Re-Assessing Port-Hinterland Relationships in the Context of Global Commodity Chains

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Introduction

Given the tremendous changes in logistics, ports are coping with a very flexible environment. This has brought several major challenges in contemporary maritime transportation, particularly over the hinterland which has received renewed attention in recent years. The maritime component of the global freight transportation system has become very dynamic and efficient. As large segments of freight distribution systems are becoming more closely integrated, port-hinterland relationships have become a fundamental component of freight distribution. It may even been argued, and as paradoxically as it sounds, that contemporary improvements in maritime shipping are mainly derived from improvements in inland transport systems. The current technological and commercial context indicates important changes in the conceptualization of hinterlands. Among the most significant forces that are shaping hinterlands, the fragmentation of Global Commodity Chains (GCC) can be considered as particularly relevant.

The setting of GCC leans on using the comparative advantage of space, namely to insure a better access to markets, labor, parts and resources, through a spatial fragmentation of production and consumption and this while maintaining the integrity of the commodity chain in terms of frequency and level of service. A complementarity between the actors of a commodity chain is established. Through the principle of location each actor seeks to find cost and/or income effective locations based on respective comparative advantages. Spatially fragmented commodity chains are emerging as the outcome of such a strategy. The function of distribution may also be expanded to cope with this geographical specialization, with a wide variety of physical flows.

Port hinterlands have become a key component for linking more efficiently elements of the supply chain, namely to insure that the needs of consignees are closely met by the suppliers in terms of costs, availability and time in freight distribution (Notteboom and Winkelmans 2001; Robinson 2002). Through a set of supply / demand relationships involving physical flows, efficiencies, and thus economies, are achieved through the principle of flow (Hesse and Rodrigue, 2004). In this flow-based system, demand is synchronized more closely with supply, imposing a reorganization of freight distribution. The complementarities in terms of origin / destination and supply / demand are thus impacting port hinterlands.

This chapter will assess the main driving forces impacting on port hinterlands and how they are coping with the substantial changes brought by the setting of global commodity chains. Doing so requires a reconsideration of the concept of hinterland itself as a dynamic space where macro-economic, physical and logistical factors are at play. Each represents a layer of intervention. It is thus argued that there is a *macro-economic*, a *physical* and a *logistical hinterland*. These processes are not without tensions between the major actors involved, such as port authorities, maritime shippers, logistics service providers and inland transport operators.

Types of Hinterlands

As early as in 1941 Van Cleef argued that geographers have not agreed upon the definition of hinterland or even upon its meaning, though it is a word of long standing (Van Cleef 1941). One element all traditional definitions of the hinterland have in common is their spatial focus. It is widely acknowledged that a hinterland is the area over which a port draws the majority of its business. At the end of the 1980s, research on the issue of hinterlands waned. This development was caused by a number of factors. First of all, the static conceptualization of the term hinterland was increasingly difficult to reconcile with the dynamic nature of maritime shipping, particularly containerization. Secondly, and probably more importantly, logistics market developments and the discontinuous nature of complex logistics networks have permitted the emergence of a discontinuous and clustered hinterland. Conventional perspectives based on distance-decay are thus ill-fitted to address this new reality. It requires a more functional approach to the concept of hinterlands, particularly its integration with issues pertaining to logistics and commodity chains.

To understand the spatial and functional nexus that hinterlands have become, three basic sub-components can be applied: the macro-economic, the physical and the logistical hinterland. The *macro-economic hinterland* tries to identify which factors are shaping transport demand, particularly in a global setting. The *physical hinterland* considers the nature and extent of the transport supply, both from a modal and intermodal perspective. Finally, the *logistical hinterland* is concerned by the organization of flows as they reconcile transport demand and supply. Although the rationale behind these components appears simple, the shape they take is subject to complex spatial and functional structures.

The Macro-economic Hinterland

The macro-economic hinterland is a matter of transport demand in terms of origins, destinations, but also the whole transactional setting in which the actors generating this demand evolve. The simplest way it can be represented is by a set of *logistical sites* with some focusing on production and others on consumption; commonly distribution centers. It is uncommon that activities generating cargo or the final consumers are directly linked with the port, instead distribution centers act as intermediaries, particularly for consumption. The exception is bulk cargo which is often directly linked with ports, but the concerned commodity chains are simpler and involving fewer actors. Logistical sites tend to be clustered often as an outcome of economies of agglomeration and regional specialization, underlining the discontinuity of most port hinterlands.

The macro-economic hinterland now goes beyond the consideration of the clients of the port, either existing or potential, within a regional setting. Globalization has insured that additional macro-economic issues have to be considered since they play a fundamental part in the generation of maritime freight traffic. They include interest rates, exchange rates, prices, savings, productive capacities and debt, factors deep within the realms of economic and financial geography. This environment is continuously changing, which increases the volatility of freight markets. Economic integration and globalization go on par with the level of political integration with initiatives such as NAFTA and the EU Single Market at the regional level, and at the global level, supported by the continuing evolution of the WTO.

