also important to gain insight in the financial flows and spill-overs between the different port actors. This allows verifying how the different port actors are being affected by certain government measures or shipping company strategies. For that, there is a clear need of micro- and industrial economic data. Such data should allow to:

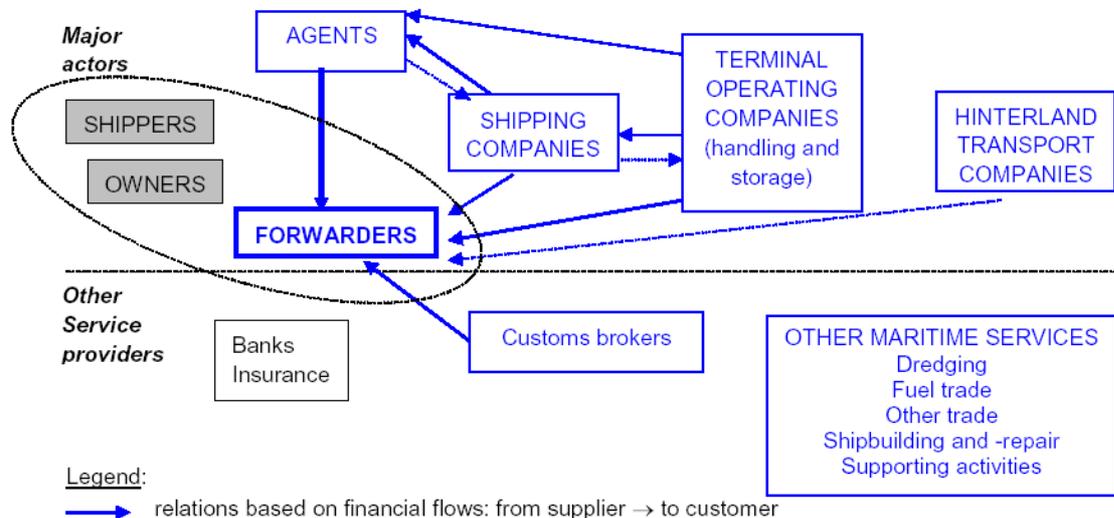
- quantify the relationships between the different port actors for several ports;
- verify to what extent it is possible to get to a generalization and/or typology of ports;
- study the future strategic evolution of all port actors;
- simulate the effects of all possible strategies and scenarios for all actors;
- check how important structural changes in the world economy have an impact on the different port actors.

One of the most prominent problems occurring when working with company level data, is their confidential nature. There is a need of good, standard confidentiality clauses that still give the researchers sufficient degrees of freedom.

Figure 5 gives an overview of the financial flows between the different actors. For Antwerp, the importance of forwarders is more than clear: a lot of these financial flows are generated by intermediation of that actor. That implies that for that port, every future incentive policy will need to be directed, among others, also to that

activity. Via consolidation a lot of cargo is being delivered at the port. Shipping lines base themselves on the size of that cargo when setting up sailing and call schedules. Exactly this type of analysis and port policy strategy can make port cargo transfer less foot loose.

Figure 5: Interrelationships between port actors



Of course, the role of a number of other port actors cannot be underestimated, especially in absolute financial flow volumes that they generate with their activities. That is even more valid in other ports, since Antwerp is typical forwarder-driven port. Antwerp's situation is compared in Coppens et al. (2007) to a number of other ports, whereby a typology is made that for instance distinguishes among forwarder-driven, agent-driven and transshipment-driven ports.

### Input-output analysis coupled to company level data reveals strategically important actors at a port.

This type of analysis can help explain in what way the biggest actors (shipping companies, terminal operating companies,...) over time can try to gain larger control over logistics chains by taking over smaller but more strategic actors. Examples exist where shipping agents were takeover targets. Equally, it is to be expected that terminal operators will undergo or search for further integration with shipping companies. The type of integration will be of a different, more flexible nature than in the past: vertical integration for shipping companies will be sought more easily in alliances than in mergers, while horizontal co-operation with terminal operators will consist more often of joint ventures and dedicated handling.

Not to be neglected is the importance of non-port groups or even non-transport groups that will gain control over port activities, with a focus which is much more oriented towards short-run financial gains than to long-run sustainability of the activity as such. In that respect, activities are being adopted selectively in the portfolio of the concerned financial groups, based on their risk, their profit perspectives, and the way in which they generate extra value that can be monetarized.

