



Maritime Policy & Management

The flagship journal of international shipping and port research

ISSN: 0308-8839 (Print) 1464-5254 (Online) Journal homepage: www.tandfonline.com/journals/tmpm20

Port regionalization: towards a new phase in port development

Theo E. Notteboom & Jean-Paul Rodrigue

To cite this article: Theo E. Notteboom & Jean-Paul Rodrigue (2005) Port regionalization: towards a new phase in port development, *Maritime Policy & Management*, 32:3, 297-313, DOI: [10.1080/03088830500139885](https://doi.org/10.1080/03088830500139885)

To link to this article: <https://doi.org/10.1080/03088830500139885>



Published online: 21 Feb 2007.



Submit your article to this journal [↗](#)



Article views: 11043



View related articles [↗](#)



Citing articles: 107 View citing articles [↗](#)

Port regionalization: towards a new phase in port development

THEO E. NOTTEBOOM*† and JEAN-PAUL RODRIGUE‡

†Institute of Transport & Maritime Management Antwerp (ITMMA),
University of Antwerp, Keizerstraat 64, 2000 Antwerp, Belgium

‡Department of Economics & Geography, Hofstra University,
Hempstead, New York 11549, USA

Logistics integration and network orientation in the port and maritime industry have redefined the functional role of ports in value chains and have generated new patterns of freight distribution and new approaches to port hierarchy. Existing models on the spatial and functional evolution of ports and port systems only partially fit into the new freight distribution paradigm. This paper aims to add to existing literature by introducing a port regionalization phase in port and port system development. It is demonstrated that the regionalization phase and associated hinterland concepts demand new approaches to port governance and a functional focus that goes beyond the traditional port perimeter.

1. Introduction

Inland distribution is becoming a very important dimension of the globalization/maritime transportation/freight distribution paradigm. Customers are calculating the total logistic cost of transporting containerized goods, implying that current efficiency improvements in logistics, namely for container transportation, are derived for a large part from inland distribution. The development of global supply chains increased the pressure on the maritime haul, on port operations and, last but not least on inland freight distribution. Inland accessibility as such has become a cornerstone in port competitiveness [1].

This contribution provides a conceptual approach to port–hinterland relationships in a changing market environment. The paper aims to discuss and extend existing models on the spatial and functional development of individual port terminals and larger port terminal systems. A ‘regionalization’ phase in port and port system development is introduced and further substantiated. The paper furthermore elaborates on governance issues linked to the regionalization phase and the development of sustainable hinterland concepts that add to a port’s competitive position.

2. Port terminals and inland freight distribution

2.1. Port development

One of the most widely acknowledged conceptual perspectives on port development is the Anyport model developed by Bird [2]. Starting from the initial port site with

*To whom correspondence should to be addressed. e-mail: theo.notteboom@ua.ac.be

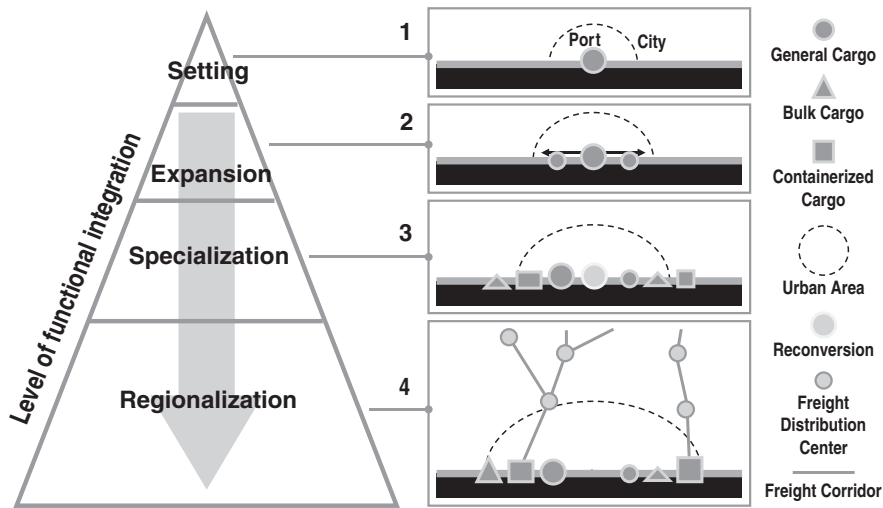


Figure 1. The evolution of a port.

small lateral quays adjacent to the town centre, port expansion is the product of evolving maritime technologies and improvements in cargo handling. Three major steps can be identified in the port development process identified by Anyport (figure 1): setting, expansion and specialization. The three phases depict well port development processes, especially in large traditional ports. The model remains a valid explanation of port development. However, the model has some weaknesses in view of explaining contemporary port development.

First of all, it does not explain the recent rise of seaport terminals that primarily act as transshipment hubs in extensive maritime hub-and-spoke and collection and distribution networks. Increased cargo availability has triggered changes in vessel size, liner service schedules and in the structure of liner shipping. Carriers and alliances have reshaped their liner shipping networks through the introduction of new types of end-to-end services, round-the-world services and pendulum services, especially on the main east–west trade lanes. As a result, a new breed of terminals has emerged along the east–west shipping lanes at unlikely places far away from the immediate hinterland that historically guided port selection. These sites have been selected to serve continents and for transshipping at the crossing points of trade lanes. They rely heavily, sometimes completely, on traffic flows that are distantly generated by the interaction of widely separated places and stimulated by the port's en route location or intermediacy. The model of Bird does not provide a base to explain the emergence of hub terminals in 'offshore' or island locations with limited or no local hinterlands.

Second, the Bird model does not include the inland dimension as a driving factor in port development dynamics. This paper proposes a new phase of port development, with stronger links with their hinterland, but also of intermediary/transshipment ports, with stronger links with their foreland. Although these two functions are not mutually exclusive, it appears that due to geographical considerations, such as proximity and intermediacy to production and consumption, ports are specializing in one function. Regionalization expands the hinterland reach of the port through a number of market strategies and policies linking it more closely to inland freight

distribution centers (figure 1). The phase of regionalization brings the perspective of port development to a higher geographical scale, i.e. beyond the port perimeter. This point will be substantiated further in this paper.

