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**A theory on the co-evolution of seaports with application to
container terminal development in the Rhine-Scheldt Delta**

Wouter Jacobs & Theo Notteboom



Utrecht University
Urban & Regional research centre Utrecht

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container terminal development in the Rhine-Scheldt Delta**

Wouter JACOBS (corresponding author)

Urban and Regional Research Center Utrecht,

Department of Economic Geography, Utrecht University

w.jacobs@geo.uu.nl

Theo NOTTEBOOM

Institute of Transport and Maritime Management Antwerp (ITMMA),

University of Antwerp, Belgium

and

Antwerp Maritime Academy

theo.notteboom@ua.ac.be

ABSTRACT

How do seaports evolve in relation to each other? Recent studies in port economics and transport geography focused on how supply chain integration has structurally changed the competitive landscape in which individual ports and port actors operate. Port regionalization has been addressed as the corresponding new phase in the spatial and functional evolution of port systems. However, these studies lack theoretical foundations that allow us to empirically assess both the role of the institutional context and of strategic agency in the competitive (spatial and functional) evolution of regional (integrated) port systems. The paper presents a theoretical framework to analyze and understand the co-evolution of seaports in a regional context by making use of the concept of windows of opportunity. The empirical part will unravel the role of seaport-based co-evolution in the processes aimed at positioning market players and ports on the container scene in the Rhine-Scheldt Delta.

Keywords: co-evolution, seaports, regionalization, institutions, economic geography

JEL classifications: O18, O30, R11, R40

1. INTRODUCTION

Over the last decade scholars within port economics and transport geography have been occupied with the strategic role of seaports within increasingly global integrated supply chain systems (cf. Jacobs & Hall, 2007; Robinson, 2002; Slack et al 2002; Notteboom & Winkelmanns 2001; Heaver, 1995; Slack, 1993). As a derived demand, maritime transport and shipping sector evolved along an emerging global division of labor based upon the principles of “the integration of trade and disintegration of production in the world economy” (Feenstra, 1998). The maritime transport sector, in particular through its mass application of the container since the late 1980s, has been indeed a key facilitator of the process of global economic integration (Levinson, 2006). At the same time, the industry itself has been subjected to these same forces as shippers’ demand for just-in-time delivery and increased cargo volumes forced the industry to integrate and flex global services through logistics manipulations, while at the same time optimize performance through economies of scale and scope. These structural changes within the industrial organization of maritime transport, in which processes of integration and market consolidation altered the strategic competitive landscape of seaports, have now been well documented.

In response to these observed changes, scholars addressed the process of port regionalization as a new phase within port systems development (Notteboom & Rodrigue, 2005). What is however less documented empirically is how this process of regionalization unfolds and what the role of both agency and institutions is within this evolutionary process. This study proposes to address a theory on understanding *the co-evolution of seaports by making use of conceptual insights from both institutional and*

evolutionary approaches within economic geography. In such a way we respond to calls from scholars for rebuilding the theoretical and empirical connections between transport and economic geography (cf. Hall, Hesse and Rodrigue, 2006). In particular we draw upon the conceptual model of Buitelaar et al (2007), in which *windows of opportunity* open and close at certain locations through deliberate collective action, helping to analyze the process of institutional evolution. By adding a relational dimension to Buitelaar's et al. perspective and applying it to the specific case of a region's evolution in container port development, we hope to make both an empirical and conceptual contribution to the recent agenda (*Economic Geography*, vol.85, 2, 2009) of synthesizing institutional and evolutionary approaches into a geographical political economy as well.

The central question of this study is: *how do seaports evolve in relation to each other?*

The structure of this paper is as follows. First we illuminate the institutional and evolutionary approaches to economic geography, ask how they relate to each other and assess how they can enrich our understanding on the co-evolution of ports within a regional context. This is followed by an overview of the evolution of ports within an increasingly integrated transport sector in section three. The fourth section presents our theory on the co-evolution of seaports, by building on the work of Buitelaar et al (2007). This theory will be then applied to three empirical cases.

2. EVOLUTIONARY AND INSTITUTIONAL APPROACHES TO ECONOMIC GEOGRAPHY

Recent debates among economic geographers gravitate around formulating synthesis between evolutionary and institutional economic geography (*Economic Geography*, vol, 85, 2). Although this contribution is not the place to repeat much about what is written on institutional and evolutionary approaches in economic geography, we want to address the state of debate as the starting point for further theoretical understanding on the regional co-evolution of ports in terms of the so-called *windows of opportunity*.

In response to an emerging Evolutionary Economic Geography (EEG) approach, as developed in particular by the Utrecht School in Economic Geography (Boschma & Frenken, 2009; Boschma & Frenken, 2006; Boschma & Lambooy, 1999), Mackinnon et al (2009) addressed a “sympathetic critique” to EEG by taking on board *power, social agency and territorial institutions* more explicitly in understanding regional economic development outcomes. As such they favor a geographical political economy framework in which evolutionary thinking in economic geography can progress (cf. Pike et al 2009). One concept within EEG that can potentially incorporate the addressed critique is that of ‘windows of (locational) opportunity’ (Boschma & Frenken, 2009).

The concept of ‘*windows of locational opportunity*’ has been developed (cf. Storper & Walker, 1989; Boschma, 1997) to describe to locational dynamics of firms in new and emerging sectors. It is argued that innovation and new industries are likely to emerge and develop rather independently of established spatial structures. This is because at the beginning of a new industry or technology there is likely to be a gap between the requirements of new firms and their direct (institutional) environment (Boschma & Frenken 2006). Therefore, many locations are initially capable of becoming agglomerations during the start up phase of a new industry, but only some will actually

successfully do so. As the industry matures over time these windows close again: the initial neutral space in which the new industry emerged, has evolved path dependently into a real place consisting of spatially concentrated clusters of specialized and related industries. Institutional adaptations have been achieved in order to accommodate the requirements of the new industry, but not every region will be capable to do so because of technological and institutional lock-in or as Boschma & Lambooy (1999, p.416) put it: “old industrial regions are closely orientated towards established industries, due to strong commitments of capital goods, management, R&D and labor to traditional technologies. This makes them less fit to diversify into new activities¹”. This line of reasoning is applied to understand the emergence of successful high tech regions such as Silicon Valley or the process of uneven regional development between the Rustbelt and Sunbelt in the US.

The problem with this understanding of windows of locational opportunity is typical to EEG with its strong emphasis on firms, innovation and organizational routines which according to critics risks “the theoretical relegation of institutions, social agency and power relations” (Mackinnon et al 2009, p.133) in the evolution of economic landscapes. Others also addressed the need to recognize and conceptualize institutional arrangements and institutional change in greater depth within the EEG framework (Strambach, forthcoming). The consequent empirical neglect is that of the interactions between other actors next to firms such as organized labor, civil society groups and the state in either enabling or constraining windows of opportunity. We think that much of these conceptual

¹ Evolutionary economic geography does however explicitly recognize that through technological relatedness and historically developed skills and craftsmanship some old industrial regions are able to upgrade and develop into more high-tech activity. Likewise, the concept of WLO has also been used in understanding the process of regional economic revitalization.

problems result exactly because of the tendency of EEG to focus on new or emerging industries at the expense of mature industries.

The conventional focus of evolutionary economic geography on innovative industries and related organizational routines does not automatically imply that similar kinds of mechanisms are in force within mature industries, such as the ports and transport industry (cf. Hall & Jacobs, forthcoming). The introduction of the container in the early 1960s clearly is an example of how a new technology was initially adopted by some ports and firms (e.g. Oakland, Rotterdam) and not by others (e.g. San Francisco, London) shaking up the contemporary port hierarchy and shipping industry relations (cf. Levinson, 2006; Rodrigue and Notteboom, 2009). However, as containerization became standardized in the early 1980s, the technology dispersed with more and more ports and market players entering the (regional) competitive game. Competitive advantage of ports became not only based upon containerization or simple geographical location factors, but more and more on the capacity of local actors to become embedded within global flows and integrated supply chains (Jacobs & Hall 2007; Robinson 2002). This local capacity of strategically coupling external industry demands with regional assets (Coe et al 2004) is on its turn dependent on existing institutional arrangements and other territorially rooted structures of power (such as the state) and local communities of practice. In some cases this strategic coupling required institutional change, e.g. changing the ownership structure of port authorities (Jacobs, 2007b), and the development of new organizational routines by port authorities and operators in terms of contracting and allocating user rights of port land (Notteboom 2006). The point to make here is that within a mature industry the drivers for opening and creating windows of locational opportunity do not develop independently of established spatial structures nor do they emerge within a neutral space.