Macro-economic conditions have often been considered in the concept of port forelands and hinterlands, but always as exogenous forces. In the current context, the structure of international trade has become fundamental to port-hinterland relationships. Since international trade is rarely a balanced account, trade imbalances, especially at the regional level, have a significant impact on port hinterlands since they impose a general direction in traffic flows completely outside the level of intervention of ports.

The Physical Hinterland

The physical hinterland is a matter of transport supply, both from a modal and intermodal perspective. It considers the network of transport infrastructure, modes and terminals connecting the port to its hinterland; the means to achieve regional accessibility in freight distribution. Intermodal transportation has become of particular relevance to improve the efficiency and accessibility of hinterlands as it links the global access of the port (through its intermodal facilities) with regional customers (ECMT 2001). Already, significant variations in the structure of hinterlands are being observed, mainly because of differences in the capacity and efficiency of inland transport infrastructures (Figure 1). For instance the remarkable level of containerized port activity along the Chinese coast is linked with very small hinterlands. This is partly the outcome of China's export-oriented strategy where manufacturing activities are located at sites in close proximity to a port, in addition to the general limited capacity of inland distribution (Wang and Oliver, 2006). On the opposite the hinterland of North American and European ports, particularly large gateways, is extensive as it is shaped along long distance inland corridors.

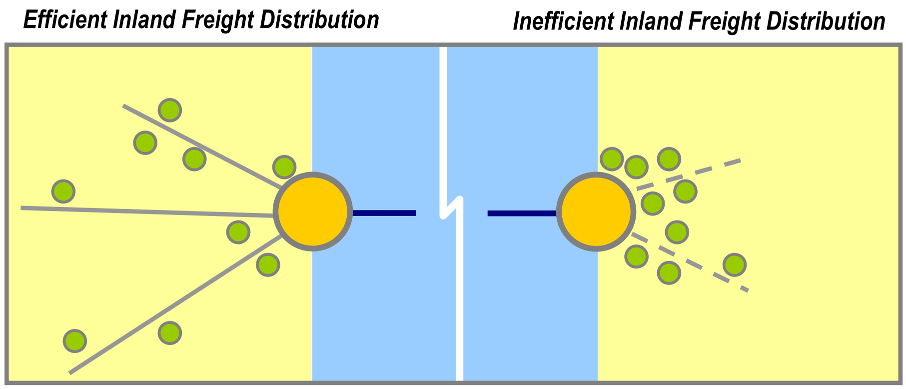

Figure 1 Gateways, Accessibility and Hinterland Effect

The Logistical Hinterland

The logistical hinterland is a matter of flows, how they are organized and how they are taking place considering the existing macro-economic and physical settings. Main issues involve modal choice and the sequencing/synchronization of maritime and inland freight distribution.

The competitiveness of global commodity chains is to a large part determined by the performance of the logistics networks as they link production, distribution and consumption (Hesse and Rodrigue 2004). These logistics networks are highly dynamic and flexible as a result of mass customization in response to product and market segmentation, lean manufacturing practices and associated shifts in costs. Two main developments concern the decoupling of order and delivery and the transition from chains to networks (see Figure 2). Distributions systems have to adapt to the new requirements brought by logistics.