2.2. Port terminal systems and port regionalization

The phase of port regionalization not only expands the Anyport model of Bird. It also extends the existing literature on the spatial development of seaport systems [3] in relation to maritime and hinterland networks. The model of Taaffe *et al.* [4] suggests an increasing level of port concentration as certain hinterland routes develop to a greater extent than others in association with the increased importance of particular urban centers. The geographical system would evolve from an initial pattern of scattered, poorly connected ports along the coastline to a main network consisting of corridors between gateway ports and major hinterland centers. The models of Barke [5] and Hayuth [6] are quite similar, though they have introduced a process of port system deconcentration. Meanwhile, some authors have introduced modifications to the above models in order to reflect the uniqueness of some port regions (see, e.g., [7]). Empirical research has demonstrated that some port systems and port ranges are getting more spatially concentrated while others are evolving to a more evenly distributed system (see, e.g., [8–12]).

Similarly to the Bird model, the models on port system development up to now (a) did not explain the recent rise of new hub terminals and (b) did not incorporate inland freight distribution centers and terminals as active nodes in shaping load centre development. This paper proposes a revised model on port system development founded on two extensions.

The first extension encompasses the explicit integration of ‘offshore’ hubs on island location or locations without a significant local hinterland. Examples are plentiful: Freeport (Bahamas), Salalah (Oman), Tanjung Pelepas (Malaysia) and Gioia Tauro, Algeciras, Malta, Taranto and Cagliari in the Mediterranean to name but a few. There are many factors behind the emergence of offshore hubs. They tend to have greater depth since they were built recently in view to accommodate modern containership drafts, placing them at a technical advantage. In addition, their sites often have land for future expansion, labor costs tend to be lower (no unions), limited inland investments are required since most of the cargo is transhipped, and terminals are owned, in whole or in part, by carriers that are efficiently using these facilities [13]. In an initial phase, these terminals solely focus on accommodating transshipment flows. As the transshipment business remains a highly volatile business, offshore hubs might sooner or later show ambition to develop services that add value to the cargo instead of simply moving boxes between vessels. These ambitions could trigger the creation of logistics zones within or in the vicinity of the port area, in many cases connected to the status of Free Trade Zone. The insertion of offshore hubs does not make the mainland load centers redundant. The terminals in the port system all have their role to play within the rich blend of liner service networks. In referring to the Asian hub/feeder restructuring, Robinson [14] argues that a system of hub ports as main articulation points between mainline and feeder nets is being replaced by a hierarchical set of networks reflecting differing cost/efficiency levels in the market. High-order service networks will have fewer ports of call and bigger vessels than lower order networks. Increasing volumes as such can lead to an increasing segmentation in liner service networks and a hierarchy in hubs (both ‘offshore’

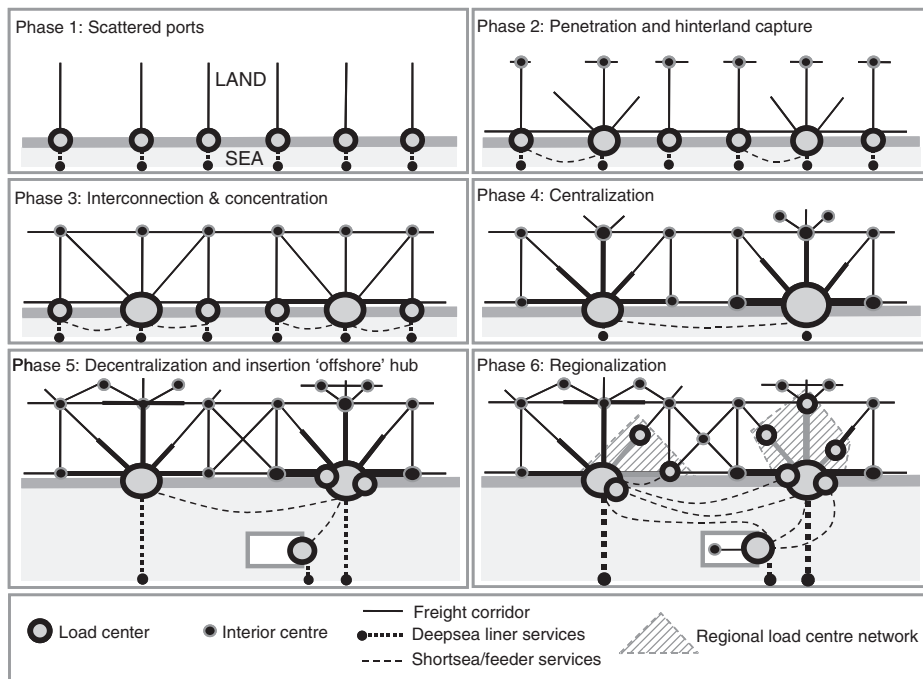


Figure 2. The spatial development of a port system.

and 'mainland'). Not all port systems feature 'offshore' hub development. In the US, many impediments in American shipping regulations gravitating around the Jones Act have favored a process of port system development with limited (feeder) services between US ports and the absence of US-based transshipment hubs (Freeport in the Caribbean to a limited extent takes up this role). Instead, the US port systems at the east and west coast are characterized by a strong inland orientation supported by extensive double-stack rail services, local and long-distance trucking and limited barging.

The second extension relates to the incorporation of inland freight distribution centers and terminals as active nodes in shaping load center development. The port regionalization phase adds to the models of Hayuth and Barke, and is characterized by strong functional interdependency and even joint development of a specific load center and (selected) multimodal logistics platforms in its hinterland, ultimately leading to the formation of a 'regional load center network' (phase 6 in figure 2). Many factors favor the emergence of this phase, namely:

- *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 problem, an issue exacerbated by the deep-water 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.

- *Global changes.* Global production and consumption have substantially changed distribution with the emergence of regional production systems as well as large consumption markets. No single locality can service efficiently the distribution requirements of such a complex web of activities. For instance, globally integrated Free Trade Zones (FTZs) have emerged near many load centers, but seeing a FTZ as a functionally integrated entity may be misleading as each activity has its own supply chain. Port regionalization thus permits the development of a distribution network that corresponds more closely to fragmented production and consumption systems.

