

Mackloet, Amanda

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Locational Dynamics in an Era of Global Economic Change: Is the Port of Rotterdam Up to the Challenge?

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Locational dynamics in an era of global economic change: is the port of Rotterdam up to the challenge?

**Paper to be presented at the 46th Congress of the European Regional Science Association,
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Amanda Mackloet MSc

Utrecht University

Faculty of Geosciences

Department of Human Geography and Urban and Regional Planning

PO Box 80115

3508 TC Utrecht

The Netherlands

a.mackloet@geo.uu.nl

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Abstract

This paper aims to shed more light on the impact of global economic changes on the locational dynamics of port related firms in the port of Rotterdam, and explores if recent port policy strategies provide an answer to these changes.

The increase in international trade, the rise of container traffic and the integration of supply chains have altered the role of ports in the global economy. These developments have led to great uncertainty, increasing competitiveness and shifts in port rankings. Today, mainly Chinese ports dominate international trade, and only a few other seaports were able to retain a steady position. Firms in the port of Rotterdam have to adapt to the changing global economic playing field and change their strategies. The most common strategy changes are concerned with flexibilisation in production and organisation and consolidation through the formation of strategic alliances. These changes may lead to new dynamics in the location of port related firms; they could decide to relocate, and newly emerging activities could appear in the port areas.

These major global changes offer a great challenge for ports. The question arises whether the players in the port of Rotterdam are up to the challenge, and can provide an answer to these transitions. An outline of the port policy strategy will shed more light on this matter.

Introduction

Over the past two decades, a number of global economic changes have affected the role of seaports. Especially the increase in international trade, containerisation and supply chain integration have had a major effect on the functioning and competitiveness of ports. As a result, the firms that operate in port areas have to respond to these changes. In which ways are they able to implement new strategies in order to adapt to the changing circumstances? And what does this mean for their locational demands?

The purpose of this paper is to explore the locational dynamics of firms over the past two decades in the port of Rotterdam. The first Section of this paper will give an overview of the literature on this theme. Although this review is not complete, it illustrates the impact of the most fundamental changes on port development. This paper starts with the main developments that affect ports. The second Section reveals that not only the global context, but the activities in the port have changed as well. The Rotterdam port cluster will be discussed. The third Section will elaborate on the strategies that port related firms have implemented in order to adapt to the global changes. Flexible production processes and strategic alliances appear to be the most common responses. The fourth Section provides an analysis of the changing locational demands of firms in the port of Rotterdam. The concluding Section will reveal if the policy plans of the stakeholders involved provide an answer to the changing world.

Global changes

The role of ports in the world economy has dramatically changed; ports are no longer the major 'break of bulk point' in the movement of cargo, but cargo now flows through many different seaports, inland ports and inland terminal facilities. This reduces the role of seaports to just one element in the global network of transport flows. This changing role of ports is induced by three main factors.

First, the growth in international trade has shaped a new economic landscape. The eradication of trade barriers and the enabling force of ICT have stimulated firms to operate on a global scale. New economies have entered the market, like Japan, China and other Southeast Asian countries (Dicken, 2003). As a result, trade flows have increased dramatically; world export rates were fourteen times greater in 1995 than in 1950 (Dicken, 2003). In contrast, world production 'only' became five times greater in that same period. The fact that trade grew more rapidly than production, indicates the increase in internationalization of production and a growing 'interconnectedness' (Dicken, 2003).

The growth of trade has created great shifts in port rankings. The port of Rotterdam has been the biggest port (in terms of annual throughput) for forty years, but has been surpassed in 2004 by Singapore and Shanghai, caused by the rapid Asian economic growth that boosted the development of its ports (Table 1). Rotterdam and other North Western European ports could also take advantage of the growing export of goods from Asia, but the expansion of the market has not simply boosted all the ports, as it has also stimulated increasing competition. Ports are all eager to get their share of world transport and to become or remain first 'port of call' for the big shipping lines. As can be seen in the shaded sections, only four ports (Rotterdam, Nagoya, Singapore and Antwerp) were able to

remain in the top-10 of port traffic league over the past 20 years. The port ranking of today is very much dominated by Chinese ports (6 out of 10), whereas they were completely absent in the top-10 of 1984.