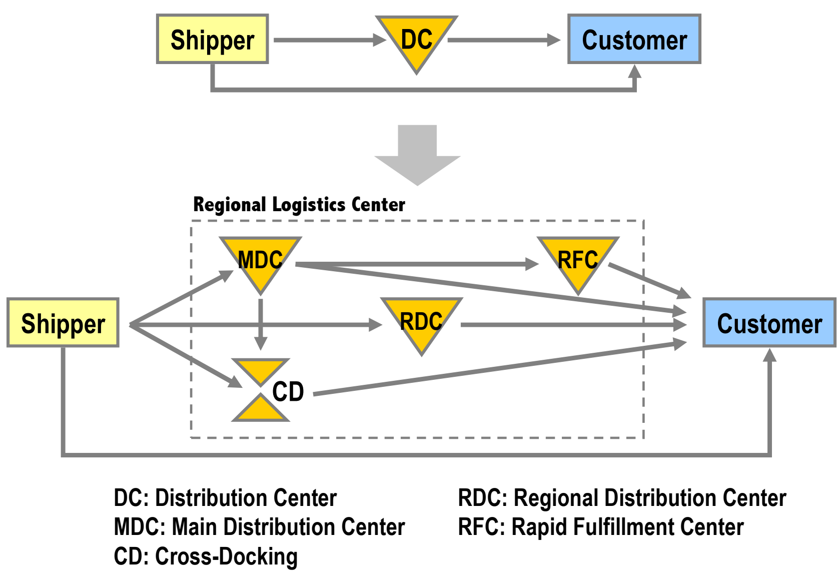

Figure 2 Reconfiguration of logistics networks: from chains to networks

Logistics networks serving global commodity chains are being redesigned to respond to varying customer and product service level requirements. The variables which affect site selection are numerous and quite diverse and can be of a quantitative or qualitative nature, cf. centrality, accessibility, size of the market, track record regarding reputation/experience, land and its attributes, labour costs, quality and productivity, capital (investment climate, bank environment), government policy and planning (subsidies, taxes) and personal factors and amenities. Many products need to be made country or customer specific (labeling, kitting, adding manuals in local languages, etc.) before they can be delivered to the customer. Historically these country or customer specific activities were mostly done in the factory, and this led to high inventory levels. Due to the increasing variety of products and shorter product life cycles, many companies have chosen to move their country and customer specific kitting or assembly operations as close to the customer as possible. This implied that the traditional storage and distribution functions of many distribution centers are supplemented by semi-industrial activities such the customizing and localizing of products, adding components or manuals, product testing, quality control or even final assembly. These activities are referred to as value added logistics services (VAL). While setting up their logistics platforms, logistics service providers favor locations that combine a central location (i.e. proximity to the consumers market) with a gateway function. Seaports and sites along hinterland corridors typically meet these requirements.

Global commodity chains have made many manufacturers contemplate global logistics strategies rather than simply relying on conventional shipping or forwarding activities. Most actors in the transport chain have responded by providing new value-added services in an integrated package, through freight integration along the supply chain. Thus, it has become widely acknowledged that the functional integration of global commodity chains goes beyond the function of manufacturing, but also includes governance and transportation (Gereffi and Korzeniewicz 1994; Gereffi 2001; Chopra and Meindl 2001; Appelbaum 2004). Carriers are becoming increasingly active in the management of hinterland flows in many ports (see e.g. Cariou 2001; Frémont 2006; Heaver 2002), namely through alliances and contracts with rail and road transport companies. For many global maritime operators the control of maritime distribution networks as well as port access (some have become terminal operators as well) has been firmly established. The matter has become to synchronize more efficiently inland distribution capacities with port / maritime distribution capacities while coping with congestion and the costs associated with a high throughput maritime / land interface. A shift to other modes (or other distribution channels) appears to be a suitable alternative to increase port hinterland efficiency.

Elements and attributes of the three types of hinterlands

The concepts, elements and attributes of each of the types of hinterland are summarized in Table 1. The three types are highly interrelated: changes in one of the attributes will have a ripple effect on the macro-economic, physical and logistical hinterlands. For instance, exchange rate mechanisms can result in shifts in the trade balance between nations. Shipping lines might react by adjusting freight rates on both legs of the trade route, while logistics service providers might take decisions ranging from simple routing actions up to the complete reconfiguration of logistics networks. The changing trade balance might also have an impact on the capacity utilization of terminals, corridor infrastructures and physical assets.

Table 1 Types of port hinterlands

	Macro-economic	Physical	Logistical
Concept	Transport demand	Transport supply	Flows
Element	Logistical sites (production and consumption) as part of GCCs	Transport links and terminals	Mode, Timing, punctuality and frequency of services
Attributes	Interest rates, exchange rates, prices, savings, production, debt	Capacity, corridors, terminals, Physical assets (fixed and mobile)	Added value, tons-km, TEU, Value of time, ICT
Challenge	International division of production and consumption	Additional capacity (modal and intermodal)	Supply chain management

An overlay of these three hinterlands reveals a complex spatial structure where logistical sites are often *functionally clustered* (Figure 3). In this particular case, imbalances that are normally occurring in the macro-economic hinterland because of clusters and their functional differences (production and consumption) are exacerbated by macro-economic conditions linked with trade imbalances. The major challenges of the contemporary hinterlands are thus linked with the international division of production and consumption for the macro-economic hinterland. Many supply chains have been extended and spatially dislocated, putting some pressures on the physical hinterland to provide additional modal and intermodal capacity. All these flows have underlined the need for supply chain management in the logistical hinterland.

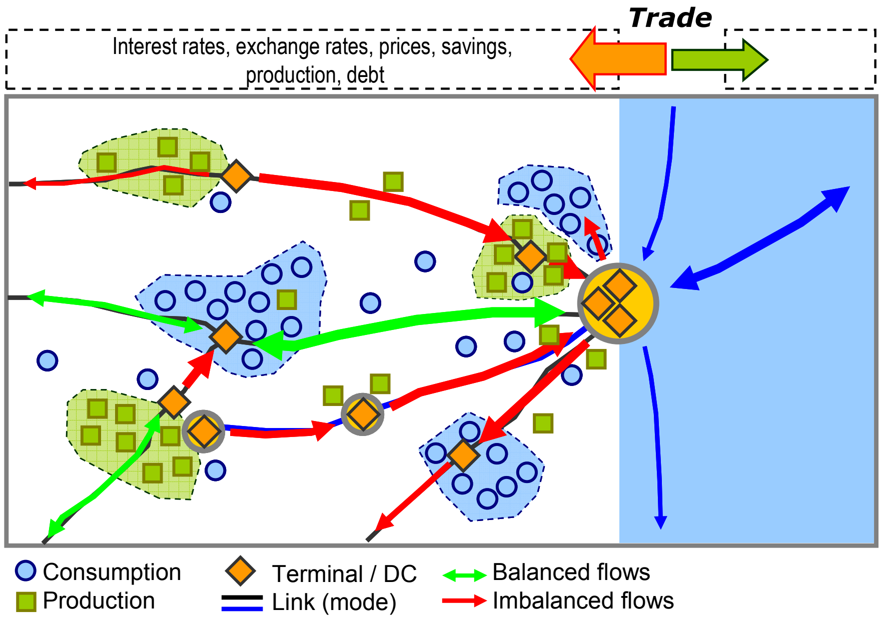

Figure 3 Gateways and the New Port Hinterlands: The "Regionalized Port"