In this new development phase the port system consequently adapts to the imperatives of distribution systems and global production networks while mitigating local constraints.

3. Substantiating the regionalization phase

3.1. *Port regionalization and logistics integration*

The transition towards the port regionalization phase is a gradual and market-driven process, imposed on ports, that mirrors the increased focus of market players on logistics integration. The tendency towards logistics integration in the port and maritime industry and the impact of changes in logistics on the functional role of ports in value chains are well documented in recent literature. Robinson [15] places the role of seaports within a new paradigm of ports as elements in value-driven chain systems. Notteboom and Winkelmanns [16] and Heaver *et al.* [17] primarily discuss logistics integration and the changing role of port authorities in the new logistic-restructured environment, while Martin and Thomas [18] address structural changes in the container terminal community.

The level of functional integration of land distribution is increasing rapidly. Many distribution functions that used to be separated are now controlled by a single entity. In a conventional situation, the majority of distribution activities were performed by different entities ranging from maritime shipping lines, shipping and custom agents, freight forwarders and rail and trucking companies. Regulations were often preventing multimodal ownership, leaving the system fragmented. The shift from one segment to the other was characterized by additional costs and delays either administrative or physical (namely intermodal). With an increasing level of functional integration many intermediate steps in the transport chain have been removed. Mergers and acquisitions have permitted the emergence of large logistics operators that control many segments of the supply chain (mega-carriers). Technology has played a particular role in this process namely in terms of IT (information technology) (control of the process) and intermodal integration (control of the flows).

In the regionalization phase it is increasingly being acknowledged that land transport forms an important target for reducing logistics costs. 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. Globally, inland access costs account for 18% of the total logistics costs, and could be reduced by one third with appropriate regionalization strategies [19]. On the crucial China–US trade link, bringing a container from inland China to a gateway port, such as Shanghai, alone accounts for more than

60% of the total transport costs [20]. Inland container logistics thus constitutes an important field of action.

The liner shipping industry is a prime example of an increased focus on logistics integration (see [21–27]). More economical ships and alliance co-operation have lowered ship system costs, but at the same time intermodal costs share an increasing part of the total cost. The portion of inland costs in the total costs of container shipping would range from 40% to 80%. Many shipping lines therefore consider inland logistics as the most vital area still left to cut costs. Lines that are successful in achieving cost gains from smarter management of inland container logistics can secure an important cost savings advantage and deliver extra value to the customers. Moreover, because this is difficult to achieve, it is likely to be a sustainable way of differentiating business from rivals.

Logistics integration thus requires responses and the formulation of strategies concerning inland freight circulation. The responses to these challenges go beyond the traditional perspectives centered on the port itself. Port regionalization thus represents the next stage in port development (imposed on ports by market dynamics), where efficiency is derived with higher levels of integration with inland freight distribution systems. Containerization, intermodality and ICT (information and communication technology) enhance the spatial and functional reconfiguration among logistics nodes. In discussing the functional development of the port of Rotterdam in the Netherlands, Van Klink used the term ‘borderless mainport’ to describe the functional development from port city to port network [28, 29]. Many ports are reaching a stage of regionalization in which market forces and political influences gradually shape regional load center networks with varying degrees of formal linkages between the nodes of the observed networks.

3.2. Corridors and inland terminals as cornerstones in port regionalization

The corridor is the main paradigm of inland accessibility as it is through major axes that port terminals gain access to inland distribution systems [31]. Since loading/discharging operations form fundamental components of intermodal transportation, regionalization relies in the improvement of terminals activities along and at either side of the corridors. This involves a higher level of integration with intermodal transport systems, namely with on-dock rail transshipment facilities and the use of fluvial barges. The new function of port terminals requires the elaboration of inland terminals to accommodate new port–inland linkages.

The immense pressure on the collection and distribution networks caused by changes in the hierarchy of port systems has always demanded and promoted the development of inland terminals. These terminals are established as part of a new concept in freight distribution and the changing role of the ocean carrier and other market players in the entire transport journey. The development of rail hubs and barge terminal networks in the hinterland is aimed at contributing to a modal shift from road transport to rail and barge, and as such enhances the regionalization phase in port and port system dynamics. Inland terminals might transfer a part of the collection and distribution function inland away from the ports, thus preventing a further overcrowding of limited seaport areas.

The regionalization phase and associated integrated hinterland networks promote the formation of discontinuous hinterlands. The direct hinterland of a seaport is rather continuous. The more distant hinterland however features a discontinuous nature (i.e. the density of hinterland destinations/origins of port cargo is lower), as a

result of the structuring effect of transport corridors and logistics nodes. The service areas of a container load center by rail and barge takes the form of sets of overlapping service areas of individual inland terminals. The size of each of the inland service areas depends on the service frequency and the tariffs of intermodal shuttle services by rail and or barge, the extent to which the inland terminal acts as a gateway and the efficiency and price of pre- and end-haul by truck. By developing strong functional links with particular inland terminals a port might intrude in the natural hinterland of competing ports. 'Islands' in the distant hinterland are created in which the load center achieves a comparative cost and service advantage vis-à-vis rival seaports (see figure 3) [32]. This observation increases competition among ports of the same port system.

Inland terminals fulfill multiple functions in the emerging regional load center networks.

First of all, inland terminals function as cargo bundling points in extensive transportation networks. Large load centers typically generate enough critical mass to install a number of direct intermodal shuttles to a limited number of destinations in the hinterland. Where there are insufficient volumes for full trains or barges, bundling concepts provide the answer and that is where inland hubs come in the picture.

