Port hinterlands

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This chapter had been included in the book:
Roger Vickerman (Ed.). International Encyclopedia of Transportation, Elsevier

Encyclopedia of Transportation

Article Title

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Abstract

The traditional notion of hinterland refers to the inland economic area influenced by the ports. In other words, hinterland represents the set of points of origin/destination of cargo flows, which pass through the port and generates the majority of its business. Following logistics and market transformations, the concept of hinterland has become rather dynamic and the traditional static approach may be misleading. In particular, it appears rather complex to identify hinterland's boundaries due to the influence of drivers that are constantly evolving. Notably, shipping lines, terminal operators and other logistics players hold a pivotal role in shaping port hinterland development. The ability of Port Authorities (PAs) to cooperate with the actors of the maritime cluster as well as inland terminals seems to be fundamental to extend the network and enhance port competitiveness. In this perspective, Notteboom and Rodrigue (2005) coined a new concept, defined as "port regionalisation", capable to explain the new phase of growth of port systems, based on the emergence of broader logistics poles.

Keywords: port, hinterland, captive markets, contestability, intermodality, corridors, port regionalisation, port authority, shipping line, terminal operator, rail operator.

Main text

1.Port and hinterland: the impact of containerisation

The concept of port hinterland has strongly changed over the years following the evolution of maritime transport and logistics industry.

A hinterland represents the inland catchments area of a port where it produces the majority of its businesses. Indeed, in the hinterland are located the points of origin/destination of cargo flows which passes through the port. In summary, the traditional notion of hinterland refers to the economic area influenced by the ports. Anyway, it is rather complex to identify the boundaries of hinterland's extension that largely depends on the different commodity flows and transport modes. Furthermore, hinterland's size is constantly changing over time due to economic cycles, seasonality effects, technological transformations, evolutionary changes of carriers and MTOs strategies, capacity constraints of infrastructures, modifications in transport policy, etc.. Hence, the concept of hinterland is very dynamic and a static approach, considering port hinterlands as being everlasting may be misleading (Olivier & Slack, 2006).

Academics started to deeply investigate port-hinterland relationships since the '60s, even though there are in literature some preliminary studies date back even earlier. Formerly, the concept of hinterland was mainly nestled in zonal models, giving scarce attention to the relevance of inter-port inland competition. Then, containerisation process and intermodality broke this approach and pushed the integration of ports as nodes of global transport chains. Therefore, the selection of gateways and corridors by carriers has been placed at the centre of the debate, reshaping profoundly the concept of the hinterland (Ferrari et al., 2011).

Nowadays, hinterland is viewed as a broad logistics area strictly linked to global supply chains and international transport players. The shape of the hinterland is no longer considered a function of the physical distance and it seems to be affected by numerous discontinuities along its boundaries. Such discontinuities are provoked by inefficiencies across the logistics chain and also by the contextual competition of distant ports. Although, some scholars still persist to consider distance as a driver for defining port hinterlands, most of academics assert that the competition among top players not necessarily grounded on inland distance.

1.1.Hinterlands become more contestable

The emergence of global networks affected the relationship between the nodes of the supply chain and their market areas. In this perspective, it is possible to identify some key factors that have facilitated the growth of gateway ports with the characteristics to compete for contestable hinterlands. Academics have extensively studied the relationships between gateway seaports and hinterland, focusing on the drivers, which have affected port catchment areas. In particular, containerization and intermodality represent two pivotal factors for the extension of port hinterlands and the strong intensification of inter-port competition.

The invention of marine containers triggered a significant revolution in the transport industry. Containers have become the common transport unit, enabling the maritime transport to stretch the business towards land and to build innovative door-to-door systems. In the second revolution, the development of intermodality, associated to rail and barge transport, further enlarged land penetration of maritime containers through the creation of landbridges (Muller, 1999). This revolution along with the introduction of logistics corridors have largely widened port hinterlands, leading to a paradigm shift from *captive* to *contestable* hinterlands. Moreover, the perception on port markets has passed from being monopolistic or oligopolistic to competitive, opening new possibilities for further exploring and developing the business.

These changes have deeply affected the relationships among ports located in the same range (e.g., Rhine-Scheldt delta, Southern California, etc.) and also, to a certain extent, in opponent ranges (e.g., USWC vs. USEC, Northern vs. Southern range ports in Europe, etc.), producing a much fiercer on-shore competition for capturing cargo. As a result, the competition led to the "natural selection" of some gateways, which emerged as leaders for their operational reliability, maritime strategic location as well as their effectiveness in inland penetration. Notably, these gateways represent nodes of global maritime networks and, thus, allow long-haul transport flows to reach broad continental areas and viceversa. It is widely demonstrated that containerisation and intermodality have progressively eroded traditional hinterland paradigms. The growing hinterland contestability, indeed, altered hinterland size as well as its shape. Hinterlands also became characterised by more discontinuous physical boundaries, even in the immediate vicinity of the port. Notteboom and Rodrigue (2005) argued this process may drive to the formation of "islands" in the distant hinterland where the load centre achieves a comparative cost and service advantage respect to their competitors. Hence, traditional perspectives based on the concept of distance-decay are unsuitable to face this new scenario. In this regard, as abovementioned, the effectiveness of inland connections and the relationship with inland terminals are fundamental for port competitiveness distance-decay are ill-fitted.