## 7. A RENEWED ROLE FOR PORT AUTHORITIES?

In recent research, Meersman *et al.* (2008) observed that, within maritime logistics chains, the involvement of port authorities in commercial affairs decreases. In short, the market power of the authorities and governments behind, shrinks. Goss (1990) a long time ago already raised questions at the future of port authorities. This concern is also expressed by other authors (see among others Verhoeven, 2008; Heaver *et al.*, 2001; Juhel, 2001; Musso, 2008).

### Also in the future not all-encompassing port management model.

According to Estache and Trujillo (2008), the question is not so much whether port authorities will survive, but in what direction a new vision on port management will develop. There are namely various new reasons why port authorities also in the future will have a role, be it possibly in a different way than is the case today. The driving forces behind the changes that port authorities must and will undergo, have to do with important developments in world trade, and, derived from that, the maritime sector: larger trade volumes and increasing specialization, growing attention for environmental affairs, growing attention for safety aspects, a changed market environment, institutional adaptations, and transport-operational changes. Moreover, one will not evolve in the future either towards the one, all-encompassing port model.<sup>8</sup>

Vanelslander (2005) dresses a matrix of forms of port governance along two axes: degree of government involvement, and degree of 'unicity of command'. In total, 25 cells are identified of possible combinations. The two most frequent ones are systems where local governments are involved, but leave out operations to private operators, and the system of full port privatization. The former is called a Latin system, whereas the latter is typified as Anglo-saxon, in view of the geographical areas where they most often feature. Brooks and Cullinane (2007) have held a wide survey among ports worldwide, so as to verify the frequency of occurrence of the different forms, and eventual variations that have lately emerged. Pallis and Brooks (2010) make a link between port governance forms and port performance.

In fact, ports do not differ really from other public services. Most ports are also subject to important political influences that are among others directed towards employment. Moreover, there is often some confusion about the port component within transport policy, for instance in relation to the national, regional or local level. The consequence of that is often a lack of a unified vision on the future of the port(s) concerned. Estache and Trujillo in that respect write: "*When too many players are involved without clear rules of accountability, coordination failures are likely to be the norm and performance will be hurt*".

There is therefore a clear need for analysis and detailed inventory of the tasks that a port authority in the future will be able to fulfil. Who does what, at what cost, and at what price? The responsabilisation makes that port authorities are facing concrete

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<sup>8</sup> There is a lot of confusion when talking about a port authority. The concept is often interpreted differently. That has to do with the differences in juridical systems, including the different interpretation that is given to the concept 'compulsory public service provision'.

goals and the management of allocated government means. It has to be clear to all market parties under all circumstances what position a port authority has, among others in the area of property, management type, degree of centralisation, the type of mandate, and the degree of financial autonomy.

## The facilitating role of port authorities remains important.

The question is what direction port authorities will evolve into in the future. Their facilitating role for sure remains important, among others in the field of infrastructure and intermodal integration, in some cases also in the area of superstructure. Main intention here is to contribute again and again to minimizing generalized costs. Shipping companies namely will not allow that economies of scale that materialize at sea, get lost at the port call or transfer. A facilitating role requires a strong power of adaptation, in the technical, financial, regulatory and institutional field.

At purely financial level, there is an important challenge in deciding on capacity management and extension. Port services cannot be inventorized. Moreover, there is the unavoidable fluctuation in ship arrivals. This requires a substantial reserve capacity to prevent long ship waiting times. This is one of the most important elements in each port development: the trade-off between the costs of new port capacity on the one hand, and the costs of leaving ships waiting on the other. This is clearly again an example of deciding under uncertainty.<sup>9</sup>

## Granting concessions is an important instrument of control.

Port authorities, in the present negotiation game between shipping companies and terminal operators, retain one important trump card, namely the power to grant concessions, linked to duration and the content conditions of those concessions. Once concessions with a longer duration are allotted, a large part of the market power of port authorities drops. A concessionaire who does not achieve the goals stated in the submitted business plan, in the past hardly could get penalized. In the future, there is therefore a clear economic incentive for port authorities to only grant concessions with long (e.g. 30 years) duration with intermediate options that are linked to the goals, as agreed initially and in agreement with the concessionaire, effectively materializing. Goals can be in the environmental field, or in the way hinterland transport is dealt with.