Inland terminals can help load center ports to preserve their attractiveness and to fully exploit potential economies of scale. The corridors towards the inland terminal

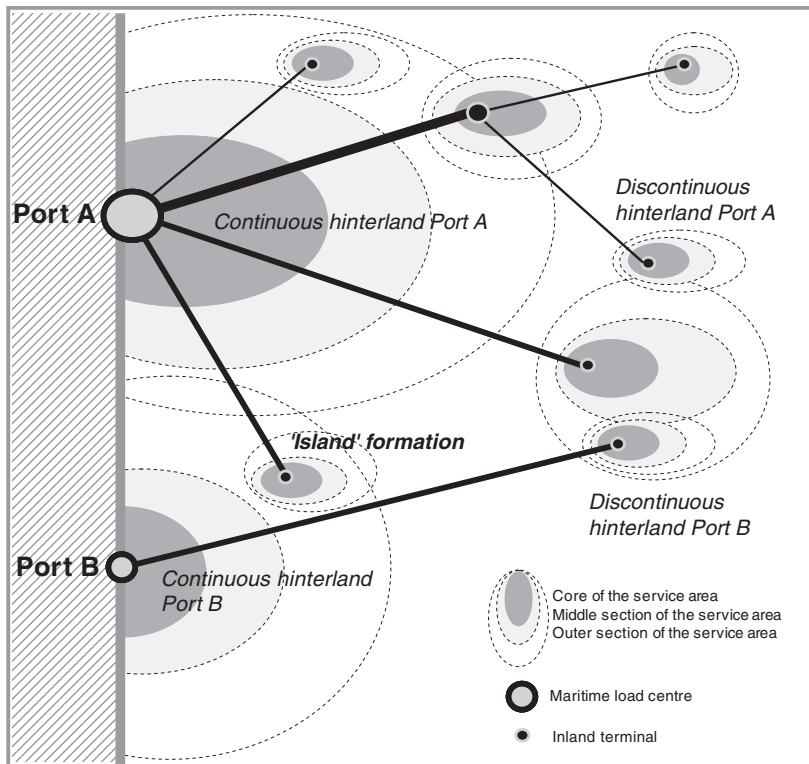


Figure 3. Intruding the natural hinterland of rival ports through the creation of corridor-based 'islands' in the distant hinterland.

network create the necessary margin for further growth of seaborne container traffic. Inland terminals, as such, acquire an important satellite function with respect to seaports, as they help to relieve seaport areas from potential congestion. However, extreme forms of cargo bundling in seaports and inland centers could decrease the efficiency of transport systems because shipments would significantly be delayed, although have low transport costs. Hence, the current development and expansion of intermodal transportation relies on the synchronization of different geographical scales. But when the synchronization level increases, the sea-land network as a whole becomes unstable [33].

Second, most inland terminals have become cargo consolidation and deconsolidation centers. Shippers use inland terminals in order to synchronize import cargoes with the production lines. Inland terminals have also acquired an important position with respect to export cargo, as many inland terminals are revealed to be excellent locations for the empty depot function. The function of an inland terminal as empty depot can also ease one of the most difficult and wasteful problems of container transportation, that is, the empty leg. Inland terminals as such have become crucial in optimizing box logistics.

Finally, a large number of inland ports have become broader logistics zones, as they not only have assumed a significant number of traditional port functions and services, but also have attracted many related logistical services. These include, for instance, low-end and high-end value-adding logistical services, distribution centers, shipping agents, trucking companies, forwarders, container-repair facilities and packing firms. Lower land costs and land availability may thus be suitable for some logistics services that would otherwise be unable to afford high-cost locations close to main ports.

In the United States, two examples are particularly illustrative of the emergence of inland terminals and their corridors. The first, regional in scale, is the Virginia Inland Port, a facility located 350 kilometers from the main port and linked with a daily rail service. The goal of this port regionalization project is clearly to expand the hinterland by creating an island trying to capture freight flows from trucking as well as from other ports (particularly Baltimore). The second, local in scale, is the Alameda rail corridor where the ports of Los Angeles and Long Beach developed an attempt to alleviate truck traffic by creating a peripheral satellite terminal about 30 kilometers away. By diverting local truck flows away from the main port facilities, economic and environmental benefits are expected.

3.3. The role of freight distribution centers in regionalization

The development of inland terminals is not sufficient by itself to ensure an efficient port regionalization and inland distribution. Infrastructures servicing freight are required at a location of convergence of inland freight, a function assumed by distribution centers where vast quantities of freight are processed.

Freight distribution centers come to the fore as turntables for low-end and high-end value-adding logistics services and develop a strong orientation on short transit times. Logistics platforms incorporate additional functions such as back-office activities. While setting up their logistics platforms, logistics service providers favor locations that combine a central location (i.e. proximity to the consumers' market) with an intermodal gateway function. Seaports and sites along hinterland corridors typically meet these requirements.

Corridor development enhances the polarization and zoning of logistics sites in transport nodes (seaports and inland ports) and along the axes between seaports and inland ports. Logistics poles exert a location pull on logistics sites by combining a strong intermodal orientation with cluster advantages. This tendency is depicted in figure 4. Conventional location theories support the tendency towards polarization (e.g. the growth pole theory). Logistics companies frequently set up close to one another, since they are attracted by the same location factors, such as the proximity of markets and the availability of intermodal transport and support facilities. The geographical concentration of logistics companies, in turn, creates synergies and economies of scale that make the chosen location even more attractive and further encourages concentration of distribution companies in a particular area. Geographical differences in labor costs, land costs, availability of land, level of congestion, the location vis-à-vis the service markets, labor mentality and productivity and government policy are among the many factors determining observed (de)polarization of logistics sites, see, e.g., [34–38].