1.2.Ports are inserted in broader supply chains

The rise of corridors has influenced the relationship between gateway ports and their hinterland. These logistics infrastructures, indeed, enable maritime gateways to enhance their penetration towards the hinterland and increase traffic volumes.

In the past, the competitiveness of a container port grounded on its standalone "physical" features (e.g. assets endowment, nautical accessibility, ship-to-shore performances, containers dwell time, etc.). Currently, port selection is strongly conditioned by hinterland accessibility and, thus, by the quality of gateway ports-hinterland connections. In this vein, physical attributes cannot be used as the only parameters for assessing the competitiveness of a port, since they no longer reflect the complexity of global supply chains. This has been provoked by the globalisation, the delocalisation of production plants as well as the physical dispersion of manufacturing inputs over a broader geographic space. Multinational manufacturers, indeed, have introduced a more flexible multi-firm organization structure, based on the fragmentation of production and logistics activities throughout globally outstretched supply chains (Olivier & Slack, 2006).

In this perspective, ports became only a stage of the entire logistics equation and their competitiveness is mostly shaped by the efficiency of logistics operations beyond port boundaries and, especially, by their inland connectivity and reliability. Therefore, ports have been increasingly competing not as individual maritime nodes, basically responsible for loading and unloading cargo, but as crucial interfaces within different logistics chains. For this reason, ports are expected to shift their strategy to an overarching supply-chain approach aiming at meeting carriers and shippers' requirements. Consequently, this might also suggest in terms of governance mechanisms the creation of an independent public body for co-ordinating the activities along the supply chain, including port operations and hinterland transportation. This is crucial for the proper functioning of the network since the lack of integration among public bodies (e.g., Port Authority, Municipality, Region, central government, etc.) and private companies can generate institutional problems and serious bottlenecks.

1.3.Shaping port hinterlands: a mix of positive and negative forces

The above arguments suggest that port capacity of attracting cargo is strictly correlated to the degree of inland penetration. In this vein, port and hinterland appear as a unique interconnected entity and the competitiveness of this broad logistics area is determined by port and hinterland mutual attractiveness as well as their attitude to collaborate each other. In particular, the quality of hinterland connections heavily affects port competition: port attractiveness is increasingly laid on the overall network costs and performances. Hence, port selection criteria takes deeply into account the role of the port as a pivotal node within the global supply chain (Ferrari et al, 2011).

Hinterland contestability can be seen as the contextual intervention of positive and negative "forces" (standalone and external factors) across the overall transport chain. These "gravitational forces" attract ports and hinterlands each other as well as generate traffic flows between them. Among these drivers, we report the main important ones, according to extant literature : the effectiveness of port handling operations, the location of distriparks and inland terminals within and nearby the port domain, the presence of an international business environment, a strong local cargo base (calling for transhipment operations as well as additional gateway cargo for long inland distances), fast vessel turnaround times, short container dwell times, efficient rail, road and barge networks and effective port governance. These positive forces extend port hinterland coverage and foster its capacity to compete against faraway ports. Nonetheless, such positive forces are counterbalanced by negative ones, which determine "frictions" to the transit of cargo flows and limit hinterland contestability. In particular, the lack of capacity in port and inland infrastructures, high port costs, inefficient, expensive and unreliable inland connections, negatively affect port development towards the hinterland, deviating the traffic flows to other corridors and/or ports. When these negative forces occur, logistics players are pushed to find alternative routes with a lower "resistance" in terms of costs and reliability. Consequently, ports that are located on inefficient or low-capacity corridors are in a disadvantageous position.

In summary, gravitational forces and frictions can be assessed through the analysis of costs (considering the overall logistics costs), capacity (e.g. port handling, inland infrastructures, etc.) and reliability of port-hinterland system. Nevertheless, this system is affected by other drivers concerning the competitive position of a port in relation to a specific hinterland region, i.e. historical, psychological, political, cultural, institutional, legislative and personal ones, which are particularly difficult to manage and can largely twist the "perfect" market-based division. In particular, bounded rationality, inertia and opportunistic behaviour are among the behavioural factors that could lead to a deviation from a "distance-decay" optimal solution.