Table 1. Port traffic league by total cargo traffic, 1984, 1994, 2004 (x million metric tons)

	(1)		(1)		(1)			
	(2)	1984	(2)	1994	(2)	2004		
Rotterdam	(1)	249,4	Rotterdam	(2)	293,4	Singapore ^a	(2)	393,4
Kobe ^{ac}	(1)	160,5	Singapore ^a	(2)	290,1	Shanghai	(1)	379,7
Yokohama ^a	(1)	117,6	South Louisiana	(1)	178,7	Rotterdam	(2)	352,4
Nagoya ^{ac}	(1)	112,8	Chiba ^a	(1)	173,7	Ningbo	(2)	225,9
Singapore ^a	(1)	111,9	Shanghai	(1)	165,8	Hong Kong	(1)	222,9
Antwerp	(1)	90,3	Nagoya ^a	(1)	137,3	Guangzhou	(2)	215,2
Osaka ^a	(1)	88,2	Yokohama ^a	(1)	128,3	Tianjin	(2)	206,2
Marseilles	(1)	88,0	Hong Kong	(2)	111	Nagoya ^a	(2)	180
Tubarao	(1)	71,3	Antwerp	(2)	109,5	Qingdao	(2)	162,7
Vancouver	(1)	59,3	Ulsan ^b	(1)	105,5	Antwerp	(2)	152,3

(1) Foreign and domestic traffic. (2) Foreign traffic only.

^a Freight tons

^b Revenue tons

^c 1985. For 1984, data of Kobe and Nagoya were not available.

Source: ISL, 1986, 1996; Port of Rotterdam Authority, 2005a.

Second, container traffic has since the 1960s dramatically increased and is still more and more dominating international transport. An increasing number of goods, that used to be handled as conventional cargo, are now transported in containers. New container terminal facilities keep being built all over the world; Antwerp's newest Deurganckdok will double the port's container handling capacity, and with the land reclamation plan of the Second Maasvlakte in Rotterdam, the capacity will increase with about ten million TEUs. These developments are however in sharp contrast to Southeast Asian developments, where vast areas of land are turned into container terminals in no-time. In Western Europe, building procedures (e.g. environmental procedures) tend to hamper a rapid and responsive development process.

The emergence of container transport has made cargo flows 'footloose', leading to a greater volatility of cargo flows. Nowadays cargo is like water: it can flow anywhere, and is always looking for the lowest cost location. As a result, Slack (1993) argues that ports have become "pawns in the game" because they have less and less control over their destinies. The container can be used on many transport modes and therefore a container should not necessarily be opened and unpacked in a seaport. Thus, the hinterland of a port is no longer fixed. The traditional monopoly that ports used to have over a captive hinterland is now subject to great uncertainty. As Slack puts it: "Maritime transport is still at the heart of container movements, but whereas the port used to be the major point of interruption (and frequently the major bottleneck) in long-distance cargo flows, today it is but one of many links in an intermodal transport chain" (Slack, 1993, p. 580). Port authorities are forced to invest in port infrastructure, but have no certainty that this will lead to increasing throughput. But if they don't build a container handling facility, there will be little or no container traffic (Slack, 1993). According to Slack this resembles a lottery, where only those who buy a ticket have a small chance to win.

Container traffic has enhanced port competition: any port with a container terminal can be a potential port of call. Surely, the increasing competition has also caused ports to climb up or fall down the ladder of port rankings. Slack et al (2002) discovered that the number of ports of call visited by container shippers has not significantly risen in the last decades. Although the *number* of ports remained fairly the same, there has been a change in *which* ports were called by the shippers; China's ports have attracted more container shippers, whereas North America and Northern Europe remained stable. An unexpected decline however, was found in the ports of South Asia, the Mediterranean, the Middle East and the Caribbean and Central America (Slack et al., 2002). The findings, again, show that container handling in ports is subject to great volatility.

The third driving force behind the changing role of ports is the integration of supply chains. Big shipping lines or logistics service providers are responsible for the organisation and integration of the physical flow of goods from origin to destination. Integrated supply chain management is now central in business strategies and involves all key players, like shippers, distributors and customers. Because of this, activities operated in ports are but one element in the overall supply chain (Notteboom & Winkelmans, 2001; Carbone & De Martino, 2003; Robinson, 2002).

In this respect, Robinson (2002) talks about "ports as elements in value-driven chain systems". According to Robinson, ports are not simply places with particular functions, but nodes in a supply chain. The port acts as a firm in that supply chain and can deliver value to shippers, for instance by the transport modes it offers. In a highly competitive environment, it is not simply the operational efficiency or location of a port that makes the difference, but the allocation in chains. Therefore, chains compete, not ports. Carbone & De Martino (2003, p. 306) view a port as "(...) a cluster of organisations in which different logistics and transport operators are involved in bringing value to the final customers". The goal is then not just to provide the basic service (e.g. transport) but a package of services that is adjusted to the customer's demands.