Processes and Tensions within Hinterlands

The dynamics in contemporary port-hinterland relationships is not taking place in a vacuum, but is articulated by the strategic and operational decisions of the stakeholders involved. These stakeholders approach hinterland issues from their respective viewpoints and objectives. Governments typically tend to follow macro-economic objectives and are deploying physical infrastructure as a prime planning tool in this context. Port authorities are a salient example of this process. Logistics providers see physical infrastructure more as a constant, because their range of objectives relate more to the operational level, i.e. managing flows that emanate from macro-economic balances. (Landlord) port authorities develop physical infrastructure (including land) to respond to and in some cases to anticipate the perceived micro-economic strategies of the port users. This section unravels some of the main tensions and issues connected to the types of hinterlands identified in the previous section.

Adaptability/responsiveness of the physical hinterland

The first major tension lies in the limited adaptability/responsiveness of the physical hinterland to changes in transport demand and associated flows. Since ports are the nexus of maritime and inland transport systems, port hinterlands are strongly shaped by port dynamics, particularly over four inter-related layers ranging from a spatial to a functional perspective:

- The **locational layer** relates to the geographical location of a port vis-à-vis the central places in the economic space and forms a basic element for the intrinsic accessibility of a seaport. The concept of centrality and intermediacy fits well within this maritime locational perspective (Fleming and Hayuth 1994). A good intermediate location can imply a location near the main maritime routes such as offshore hubs (e.g. Singapore, Mediterranean load centre ports such as Marsaxlokk and Gioia Tauro) and/or near production and consumption centers such as gateway ports (e.g. Rotterdam, New York, Santos) (World Bank 1992). For gateway ports, a good location is a necessary condition for attaining a high intrinsic accessibility to a vast hinterland, which often builds upon the centrality of the port region. It becomes a sufficient condition when the favorable geographical location is valorized by means of the provision of efficient infrastructures and transport services.

- The **infrastructural layer** involves the provision and exploitation of basic infrastructure for both links and nodes in the transport system. Containerization and intermodal transportation, particularly the transshipment infrastructures they rely on, have contributed to a significant accumulation of infrastructures in a number of ports. This is where the intrinsic accessibility is valorized since a port site has little meaning unless capital investment is provided;
- The **transport layer** involves the operation of transport services on links and corridors between the port and other nodes within the multimodal transport system and the transshipment operations in the nodes of the system. It is a matter of volume and capacity;
- The **logistical layer** involves the organization of transport chains and their integration in logistical chains. This layer is mostly managerial with a decision making process in terms of the allocation of modes and the booking of transshipment facilities.

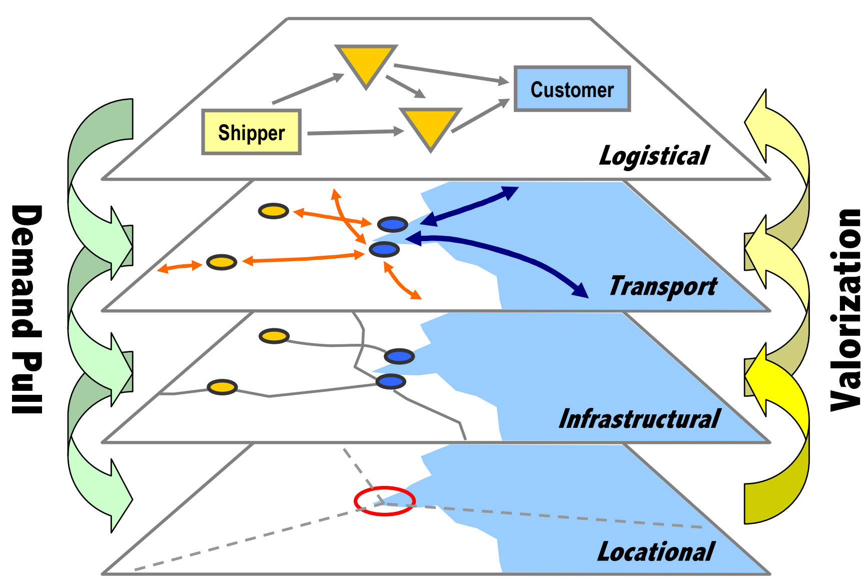

Figure 4 A multi-layer approach to port dynamics

The upward arrow in Figure 4 depicts that each layer valorizes the lower layers. The downward arrow represents the demand pull exerted from the higher levels towards more fundamental layers. In a demand-driven market environment the infrastructural layer serves the transport and logistical layers. The more fundamental the layer is, the lower the adaptability (expressed in time) in facing market changes. For instance, the planning and construction of major port and inland infrastructures (infrastructural level) typically takes many years. The duration of the planning and implementation of shuttle trains on specific railway corridors (transport level) usually varies between a few months up to one year. At the logistical level, freight forwarders and multimodal transport operators (MTOs) are able to respond almost instantly to variations in the market by modifying the commodity chain design, i.e. the routing of the goods through the transport system. As adaptable as they may be, they are still dependant on the existing capacity, but their decisions are often indications of the inefficiencies of the other layers and potential adjustments to be made.