Phase 4 in the model introduces the regionalization of port activity. The concept of a ‘logistics pole’ is the logistical equivalent of the concept ‘regional load center

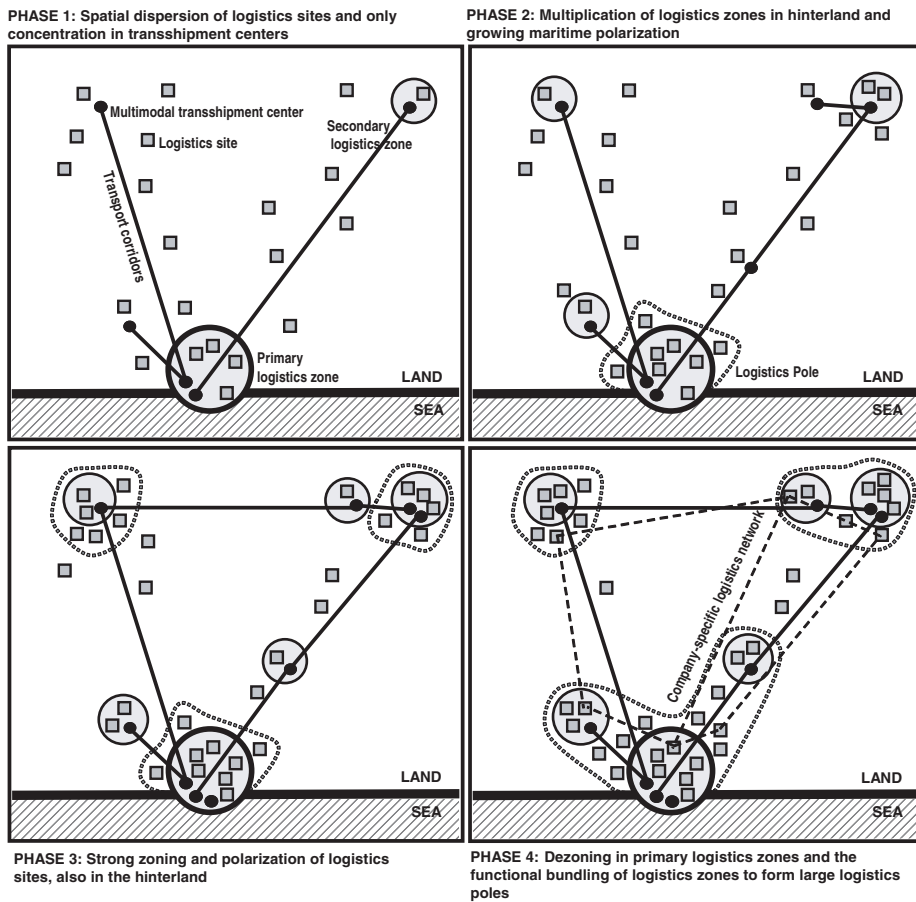


Figure 4. A spatial model on logistics sites in the hinterland.

network', being that the latter is defined out of a cargo-flow perspective. A logistics pole can only perform well if an efficient regional load center network is in place to guarantee the cargo linkages in and between logistics zones. In the regionalization phase, the interaction between seaports and inland ports and terminals leads to the development of a large logistics pole consisting of several logistics zones. A virtuous cycle is created, producing scale effects, which ensures high productivity from inter-modal synchronization and the compatibility of goods flows with the logistics of shippers. Seaports are the central nodes driving the dynamics in a large logistics pole. But at the same time, seaports rely heavily on inland ports to preserve their attractiveness.

The process described in figure 4 is highly dynamic. An unbalanced development of inland terminals and corridors might simply move bottlenecks from the load center ports to corridors and inland centers. Given this constraint, companies might consider relocating their logistics sites from the saturated areas to nearby locations or even to locations far from the saturated logistics zone. Spatial relocation patterns might change the relative importance and internal spatial configuration of logistics poles.

The trend towards spatial (de)concentration of logistics sites in many cases occurs spontaneously as the result of a slow, market-driven process. But also national, regional and/or local authorities try to direct this process by means of offering financial incentives or by reserving land for future logistics development [39].

4. Governance issues in the regionalization phase

The port itself is not the chief motivator for and instigator of regionalization. Regionalization results from logistics decisions and subsequent actions of shippers and third-party logistics providers. This observation does, however, not imply ports should act as passive players in the regionalization process. The regionalization phase demands appropriate port governance structures to be in place to face the challenges posed by changing port–hinterland relationships. The governance framework should recognize the rights and potential contribution of the various stakeholders in developing new approaches to port–hinterland issues [40]. This section explores some of the main governance issues port authorities and other stakeholders face in the transition towards a regionalization phase.

4.1. Changing the geographical scope of port governance

In the regionalization phase logistics chains have become the relevant scope of port competition. The success of a port will depend on its capability to fit into the networks that shape supply chains. In other words, the port community has to fully benefit from synergies with other transport nodes and other players within the networks of which they are part. This supports the development of broader regional load center networks, serving large logistics poles. The availability of powerful information channels and systems and the capability of having a knowledge transfer among companies are two of the main determinants for the success of logistics poles and associated regional load center networks.

4.2. The role of port authorities

The public sector has redefined its role in the port and shipping industries through privatization and corporatization schemes (see [41, 42]). With the reassessment

of the role of the government much attention is now paid to governance issues in ports and shipping (see [43, 44]). The role of seaport authorities in governing the regionalization phase will slightly differ according to the type of port exploitation [45].

In the tradition of the landlord port, it is tempting to presume that port authorities should act as 'facilitators' in transport chains. Port authorities should constantly rethink and broaden their role as facilitator. Port authorities could work together with various stakeholders (carriers, shippers, transport operators, labor and government bodies) to identify and address issues affecting logistics performance. Port authorities' interest concerns generally the overall efficiency and the growth of trade rather than the performance of particular sectors. The port authority can be a catalyst even when its direct impact on cargo flows is limited.

In the regionalization phase port authorities can play an important role in shaping regional load center networks and logistics poles. Port authorities should promote an efficient intermodal system in order to secure cargo under conditions of high competition. This includes, for example, the involvement in the introduction of new shuttle train services to the hinterland, together with the respective national railway companies, rail operators, terminal operators, shipping companies and/or large shippers. The development of strategic relationships with other transport nodes is another important role for port authorities. It is often assumed that only private market players should be involved in setting up these types of cooperative networks. Major fields of possible cooperation among (public) authorities of ports and inland centers are traffic management, site issuing, hinterland connections and services, environmental protection, marketing, and research and development (R&D).

The implementation of regional load center networking strategies can vary from informal programs of coordination to advanced forms of strategic partnerships through strategic alliances, (cross-)participation, joint ventures or even mergers and acquisitions. The optimal form for shaping the coordination and cooperation within a port network will largely depend upon the institutional and legal status of the partners involved [46]. Sometimes very simple coordination actions can substantially improve inland freight distribution, with benefits for all parties involved. For example, regional authorities and market parties can jointly take action to better streamline container flows and reduce empty hauls. One solution could be to develop intermodal services between import-dominated locations in the hinterland and export-dominated locations as to create a loop system resulting in shorter distances and considerable savings in costs due to the reduction of empty hauls.