Notteboom & Winkelmans (2001, p. 79) support this, by arguing that "(...) ports can no longer expect to attract cargo simply because they are natural gateways to rich hinterlands. Major port clients consider ports merely as a sub-system in the logistics chain. Accordingly, they concentrate their service packages not on the ports' sea-to-land interface but on the quality and reliability of the entire transport chain". Therefore, the authors suggest that ports should be more flexible to constantly adapt to the changing market environment. Ports should then not only focus on cost leadership (economies of scale) but create economies of scope by building inimitable and durable core competencies (Notteboom & Winkelmans, 2001; Van Klink & De Langen, 1999).

Altogether, the increase in international trade, container transport and supply chain integration has increased competitiveness and created a lot of uncertainty for port activities. Some port move up the global hierarchy of cargo throughput, others fall down. Cargo flows have become more volatile and natural hinterlands are no longer guaranteed. As we have seen, today it takes more to attract cargo than just offering the necessary facilities. Firms in the port will need to adapt to these circumstances and change their strategies.

Changing port activities

Before going into detail on the changing strategies of port activities, it should be highlighted what is actually meant by 'port activities'. Therefore, this Section starts with an outline of the players in the port, followed by some key figures about port activities in Rotterdam.

Port activities

Activities related to seaports can be considered as a cluster, because a large number of port related activities have located in port areas. According to Michael Porter's definition, a cluster is "a population of geographically concentrated and mutually related business units, associations and public (-private) organisations centred around a distinctive economic specialisation" (Porter, 1990, p. 149). However, it is difficult to highlight the geographical boundaries of the cluster; port related activities are not just located in port areas, but are widespread so that we can actually better speak of a 'port network' (Van Klink, 1995). But the purpose of this paper is not to study in-depth the port of Rotterdam as a network, but the location of port activities in the actual, limited port areas.

De Langen (2004) has made a distinction of five different port related activities. First, *cargo handling* can be seen as the core activity. Around cargo handling, a wide range of related activities has emerged. Second, *transport* is logically most related to cargo handling. Third, *logistics* activities come into play when cargo is temporarily stored on the quay or in warehouses. Fourth, since the Industrial Revolution ports have become attractive sites for the location of *manufacturing* activities, because cargo handling offers the opportunity to manufacture the imported or exported goods. This accounts especially for steel and oil refineries. Fifth, *trade* and wholesale takes place in ports, because transport can only take place unless a trade agreement is made between buyer and seller. Nowadays, trade is rarely taking place on the quays of the port, but on stock exchanges in city centres or by internet. In addition, *public and private associations* have originated in the port, like the port authority, business associations and other port related organisations.

The Rotterdam port cluster

The Rotterdam port cluster consists of over 2200 firms, of which an overwhelming majority in the transport sector (Table 2). The number of firms has slightly dropped the last two decades. The employment loss is somewhat bigger. The mechanisation of production processes has mainly caused this strong decline in port related employment.

Strikingly, the port's core activity, cargo handling, is managed by only 50 firms. This also holds true for many production activities in the port; a population that consists of only 178 firms, but they are large in size. The strongest decline in both firm numbers and employment can be witnessed in stevedores, transport services (e.g. cargo control, salvage, ship chandlers) and industry. However, employment by container stevedores has increased, which is most likely related to the overall increase in the number of TEU's handled in the port. Consolidation processes such as mergers and takeovers, as will be discussed in the next Section, might be responsible for the small number of container handling firms. Furthermore, despite the overall decline in the industrial sector, the number of firms in

the chemical industry has increased, whereas the employment has decreased. This process is contradictory to that in container handling, where the number of firms decreases. A process with different driving forces, for instance the split-up of business units, is likely to cause this growth in firm numbers. These strategic processes will be discussed in the next Section.

Both road transport and warehousing show high growth rates over the past two decades. The rise of container transport but also the development of logistics parks in the port are likely to be related to this growth rate.