On the contrary, typical for mature industries is that material and societal interests have become much more articulated in certain competitive locations and within corresponding institutional frameworks. Competition and other market-based selection mechanisms provide pressure for change, but they unfold within existing (spatial) structures of power and communities of practice.

Related to this issue is thus that the concept of ‘windows of locational opportunity’ in its original understanding largely ignores the role of existing institutions and of strategic actions in the possible locational opening of new windows of opportunity. It remains unclear how the strategic actions of different types of territorially embedded and non-embedded actors are capable of opening new windows for locational opportunity for investment within certain economic sectors or within certain regions. It ignores the capacity of industries and firms to monitor or scan the changes and contingencies for windows of opportunity across a spatial variety of industrial regions by exactly taken into account those changes in regional factor endowments, including the local capacities to transform regional institutional regimes according to their interests. Likewise, it remains unclear on how territorial institutions constrain or enable those same strategic actor interactions that allow for windows of locational opportunity for investment and innovation. These issues are particular relevant for different locations that are competing for similar investments, but where strategic actors such as states, labor unions and firms can have stakes at more locations.

Therefore, evolution within a mature industry is as much about the development of new skills or matching territorial institutions and organizational forms with innovations, as it is about power conflicts between vested- territorially institutionalized- interests and the

matching of regional assets with external market demands in regional competition. What is needed is an approach that helps us to better understand the role of actors and institutions in creating windows of locational opportunity for regional development and investment in relation to each other. The concern about the strategic role of actors- constrained or enabled by territorial institutional frameworks- in opening up competing windows of locational opportunities for investments and innovations needs, in our view, further conceptual and empirical understanding. The way forward we propose is by making use of the work done by Buitelaar et al (2007) on windows of opportunity, in which they elaborate the role of social agency and existing institutional structures on the process of institutional change. We continue by first sketching major developments in the maritime ports sector, after which we address our theory on the co-evolution of seaports in terms of windows of locational opportunity.

3. INTEGRATION AND REGIONALIZATION AS DRIVERS OF PORT DEVELOPMENT

The market environment in which container ports and shipping lines are operating is substantially changing. World trade is facilitated through the elimination of trade barriers and the liberalization and deregulation of markets. The public sector has redefined its role in the port and shipping industries through privatization, commercialization and corporatization schemes. International supply chains have become complex and logistics models evolve continuously as a result of influences and factors such as globalization and expansion into new markets, lean manufacturing practices and associated shifts in costs. The evolutions in supply chains and logistics models urge market players to revise their function in the logistics process (Notteboom and Winkelmanns, 2001; Robinson, 2002). In

response to the mounting challenges, the last decennia have seen a massive consolidation and vertical integration in the maritime and logistics industry.

Through a vertical integration of their activities market players such as shipping lines, forwarders, transport operators and logistics groups seek to reduce costs, to improve efficiency, to generate revenue and to deliver value and a 'one-stop shop' service to the customer. The provision of integrated services does not always need to coincide with the ownership of the related assets. In many cases, the integration is achieved through close partnerships with other players. Market consolidation has resulted in large port clients who possess a strong bargaining power vis-à-vis terminal operations and inland transport operations. The loyalty to the home port tends to fade as large players are expanding their reach over more than one port. Magala and Sammons (2008) argue that port choice is to be considered as a by-product of a choice of a logistics pathway. Port choice becomes more a function of the overall network cost and performance. A growing understanding of the strategic role of ports in global logistics networks has made supply chain managers base their port choice decisions increasingly on reliability and capacity considerations next to pure cost considerations (ESPO/ITMMA, 2008).

Notteboom and Rodrigue (2005) introduced a regionalization phase in port and port system development to capture ports' responses to the changing market environment. The model extends existing spatial models of Taaffe et al (1963), Hayuth (1981) and Barke (1986). The port regionalization phase is characterized by a strong functional interdependency and even joint development of a specific load centre and (selected) multimodal logistics platforms in its hinterland, ultimately leading to the formation of a regional load centre network. Port regionalization permits the development of a

distribution network that corresponds more closely to fragmented production and consumption systems. The transition towards the port regionalization phase is a gradual and market-driven process that mirrors the increased focus of market players on logistics integration (Notteboom and Rodrigue, 2005).

Although the model draws implications for port governance and recognizes potential constraining institutional factors in the evolution of regional integrated port systems, it under theorizes the role of both strategic agency and institutional structure. It remains unclear how exactly territorially endorsed institutional legacies constrain (or enable) regional integration, and, how this in turn shapes actors' expectations and strategic actions. In addition, it remains unclear under what conditions and by what actions actors actually succeed in formalizing regional integration. This becomes critical when ports are located in close spatial proximity of each other, but within two different (nation-) state or port authority jurisdictions.

But also the private sector will have its reservations: vested interests, contractual agreements and made investments in what are essentially competing locations may result in strong place-bound commitments. Such private commitments can result in territorial (multi-scalar) coalitions, or other forms of collective action, between powerful special-interests organizations (cf. Boschma & Frenken, 2009) and state agencies, which can act as countervailing force against formalized regional integration. Indeed, as Hall & Jacobs (2009) put it when referring to port regionalization: "there is every reason to expect resistance to changing such institutional arrangements that are a reflection of deeply held constitutional systems and established national interests that were never intended to

anticipate new port technologies or facilitate inter-port cooperation and coordination in infrastructure upgrading”.

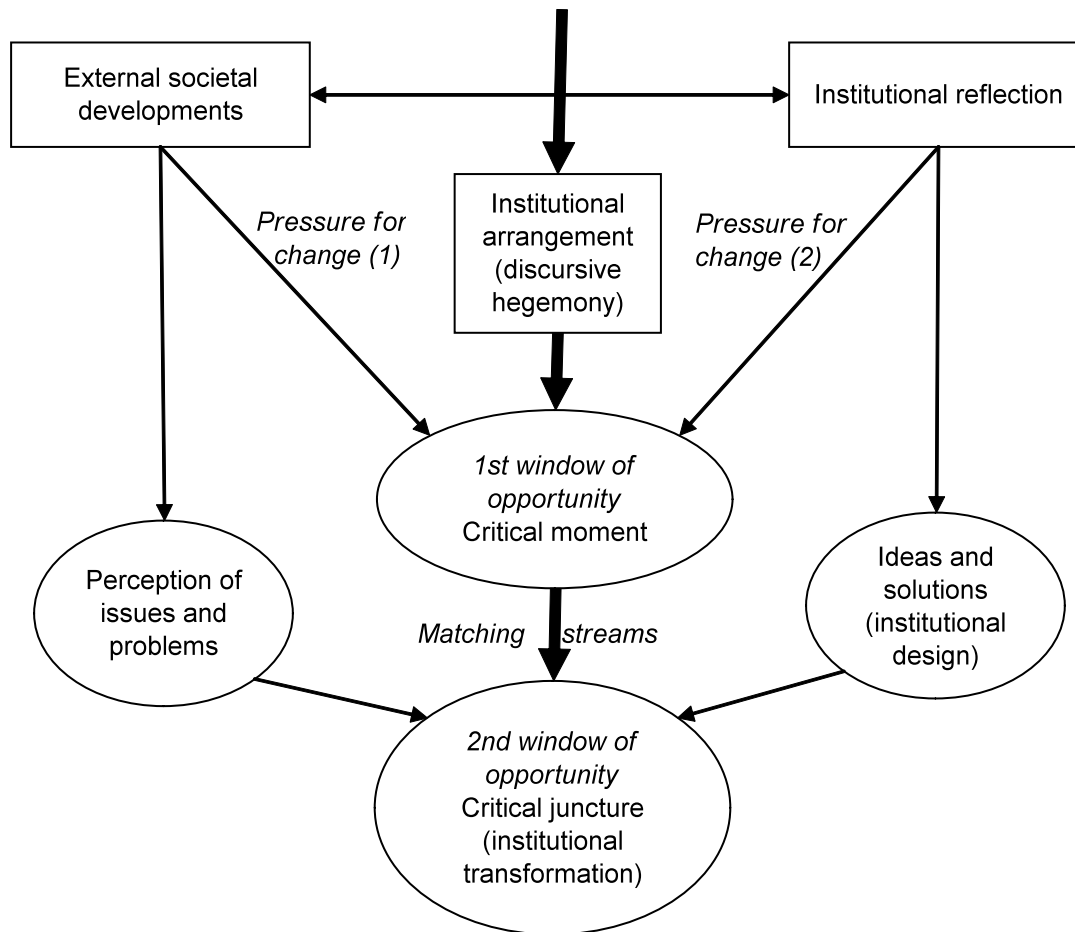
4. A THEORY ON THE CO-EVOLUTION OF PORTS