4.3. Concerns in the regionalization phase

4.3.1. Over-optimism The regionalization phase often triggers a too optimistic attitude among planners in terms of the future development potential of specific port and inland sites. A lack of clear insights into market dynamics could lead to wishful thinking by local governments and an overoptimistic perspective on the logistics development potential of the regions concerned. This can lead to overcapacity situations, redundancies and cutthroat competition between incumbent sites (ports or logistics zones in the hinterland) and newcomers in the market.

4.3.2. Slow start Another point of concern is the time needed to develop a regional load center network. Even in case the benefits of port regionalization are quite

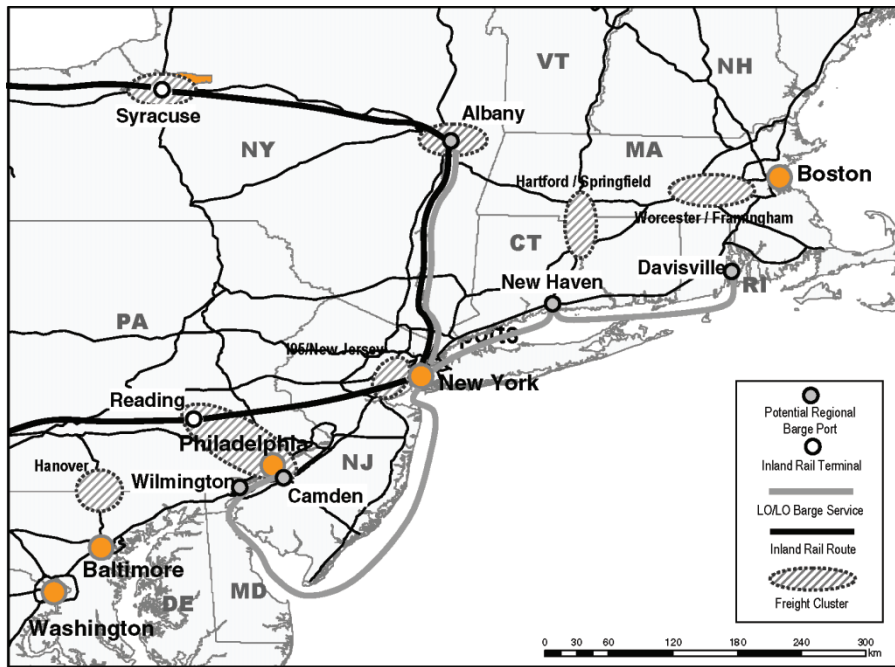


Figure 5. Port inland distribution network.

obvious, it often demands years of painstaking efforts of port authorities and market players to gradually build the network. The case of New York is illustrative in this respect as it went through all the phases in port development [47]. The port of New York and the road infrastructure that serves it is under increasing pressure as cargo throughput surges with the port handling more than 4 million TEU in 2003. The need for port regionalization is thus particularly acute. The Port Authority of New York, New Jersey has developed an ambitious \$60 million plan to siphon off some of that traffic through a web of inland hubs connected to the mother port by barge and rail (figure 5). The Port Inland Distribution Network (PIDN) plan would free up valuable terminal space, ease mounting congestion and provide environmental benefits. It would also provide reliable, scheduled service for containers no longer subject to the saturated highway system and it should offer clear logistical benefits for carrier, shipper and consignee. However, the first service—Albany ExpressBarge, a barge operation linking New York and New Jersey NY/NJ) with Albany 150 miles to the north—is confronted with a slow start. In the period April 2003–September 2004 it only handled 15% of what its initiators had anticipated, about 3,541 TEU. The port authority outlined a range of operating concessions and financial subsidies to help kick-start the new service [48]. A number of freight clusters have already been established around major highways in the periphery of metropolitan areas of the Boston–Washington corridor. Existing distribution activities may take time to respond and adjust to this new inland freight distribution strategy as trucking dominates regional inland distribution. It will take time to get all these new services off the ground, to make them self-sustaining and to change existing freight distribution practices. PIDN should decrease the market share of road haulage in

container land movements to and from the port of NY/NJ from 85% now to 57% in 2020, while the share of barges and rail are expected to reach 20% and 23% respectively. In addition, many market factors are favoring the extension and the consolidation of the PIDN in the medium run, namely congestion and higher energy costs creating diseconomies in the trucking industry. In such a context, port regionalization would be seen as a more cost effective alternative, a stronger driving force than policies and incentives from the port authority. The role of the Port Authority of New York and New Jersey in port regionalization thus remains to be seen.

4.3.3. Port-related activities Concerns also exist with respect to the spatial distribution of logistics activities in the load center network. As the hinterland becomes a competitive location, the question remains as to which logistics activities are truly port related. The chances for distribution centers in the traditional processing industries to locate in seaports may be good because of the existence of large industrial clusters in seaports. Next, seaports may be attractive alternative locations for the relocation of distribution centers focusing on sea–sea operations. In the new logistic market environment, the following logistics activities typically find a good habitat in ports:

- Logistics activities resulting in a considerable reduction in the transported volume.
- Logistics activities involving big volumes of bulk cargoes, suitable for inland navigation and rail.
- Logistics activities directly related to companies that have a site in the port area.
- Logistics activities related to cargo that needs flexible storage to create a buffer (products subject to season dependent fluctuations or irregular supply).
- Logistics activities with a high dependency on short-sea shipping.