Table 2. Port related activities and employment in the Greater Rotterdam* area, 1985 & 2004/2005

	Number of firms**			Employment***		
	1985	2005****	Change (%)	1985	2004	Change (%)
Stevedores	99	50	-49.5	10732	5441	-49.3
Multipurpose	60	25	-58.3	3197	629	-80.3
Labour pool	1	1	0.0	2300	785	-65.9
Full-container	11	9	-18.2	2240	2494	11.3
Roll on/roll off	2	3	50.0	168	294	75.0
Dry bulk (ore, coal, grain)	25	12	-52.0	2827	1239	-56.2
Transport	1125	997	-11.4	17547	14421	-17.8
Navigation	78	40	-48.7	7988	2775	-65.3
Inland navigation	626	436	-30.4	3502	2785	-20.5
Others (pipe, rail, road)	421	521	23.8	6057	8881	46.6
Storage and distribution	58	63	8.6	2168	2559	18.0
Warehousing	36	48	33.3	489	1469	200.4
Oil transshipment and storage	22	15	-31.8	1490	1090	-26.8
Distribution of fruit and vegetables	28	-	-	189	-	-
Intermediaries	632	628	-0.6	8260	7784	-5.8
Transport related services	406	255	-37.2	7404	5817	-21.4
Port industries	222	178	-19.8	30021	13608	-54.7
Oil refineries	15	10	-33.3	6463	3815	-41.0
Manure factories	4	-	-	1736	-	-
Chemical industry	37	65	75.7	8633	6251	-27.6
Food	27	8	-70.4	3009	1490	-50.5
Shipbuilding and repair	139	95	-31.7	10180	2052	-79.8
Public authorities	38	11	-71.1	3893	4926	26.5
Port of Rotterdam Authority	13	5	-61.5	757	1370	81.0
Customs	23	5	-78.3	1667	1198	-28.1
Others	2	1	-50.0	1469	2358	60.5
Others	66	49	-25.8	2442	3387	38.7
TOTAL	2646	2231	-15.7	82467	57943	-29.7

* The Greater Rotterdam area comprises the municipalities of Barendrecht, Bergschenhoek, Berkel, Bleiswijk, Brielle, Capelle a/d IJssel, Hellevoetsluis, Krimpen a/d IJssel, Maassluis, Bernisse, Rotterdam, Ridderkerk, Rozenburg, Schiedam, Spijkenisse, Albrandswaard, Oostvoorne, Vlaardingen.

** The number of firms is based on firm locations. Some firms can have more than one location so the data may be slightly distorted.

*** Directly port related gross employment rates.

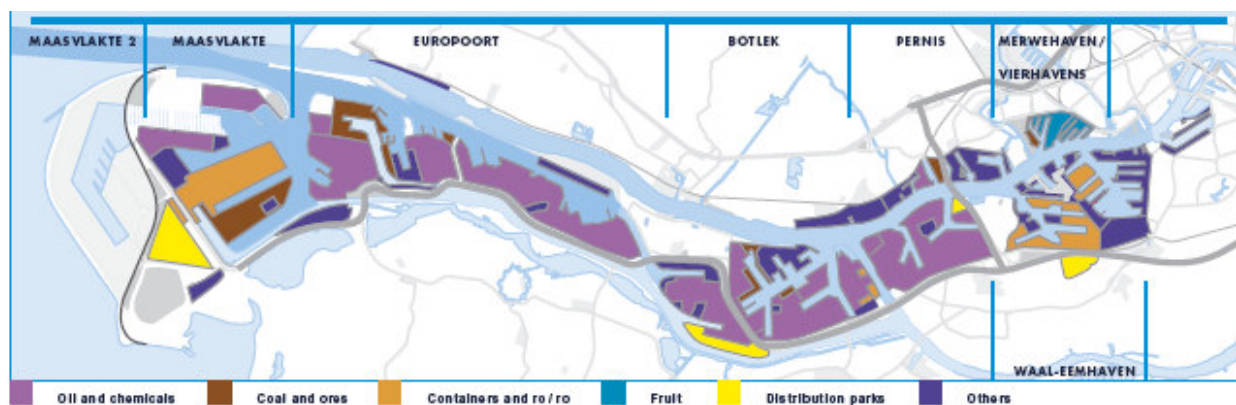
**** Data on firm locations in 2005 is preliminary.

Source: Port of Rotterdam Authority, 2005a; 2006.

The port area

Figure 1 shows the abundance of the petrochemical industry in the port; especially the Western, 'newer' parts of the port (Pernis, Botlek, Europort and Maasvlakte) are dominated by oil and chemicals. The Eastern part of the port (Merwehaven, Vierhavens, Waalhaven, Eemhaven) is the oldest and more diversified part with not only container handling, but also fruit handling, general cargo handling and distribution.

Figure 1. The Rotterdam port area



Source: Municipality of Rotterdam, 2004.