2.The active role of key actors in developing port hinterlands

The success of a seaport grounds on its ability to cooperate with maritime cluster and logistics operators in order to exploit all the synergies with the other nodes of the supply chain. In particular, the collaboration between seaports and inland terminals has led to the development of large logistics areas that occurred both spontaneously, as the result of a slow market-driven process, and carried by national, regional or/and local authorities through financial and regulatory actions. These partnerships prove to be not only of competitive nature but also of a complementary nature since they can enhance cargo flows and the competitiveness of the entire supply chain. As regard seaports, the geographical concentration of logistics companies in the hinterland and the development of frequent well-structured connections lays the foundations to a superior network that positively influences port attractiveness and encourages shipping lines to call and invest in that specific port.

Therefore, the development of a broader port hinterland is mainly due to the strategies of maritime and logistics actors. In particular, this section reports the impact of horizontal and vertical relations among shipping lines, terminal operators, rail transport operators and PAs, aiming at supporting the growth of logistics zones and supply chains.

2.1.Shipping lines

Over the last years, shipping lines have implemented internal and external growth strategies aiming at reaching major economies of scale and lowering transport costs. As a result, a significant number of Mergers & Acquisitions (M&As) have been carried out in the industry, giving rise to a gradual market concentration. Nowadays, the top-10 carriers control the 82.8% of the world market shares of container shipping industry, the 64.5% share by only the top-5 (Alphaliner, 2019). In addition, the formation of global alliances and the deployment of increasingly bigger ships contribute to reduce the overall ship system costs as well as to increase the bargaining power of ocean carriers versus terminal operators and PAs. Nonetheless, shipping lines have to face more demanding shippers' requirements that represent a serious challenge for their competitiveness, especially in terms of frequency, reliability and geographical coverage of the services. Therefore, due to the inefficiency of many ports of call, liners have gone beyond simple long-term contracts with terminal operators and have started to acquire shares in several maritime container terminals located in strategic positions in order to directly control and enhance their capacity.

When it comes to the development of hinterland network, scholars demonstrated that the portion of intermodal costs on total transport costs is constantly increasing, reaching the range between 40% and 80%. This supports the notion that inland logistics represents a fruitful area for shipping lines' growth strategies due to the possibility to manage the entire transport service and provide more competitive services (i.e. carrier haulage). In this vein, they can further reduce the overall costs related to transport activities (i.e. point-to-point) as well as foster and monitor logistics operational performances. Hence, shipping lines have developed rail, barge and truck services through own companies (i.e. associated firms or controlled entities) or long-term strategic partnerships with major logistics players. Ultimately, the most ambitious companies have invested in inland terminals and depots aiming at accelerating inbound and outbound container flows.

2.2.Terminal operators

Large global terminal operators have emerged in maritime logistics and inland transport to counterbalance the new dominant position of shipping lines. In this vein, an increasing consolidation occurred also in this industry, fed by the growing presence of institutional investors (e.g. banks, private equity funds, insurance companies, pension funds, etc.) that have revealed a strong interest for the terminal business. As a result, four worldwide operating companies (i.e, Hutchison Port Holdings, PSA International, DP World and APM Terminals) dominate the container handling industry, controlling more than 40% of the market share. In addition, Cosco Shipping Ports (CS Ports), formed by the merger of the two Chinese conglomerates, Cosco Group and China Shipping Group, reached for the last two consecutive years the primacy of the industry (Lloyd's list, 2018). CS Group achieved this result through the take-over of Greek transhipment hub Piraeus and Spanish port operator Noatum that have considerably enhanced its volumes of container handled. Contextually, terminal operators have strengthened their position in relation to customers by establishing equity joint ventures (EJVs) with shipping companies aiming at co-managing strategic container terminals worldwide. In such a way terminal operators can secure a more stable cargo base and reduce traffic volatility.

Given the above, leading terminal operators have been developing diverging strategies towards extending their business and network. In particular, they have increased the array of logistics services provided, including inland transport (i.e. *terminal operator haulage*), and their influence throughout the supply chain. Furthermore, they have incorporated several inland terminals in order to create extended gates of seaport terminals. In this vein, they could meet shippers' requirements, moving closer to the "final customer", as well as relieve the pressure and congestion of seaport terminals. Hence, terminal operators nowadays appear as key actors for the successful development of port hinterlands.

2.3.Rail transport operators

Rail transportation is at the heart of the logistics debate, especially in Europe, because it appears geographically, politically and economically fragmented and far to the realisation of a greater intermodal infrastructure for supporting seaport expansion. Nevertheless, the ongoing sectorial liberalisation and the increasing involvement in the industry of major shipping lines, terminal operators and PAs are pushing to a new era for railway transport. Their initiative has proved to be essential to overcome the limits of rail services that lay on the high entry costs and the fragmentation of cargo flows. In this vein, rail operators have designed more efficient networks by connecting the main nodes of the supply chain that includes seaport terminals and logistics centres located in the hinterland. According to the hub-and-spoke model, cargos are bundled in the abovementioned logistics nodes and transported by frequent fast shuttle trains. This system has proved to be particularly effective in the European ports of the Northern range thanks to the well-developed railway infrastructure designed by local and national governments.