Port areas typically possess a strong competitiveness for distribution centers in a multiple import structure and as consolidation centers for export cargo. Many seaports have responded by creating logistics parks inside the port area, often associated with a status as Free Trade Zone. The concentration of logistics companies in dedicated logistics parks offers more advantages than providing small and separated complexes. However, emerging load center networks mean that even port-related logistics activities become footloose. Peripheral seaport-based logistics parks located just outside the port area typically offer advantages with respect to congestion, costs of land and labor. These peripheral parks are part of the greater seaport region and may benefit from suppliers and other specialized inputs associated with the seaports. Port-based logistics parks located outside the greater seaport area (sometimes at a distance of more than 100 kilometers from the seaport itself) but with a clear orientation to one or more seaports with respect to the origins of the (containerized) cargo also constitute a valid alternative to logistics parks in seaport areas. The footloose character of port-related activities urges port authorities to stimulate the formation of a load center network. At present, only strictly seaport-bound activities (i.e. bound to the quays) are captive to seaport areas. Unfortunately, the mindset of many port authorities is limited to these port-bound activities (i.e. the ship as focal point), thereby leaving opportunities for the broader development of port-related logistics activities in the framework of load center networks unexplored (i.e. adding value to the cargo as focal point).

4.3.4. *The distribution of costs and benefits* The (re)distribution of wealth among the players and nodes in the network is a major governance concern when developing regional load center networks. The external spill-over effects of ports are expanding from the local port system towards a much larger international economic system. As such, the regionalization phase enhances a situation where port benefits are likely to 'leak' to users in inland locations. But unfortunately at the same time, many of the negative externalities remain spatially concentrated in the seaports. For instance, pollution from exhaust fumes by diesel engines now attracts a lot of attention in the US, with ports being one of the most severely affected areas. This kind of situation potentially brings about major socio-economic conflicts related to seaport development and raises issues about optimal port location for a given region. For example, the local community might wonder whether it is getting a fair input payback for the scarce local resources used by ports.

4.3.5. *Free riders* Another concern relates to the 'free rider' phenomenon in the regionalization phase. Ports might develop strong ties with inland terminals in the hope that this will bind cargo to the seaport. However, cargo flows follow the most convenient route controlled by the freight forwarder, so a seaport cannot make cargo generated by an inland terminal captive to the port, even if inland terminal and seaport belong to the same load center network. Investments of one load center in setting up inland terminals might thus have positive cargo impacts on adjacent rival load centers that just benefit from the new inland terminals without having invested in them. Port authorities are generally aware that free-rider problems do exist. This might make port authorities less eager to embark on direct formal strategic partnerships with a selected number of inland terminals. Instead, port authorities typically favor forms of indirect cooperation, for example through joint marketing and promotion, which are less binding and require less financial means.

4.3.6. *Politicization of and local rationality in the regionalization process* Regionalization is in principle a market-driven process, yet for the most part ports still rely on governments to do the necessary investments in basic infrastructures, which should ensure a good accessibility by land or by sea. As such the public sector plays a key role in shaping the side constraints for what market players can achieve in the area of regionalization. Port regionalization therefore often turns out to be a process very heavily influenced by political imperatives rather than by the 'invisible hand' of an efficient market. Local rationality of port authorities and governments is a major factor as well. Port expansion schemes of major gateway ports, that are intended to serve an entire economic region, tend not to be decided at the regional level but at the local (i.e. port, city, national) level. The local economic aspirations of officials and politicians at cityport level promote the belief that existing ports will continue to be optimal locations in the future, which in some cases may not be the case. Any regionalization strategy developed by a port authority or local government has the intention to improve the competitive position of the port, but this does not necessarily imply that the final configuration of the related load center network provides the most optimal solution for serving the larger hinterland regions as a whole.

5. Conclusions

Regionalization represents a new phase in the development of port systems, which has traditionally focused on the port itself. In this phase, inland distribution becomes

of foremost importance in port competition, favoring the emergence of transport corridors and logistics poles. The port itself is not the chief motivator for and instigator of regionalization. Regionalization results from logistics decisions and subsequent actions of shippers and third party logistics providers. Port authorities are invited to embrace and enhance the regionalization process in view of addressing current port-related challenges, mainly congestion, growing costs, limited handling capacity and the generation of additional traffic while being able to answer the requirements of modern freight distribution. With a more efficient access to the hinterland, mainly through modal shift, port competitiveness is thus increased. This also leads to questions with respect to the limits of port regionalization in terms of capacity and cost efficiency.

The strategic scope of port authorities should go beyond that of a traditional facilitator. Port authorities can play an important role through an active engagement in the development of inland freight distribution, information systems and intermodality. Direct and indirect forms of networking with nodes and market players constitute probably the most important role for port authorities in the regionalization phase, as gaining competitive advantage will more and more become a matter of going beyond the port boundaries both in terms of physical investments and managerial capabilities.

References and notes

1. CEMT, 2001, *Land Access to Seaports*. Round Table 113, European Conference of Ministers of Transport (Paris: OECD).
2. BIRD, J., 1980, *Seaports and Seaport Terminals* (London: Hutchinson University Library).
3. A port system is defined as a group of ports sharing a similar geographic characteristic, e.g. coastline, bay and to some extent serving overlapping hinterland regions.
4. TAAFFE, E. J., MORRILL, R. L. and GOULD, P. R., 1963, Transport expansion in under-developed countries: a comparative analysis. *Geographical Review*, **53**, 503–529.
5. BARKE, M., 1986, *Transport and Trade* (Edinburgh: Oliver & Boyd).
6. HAYUTH, Y., 1981, Containerization and the load center concept. *Economic Geography*, **57**(2), 160–176.
7. WANG, J. J., 1998, A container load center with a developing hinterland: a case study of Hong Kong. *Journal of Transport Geography*, **6**(3), 187–201.
8. KUBY, M. and REID, N., 1992, Technological change and the concentration of the US general cargo port system: 1970–1988. *Economic Geography*, **68**(3), 272–289.
9. NOTTEBOOM, T., 1997, Concentration and load centre development in the european container port system. *Journal of Transport Geography*, **5**(2), 99–115.
10. MCCALLA, R., 1999, From St John's to Miami: containerisation at eastern seaboard ports. *GeoJournal*, **48**, 21–28.
11. HAYUTH, Y., 1988, Rationalization and deconcentration of the US container port system. *The Professional Geographer*, **40**(3), 279–288.
12. LAGO, A., MALCHOW, M. and KANAFANI, A., 2001, An Analysis of Carriers' Schedules and the Impact on Port Selection. *Proceedings of the IAME 2001 Conference*, Hong Kong, 123–137.
13. TRI MARITIME RESEARCH GROUP, 2003 Container Transshipment and Demand for Container Terminal Capacity in Scotland (Edinburgh: Transport Research Institute, Napier University).
14. ROBINSON, R., 1998, Asian hub/feeder nets: the dynamics of restructuring. *Maritime Policy & Management*, **25**(1), 21–40.
15. ROBINSON, R., 2002, Ports as elements in value-driven chain systems: the new paradigm. *Maritime Policy & Management*, **29**, 241–255.
16. NOTTEBOOM, T. and WINKELMANS, W., 2001, Structural changes in logistics: how do port authorities face the challenge? *Maritime Policy & Management*, **28**, 71–89.