In addressing a theory of co-evolution we extend the work done by Buitelaar et al (2007). Analogous to Kingdon’s (1995) model of policy agenda setting and windows of opportunity, they developed a theory of institutional change which they argue is a combination of both evolution and deliberate design (figure 1). The starting point is an existing institutional arrangement (supported by a hegemonic discourse) at t_0 that under pressure of both external (societal and market) developments and institutional reflections by the actors involved (referred to as ‘bricoleurs’) creates a first window of opportunity for change. The external developments generate pressure for change as the perception of problems and issues at stake are considered to be incompatible with the existing institutional arrangement. The institutional reflections by the bricoleurs generate ideas and solutions for the economic dysfunctional or societal incompatible institutional arrangement in what can be referred to as institutional design. When the existing institutional arrangement is successfully challenged a *critical moment* for change will occur at t_1 .

However, this still will not imply that institutional transformation will be effectuated. At the critical moment opponents of change will be mobilized that will position themselves in the arena with the possibility that alternative ideas and solutions gain support. Therefore, in order for institutional transformation to be effectuated a second window of

opportunity needs to be opened at t2: *the critical juncture*. This critical juncture emerges when, analogous with Kingdon's three matching streams, external developments have been translated into perceived problems that require action are matched by solutions and an appropriate institutional design, which, most crucially, are politically and institutionally supported and endorsed. Once these three streams are matched institutional transformation will occur, resulting in rare cases to the creation of an entire new path of development. In most cases, however, the institutional transformation will be less radical and much more incremental. Institutional dynamics therefore inhibit degrees of 'plasticity' (Strambach, forthcoming), which refers to the continuity of change without necessarily breaking out existing paths. This is due to the fact that possible solutions and alternative designs put forward are in most cases confined to existing dominant interests and constrained by investments made in the past. As such, this conceptual model provides "a better understanding of how actions aiming at institutional design are positioned within a perspective of institutional evolution" (Buitelaar et al, 2007, p. 897).

Figure 1: A model of institutional change (Buitelaar et al, 2000, p.897).



Buitelaar et al (2007) rightfully mention that the model is somewhat stylized and that the empirical reality is much more messy than the model suggests. It should therefore be read as an analytical model. Nonetheless, we agree with the analytical value of this model, but see possibilities for further sophistication and extension of its applications, not least considering our concern of co-evolution. First of all, we do not think that this model is limited to institutional transformation per se. Within this model, the concepts of institutional arrangements and design can be easily replaced by organizational routines and organizational forms (cf. Boschma & Frenken, 2006). This corresponds with the perspective that views institutions as both internal (routines) and external (rules of the

game) to the firm as unit of analysis in evolutionary economic geography. Firms for example operate within a dynamic environment in which they constantly monitor their competitors' moves, market opportunities and socio-political developments (such as demographic changes or new legislation) in close coordination with the firm's performance. Changes within that environment, for example a new technology, new legislation or the removal of barriers to trade, can generate pressure for change of the organizational forms and/or routines. Organizational reflection can come internally from for example the shareholders or the R&D department or externally from consultants or the labor unions. This might result in critical juncture internal to the firm where the firm adopts a new business or governance model (e.g. outsourcing) or a new technology (e.g. ICT) which in turn changes the organizational form and/or routines.

Such transformation or evolution is most definitely not without conflicts of power and capitalist antagonisms. Labor often conflict with a firm management's decision for replacement by new technology and machinery- a reoccurring event at the waterfront where union interests have been particularly articulated (Turnbull, 2006). Likewise, international operating terminal operators are capable of transferring their successful routines to different ports in different countries, but at the same time ports resemble 'local communities of practice' that are firmly rooted in robust territorial rooted structures of power and corresponding institutional realities (Hall & Jacobs, forthcoming; Jacobs, 2007a; Hall 2003).

A second issue is that the model confines itself to institutional arrangements at a particular time and place, and in doing so, considers the process of institutional transformation in relative isolation. Although it recognizes 'external societal

developments' as a pressure for change, it restricts the process of reflection and change within certain jurisdictional boundaries and a particular society. This becomes apparent in their illustrations of land policy and regional governance within the Netherlands. This is problematic in a competitive and interconnected world, where external pressures for change occur simultaneously at different locations, albeit under different institutional conditions, and where stakeholders can have strategic interests at multiple locations and at different scales linked through networks (corporate and social) and institutionally articulated (multi-level) governance arrangements of the state. Moreover, we argue that part of the external pressures that lead to a window of opportunity at a certain location, might as well be a critical moment at another, competitive location.

What is needed, therefore, is a perspective that views the processes of change and reflection- and of evolution and design- in *relational* terms. Such a relational approach requires a “sensitivity to questions of power and interest, recognizing that such strategies are often formulated by dominant and hegemonic groups” (Mackinnon et al, 2009, p.137) More specifically, this implies a relational perspective of power, politics and collective action, whereby power is viewed in relational terms (Allen et al 1998) as “the capacity to exercise that is realized only through the process of exercising” (see also Dicken et al. 2001; Yeung, 2005; and for the specific case of seaports: Jacobs & Hall, 2007). Such a perspective will allow us to analyze how windows of opportunity through strategic or collective action occur at different locations but under similar pressures, most notably competition within a certain industry, which result in a co-evolution between competitive places. While the port and maritime industry is not a new industry, vertical and horizontal integration has clearly changed the competitive setting in the industry, whereby firms can have direct intra-organizational stakes in several spatially proximate locations, leading to

new patterns of co-evolution between ports (cf. Hall & Jacobs, forthcoming). In addition firms and port authorities have developed new routines in correspondence with each other: carriers and shipping lines are searching for dedicated container handling space within gateway regions, while port authorities in search of investments and embeddedness within global flows offer terminal lease concession agreements to their global operating clients. This makes the application of the concept of windows of locational opportunity very relevant in the more mature port and maritime industry.

Our model extends that of Buitelaar et al (2007) in the following manner. We argue that for locations specialized in certain economic activity and within close proximity of each other, a *pattern of co-evolution emerges*. This co-evolution is the result of competition between firms in which specialized locations compete for similar investment opportunities and by which each location closely monitors the other's strategies. Our conception of co-evolution differs from its understanding within EEG. Within EEG, co-evolution refers to the inter-related development process within and between industries that result from innovation and agglomeration externalities. Here, we empirically focus on the co-evolution of specialized port locations within a region resulting from competition for similar investment opportunities. Nonetheless we theoretically accept the possible influence of organizational routines in the process of opening windows of locational opportunity as well as the role of critical moments and junctures internal to the firm.