Next to concessions, the negotiation power of port authorities thus seems to have become limited, for sure in comparison to on the one hand very large shipping companies, and on the other hand terminal operators that focused in the past decenny also on a limited number of big world players.<sup>10</sup>

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<sup>9</sup> An important exercise consists of simulating what happens when effective demand exceeds or undercuts expected demand. Estache and Trujillo (2008) write the following about this: "When capacity excess occurs, it tends to cost taxpayers a lot but the resources remain within a given country. Once the distribution of capacity is distributed across countries, local excess capacity may imply cross-country subsidies. In that context, the financing needs of a multi-country business model will be challenged at the national level".

<sup>10</sup> Among the terminal operating companies, the top 7 generated 2007 a little more than 337 million TEU in container throughput, representing 33,5% of the global container handling market. Among the shipping companies, the top 25 beginning 2010 had more than 11,2 million tonnes of capacity in their hands, and with that represented

## Co-operation via financial cross participations

When port authorities in the future wish to keep or re-enforce their market position, they will need to act pro-actively. Far-reaching co-operation between port authorities, whereby the interests are made common or at least running parallel, can be a desirable strategy. This can be done through taking financial cross participations in each other's capital. At that moment, each tonne or TEU that is being acquired within the co-operation agreement is a pure benefit for each participating port authority. But above all, the negotiation power of the port authorities increases a lot, not only because through co-operation, they have grown into a bigger player, but also by the fact that shipping companies and terminal operators will no longer or at least less easily be able to play out port authorities against each other. At the same time, less overcapacity will be constructed. A side policy needs to take care for the co-operation strategy not to lead to higher prices by possible falsified competition.

It is then necessary to estimate and stimulate all possible co-operation strategies, including quantification of possible consequences. Geographical borders should not be a barrier to co-operation. It is evident that for all possible strategies, also the industrial-economic consequences should be included.

In short, the possible future of port authorities can be summarized as follows. Under unchanged strategies, existing port authorities risk to be doomed for a purely administrative function, which, with the exception of concession policy, boils down to limited market power. Acting pro-actively, in the direction of a non-deliberate co-operation, will re-inforce the negotiation power vis-à-vis shipping companies and terminal operators. The latter means surviving.

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83% of the world liner fleet. Moreover, another 3,9 million TEU were on order. Of the top 25 shipping companies, 13 participated to an alliance.

## 8. CONCLUSION

A number of conclusions can be drawn from the analyses from this contribution.

First of all, ports are no stand-alone nodes, but parts of logistics chains, which gain increasing importance. In relation to these chains, a number of derived characteristics are important. These are: which chains are important now, and will be in the future; which are the important actors and what strategies do they have; how can hinterland connections impact on the functioning of chains; what is the future role of port authorities. Separate conclusions can be drawn on each of these.

With respect to the important logistics chains and their evolution, it is clear from the statistics that transport in general and maritime transport in particular keep on growing faster than GDP growth. Whether this trend will continue in the future, should be the subject of scenario analysis.

Further on, it is clear that a whole lot of actors may decide on whether or not to call at a port, each of them having own interests and objectives. Through privatization and globalization, the clear division between the different actors has blurred, and led to mixed strategies.

In the decision about whether to call at a port and how well a port fits into a chain, hinterland connections gain relevance. Their capacity should be sufficient, but they should also be managed in a welfare-optimizing way. Moreover, their future provision is not evident under the current public financing system, in view of shrinking government budgets. A solution to most of these issues should be a good pricing system.

Finally, it is important to see what port authorities will be able to do and no longer to do in the future. It seems obvious that their classical, strong role, has disappeared over the past decades, in favour of other actors. The only remaining asset, concessions, therefore gains importance. The conditions that will be included in concessions will be all the more crucial for the efficient use of scarce port resources. The issue of cross-port co-operation emerges as a new challenge, where a trade-off between costs and benefits imposes itself.

Previous conclusions show that port dynamics have gained pace lately, and that further research is required to get full grip on the impact these dynamics will have, and the direction they will go in the future.

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