

## LOCATION SPLITTING A STRUCTURAL TRANSFORMATION OF PORTS?

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### ABSTRACT

As theoretical approaches to port development have advanced over the years, the role of the inland terminal has attracted increasing focus, particularly under the framework of port regionalisation. This paper will explore port regionalisation in different contexts through a greater focus on the drivers and direction of a number of inland terminal development strategies.

The paper will build on previous work by combining inland terminal taxonomies and the theory of directional development with traditional port development models. The aim is to explore strategies of location splitting and ask whether they represent the structural transformation of ports. Regionalisation strategies will be compared and contrasted through examples derived from field work undertaken in Europe and the USA. The paper will disaggregate the process of port regionalisation, revealing how the integration and cooperation involved in different location splitting models reflect different approaches to structural transformation.

**Key words:** inland terminal, port development, regionalisation, hinterland, location splitting

## 1. Introduction

*“The displacement of agents and actions by process nouns entails a shift away from the study of actors, bureaus and social groups, the structures within which they operate, their actions and outcomes, towards a discourse in which processes themselves become the causal agents.” (Markusen, 2003; p703)*

The aim of this paper is to analyse the port regionalisation concept by exploring concrete examples of different port hinterland development strategies. Notteboom and Rodrigue (2005) state that inland terminals are becoming active nodes in shaping the transport chain of which they are a part; this paper will examine how these “active nodes” are developed in order to advance the theoretical understanding of the regionalisation concept within port development theory. The paper begins with a review of theoretical port development models, culminating in the concept of port regionalisation, before arguing for a needed review of the port regionalisation process that includes drivers and direction of hinterland development strategies.

The paper examines case studies of European load centres, followed by large and small scale intermodal corridors in the United States. These examples will be used to explore the drivers of location splitting strategies (Wilmsmeier et al, 2011) as part of a discussion on the materialisation of structural transformation of ports. The list of inland terminal development concepts is intended to be a representative, but not exhaustive, sample of specific kinds of port development directions observed from the field work undertaken by the authors.

## 2. Port Development

A number of authors have attempted to explain the complex process of port development by proposing different conceptual frameworks. This paper builds on the “main street” concept outlined by Taaffe et al. (1963), whereby “since certain centres will grow at the expense of the others, the result will be a set of high-priority linkages among the largest.” (p505) However, the location and functions of the nodes connected along these priority corridors is changing. Whereas in the past these corridors were more static, due primarily to the geographical entry barrier represented by port location, they have become increasingly dynamic.

Bird’s 1963 “Anyport” model was an early attempt to categorise port development, and his model is still widely referenced today. His model was developed through a study of British ports, and although this work was written before the advent of containerisation, his model remains useful. Bird’s six stages are primitive, marginal quay extension, marginal quay elaboration, dock elaboration, simple lineal quayage and specialised quayage. Bird also recognised that different parts of the port may be at different stages of development, which means that potentially sub-optimal facilities will still be in use in parts of the port: “Because of the great capital cost of port installations, it is often cheaper progressively to downgrade a dock or quay in traffic importance rather than scrap it altogether.” (Bird, 1963; p34). The two general development strategies charted by Bird are expansion away from the original town site towards large purpose-built berths with deeper water, and the move towards specialised handling facilities, for example oil products or containers.

In 1967 Rimmer discussed the models of both Taaffe et al. and Bird, and produced a five-stage model: scattered ports, penetration lines, interconnection and concentration,

centralisation, and finally decentralisation. Hoyle (1968) presented a modified version of Bird's model, demonstrating the difference stages for East African ports that were built in the twentieth-century, unlike those in Bird's model that grew out of medieval estuary port sites. Some authors consider that Bird's six phases can be condensed to three: setting, expansion and specialisation (Rodrigue et al., 2009).