Changing strategies

This Section will elaborate on the major strategic changes that port related activities have implemented. When reviewing the recent literature about ports, two major strategic shifts keep popping up: flexibilisation and consolidation. The flexibilisation strategy aims at a higher responsiveness towards consumer demands. The second common strategy is the process of consolidation, and especially the formation of strategic alliances. For port related activities, this is most apparent in the petrochemical industry, container shipping industry and logistics services.

Flexibilisation processes

Flexibilisation processes occur both at the operational level (production processes) and at the organisational level. Concerning the operational level, fundamental changes in production have come into the fore over the last decades. The most significant shift is what is usually referred to as a shift from Fordist to Post-Fordist or flexible production systems (Piore & Sabel, 1984).

Fordist production processes became widespread when automobile producer Henry Ford was very successful in producing standardised cars on a large scale. This cost- and efficiency driven production made consumer goods accessible for almost everybody. 'Mass consumption' entered the scene, stimulated by Fordist production principles but also by the growing prosperity in North America and Western Europe. This production process required large investments in machinery, and because of the inflexibility of the machines each production model required a different machine, thus requiring a lot of space. These large production plants were originally located close to the resources, like an iron

ore or coal mine. Since the 1950's raw materials were increasingly imported, which turned seaports as 'break of bulk points' (Dicken & Lloyd, 1990) into an excellent site for industrial plants, especially for large petrochemical complexes (Kuipers, 1999).

The main reason for the crisis in Fordist production in the 1970's was the inability of the system to respond to a growing variety of customer demands. A more flexible production emerged, which was able to quickly respond to the unpredictable market (Kuipers, 1999). Added value, high qualified labour and a dynamic basis for growth are important elements in this system (Table 3).

Table 3. Fordist and Post-Fordist production principles in the port of Rotterdam

Fordist production	Post-Fordist / Flexible production
Invest in efficiency	Flexible mechanisation
Space as a measure for competitiveness	Enhancing spatial productivity
Focus on throughput / transshipment	Focus on added value
Port as a source of regional prosperity	Port as an element in a value network
Restriction of labour through mechanisation	Labour as an asset
Stability as a basis for growth	Dynamics as a basis for growth

Source: Van Klink & De Langen, 1999.

In spite of the overall shift towards flexible production processes, the petrochemical industry in the port of Rotterdam is still characterised by Fordist production principles. The industry is mainly focused at producing large quantities, regardless of the market circumstances (Kuipers, 1999). Nevertheless, despite the lack of large scale innovation, the industry has not been completely standing still. Production processes have been intensified and diversified. Furthermore, although production processes remained traditional, flexibility has increased at the organisational level. Large petrochemical sites have been split up into smaller business units. Former large conglomerates, like Shell, sell these business units to other parties and focus on their core competence (Kuipers, 1999). This overall trend of going 'back to basic', or 'vertical disintegration' has also taken place in the petrochemical industry.

In contrast to the petrochemical industry, the logistics and distribution sector has fully committed itself to flexibility processes, both in organisation and production. A shift from 'built to stock' to 'built to order' has taken place, keeping supplies as low as possible and starting to produce not before the customer has placed an offer (De Wit & Van Gent, 2001). A quick response and delivery have become crucial in today's economy.

These flexibility processes in logistics have also found its way to the port of Rotterdam. Most EDCs located in Distripark Maasvlakte appear to develop durable, high-quality products with a high responsiveness (Kuipers & Eenhuizen, 2004). This is contradictory to the common assumption that logistics activities in seaports should preferably aim at scale economies, low responsiveness and a low service level. A more flexible approach, it was believed, could not find a good seedbed in a seaport because of a range of agglomeration disadvantages, like congestion and high land prices. Thus, in spite of the peripheral location of Distripark Maasvlakte with respect to the consumer market and the congested roads, the park is filled with flexible oriented logistics activities. They, surprisingly, especially use highly congested road transport in order to enable quick deliveries (Kuipers & Eenhuizen, 2004).

Strategic alliances

As we have seen, a small number of relatively big firms are located in the port of Rotterdam. An ongoing consolidation process of mergers, acquisitions, takeovers, joint ventures and alliances is in part responsible for this. The formation of strategic alliances will be central in this analysis, because of its recent strong appearance. This form of collaboration exist for some time already; but the large scale of alliance formation of today is rather new: "What is new is their current scale, proliferation and the fact that they have become *central* to the global strategies of many firms rather than peripheral to them" (Dicken, 2003, p. 227-228).