The line of reasoning we propose is as follows. A certain firm decides to invest in a region. At a certain location there is a window of opportunity for (port) development, resulting in a critical moment. However, these developments are critically scanned by the location's close-by competitor that in turn starts to strategically react and which might

result in a window of opportunity as well. Illustrative for this situation has been given by Hall's (2003) analysis of the development of the port of Baltimore. Maersk was reconsidering its location in the port of New York as its principal load centre for the US East Coast. This created a critical moment for the agents acting on behalf of the port of Baltimore to lure Maersk and its containerized traffic to its port. However, in response to Maersk's potential departure, the port of New York agreed upon dredging concessions in order to fulfill Maersk conditions for an extension of their operations on the Hudson. In conceptual terms this means that in New York a critical juncture did emerge whereas in Baltimore it did not, i.e. the window closed again.

Figure 2: A model on the co-evolution of ports

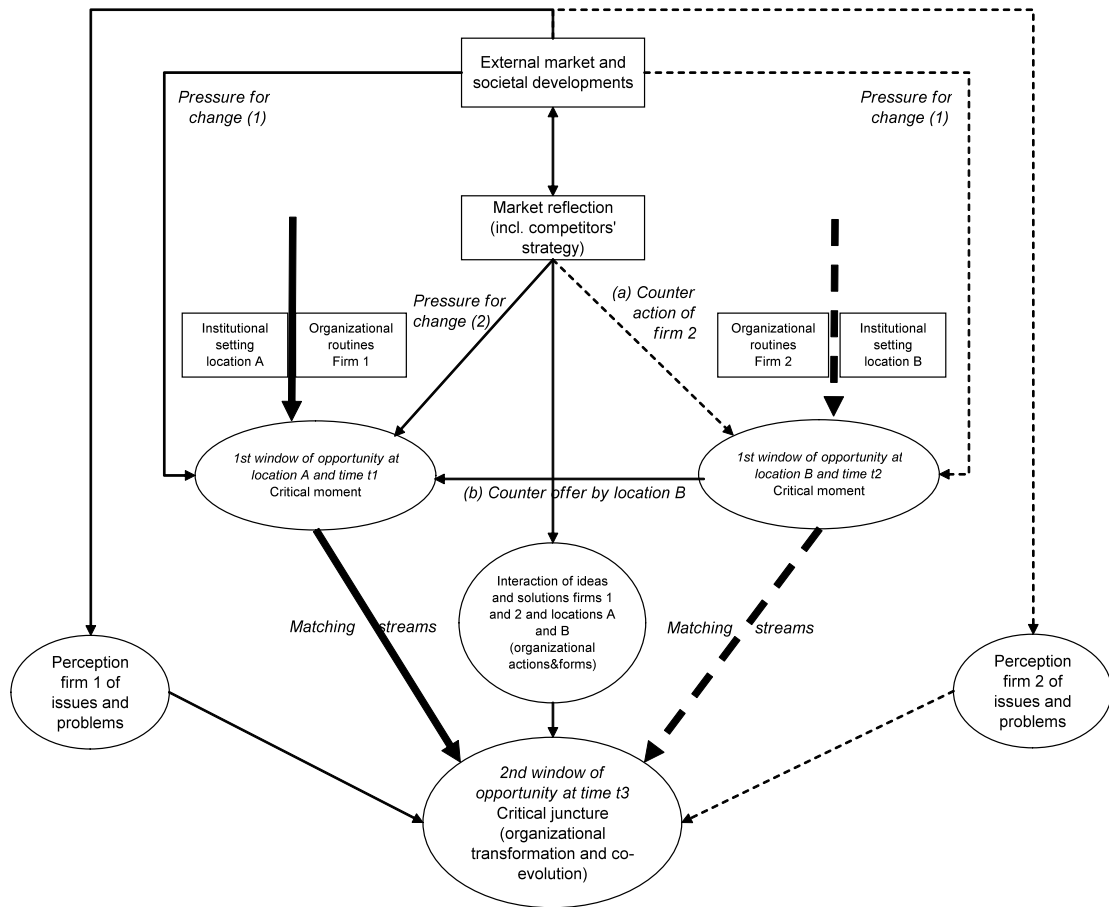


Figure 2 provides a schematic representation of our extended version of the model of Buitelaar et al (2007). The simplified model assumes two competing firms and two competing locations for terminal development in the same gateway region. Each of the firms will face specific external market and societal developments. At a certain point in time (t1) the existing port hierarchy in the port region is challenged by a first window of opportunity for firm 1 in port location A. This window of opportunity is created under pressure of both external market developments and the market reflection of firm 1, and generates a first critical moment. In case port location A gives a positive reply to the pressure then two actions can occur:

- (a) a competitive action might be triggered via a market reflection of firm 2 to develop a terminal in competing location B;
- (b) port location B tries to counter the terminal plans in port location A by making a strong offer to lure firm 1 away from its plans to develop activities at location A.

In both cases, the result is the opening of a window of opportunity in port location B at time t_2 . The interaction between firms 1 and 2 and locations A and B triggers a process of action and reaction spread out in time and eventually resulting in a second window of opportunity at time t_3 . The transformation in the port region will be effectuated following a critical juncture at t_3 . This transformation could involve a wide range of possible outcomes: (1) no terminal developments at all, (2) terminal development at location A and operated by firm 1, (3) terminal developments at both locations with each location having a different operating firm, (4) terminal development at location A and operated by firm 2, (5) terminal development at location B and operated by firm 1, etc.. The outcome will be determined by the interaction between perceptions, reflections and critical moments and the way this interaction culminates in the critical juncture.

The co-evolution of ports is thus driven by a set of complex interactions that could lead to a multitude of possible outcomes. This observation is in line with the findings of Notteboom (2009a) who stated that “.. a certain degree of path dependency in the development of ports at a regional scale exists, but the sequence of events makes a difference for the outcome. Port development processes also show a certain degree of contingency. Strategies and actions of market players and other stakeholders may deviate from existing development paths.”