Looking back in 1971, Bird commented that his model was not intended to fit every port, and he conceded that limitations may be apparent due to the fact that port development models can be based on different factors. While his "Anyport" model is based on port installations, Bird noted that these structures generally reflect wider issues such as changing ship requirements or developments in hinterland access.

Hayuth (1981) developed the concept of dominant ports or load centres that increase their inland penetration and hinterland capture, very much like in the model of Taaffe et al. and Rimmer. Hayuth noted that: "it is difficult to weigh the importance of each factor in the development of a load centre port, but a large-scale local market, high accessibility to inland markets, advantageous site and location, early adoption of the new system, and aggressiveness of port management are major factors to consider." (p160) Therefore in terms of the port system as a whole, fewer, larger ports dominate the main transport corridors.

Barke (1986) produced a similar model, with an additional focus on decentralisation, whereby some port activities are moved from the port to less congested areas. However, in contrast to some of the inland terminal concepts, discussed in this paper, Barke specifically noted that these activities remain "within the city region, and transport and communications technology ensure that they are within easy contact of the core." (p122)

Van Klink (1998) suggested port city, port area and port region as summaries of previous port models, and identified the rise of port networks as a fourth stage in port development, including logistical control of inland access as a new role for the port in this phase of development, particularly related to the integration of activities at non-contiguous sites. The idea is then developed into a discussion on the kind of networks possible, based on directions of interdependence. This development leads to the importance of cooperation strategies throughout the hinterland area rather than the old model of investment in the port area alone. The concept of selectiveness of core activities points to a strategy of moving non-core activities to other locations, allowing the port to focus on the core activity of container throughput, for example the use of ECT's inland terminals for Rotterdam traffic that will be discussed in this paper. Kuipers (2002) backs up this observation.

Notteboom and Rodrigue (2005) added a phase of "port regionalisation" to Bird's port development model. In this and other papers they have explored the growth of logistics poles and other hinterland integration issues. They argued that the work of Bird, Taaffe et al., Hayuth and Barke does not address the rising importance of inland load centres to port development, particularly the integration of inland terminals to the transport network. In some ways the regionalisation model can be seen as a combination of load centres (Hayuth) and priority corridors (Taaffe et al.). Rimmer and Comtois (2009) ask "what is regionalisation but decentralisation?" (p38) Indeed, such terminology must be read critically in order to determine its usefulness.

Rimmer and Comtois are critical not just of the regionalisation model but of what in their view is an overly land-focused approach taken by Taaffe et al. and subsequent authors. They believe that developments in maritime space have been incorrectly de-prioritised vis-à-vis landside developments. However it could be argued that the key distinction is that in

Notteboom and Rodrigue's model the inland nodes are actively involved in shaping the chain. Indeed, they remark that "the transition towards the port regionalisation phase is a gradual and market-driven process, imposed on ports, that mirrors the increased focus of market players on logistics integration." (p301) What is needed is a detailed discussion of whether regionalisation is in fact imposed on ports, who does it and how it is done, and what strategies ports (either terminals or port authorities) are adopting to deal with the process.

Olivier & Slack (2006) talk about a renewed focus on questions of agency, upon the ability of ports to "steer their own future" (p1414). Following the discussion by Heaver et al. (2000): "Will port authorities become fully-fledged partners in the logistics chain, will their involvement be restricted to a supporting role (safety, land-use and concession policy), or might they disappear from the scene entirely? In order to find answers to these questions, further research, in particular more disaggregated empirical research, is urgently required" (p373), this paper discusses the drivers and directions of port hinterland development strategies.

The decreasing importance of the port in the transport chain along with a greater focus on the terminal rather than the port have become key issues over the last decade and a half (e.g. Slack, 1993; Notteboom & Winkelmanns, 2001; Robinson, 2002; Slack, 2007). One question that arises is whether the development of inland terminals by a port is not in fact a backward step in port development, actively shifting influence to an inland location. Current evidence suggests that this is not in fact the case (e.g. Monios, 2011). Therefore Rimmer and Comtois may be correct in criticising the landward focus of recent research, as it would seem that undue power has not shifted to inland terminals. But it is impossible to generalise about such developments as individual ports will pursue the strategy appropriate to their needs. Notteboom & Rodrigue (2009) contend that port authorities have in the past been afraid of losing influence to inland terminals but some are recognising that there are many benefits to cooperation.