An alliance can be defined as an "informal, or formal, arrangement between two or more companies with a common business objective" (Czinota and Ronkainen, 1998 in Carbone & Stone, 2005, p. 502). The main reason to cooperate with other firms is that no single firm has all the resources to deliver an optimal product and therefore needs other firms to fulfil their non-core competence. Strategic alliances can help firms to deal with market uncertainty, allocation of resources and market penetration (Alix et al., 1999). An extended market coverage can be more easily reached through alliance formation than setting up shop everywhere.

Alliance formation in three major port related activities (petrochemical industry, container shipping and logistics) will now be discussed in more detail. As seen before, the petrochemical industry has provoked a process of vertical disintegration, in which firms have pushed off several business units. Many of these business units are still located on the same terrains as their 'mother firms' and keep close connections. The number of mutual deliveries in the industrial sector (oil, chemicals, shipbuilding) accounted for about half of all mutual deliveries in the port in 1997 (Manshanden et al., 2002). A great number of pipelines link the firms in the port to each other. Because of the capital-intensive character of the industry, the need to be close to one another is higher than in most other sectors; transport and cargo handling costs are relatively high. Despite their fixed character, the oil and petrochemical industry is one of the most interlinked clusters of the Netherlands, in terms of sales relations (Oosterhaven et al., 2001).

Because of these intense linkages, many petrochemical firms have formed alliances. By selling business units, but subsequently keeping linkages, the flexibility of the firms can be enhanced. Alliances in the petrochemical industry are mainly cost driven, because the industry is under a lot of pressure due to high fuel prices and the competition from the Middle and Far East.

In the container shipping industry, alliances are set up to deal with the growing competition. The most well-known examples are the establishment of the Grand Alliance (Hapag-Lloyd, MISC, NYK, OOCL), United Alliance (Hanjin, DSR-Senator, Cho Yang), New World Alliance (HMM, APL, MOL), Cosco/Yangming/K-Line and Maersk-Sealand, which recently took over P&O Nedlloyd, increasing its already biggest market share of over 12 per cent in 2004 (ISL, 2005).

According to Slack et al (2002) alliance formation in the container shipping industry is induced by globalization and competition. Because of the immense growth in international trade, shippers are forced to extend their market coverage and deploy ever larger and costly vessels. The emergence of new shipping lines has further enhanced competition. This created the need to restructure the container shipping industry (Slack et al., 2002). A similar trend can be witnessed in the closely related

industry of container terminal facilities, where consolidation processes are also apparent. The major players in the container shipping industry are not seldom also the major owners of container terminals.

Alliance formation is also widely accepted by logistics service providers (LSPs). LSPs outsource physical transport and are responsible for the organisation of (parts of) the supply chain. As more and more activities are outsourced by LSPs, only the most strategic activities are performed by the LSPs themselves. These are called third or even fourth party LSPs, depending on the level of outsourcing and strategic activities. When the number of outsourced activities to be coordinated rises, the reduction of transaction costs becomes increasingly important. Furthermore, as logistics chains become integrated and more complex, IT and knowledge exchange becomes important to deliver tailor-made solutions. However, fear of opportunistic behaviour and loss of knowledge is limiting a further upscaling of logistics services (Visser & Lambooy, 2004).

Alliance formation can basically have two main reasons: cost reduction and/or innovation. Economists like Williamson (1985) attach value to the reduction of transaction costs. This seems to be the case in the container shipping and petrochemical industry. These industries are dealing with very low margins of profitability and are mainly concerned with minimizing costs.

Nevertheless, innovation and collective learning can also be a driving force behind alliances (Nooteboom, 2000). This is especially the case with LSPs. Alliance formation in LSPs is in part also encouraged by cost reduction: a broader market coverage and enlargement of the assets (ships, trucks, etc.) is aspired to reduce costs and cope with the necessary investments in infrastructure and ICT. However, according to empirical research by Carbone & Stone (2005) economies of scope were also very important to LSPs in terms of business process re-engineering and the entry into new market segments. Also, high value-added services were mentioned, like contract maintenance and repair, post-manufacturing and reverse logistics (Carbone & Stone, 2005). LSPs regard innovation as a necessity because of the low margins and strong competition (Visser & Lambooy, 2004).

In sum, the transport developments on a worldwide scale also cause changes at the port level. Port activities respond, in part, to this by flexibility processes and alliance formation. These two changes have contradictory outcomes. On the one hand, flexible production processes have led to a deconcentration into smaller business units. On the other hand, alliance formation has led to an organisational concentration process of larger, but loosely coupled firm complexes.