The differences in responsiveness on the proposed levels leads to considerable time lags between proposed structural changes on the logistical and the transport level and the necessary infrastructural adaptations needed to meet these changes adequately. This issue becomes particularly acute when a paradigm shift towards supply chains takes place (see e.g. Robinson 2002). This observation partly explains both the existing undercapacity (congestion) and/or overcapacity situations in hinterland networks and port systems around the world. It is becoming increasingly common to see transport operators taking control of the valorization process by positioning themselves through the logistical, transport, infrastructure and locational layers. Global port holdings, such as PSA, Hutchison Port Holding, APM Terminals and DP World, are a salient example of this strategy as they select relevant locations (valorizing intermediacy and centrality), invest in the development of infrastructures, including hinterland access, have intricate linkages with – maritime – transport companies and are a crucial element of global commodity chains.

The tensions between the infrastructural layer and the transport and logistics layers can be illustrated by analyzing the development of terminal capacity in European ports. Table 2 points to considerable delays in the planned opening of terminals and the actual opening of the container handling facilities. The delays are a mixed result of:

- Time-consuming planning processes involving a large number of stakeholders (market players, community groups, environmental organizations, etc..). Unfortunately, quite a number of stakeholders take seaports for granted and are ignorant on how ports operate or in what ways they contribute to the economy as a whole and our wellbeing in particular (Notteboom and Winkelmans 2003; Dooms and Verbeke, 2006). Ports are considered by many as nodes that are abundantly available and as tools in satisfying the hunger for consumption of globally produced products.

- Complex environmental legislations which do not always guarantee legal certainty to port/terminal developers. The application of the Bird and Habitat Directives of the European Commission serves as a good example (Van Hooydonk 2006). Additionally, nimbyism has become is significant force sidetracking many large infrastructure projects, ports being no exception;
- Legal complications with financial institutions or building contractors, which can result in a construction halt that can last for months;
- The political aspect related to the provision of most basic port infrastructures further complicates and lengthens the decision-making process.

Table 2 Delays in the planning process – some cases from Northwest Europe

	Development of initial plans	Proposed date for start operations (first phase)	Actual or earliest date for start terminal operations
Le Havre 'Port 2000' – France	1994	2003	2006
Antwerp – Deurganck Dock - Belgium	1995	2001	2005
Rotterdam – Euromax Terminal – the Netherlands	2000	2004	2008
Rotterdam – Maasvlakte II – the Netherlands	1991	2002	2013/2014
Deepening Westerscheldt* -the Netherlands/Belgium	1998	2003	2008 ?
Wilhelmshaven/JadeWeserPort - Germany	n.a.	2006	2010
Cuxhaven - Germany	n.a.	2006	Never
Dibden Bay – UK	n.a.	2000	Never
London Gateway – UK	n.a.	2006	2009
Bathside Bay – UK	n.a.	2004	2008
Felixstowe South – UK	n.a.	2006	2007
Hull Quay 2000/2005	n.a.	2000	2007

* Nautical access to the port of Antwerp

Because of the above factors, seaports are on the verge of becoming scarce goods. Port congestion along the US West Coast and in many European ports, such as in the summer of 2004, demonstrated how scarcity of port facilities and intermodal throughput capacity can impact a broader economic system. Scarcity in markets can lead to more efficient use of resources, which is on the long run positive. But accepting a continuous high level of scarcity as the new normal might in the longer term have adverse effects on the whole logistics system and eventually also on global production and consumption networks. Therefore, it is a joint responsibility of port managers, policy makers and other stakeholders to foster seaports and the broader networks of which they are part, to look after their well-being and to safeguard their future development potential.

The limited and slow adaptability of the physical hinterland to changes in transport demand and associated flows is equally felt in inland infrastructures. The implementation of modal shift policies of governments at the local, regional, national and supranational levels are often hampered by the existence of infrastructural bottlenecks and a low interoperability and interconnectivity between modal transport systems (both point and line infrastructures).

As the dynamics in the macro-economic and logistical hinterland is high, long delays in the realization of physical infrastructures could ultimately lead to a misallocation of resources. Hence, the market conditions might change considerably in the time-span between the planning phase and the actual realization of an infrastructure. So, an infrastructure investment which at the time of its conception seemed feasible and market-driven, could end up as an investment in the wrong place, at the wrong time, for the wrong market and using the wrong technology. Such missteps can have serious impacts on markets in terms of rates, user costs and competition levels.