According to the port regionalisation concept, logistical integration and network orientation (see also McKinnon, 2001; Robinson, 2002; Christopher, 2005) as well as the globalisation and "terminalisation" of seaports (Slack and Frémont 2005; Rodrigue & Notteboom, 2009; Notteboom, 2009) explain the emergence of the so-called "offshore hub ports" and the geographical and functional expansion of load centres to become "regional load centre networks". Here, the concept of centrality that explains to some extent the formation of gateways, is replaced by the concept of intermediacy (Fleming and Hayuth, 1994; Ducruet, 2005), where a large direct hinterland market is not a necessary condition for concentrating large traffic volumes. Instead, discontinuous hinterlands are supported by logistic zones and inland distribution centres that are connected to the ports by high volume transport corridors, which at the same time reflects the degree of logistic integration among carriers and the new "mega carriers". Ng and Gujar (2009) discussed centrality and intermediacy as determining concepts of inland nodes and how they can be affected by government policy. In this sense the adjusted definition of hinterland obtains, one that considers core, congruent and extended hinterlands, which adjusts to changes in port service demand (Sanchez and Wilmsmeier, 2007).

Based on the product lifecycle theory and following Schaeztl (1996), Cullinane and Wilmsmeier (2011) argued for "location splitting" (Standortspaltung) as a means to extend the port life cycle when limitations in feasible rationalisation, investment and access are reached. Such creation of a subsidiary in the hinterland provides a potential solution that

avoids an inevitable decline, invoked either through the inappropriateness of the actual port location or a newly emergent regime of competition. Thus the question arising is whether location splitting as proposed by these authors can be induced by landside driven factors as well. The “structural transformation” of a port or port system as a response to the exponential growth in capacity can be multifaceted, particularly as the influence of supply chain structures on transport operations can result in transport nodes becoming integrated within different arrangements such as load centres and port centric logistics (Monios & Wilmsmeier, 2011). This structural transformation is accompanied, driven and strengthened by supply chain development and increasing vertical integration (e.g. Heaver et al., 2000; Heaver et al., 2001; Frémont & Soppé, 2007; Hayuth, 2007; Olivier & Slack, 2006; Notteboom, 2008).

The current research will examine how different actors attempt to influence inland corridors and direct regionalisation processes through different concepts. It is argued that missing from the regionalisation model are both the differentiation of drivers of development (e.g. port authority, port terminal, rail operator, public organisation) and the direction (i.e. land-driven vs sea-driven). Wilmsmeier et al. (2010, 2011) borrowed from the terminology of industrial organisation (i.e. forward and backward integration) to introduce a conceptual approach to inland terminal development, contrasting Inside-Out development (land-driven e.g. rail operators or public organisations) with Outside-In development (sea-driven e.g. port authorities, terminal operators), illustrated in figure 1.

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Wilmsmeier et al. (2011) focused on the drivers and the spatio-temporal development direction of the ports’ structural transformation. They argued that this perspective has not received sufficient attention in discussions of the port regionalisation concept. This model can be used to aid disaggregation of regionalisation strategies and comparison of potentially conflicting strategies that may be pursued by terminals within a port or between ports within the same range. The aim of this paper is to compare different kinds of intermodal corridors and inland terminals in different geographical spaces and scales.