5. CONTAINER TERMINAL DEVELOPMENT IN THE RHINE-SCHELDT DELTA

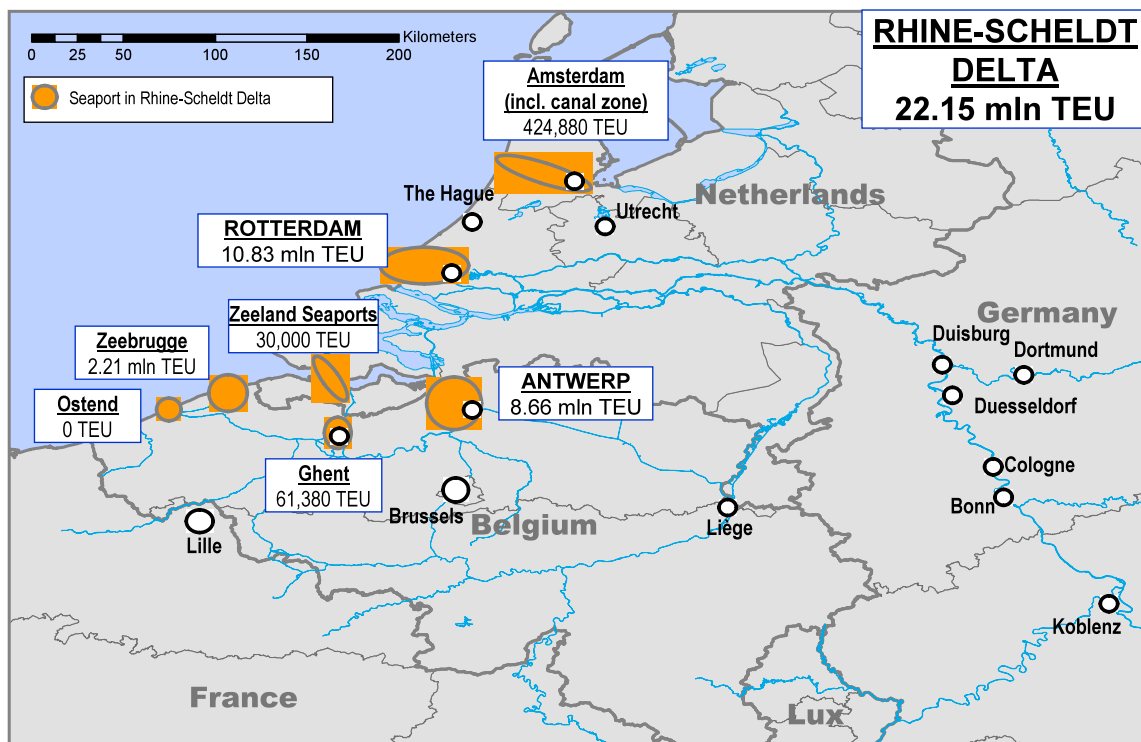
5.1. Profile of the Rhine-Scheldt Delta

In the remainder of this paper we will illustrate the conceptual model on port co-evolution by applying it to a number of terminal development cases in the port system of the Rhine-Scheldt delta, the fourth largest container gateway region in the world and the most important gateway region in Europe (Notteboom, 2009b). The Delta features a high concentration of seaports with a joint container throughput of 22.2 million TEU in 2008 (about 23% of the European total), see Figure 3. Only Rotterdam, Antwerp, Zeebrugge and more recently also Amsterdam are involved in large-scale container terminal operations (see table 1). The port of Flushing, managed by Zeeland Seaports, is striving to join the list of large-scale container load centres in the region.

The Rhine-Scheldt Delta is an interesting gateway region in view of illustrating the theoretical model. First of all, the region features a mix of large established ports (Rotterdam and Antwerp, respectively the largest and third largest container port in Europe) and a whole range of medium-sized and small load centres which, to a larger or lesser extent, challenge the position of the large load centres. This makes the co-evolution approach particularly interesting. Secondly, the region is home to a large number of global terminal operators and all leading shipping lines have calls in one or more ports. The presence of strong market players places the role of firms' routines at the center stage of the co-evolution within the port region. Thirdly, Notteboom (2009b) demonstrated that

the relationships between the ports are not only of a competitive or substitutive nature. A level of port complementarity exists emanating from terminal ownership structures, the ports' cargo orientation in the foreland and the hinterland and locational and logistics qualities of the respective seaports. Fourthly, the ports in the Rhine-Scheldt delta region are embedded within different local governance structures and national institutional frameworks, resembling vested interests that remain resilient to formalized regional integration. As such, the Rhine-Scheldt delta region forms a good focus for illustrating the role of strategic action, power conflicts and territorial institutions in the co-evolution of seaports.

Figure 3: Container throughput in the gateway ports of the Rhine-Scheldt Delta in 2008



Note: Zeeland Seaports is comprised of the ports of Flushing and Terneuzen

Source: own calculations based on statistics respective port authorities

Table 1: Annual growth rates in the main container ports of the Rhine-Scheldt Delta (in %)

	Antwerp	Zeebrugge	Rotterdam	Amsterdam	All ports (*)
1980-1990	7.90%	6.33%	6.79%	-0.40%	6.66%
1990-1995	8.50%	9.59%	5.48%	5.73%	6.52%
1995-2000	11.88%	12.81%	5.56%	-7.26%	8.01%
2000-2005	9.71%	7.84%	8.16%	4.48%	8.73%
2005-2008	10.12%	16.21%	5.26%	86.17%	8.63%
<i>Market share 2008</i>	<i>39.1%</i>	<i>10.0%</i>	<i>48.9%</i>	<i>1.9%</i>	<i>100.0%</i>

(*) Including also Ghent, Ostend and Flushing

Source: own calculations based on statistics respective port authorities

5.2. Evolution of terminal capacity in the Rhine-Scheldt Delta

The existing large load centers are developing new terminals to meet future demand for container handling capacity. New container terminal capacity is developed downstream away from the historical core of the city. In the 1980s the sustained growth of container throughput in Rotterdam led to the construction of massive container facilities on the Maasvlakte, an area that was reclaimed on the sea. The Maasvlakte terminals handled more than 7 million TEU in 2008. Antwerp has witnessed the same kind of development in the 1990s, when the Antwerp port community and the Flemish government decided to build container capacity along the river Scheldt in front of the locks, thereby allowing considerable savings in the port turnaround time of container vessels. The first Scheldt terminal (Europe Terminal) started operations in 1990. The second Scheldt terminal (North Sea Terminal) followed in 1997. Antwerp opened the first phase of a tidal container dock on the left bank of the River Scheldt in 2005. When fully operational, the Deurganck dock will reach an annual capacity of at least 8 million TEU.

Rotterdam and Antwerp will further develop downstream port areas in the future. The port of Rotterdam has started construction on a second Maasvlakte on land reclaimed from the sea. A large part of Maasvlakte II would be dedicated to the container business. The first terminal should be open for business by 2013-2014. In the meantime, the new Euromax-terminal (at the north of the current Maasvlakte) started operations in 2008. Antwerp has plans for the development of a second large tidal dock on the Left Bank. This Saefthinge Dock could very well double the port's current container terminal capacity. The above examples make clear that the large load centers in the area are responding to carriers' demand for new large terminal capacity.

Medium-sized coastal ports and new hub terminals in the Rhine-Scheldt Delta hope to successfully challenge the position of the large load centers. Zeebrugge and Amsterdam are already vying for deepsea container flows. Zeebrugge is still a long way from operating at anything like full capacity. The Dutch seaport Amsterdam opened its Ceres Paragon terminal in 2001 with its distinctive state-of-the-art handling system based on an indented berth. The terminal with a capacity of some 950,000 TEU opened during a market slump and remained empty for years. Flushing has well-advanced plans of becoming a deepsea container port in the near future. Three projects are planned or already under construction (see later sections of this paper) which, if all realized, would in the longer term bring the capacity of Flushing to more than 5 million TEU. The container terminal initiatives in Zeebrugge, Amsterdam and Flushing aim to multiply the routing options available to cargo moving through the Rhine-Scheldt Delta.