17. HEAVER, T., MEERSMAN, H., MOGLIA, F. and VAN DE VOORDE, E., 2000, Do mergers and alliances influence European shipping and port competition? *Maritime Policy & Management*, **27**, 363–373.
18. MARTIN, J. and THOMAS, B. J., 2001, The container terminal community. *Maritime Policy & Management*, **28**, 279–292.
19. STOPFORD, M., 2002, Is the Drive for Ever Bigger Containerships Irresistible? Lloyds List Shipping Forecasting Conference (http://www.clarksonresearch.com//acatalog/ci_paper_april2002.pdf).
20. CARRUTHERS, R. and BAJPAI, J. N., 2002, Trends in Trade and Logistics: An East Asian Perspective. Working Paper No. 2, Transport Sector Unit (Washington, DC: World Bank).
21. KONINGS, R., 1993, De rol van de zee-rederij in het achterlandvervoer van containers. *Tijdschrift Vervoerswetenschap*, **29**, 225–233.
22. BAIRD, A. J. and LINDSAY, A. J., 1996, Strategic Choice in the Global Container Shipping Industry: A Resource-based Approach. *IAME '96 Conference* (Vancouver: International Association of Maritime Economists).
23. GRAHAM, M. G., 1998, Stability and competition in intermodal container shipping: finding a balance. *Maritime Policy & Management*, **25**, 129–147.
24. CARIOU, P., 2001, Vertical integration within the logistic chain: does regulation play rational? The case for dedicated container terminals. *Transporti Europei*, **7**, 37–41.
25. EVANGELISTA, P. and MORVILLO, A., 1998, Logistic Integration and Co-operative Strategies in Liner Shipping: Some Empirical Evidence. *8th World Conference on Transport Research*, Antwerp, July 1998.
26. HEAVER, T., 2002, The evolving roles of shipping lines in international logistics. *International Journal of Maritime Economics*, **4**(3), 210–230.
27. NOTTEBOOM, T., 2004, Container shipping and ports: an overview. *Review of Network Economics*, **3**(2), 86–106.
28. VAN KLINK, H. A., 1995, Towards the borderless mainport rotterdam: an analysis of functional, spatial and administrative dynamics in port systems. *Tinbergen Institute Research Series*, No. 104.
29. VAN KLINK, H. A., 1997, Creating port networks: the case of rotterdam and the Baltic Region. *International Journal of Transport Economics*, **24**(3), 393–408.
30. RODRIGUE, J.-P., 2004, Freight, gateways and mega-urban regions: the logistical integration of the BosWash corridor. *Tijdschrift voor Sociale en Economische Geografie*, **95**(2), 147–161.
31. VAN KLINK, H. A. and VAN DEN BERG, G. C., 1998, Gateways and intermodalism. *Journal of Transport Geography*, **6**(1), 1–9.
32. The Virginia Inland Port is such an example of a hinterland island terminal linked by rail to the port of Hampton Roads.
33. RODRIGUE, J.-P., 1999, Globalization and the synchronization of transport terminals. *Journal of Transport Geography*, **7**, 255–261.
34. BUCK CONSULTANTS, 1996, *Seaports and their Hinterlands* (Nijmegen: Buck Consultants).
35. BUCK CONSULTANTS, 1997, Samenwerking tussen zeehavens in Nederland: verslag van samenwerking in de praktijk, *Nationale Havenraad* (Nijmegen).
36. COLIN, J., 1997, New Trends in Logistics in Europe. *ECMT, Round Table 104*, Paris, 93–151.
37. OJALA, L., 1997, New Trends in Logistics in Europe. *ECMT, Round Table 104*, Paris, 35–91.
38. STABENAU, H., 1997, New Trends in Logistics in Europe. *ECMT, Round Table 104*, Paris, 5–34.
39. HESSE, M., 2004, Land for logistics: locational dynamics, real estate markets and political regulation of regional distribution complexes. *Tijdschrift voor Sociale en Economische Geografie*, **95**(2), 162–173.
40. BROOKS, M., 2001, Good Governance and Ports as Tools of Economic Development: Are they Compatible? *Proceedings of the IAME 2001 Conference*, Hong Kong, 1–19.
41. GOSS, R., 1990, Economic policies and seaports—Part 3: are port authorities necessary? *Maritime Policy & Management*, **17**, 257–271.

42. BAIRD, A. J., 2000, port privatisation: objectives, process and financing. *Ports and Harbors*, **45**, 14–19.
43. *Ibid.* 39.
44. WANG, J., NG, A. K. Y. and OLIVIER, D., 2004, Port governance in China: a review of policies in an era of internationalising port management practices. *Transport Policy*, **11**(3), 237–250.
45. An often used distinction is that between landlord port, tool port and service port; see Port Reform Toolkit of the World Bank.
46. The institutional context often does not allow formal strategic partnerships with authorities of inland ports. The shareholder structure of many inland ports reflects the emphasis that still lies on the public tasks, that is, the stimulation of regional economic development.
47. RODRIGUE, J.-P., 2004, Appropriate Models of Port Governance: Lessons From the Port Authority of New York and New Jersey. In: *Shipping and Ports in the 21st Century*, edited by D. Pinder and B. Slack (London: Routledge).
48. The Port of Albany offers free storage of empty containers, while empties are also returned free to New York. Given the existing imbalance in the trade, this last element is critical in the start-up phase. The federal government has supplied subsidies for congestion mitigation and air quality and to help pay for a mobile crane in the Port of Albany.