The logistical hinterland and a broader functional focus on ports: Port Regionalization

In addition to ports facing a restructuring of their facilities, mainly due to external pressures, their hinterlands are also subject to considerable changes, particularly in the context of the emergence of global commodity chains. It is now widely acknowledged that port forelands and hinterlands are part of the same continuum and that they are closely bound together in a symbiotic relationship. Robinson stressed the need for an integral approach of the triptych foreland-port-hinterland by stating that the separation of foreland and hinterland relationships of a port into two neatly labeled packages represents a false dichotomy. The flow of commodities from foreland to hinterland might better be viewed as a continuum (Robinson 1970). However, this continuum has become increasingly blurred even if at the start they were never considered to be well defined spaces of interaction. This is more so with forelands with for instance pendulum services where ports have become a sequence of calls that can be modified quite rapidly. Since hinterlands are at priori serviced by inland transport systems, and thus more bound to the friction of distance, they have a more cohesive spatial structure.

Changing port-hinterland relations have a clear impact on port development patterns. The performance of seaports is strongly entwined with the development and performance of associated inland networks that give access to cargo bases in the hinterland. Load centers are only as competitive as the inland and relay links that connect to it. To reflect changes in port-hinterland dynamics, Notteboom and Rodrigue (2005) introduced a regionalization phase in port and port system development by extending existing spatial models of Taaffe et al (1963), Hayuth (1981) and Barke (1986). Regionalization expands the hinterland reach of the port through a number of strategies linking it more closely to inland freight distribution centers. The phase of regionalization brings the perspective of port development to a higher geographical scale, i.e. beyond the port perimeter. 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 or logistics pole (figure 5). The port system consequently adapts to the imperatives of distribution systems as supply chain management strategies finally permeate to less dynamic layers (transport, infrastructure and even locational).

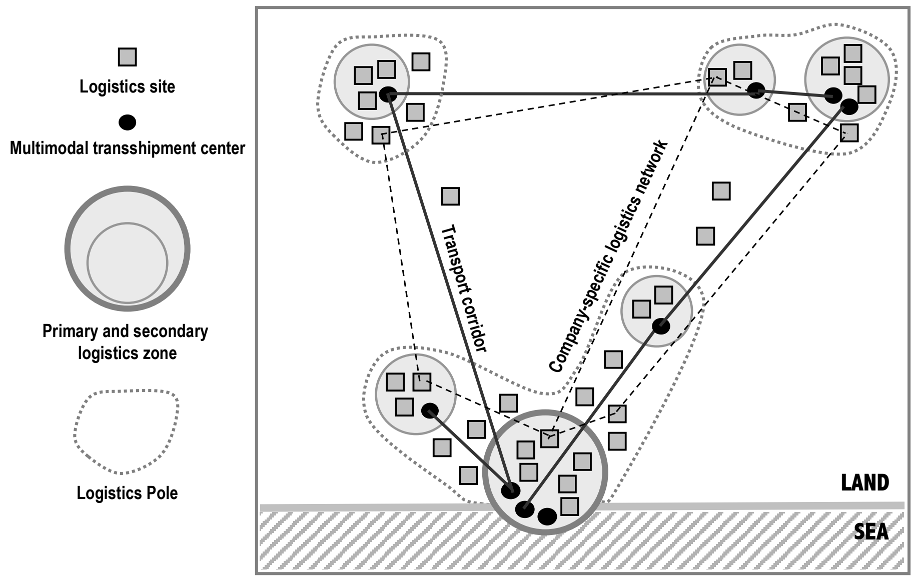

Figure 5 Port Regionalization and the development of logistics poles

An important driver for the creation of regional load centre networks and logistics poles relates to the requirements imposed by global production and consumption networks. No single locality can service efficiently the distribution requirements of a complex web of activities. 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. In the regionalization phase it is increasingly being acknowledged that land transport forms an important target for reducing logistics costs. The responses to these challenges go beyond the traditional perspectives centered on the port itself. Regionalization as such provides a strategic answer to the imperatives of the inland distribution segment of the supply chain in terms of improving its efficiency, enhancing logistics integration and reducing distribution costs.

Another factor having a major impact on port development dynamics are local constraints. Ports, especially large gateways, are facing a wide array of local constraints that impair their growth and efficiency. The lack of available land for expansion is among one of the most acute problems, an issue exacerbated by the deepwater requirements for handling larger ships. Increased port traffic may also lead to diseconomies as local road and rail systems are heavily burdened. Environmental constraints and local opposition to port development are also of significance. Port regionalization thus enables to partially circumscribe local constraints by externalizing them.

Many ports around the world are reaching a stage of regionalization in which market forces gradually shape regional load centre networks with varying degrees of formal linkages between the nodes of the observed networks.