Locational dynamics in the port area

The present Section discusses the locational dynamics in the actual port area of Rotterdam. In this paper, the concept of locational dynamics is regarded as the migration of firms to other sites or regions, or the location of new firms in an area. Land use at the firm level (e.g. the amount of rented acres) will not be discussed here.

Locational dynamics

Locational dynamics in the petrochemicals appear to be modest. Petrochemical installations are very capital intensive and therefore hard to relocate. The 'footlooseness' of the industry is therefore rather

limited. But, as we have seen in Table 2, the number of petrochemical firms has grown, whereas all other industrial activities in the port have decreased. The aforementioned vertical disintegration (the splitting up of business units) is mainly responsible for the growing firm numbers.

Yet, another important element can be added to the growing number of petrochemical firms. The Port of Rotterdam Authority has, since the late 1990s, actively promoted what they refer to as 'co-siting'; the location of a host firm on the site of another firm. Many firms have in the past rented large sites as internal reserves. Because of high land prices and process intensifications, less space is needed, thus a number of firms were willing to accept a neighbour on their terrain. The knife cuts on two sides: some firms could even benefit from the new firm by the sales relations that emerged between them, and the port authority found a way to deal with the lack of space in the port area.

Flexibility processes in logistics have also had effects on land use. The growing importance of responsiveness to the actual consumer demand pulls firms towards the markets of their end consumers. A process of 'maritime deconcentration' has taken place, which has driven some port related activities towards more central locations (Van Klink, 1995). Over the past decades, employment in transport and distribution has increased in the Central and South Eastern regions in the Netherlands, in the Greater Rotterdam area the overall growth remained fairly the same. It appears that port activities were not 'pushed away' by negative spillover effects such as congestion, land prices and labour costs. A study by Buck Consultants (1996) also revealed that growth in transport related sectors outside Rotterdam is merely stimulated by autonomous growth rather than relocation. With the exception of the area close to Rotterdam (Moerdijk, Dordrecht, Hoeksche Waard) which functions as a 'spillover area' for the busy port of Rotterdam. These firms are then still able to benefit from agglomeration advantages, but avoid some of the agglomeration disadvantages, or negative spillover effects.

The attractiveness of the port area for transport and distribution firms is in part induced by the development of Distriparks in the port area. The Port of Rotterdam Authority was very successful in setting up three Distriparks dedicated to warehousing, close to container terminals, rail and road. These parks offer distributors the facilities to engage in value added logistics, by not only storing goods, but processing these goods by assembling, unpacking and labelling on a just-in-time basis. Although these value added activities are still relatively simple (they don't require a highly skilled workforce), the Distriparks-concept is proven to be successful; big multinational companies like Reebok, Epson and Canon have found their way to the Distriparks and have set up a European Distribution Center (EDC) in which the distribution for the entire European (and often also Middle Eastern and Northern African) market is organized.

The Distriparks have, more or less, worked as a counterforce against the aforementioned 'maritime deconcentration'. This is contrary to the port of Antwerp, for instance, where the location of EDCs in the port area itself is made nearly impossible because of the inflexible labour laws (Mackloet, 2004). The distributors on Distripark Maasvlakte mainly use road transport, so, again, agglomeration disadvantages do not seem to have a detrimental effect on the attractiveness of the port.

Yet, because of its peripheral location, the firms on Distripark Maasvlakte do have trouble with attracting employees; the city of Rotterdam is located at a distance of about 40 kilometres and the

mainly low educated employees prefer work with less travel expenses. Despite the successful operation of the present firms, some sites still remain vacant on Distripark Maasvlakte. The other two parks are closer to the city and are at the moment for the largest part filled, with smaller firms.

Newly emerging sectors in the port?

Only about one third of all port related firms in the Greater Rotterdam area are actually located in the port area itself. Furthermore, only about 40 per cent of the firms in the port area can be marked as directly port related firms. Indirectly or non-related firms mainly consists of wholesale, services, industry and construction. Most of these activities (e.g. wholesale and manufacturing of metals, chemicals or automobiles) are linked to the port cluster and have important sales relations with port related firms (Port of Rotterdam Authority, 2002; 2006).

According to Kuipers (1999, p. 515) the port of Rotterdam suffers from a lack of new firm dynamics: "(T)oday, at the end of the nineties, virtually the same branches of industry play an important role in the port of Rotterdam as was the case in the early seventies: transport and petrochemicals. The question is whether the port of Rotterdam, due to the lack of large-scale innovation, is not an example of a port which is slowly but surely falling outside the developing hierarchy of 'global cities' – based on new, non-industrial functions – and is consequently following the footsteps of a port such as Liverpool".