Beneath the umbrella term of intermodal terminals, different terminology has developed to highlight different behaviour. Rodrigue et al. (2010) related this multiplicity of terms to the variety of geographical settings, functions, regulatory settings and the related range of relevant actors. This paper will extend the understanding of port regionalisation by exploring its relation to different types of inland terminal concepts, which was lacking in previous papers. By looking at the drivers and direction of each model, this paper will relate this variety of inland terminal concepts back to a discussion of the inland aspect of port development, revealing how space and scale influence port development strategies. For more explicit discussion of the issues surrounding inland terminal taxonomies, the reader is referred to previous literature (Wilmsmeier et al., 2011; Monios, 2011; Monios & Wilmsmeier, 2011; Notteboom & Rodrigue, 2009; Rodrigue et al., 2010; Roso et al., 2009).

### **3. Case studies**

Differences between Europe and the USA have been noted by previous authors (Notteboom & Rodrigue 2009; Rodrigue et al. 2010; Wilmsmeier et al., 2011). Landbridge rail services are more common in the USA, with long distances and double-stack clearances allowing economies of scale impossible on the dense European network, where the norm is many small terminals rather than few large ones. Therefore relations with ports are more operational than strategic (Wilmsmeier et al., 2011). Inland terminals are generally owned and operated (even if contracted to a third party) by rail operators. This section analyses six case studies differentiating drivers and direction of port development in a spatial policy perspective.

#### **3.1 Spain: Outside-In vs Inside Out load centres<sup>1</sup>**

In Spain the public port authorities have been involved in developing inland terminals at Azuqueca de Henares (just outside Madrid), Coslada (Madrid) and Zaragoza (about half distance between Madrid and Barcelona), to serve the large industrial area in this part of Spain). All three sites are multi-user facilities, in none of which does a port own the majority shareholding. Therefore even though the port authority may be considered the driver of each development, they are not integrated with the inland terminals. Nevertheless, the port authorities are actively involved in steering the regionalisation process and engaging in relevant marketing and branding activities in relation to their inland integration. However, as in other countries, regional development agencies want to attract economic development to their regions by building new sites. A Madrid-based agency has proposed to develop a new, large site at Arganda del Rey, to the southeast of Madrid.

Therefore market-led Outside-In development is being superseded by public-led Inside-Out development. This raises questions about the public involvement in Coslada, which unlike the other two terminals, has direct involvement from the four major container ports (Valencia, Barcelona, Algeciras, Bilbao) and the national port administrative body Puertos del Estado. Secondly, as the new site is located in Valencia's natural hinterland, there will be little incentive for Barcelona to use it. Therefore Barcelona would likely continue to use Zaragoza to access the industrial area in northeast Spain and Azuqueca to access Madrid, while Valencia would potentially move its Madrid access point from Coslada to the new site at Arganda del Rey.

From a port development point of view, the development in inland terminals does not represent a structural transformation, but the ports are improving their hinterland access by ensuring terminal facilities in appropriate locations. Additionally, Barcelona and Valencia are both developing logistics zones within the port perimeter as well as being involved in the inland load centres. Therefore the port authorities at Spain's two largest container ports (excluding transshipment) are pursuing multi-layered regionalisation strategies in partnership with a number of stakeholders.

#### **3.2 Netherlands: ECT - Outside-In load centre with extended gate functionality**

The Netherlands case shows private port terminal operator ECT Rotterdam developing an integrated service offering at Venlo. ECT owns both the port terminal and the inland barge and rail terminals, and they sub-contract rail and barge operators to run scheduled

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<sup>1</sup> Spanish case studies have been discussed elsewhere in more detail (Monios, 2011; Roso, 2010; Rodrigue et al., 2010; Van den Berg and de Langen, 2011).

services between the two locations. ECT manages the container flows on all services according to their own container management requirements. This system is perhaps the best example of the Roso et al. (2009) “dry port” definition, which envisages a combination of an Inland Container Depot (ICD) with a freight village, incorporating extended gate integration with the port operations. Interestingly, ECT do not use this terminology; they prefer instead the “extended gate” term. Rodrigue et al (2010) classify Venlo’s extended gate operation as a satellite terminal, as it is fully integrated with the port terminal stack management and can therefore be used as an extension of the port yard or a kind of overspill system. However, unlike a simple overspill or extended yard function which would normally be located fairly close to the port, Venlo functions as a load centre serving a large hinterland market. The logistics centre at Venlo is operated through a joint venture between ECT and Seacon Logistics.