5.3. The market players in the Rhine-Scheldt Delta

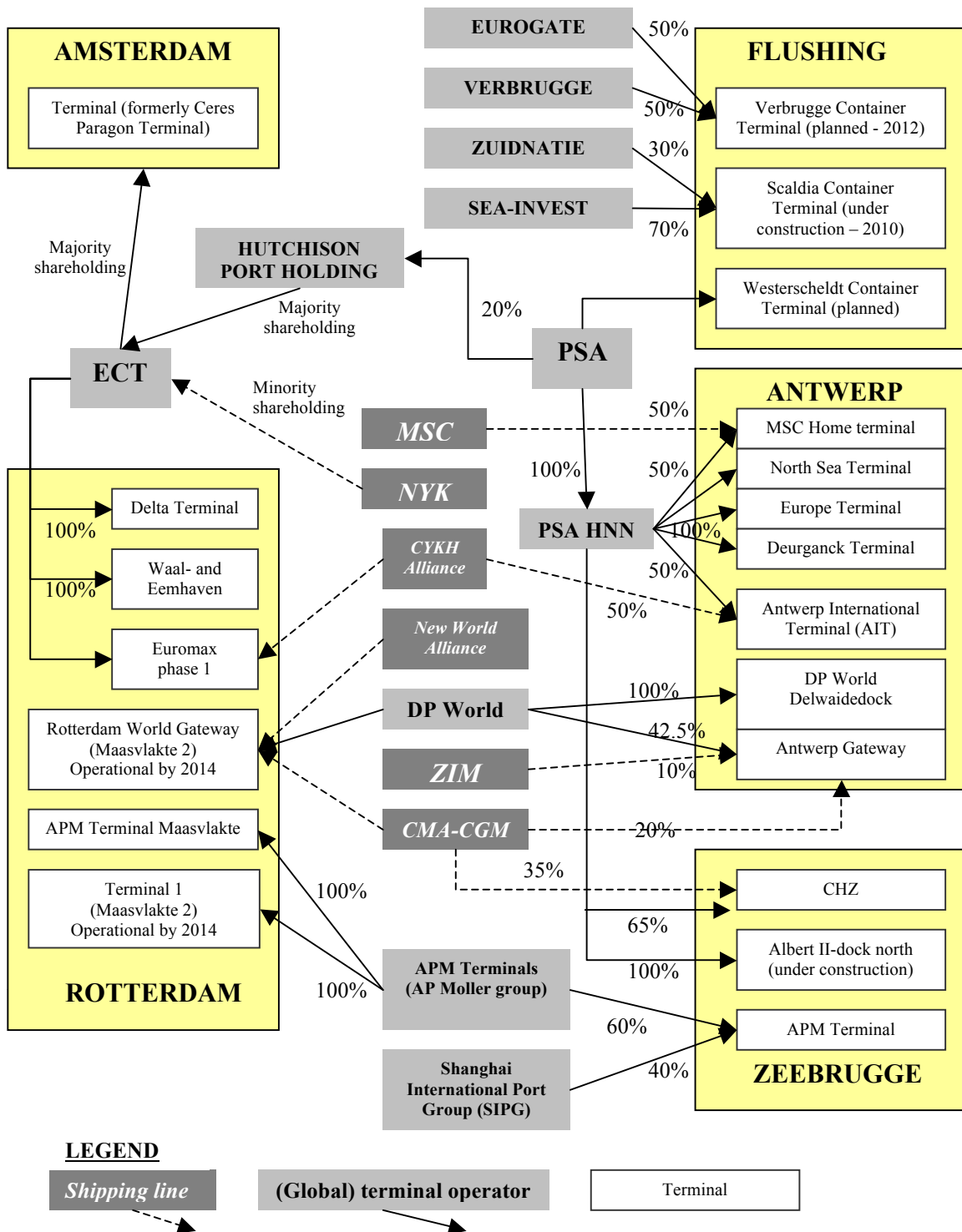
The complex ownership structures of the terminals in the Rhine-Scheldt Delta are depicted in Figure 4 (situation in the fall of 2009). It can be observed that quite a number of global terminal operators and shipping lines have interests in more than one terminal of the Delta, often even in different ports. Shipping lines typically set up a partnership with a global terminal operator via a joint-venture or a minority shareholding to develop a terminal. For example, MSC has teamed up with PSA MSC at the large MSC Home Terminal (nearly 4 million TEU in 2008) in the Belgian port of Antwerp (50/50 joint-venture). These kinds of arrangements are a good way for global terminal operators to hedge the risks associated with the container business. However, shipping lines can and sometimes do make a totally different choice for the next port. Business relationships in general are footloose and opportunistic in nature. For example, CMA CGM has linkages with DP World in Antwerp and also Rotterdam in the future, but has a partnership with PSA HNN in Zeebrugge.

Notteboom (2009b) demonstrated that ten years ago local terminal operators dominated the container handling scene. At present, the container terminal business in the Delta is dominated by four global terminal operators (Singapore-based PSA, Dubai-based DP World, APM Terminals and Hong Kong-based Hutchison Port Holding) and a handful of shipping lines, which have minority shareholdings or are engaged in joint-venture arrangements (e.g. CMA-CGM and MSC to name but a few).

Since the spring of 2006, APM Terminals operates a container terminal at the Albert II dock south in Zeebrugge (formerly known as Flanders Container Terminal). In recent years, shipping line CMA-CGM has developed Zeebrugge as a major hub in its network. Terminal operator PSA HNN is developing another container handling facility at the

northern side of the Albert II dock. In the summer of 2007, a consortium lead by DP World was granted the concession for the second phase of Maasvlakte 2. This implies that one of the two terminal giants in Antwerp will also have its presence in Rotterdam by 2014. In late 2008, Hutchison Port Holding took a majority shareholding in the terminal in Amsterdam, thereby expanding its reach outside Rotterdam. PSA HNN is expected to further widen its operational base in the Delta through its involvement in the planned WCT in Flushing.

Figure 4: The complex inter-firm relationships in terminal operations in the Rhine-Scheldt Delta – situation in the fall of 2009



- The CKYH Alliance includes the shipping lines Cosco, K-Line, Hanjin and Yang Ming.
- NYK is part of the Grand Alliance that includes the shipping lines Hapag-Lloyd, NYK and OOCL. The Malaysian shipping company MISC was a member of the Grand Alliance till early 2009.
- The New World Alliance includes the shipping lines APL, MOL and Hyundai Merchant Marine.

Source: Notteboom – ITMMA

The emergence of network structures at the side of shipping lines and terminal operators will allow them to offer more routing alternatives to their customer base, thereby taking advantage of the cargo control characteristics of the load centres involved. These network structures enhance co-evolution among the ports considered. Shipping lines are not putting all their eggs in the same basket, so a multi-port region can offer an opportunity for a port operator to enter a regional market by using a new terminal or port outside the stronghold of a competitor. These competitive dynamics support new port hierarchies and a multiplication of the number of ports engaged in containerization.

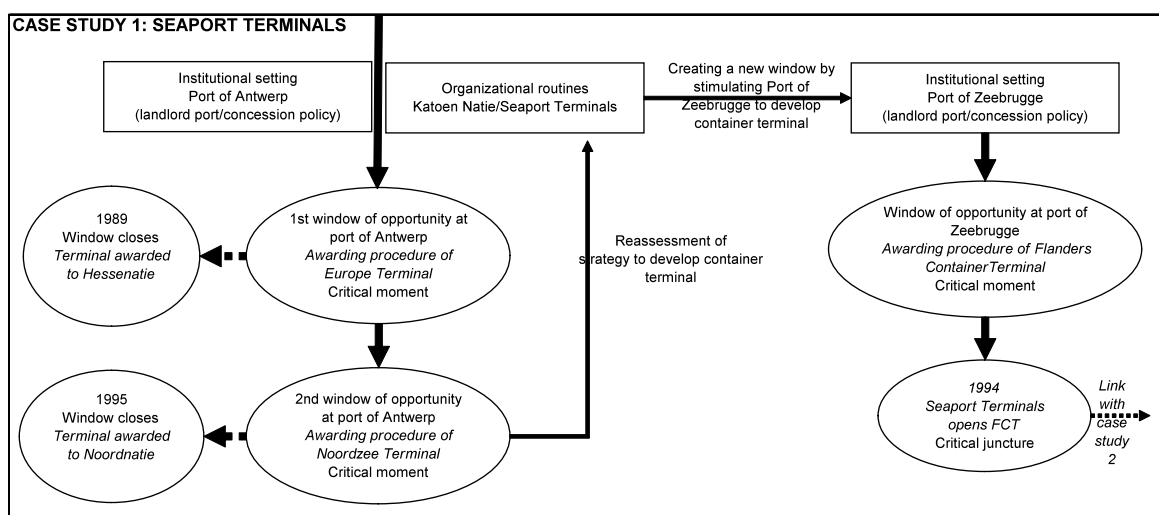
In the remainder of this section we discuss three concrete cases of firm-interrelationships and windows of opportunities shaping terminal development and port competition in the region. The three cases are the rise and fall of Seaport Terminals, the expansion strategy of Maersk/ APM terminals and Flushing's ambitions to enter the container scene.