One of the problems port authorities are facing relates to the infrastructural part of the port regionalization phase. Port authorities try to enhance the intermodal capacity of the port with a heavy reliance on the performance of infrastructures and transport services. However, the maneuverability offered to port authorities seems to be restricted. First of all, the hinterland infrastructure level is dominated by public authorities who have to take into account social and political aspects and financial limitations in the decision making process. Secondly, the logistical hinterland is dominated by market players, which under normal circumstances do not have to give account to the port authority.

Landlord port authorities are very dependent on the government for guaranteeing the maritime access and land access to the port. The dispersion of responsibilities among several government departments and ministries makes it very difficult to develop an integrated intermodal transport policy and obliges the port authorities to design their lobbying strategies accordingly, involving a large number of departments of the local, regional, national and supranational government agencies. The situation becomes even more complicated when considering the involvement of local and regional governments in the development of logistics zones and inland terminals. In summary, the powers of port authorities in developing hinterland infrastructure are limited. In most cases, the role of the port authority is restricted to initiator and facilitator of the necessary infrastructures that should guarantee a maximum of land accessibility in relation to the logistics pole.

The logistical hinterland facing the macro-economic reality: the repositioning of containers

Port hinterlands around the world have been shaped by powerful macro-economic forces. With global trade imbalances, the logistical hinterland has been facing acute pressures to cope with disequilibrium in transport flows. For example, the US – Asia imbalance in container flows is particularly revealing; containerized exports have simply not kept pace with imports. In recent years containerized freight flows between Asia and Europe have become three times as voluminous as containerized flows between Europe and the United States. For the United States, this implied an imbalance of about 11.1 million TEU with Asia and Europe in 2005, which has grown substantially in the last 10 years. The outcome are rate imbalances across the Pacific as it costs more per TEU for westbound flows than for eastbound flows, making freight planning a complex task for container shipping companies. About

70% of the slots of containerships leaving the United States were empty in 2005 (Boile 2006). Thus, production and trade imbalances in the global economy are clearly reflected in physical flows and transport rates. The impacts on the geography of maritime transportation are major, requiring a re-assessment of their strategies in terms of port calls and hinterland transportation.

As such, the repositioning of empty containers is one of the most complex problem concerning global freight distribution, an issue being underlined by the fact that the equivalent of about 2.5 million TEU of containers (USA) are being stored empty, waiting to be used. The major causes of this problem include:

- **Trade imbalances**. They are probably the most important source in the accumulation of empty containers in the global economy. A country / region that imports more than it exports will face the systematic accumulation of empty containers, while a country / region that imports more than it exports will face a shortage of containers. If this situation endures, a repositioning of large amounts of containers will be required between the two trade partners, involving higher transportation costs and tying up existing distribution capacities.
- **Repositioning costs**. They include a combination of inland transport and international transport costs. If they are low enough, a trade imbalance could endure without much of an impact as containers get repositioned. Repositioning costs can also get lower if imbalances are acute as carriers (and possibly terminal operators) will offer discounts for flows in the opposite direction of dominant flows.
- **Manufacturing and leasing costs**. If the costs of manufacturing new containers or leasing existing units are cheaper than repositioning them, which is particularly possible over long distances, then an accumulation can happen. Inversely, higher manufacturing or leasing costs may favor the repositioning of empty containers.
- **Usage preferences**. A large number of shipping lines use containers as a way of branding the company name. This observation combined with the reluctance of shipping lines to share market information on container positions and quantities, makes it very difficult to establish container pools or to widely introduce the grey box concept.

The repositioning of empty containers is becoming a logistical challenge, particularly in North America where imbalances are taking dramatic proportions. At start, the causes are linked with the macro-economic hinterland where acute trade imbalances are forcing an accumulation of empty containers in the United States at the rate of 150,000 TEU per week. The problem is also exacerbated in recent years by the comparative costs of long distance repositioning versus container manufacturing costs. The manufacturing alternative has often been made more attractive than repositioning, particularly in the case of China. Container repositioning is itself a multi-scale problem. The lower the repositioning scale the more sustainable container repositioning is. Three scales can be considered:

- **Local repositioning** occurs regularly as containers are reshuffled between locations where they are emptied to those where they are filled. It is of short duration with limited use of storages facilities since containers are simply in queue at the consignee or the consigner, especially if they are managed by the same freight distributor. Massive local repositioning is very common in gateway regions with multiple load centers. For instance, the container exchanges between Antwerp and Rotterdam, both located in the Rhine-Scheldt Delta and only 100km apart, amounted to some 1 million TEU in 2004. About 30% of these flows involved the repositioning of empties, as Rotterdam is a major import port and Antwerp is more export-driven.
- **Regional repositioning** involves industrial and consumption regions where there are imbalances, often the outcome of economic specialization. For instance, a metropolitan area having a marked service function may be a net importer of containers while nearby area may have a specialization in manufacturing, implying a status of net exporter. The matter then becomes the repositioning of the surplus containers from one part of the region to the other. This may involve a longer time period, due to the scale and scope of repositioning and often requires the usage of specialized short duration storage facilities. This scale offers opportunities for freight forwarders to establish strategies such as dedicated empty container flows and storage depots at suitable locations. Sometimes very simple co-ordination actions can substantially improve inland freight distribution, with benefits for all parties involved. In the Netherlands, for instance, the Rotterdam port authority, regional authorities and market parties worked out a better streamlining of container flows by barge. Import-dominated locations in the hinterland were linked to export-dominated locations by barge, creating a loop system resulting in shorter distances and considerable savings in costs due to the reduction of empty hauls (figure 6).