The extended gate or terminal haulage concept (as opposed to carrier or merchant haulage) has been discussed by Van der Horst & de Langen (2008), Notteboom & Rodrigue (2009) and Veenstra et al. (2011). Rodrigue & Notteboom (2009) noted that the success of such an integrated haulage concept depends on the visibility of cargo in the transport chain. By integrating not only the port and the inland terminal, but also the logistics operation through a joint venture, ECT is able to combine knowledge of the primary and secondary haul requirements, which enables better planning of cargo movements.

Venlo is thus a case of Outside-In development, driven by the private port terminal operator. In terms of port development, it can be viewed as a distinct stage of regionalisation because of its integration of operations. Ports can use a variety of mechanisms to coordinate the hinterland transport chain and thus reduce transaction costs (de Langen & Chouly, 2004; Van der Horst & de Langen, 2008; Van der Horst & Van der Lugt, 2009), but full integration is rare, and thus stands out as an innovative development. Thus the strategy of location splitting has allowed a structural transformation of port operations. Venlo represents an attractive hinterland access strategy, however many institutional, operational and legal difficulties prevent comparable developments elsewhere (Veenstra et al., 2011).

### **3.3 Sweden: Inside-Out load centre**

The key point for discussion in terms of regionalisation is that in Sweden municipalities have the power to develop inland terminals directly rather than simply attracting private operators to do so. Therefore the public sector can take the initial risk in order to build necessary infrastructure developments and then seek to attract private interest afterwards. However this represents a risky strategy. In the case of Falköping, an inland terminal has been developed and followed by a long process to develop a closer integration with the port of Gothenburg, a port which already has rail services to 25 other inland locations. Indeed, the port of Gothenburg has named the system of connected inland terminals the “railport” system, underlining the relevance of industry branding to inland terminal taxonomies. However in the case of Falköping the port has been a somewhat reluctant partner and full integration or even close cooperation has not been forthcoming and the site is struggling to attract container traffic (for details see e.g. Bergqvist et al., 2010; Wilmsmeier et al., 2011).

The Falköping case therefore represents an example of Inside-Out development, usually pursued by public bodies seeking to attract economic development to a region. While there has been an attempt to integrate the terminal with the port operations, the site is simply an intermodal terminal offering rail access to the area, one of many in the country. Small

intermodal terminals are the most common kind of inland facility in Europe, and they are generally run by rail operators or logistics companies rather than demonstrating close ties with the sea port. Thus the port of Gothenburg has not needed to be proactive in developing a hinterland access strategy because this and other sites around the country have been seeking actively to accommodate the port. This case demonstrates that policy and planning must be aligned with market demand and operational requirements. Even when the market is known to exist, it can be difficult to capture, and these difficulties are exacerbated under conditions of municipal development where it can be difficult to consolidate market demand across political boundaries.

### **3.4 Italy: Inside-Out load centre**

Italy exhibits a distinctive model of interporti or freight villages, which are large logistics parks with attached intermodal terminals. The definitive aspect of this model is that the focus is firmly on logistics and supply chain management as much as transport. They are built with the aim of improving logistics in their regions, and many of these sites have had public involvement at some point in their development, and many retain public-private ownership models.