The increasing role of rail transport operators for the growth of port-hinterland is due to their new commercial attitude that fosters the improvement of the services provided (e.g. decreasing of lead time for booking, digitalisation of documentation, track and tracing, integration of intermodal services and door-to-door transport). In particular, the integration of effective railway connections by seaports allow enhancing supply chain performances and promoting intermodality that constitutes a prerequisite for the creation of broader logistics areas.

2.4.Port authorities

Port authorities' main objective is to attract users by providing competitive services to shippers, carriers and the other logistics stakeholders of the supply chain. In this regard, currently the main challenge is represented by hinterland connections that allow PAs to get far from port boundaries, promote intermodality and increase their revenues. As well known, ports are pivotal nodes of the logistics chain thanks to their accessibility to the sea and foreland connections. This gives PAs the power to shape hinterland networks and preserve their centrality in the system. Nevertheless, the worldwide transport network, considering both land and sea transport services, is becoming increasingly complex due to the growth in the number of intermodal logistics centres (on the land side), and sea ports, especially transhipment ports that offer valuable routing options for container flows. Most European container ports are facing, indeed, a dramatic increase in the relative growth of transhipment traffic flows that requires a strengthening of both port infrastructures and inland long-distance infrastructures. Therefore, PAs are expected to develop even closer collaboration with various logistics operators, especially inland and intermodal terminals, in order to foster ports' competitiveness and intensify demand flows.

In this perspective, many PAs have launched several projects and initiatives in partnership with inland terminals aiming at creating new logistics zones along the main hinterland corridors. For example, Hamburg Port Authority have invested in rail terminals (Melnik, Budapest, etc.) to support its rail traffic via Potzug, Metrans and HHCE, while Barcelona Port Authority entered into partnerships to expand the port hinterland, through the setting up of dry ports and logistics zones (i.e. Toulouse, Zaragozza and Madrid).

As reported, the success of a port lay on the capability of PA to collaborate with maritime cluster and logistics players in order to create synergies for a broader regional logistics network. The development of these logistics poles generates, indeed, benefits for all the actors involved. In particular, Rodrigue and Notteboom (2009) draw attention to the advantages originating from the cooperation between PAs and inland terminal that include, amongst others, stronger support for cargo handling function (due to a better use of port space area); expansion towards the hinterland, and possibility to fight with competing ports for their market shares; stronger position for luring (foreign) investments and subsidies because of more attractive, reliable and frequent integrated hinterland services; enhancement of intermodal services and better modal split in favour of rail transport; simplification of customs procedures.

3.The emergence of port regionalisation

As reported in the previous Section, inland distribution is becoming a fundamental dimension of the maritime transportation and freight distribution paradigm. The development of global supply chains have increased the pressure on the main actors of maritime logistics, including shipping lines, terminal operators, rail transport operators, PAs and inland terminals. In particular, hinterland accessibility constitutes a cornerstone for port competitiveness and thus the ability of PA to develop port systems commercially oriented towards the hinterland is essential for its success.

In this regard, Notteboom and Rodrigue (2005) coined a new concept, known as “port regionalisation”, to explain this new phase of growth of port systems, which was traditionally based on the activities confined in port perimeter. In the regionalisation model, instead, inland distribution becomes an essential driver for port competition since it promotes the emergence of transport corridors and logistics poles. The authors argue that PAs do not lead this process as “motivators” or “instigators”. The process, conversely, derives from the collaboration and strategic coordination between shippers and third party logistics providers. In this vein, PAs are expected to embrace the regionalization process in order to face current port-related challenges, including congestion, limited handling capacity and growing costs associated to additional traffic. Hence, hinterland accessibility resolves the abovementioned problems by exploiting logistics corridors and rail transport to accelerate cargo flows and increase the handling capacity of seaport terminals. Furthermore, regionalisation extends seaport terminals towards the hinterland, moving the port closer to its customers and enhancing freight distribution.

Finally, regionalisation enables PAs to go much beyond the role of a traditional facilitator. PAs, indeed, cover an active role for the development of a more efficient supply chain, grounded on inland freight distribution, information systems and intermodality (Notteboom and Rodrigue, 2005). In particular, PA networking activities represent one of the most peculiar aspects of regionalisation. Coordination and cooperation among the abovementioned maritime logistics actors constitute the pillars of this model and guarantee a valuable competitive advantage to seaports.

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