5.4. Case study 1: the rise and fall of container activities at Seaport Terminals

In the late 1980s, Seaport Terminals was one of the main container terminal operators in Antwerp. Seaport Terminals wanted to secure its future development potential by aiming for the concession of one of the two new Scheldt terminals in Antwerp. However, the

Europe Terminal (opened in 1990) was granted to Hessenatie and the North Sea Terminal (opened in 1997) to Noordnatie so the two consecutive windows of opportunity to expand the firm's position in the container terminal industry in Antwerp closed. After a series of unsuccessful legal actions against both decisions of the Antwerp Port Authority, Seaport Terminals moved its attention to the coastal port of Zeebrugge in the 1990s. Via its interaction with the local port authority Seaport Terminals was able to open a new window of opportunity in the container business. Mother company Katoen Natie eventually obtained a concession to operate the new Flanders Container Terminal (FCT) in Zeebrugge (critical junction). Many saw the move to Zeebrugge as a way for Seaport Terminals to hit back on Antwerp. However, Katoen Natie/Seaport Terminals never succeeded in reaching a reasonable utilization rate at FCT. Katoen Natie finally pulled out of container terminal activities in Zeebrugge. The Antwerp container activities of Seaport Terminals were sold earlier to P&O Ports in 2000.

Figure 5: Co-evolution between the ports of Antwerp and Zeebrugge driven by organizational routines of Katoen Natie / Seaport Terminals and the institutional setting/concession policy of the respective port authorities



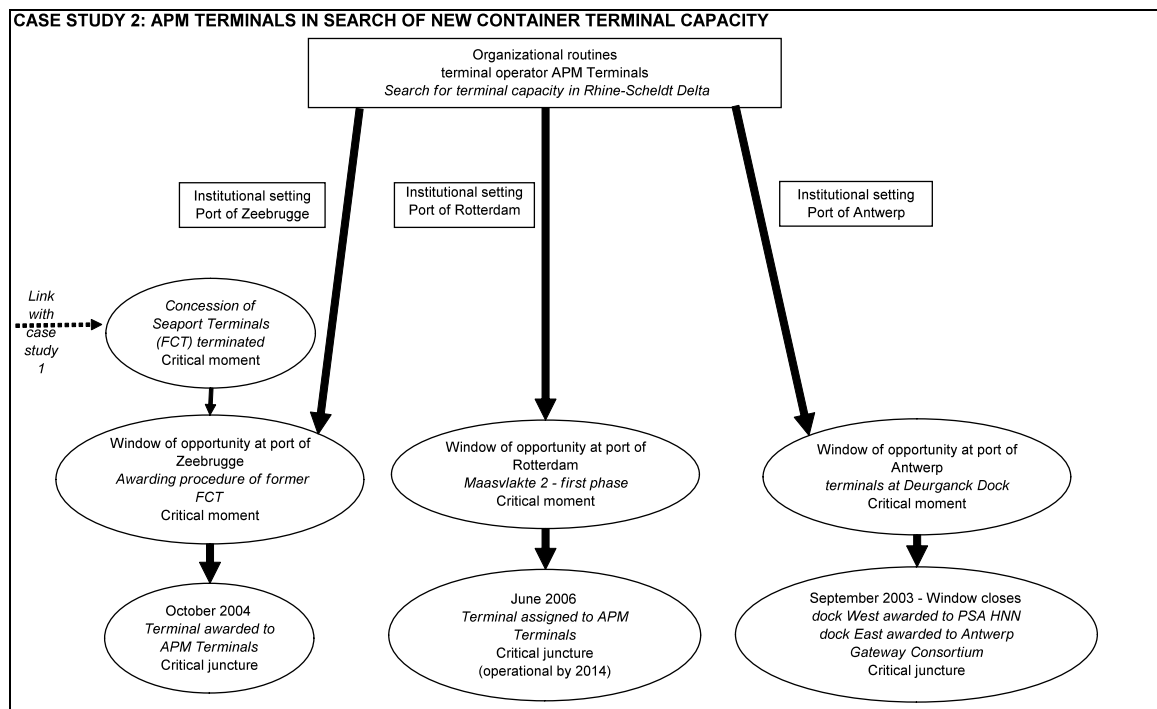
5.5. Case study 2: the expansion strategy of Maersk / APM Terminals

The gradual acquisition of ECT, the leading terminal operator in Rotterdam, by Hong Kong based Hutchison Port Holding in the late 1990s led to an intervention of the Merger Task Force of the European Commission. This intervention resulted in the Maersk Delta terminal to become a fully-owned dedicated terminal for Maersk (critical juncture). A few years later, this terminal at the northern side of the container peninsula at the Maasvlakte was taken up in the portfolio of the group's new subsidiary APM Terminals. Following a DG Competition decision on the joint exploitation of the new Euromax terminal in the port of Rotterdam by ECT and P&O Nedlloyd (case M.3576 of 2004) and following the later acquisition of P&O Nedlloyd by Maersk Line, the exploitation of the Euromax terminal was awarded to ECT (opened in 2008), while the AP Moller group would in return be awarded the first concession on Maasvlakte 2.

APM Terminals soon faced capacity constraints in Rotterdam. The existing facility is reaching full capacity and the new 4.5 million TEU terminal at Maasvlakte 2 will only be available in 2014 at the earliest. Maersk made an attempt to enter the Antwerp container business as a candidate for one of the phases of the Deurganckdock, but this window of opportunity closed as Maersk did not succeed in securing a terminal in Antwerp. The eventual winners were PSA HNN (west side of the dock) and the Antwerp Gateway consortium (east side). The AP Moller group was more successful in Zeebrugge when in 2004 the port authority MBZ opened a window of opportunity to enter the port. In October 2004, MBZ announced that APM Terminals has been named the preferred bidder for the concession to manage and operate the former Flanders Container Terminal. The terminal with a design capacity of 2 million TEU resumed operations in 2006 and gives

Maersk Line some room for growth in the Rhine-Scheldt Delta. In late 2008, Shanghai International Port Group (SIPG) acquired a 40% shareholding in the Zeebrugge facility. The involvement of SIPG should be seen in connection to the deal APM Terminals could make with the port of Shanghai on the exploitation of a large container facility at the new Yanshan port in the outer Hangzhou bay. In December 2005 APMT and SIPG signed a joint venture contract together with Hutchison Port Holdings, Cosco Pacific and China Shipping Group to operate the second phase of Yangshan port. The links between APMT and SIPG demonstrate that port co-evolution is not necessarily limited to the local/regional scale, but can even have a global dimension.

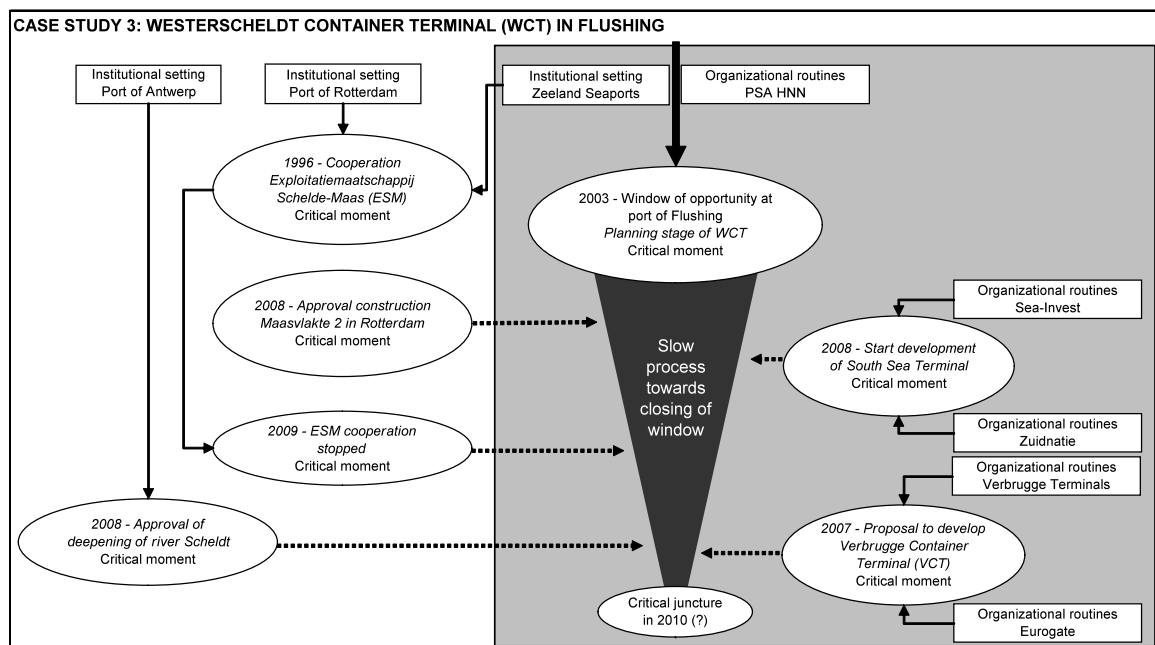
Figure 6: Co-evolution between the ports of Antwerp, Rotterdam and Zeebrugge driven by the search of APM Terminals for new container terminal capacity in the Rhine-Scheldt Delta and the institutional setting of the respective port authorities