Freight villages are very much an example of Inside-Out development, as logistics/warehouse/freight village activities are land-focused. Therefore the Roso et al. (2009) “dry port” model (ICD + freight village + extended gate: see Venlo example above) is extremely difficult to develop because extended gate functionality requires strong port involvement, if not full integration. Results from field work in Italy showed that the freight village concept is good for logistics but has had very little success integrating with ports. Indeed, even getting rail traffic at all is not easy due to the road-dominated and fragmented Italian logistics system, and some freight villages have very large intermodal terminals with very low rail traffic. Yet this is not the entire story, as can be shown by comparing two inland terminals in respect of their relations with ports.

The Rivalta Scrivia freight village in the hinterland of the port of Genoa has high port traffic and they are even working towards a potential trial of an extended gate concept (for more detailed discussion see Caballini & Gattorna, 2009). They have good relationships with the port, unlike many other freight villages in Italy. But this is because the port needs the inland node due to its congestion issues. This is not the case with other ports in Italy. The port of Naples has problems with congestion and long dwell times, and Iannone (2011) showed that it can actually be cheaper to send the container by rail to an inland node even at relatively short distance, due to the saving of dwell time charges. However problems of fragmented transport operators and the inability to build cooperation between organisations have prevented these services from prospering.

A key point to note when discussing freight villages as integrated sites is that, firstly, the general model is for the intermodal terminal to be operated by a separate company, and secondly, the terminals are shared use, some shippers located within the freight village and some not. Indeed, the majority of the rail traffic at large freight villages such as Bologna and Verona is actually for companies outwith their site. Rivalta Scrivia proves an exception to this rule, as the operators of the site work directly with the shippers located there rather than through 3PLs. This separation of the transport and supply chain functions supports the conceptual framework developed by Rodrigue et al. (2010), and will be discussed further below.

### **3.6 USA: Heartland corridor and Rickenbacker Inland Port: Inside-Out load centre**

The Heartland Corridor is a multi-state Public Private Partnership (PPP) that brought together almost \$200m in funding from public and private sources to upgrade a coal line to double stack capacity from the port of Virginia at Hampton Roads through West Virginia to Columbus, Ohio. In addition to upgrading the line to double-stack height, a large intermodal terminal opened at Rickenbacker, Ohio (just outside Columbus) in 2008. The new direct double-stack service cuts over 200 miles and about 24 hours off the previous diverted route.

To some extent this new strategy alters the landbridge style of North American rail operation, in that cargo for the northeast can be handled through eastern ports rather than crossing the country from Los Angeles/Long Beach and passing through the bottleneck of Chicago. Improved direct access for hinterland regions means they are less dependent on diverted flows through other load centres. Yet the extent to which this is possible will also depend to a large degree on whether shipping lines are prepared to take the extra time from Asia to traverse the expanded Panama Canal (from 2014) to access east coast ports. Therefore the success of this project rests partially on the activities of others, and the decision is primarily that of the shipping lines.

The corridor is an example of Inside-Out development, as it was driven primarily by the inland markets, having been initiated by the Appalachian Regional Commission in 1999. The primary aim was for these markets to overcome their traditionally peripheral location by developing good port access. While numerous stakeholders from all aspects of the transport chain were involved, the corridor has remained primarily a rail project, and the new intermodal terminal at Rickenbacker, outside Columbus, is owned and operated (through a third party contractor) by rail operator Norfolk Southern. While the port of Hampton Roads has played a supportive role throughout the process as it will benefit from improved inland access in order to compete with west coast ports, it is not actively involved in the developments. The project has been discussed in more detail by Monios & Lambert (2011a&b).

### **3.7 USA: Alameda corridor: Outside-In corridor**

The Alameda Corridor is a short (20 miles), high capacity (3 double-stack tracks) line designed to reduce congestion and other negative externalities associated with the extremely high container flows of the San Pedro Bay ports (Los Angeles and Long Beach – combined 2009 throughput of 11.8m TEU). The project consolidated branch lines of two rail operators Burlington Northern Santa Fe (BNSF) and Union Pacific (UP), reduced conflicts at 200 grade crossings and included a 10 mile trench. The line was developed through a PPP and was opened in 2002, with a capacity of about 150 trains per day. The total cost of the project was \$2.43bn.