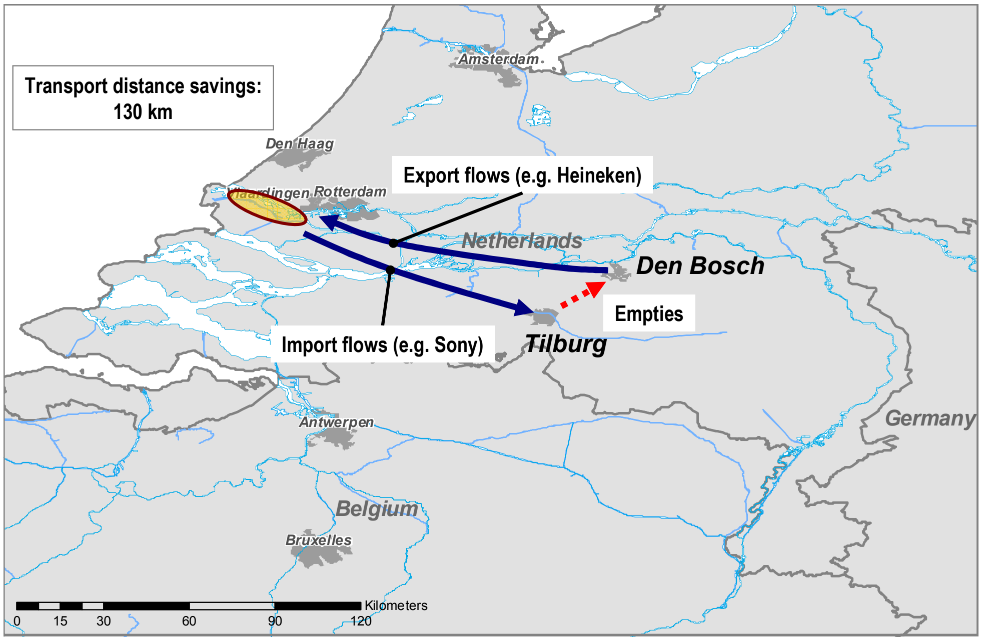

Figure 6 Example of streamlining inland box logistics

- **Global repositioning** is the outcome of systematic macro-economic imbalances between trade partners, as exemplified by China and the United States. Such a repositioning scale is obviously the most costly and time consuming as it ties up substantial storage capacity, in proportion to the trade imbalance. Significant inland freight distribution capacities are also wasted since long distance trade, especially concerning manufactured products, tend to involve a wide arrays of destinations in a national economy. This is paradoxical as maritime container shipping capacity will be readily available for global repositioning, but high inland freight transport costs could limit the amount of empty containers reaching the vicinity of a container port. It may even force an over supply of containers as the trade partner having a net deficit of containers (exporter) may find more convenient to manufacture new containers than to reposition existing units, which disrupts the container leasing market. In the United States particularly, the macro-economic imbalances forbid any short term solutions to this problem. In fact, those imbalances are exacerbating repositioning costs.

Conclusions

This chapter underlined the need to reassess port-hinterland relationships. The conventional spatial representation of hinterlands is being challenged by new functional realities notably with the emergence of global commodity chains. Given this paradigm shift, port-hinterlands can be represented within three dimensions: macro-economic, physical and logistical. This imposes a broader perspective regarding supply, demand and their related flows. Stakeholders have to act accordingly.

The conventional representation of a hinterland, often linking the clients of the port with a distance decay perspective, is being replaced with one where spatial discontinuity and clustering prevails, but which is more functionally integrated. As such, ports have become regionalized entities, where maritime transportation is linked more closely with inland distribution. It was demonstrated that this paradigm shift has given rise to mounting tensions between the macro-economic, physical and logistical layers, inviting port authorities, market players and other port community stakeholders to develop an integrated approach towards critical issues such as infrastructure development, port regionalization and container repositioning.

The current context also leaves many questions and issues unanswered. Since port regionalization involves a more functionally integrated hinterland, substantial commitments in terms of access need to be secured, such as investments in inland distribution (load centers) or agreements with inland freight forwarders (rail, barge and truck operators). The outcome is commonly the setting of high capacity corridors. Thus, regionalization can be linked with less hinterland competition and a more secure customer base for the port. While the development of global commodity chains, global maritime shipping companies and global port operators are associated with a very flexible freight distribution environment, regionalization appears to be a strategy where ports are coping through spatial fixity. The role of port authorities remains to be seen in such a setting which goes beyond what they would conventionally consider as their jurisdiction, both from a geographical and functional perspective. At an even wider scale, to what extent global maritime transport companies and port operators will be able to control segments of the commodity chains, particularly over port hinterlands?

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