This one-dimensional development is in part a result from the past. In the period after the Second World War until the 1970s the port authority allowed only firms to locate in the area that brought a certain amount of seaborne cargo with them, the so-called 'ton measure' ('tonnenmaat'). So only firms that directly supplied their goods from the nearby terminals got a chance to establish a site in the port area. This measure was, at that time, a necessity because the demand for land outweighed by far the acres of land available for lease (De Goey, 1990). According to Van Laar (2000), this strategy created a one-dimensional economic structure, by not allowing any non-port related activities. The division between port and city, which had already set in with the development of new and remote port areas, was further enlarged.

The question arises whether a greater diversity of firms in the port area would have stimulated higher economic growth. According to Jacobs (1961) diversity of functions and economic actors is very important to keep an area vivid and economically viable. Moreover, a diverse population could better resist external shocks and economic crises. Yet, a more homogeneous population might be better able to engage in joint problem solving, product development and knowledge exchange. Firms need to have some sort of 'connection' and 'speak each others language' in order to benefit from each other.

In this respect, Frenken et al. (2002) introduced the notions 'related variety' and 'unrelated variety'. Their empirical study of 40 Dutch regions showed that related variety in a region enhanced employment growth. This didn't mean that unrelated variety could lead to unemployment. On the contrary, unrelated variety could prevent unemployment, because the sectors can act as a portfolio against unemployment shocks. So unrelated variety more or less dampens the dynamics of the economy – not only the 'ups', but also the 'downs'. In sum, the findings suggest that related firms in a region are better able to spur economic growth than unrelated firms.

Although only about 40 per cent of the firms in the port area can be marked as directly port related, most activities in the port area seem to be related to each other, either direct or indirect. 'Related variety' is thus very much applicable to the Rotterdam port area. More research about urban economic actors in the port is necessary to assess the relevance of unrelated variety for port development.

Conclusions and policy implications

It may become clear that seaports are facing more uncertainty and competition today; the increase in international trade and container traffic has created major shifts in port rankings; some ports (mainly Chinese) were able to climb up the ladder, whereas others have fallen down. Cargo flows have become more volatile and ports have less control over their destinies. Furthermore, because of the increasing complexity of logistics chains the *allocation in chains* is now more important than the *location in space* of ports. Not just offering the necessary facilities, but creating more value becomes necessary for port activities.

Are the port players then up to the challenges posed by these global changes? Firms in the port of Rotterdam have responded to these changes by making their organisation and production more flexible, for instance by the splitting up of business units. Another common response comprises the formation of strategic alliances. Most of these alliances are aimed at creating economies of scope. Low margins of profitability force firms to engage in alliances, but these strategies do not coincide with the need to create more value.

According to De Langen (2004), a lot of knowledge is available among the port players, but a lack of cooperation hampers a proactive development towards more value creation. The study also revealed that there are enough 'leader firms' in the port that are willing to invest in port development, without a direct single interest. A 'collective action regime' is still underdeveloped in the port of Rotterdam. This could hamper the adaptation to new market developments.

In a collective action regime, both firm and government should play a role in the development of the port. In their recent policy plans, the port authorities do seem to be aware of the global changes that are affecting ports. The 'Business Plan 2006-2010' of the Port of Rotterdam Authority (2005b) notes that the growth of world trade creates the need to rapidly develop extra space. In addition, it is also recognised that the already existing space in the port area should be used more intensively. Co-siting initiatives are one example of this, but the restructuring of port areas will also be necessary. The Port of Rotterdam Authority has, in cooperation with the Municipality, developed a restructuring plan for 'Stadshavens', a port area close to the city centre. The plan comprises the development of houses and offices, but also the stimulation of port activities, for example maritime services.

In its 'Port Vision 2020' the Municipality of Rotterdam (2004) is aiming at a higher quality of the port area, by developing a diversified port area, but also a 'knowledge port', through the stimulation of innovative firms. The diversity in the port area is rather limited, since most firms are, directly or indirectly, linked to the port. It remains unclear if unrelated, urban oriented activities can play a role in

the port and stimulate innovation. The stimulation of maritime services in Stadshavens might be a good example to enhance diversity and innovation in the port area.

Although the global changes are acknowledged by the players in the port, it seems that the underdevelopment of a collective action regime hampers a common innovation strategy towards more value creation. More insight is needed into the organisational capabilities of the port players and to what extent a proactive regime can stimulate the economic and spatial development of the port.

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