5.6. Case study 3: Flushing’s plans to enter the container scene

In the late 1990s, the port authority of Flushing (later merged with the port of Terneuzen to become Zeeland Seaports) developed its first ideas to enter the container scene. The port of Flushing and the Port of Rotterdam jointly set-up an economic cooperation agreement (ESM) in the same period to develop the Scaldia port, an area in the inner port of Flushing. This move represented a new institutional setting for the port of Flushing. The ESM actively participated in realizing Flushing's ambitions to have a large-scale container facility at its disposal. While the Rotterdam Port Authority never made official statements on the reasons behind the cooperation with Flushing, it was quite clear that the port of Flushing could serve as a strategic reserve to Rotterdam in case the Maasvlakte II project would be jeopardized at some point.

Figure 7: Co-evolution dynamics in the framework of the plans of the port of Flushing (Zeeland Seaports) to enter the deepsea container terminal market via the Westerscheldt Container Terminal (WCT)



The first concrete plans to develop a large-scale terminal in Flushing date back to 2002-2003. The idea at that time was to develop a Westerscheldt Container Terminal (WCT) at the mouth of the river Scheldt outside the existing dock system. The initial design

encompassed a quay length of about 2.4 km. However, due to environmental objections mainly linked to the existence of a fossil beach at the terminal site, the port authority had to downsize the terminal design to 2km quay length. Right from the start, PSA was actively involved in the design of and the support to the terminal initiative. Many saw the involvement of PSA as a defensive move to make sure that no competitor would take control of a terminal that is located at the front door of its large facilities in Antwerp. Hence, the Antwerp port is also located along the River Scheldt, about 80km upstream from Flushing.

The decision process on the development of WCT has still not been completed, despite approximately six years of study work including a pile of environmental studies, social cost-benefit analyses and market studies. The lengthy process had two important side-effects that could even jeopardize the whole project.

First of all, when the WCT initiative was first introduced there was still a considerable amount of uncertainty on whether the large ports Antwerp and Rotterdam would be able to secure a further growth of container capacity in the port:

- In 2003, the construction works at the new Deurganckdock in Antwerp were halted for almost a year due to legal actions of a community group of a nearby village. This temporarily led to nervous reactions and a growing uncertainty in shipping and terminal operator circles;
- The much-needed dredging program for the river Scheldt, the artery to the Antwerp port, still needed approval. The whole decision on the deepening of the river was made subject to a broad debate on the economic, natural and environmental function of the Scheldt Estuary. The final approval to start deepening the river came in 2008

and thereby ended a period of uncertainty for shipping lines which want to deploy larger vessels to call at Antwerp;

- The start of the new millennium implied that Rotterdam's plan to develop Maasvlakte II entered a phase of concretization. However, mainly environmental issues resulted in a very lengthy decision process and uncertainty in the market. Even up to the year 2008, legal actions and objections from a number of stakeholders continued to undermine the port authority's expansion plans. Construction at the breakwater eventually started in late 2008 while in the past years several terminal operator groups were granted a concession at Maasvlakte (either via direct appointment or through a competitive bidding process). This set of critical junctions ended a long period of anxiety about the realization of this very strategic project to Rotterdam's future.

In summary, the uncertainty surrounding the realization of a number of strategic projects in Antwerp and Rotterdam opened a window of opportunity for Flushing to successfully enter the container market. Recently, all these strategic projects have been approved. At present the window of opportunity for Flushing might not be entirely closed, but the room to manoeuvre has certainly become much smaller.

Secondly, the long discussion on the feasibility and desirability of WCT created an atmosphere in the market where the discussion shifted from the question to whether Flushing needs a large-scale container terminal to the question whether WCT is the best alternative for developing large-scale container facilities in Flushing. This shift in the debate opened a window of opportunity for incumbent firms in the port and also attracted newcomers. In 2007, incumbent terminal operator Verbrugge announced that the company seeks to refurbish its large multifunctional terminal in the inner port and to convert it into a container terminal with a capacity of 2.5 million TEU (compared to 2.2

for WCT). This action created a shockwave among the defenders of the WCT as Verbrugge did not coordinate its announcement with the port authority. On top of this, Verbrugge later on announced that they will team up with the German/Italian leading terminal operator Eurogate. Obviously, Eurogate saw the plans of Verbrugge as a window of opportunity to enter the Rhine-Scheldt Delta after years of unsuccessful bids in the other ports of the Delta. At present, three initiatives are developing to start deepsea container terminal handling: the Westerschelde Container Terminal (WCT), the Verbrugge Container Terminal (VCT) and the South Sea Terminal (SST). Sea Invest/Zuidnatie is planning to start the South Sea Terminal in 2011 with a maximum initial capacity of 600,000 TEU. The other terminals are still in a planning phase. A new critical junction is near.

6. CONCLUSIONS

This paper responds to recent debates within economic geography about conceptually integrating institutional and evolutionary approaches as well as applying these recent insights to study port development. This paper has focused on the role of territorial institutions and strategic action in opening windows of opportunity at different competing locations for investment and growth within a certain economic sector. Such a relational approach is particular relevant in a sector dominated by international firms that have strategic stakes at several locations in a region, but where alternative locations seek to enter the regional market; often in alignment with competitor firms and local authorities. In such situation we can expect a process of co-evolution to take place, whereby a window of opportunity at one location triggers a response at another location. The

locational dynamics of co-evolution are thus at the heart of the paper. While this approach on co-evolution differs from EEG, we theoretically accept the possible influence of organizational routines in the process of opening windows of locational opportunity as well as the role of critical moments and junctures internal to the firm.

The illustrative case studies demonstrate that the competitive development in the gateway region of the Rhine-Scheldt Delta is highly depending on a complex of missed and successful bids for terminal concessions, as part of the institutional setting at these locations, in combination with a set of merger and acquisition moves in the terminal operations industry and liner shipping, as part of firms' routines. The outcome of each event has had an impact on the possible outcomes in the next step of the regional port system development. The combination of (missed) windows of opportunities and critical junctions has created a distinctive path of co-evolution among ports in the Rhine-Scheldt Delta.

How to proceed with the development and application of this framework? More theoretical work can be done on the concept of co-evolution in a seaport context, bringing it more in line with its application with EEG. The question then becomes how technologies, institutions and firm routines within the maritime ports industry co-evolve. Empirically more case study work needs to be done on the organizational routines of firms in the industry. This is especially relevant as the industry has witnessed processes of integration whereby a few global terminal operators and various forms of terminal-related partnerships between shipping lines and these global operators have entered local stevedore markets. How exactly are firm routines and tacit skills influenced by these processes? The port industry has historically been characterized by local-based family-

businesses which typically exerted a strong influence on and interaction with local institutional settings. These businesses now are confronted with different types of business models often characterized by a strong network orientation and a weakening local embeddedness and dependence. A related avenue of future empirical research should focus more on the relationality within the industry, specifically on inter-personal relationships. How for example does executive management circulate within port businesses and relevant government agencies?; and how does previous business partnerships affect the likelihood of future collaboration at different port locations? How do inter-personal relational networks constrain and enable windows of locational opportunity in port development? These are just some of the questions requiring further empirical scrutiny. In that respect we believe that our model is not confined to the Rhine-Scheldt Delta and that it can be internationally applied to other ports in proximity.

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