In this example, the ports are more involved in the project than the Virginia port authority in the Heartland Corridor, because the ports are the financial guarantors of the corridor and will lose money if the route is not used and incurs losses. Indeed, the ports were involved from the beginning, purchasing the required rail lines from the railroads and extracting an advance agreement from the railroads to use the corridor once it was built.

Yet while the corridor solves certain problems for the port, it presents other issues for the two competing rail operators. UP have a large intermodal yard (ICTF) in Carson (about 4-5 miles from the port), therefore they are able to truck their containers there for consolidation on block trains, then send those up the Alameda Corridor and across the country. Whereas BNSF's main yard is at the end of the corridor, in Los Angeles. Therefore

BNSF often drive trucks from the port to transloading warehouses in the area surrounding the port for transloading from 40ft maritime containers to 53ft domestic containers.<sup>2</sup> Then the domestic container is trucked to their LA yard for rail access to the interior, thus bypassing the corridor. Therefore when rail corridors are built, it is important to understand issues such as train marshalling that can have major impacts on usage of the mainline. Out of a total port throughput in 2009 of 11.8m TEU, 3.4m TEU travelled along the corridor while 4.3m travelled inland by truck. 3.4m TEU used rail after transloading into larger containers. Therefore a significant amount of rail traffic is actually bypassing the corridor due to this problem.

The Alameda Corridor is thus an example of Outside-In development, driven to a large degree by the publicly-owned port authorities in order to overcome congestion problems. This was done by setting up the Alameda Corridor Transportation Authority (ACTA) as a joint powers authority. However, unlike a conventional satellite terminal strategy, the containers are not sent to an inland terminal acting as a spillover site for container management. It is left to the two rail operators to organise their own marshalling strategies, and due to historical developments, UP is best-placed to do so.

The Alameda Corridor further presents an interesting example of a high-capacity corridor exerting influence within a small spatial scale, in contrast with the multi-state Heartland Corridor. It even produces other effects after the 20-mile corridor empties into the normal branch lines for interior transit. As trains have priority over roads (as it is the rail operators' own private land), significant congestion can be produced in the eastern part of LA county. Therefore a new project called Alameda Corridor East is being developed to replace at-grade junctions with grade separations, mostly at the expense of public funding. The two projects have been discussed in more detail by Callahan et al. (2010) and Monios & Lambert (2011b). The Alameda Corridor has also been studied by Jacobs (2007).

#### **4. Roles of the driver and direction of port regionalisation**

An inland intermodal terminal can provide port access to a region that suffers from poor accessibility to ports, fulfilling aims of both the inland region and the port. Consolidation of flows to provide economies of scale, decreased transport costs through access to main routes and increased frequency of services providing flexible options are all desirable for shippers in inland regions, while the port benefits from increased traffic along this corridor. Yet while the port has an interest in improving hinterland links, it can be achieved in different ways.

Notteboom & Rodrigue (2005) stated that regionalisation "is characterised by strong functional interdependency and even joint development of a specific load centre and (selected) multimodal logistics platforms in its hinterland" (p300), and they go on to remark that "the implementation of regional load centre 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." (p307) This account does not clarify who drives the development of the strong interdependencies that lead to port regionalisation. As the case studies reveal, the direction

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<sup>2</sup> This behaviour relates to a general trend in US intermodal freight transport, whereby carriers are reluctant to send a maritime container inland because it will struggle to find an export load to send it back to the port. Moreover, economies of scale gained by using larger containers (53ft domestic vs 40ft maritime) mean that for long-distance hauls, it is more economic to transload into the domestic container near the port and send the empty 40ft back to the port for repositioning.

of development and the drivers, whether public, private or in combination, do have significant impact on the level of created interdependencies, which particularly materialise in the level of logistics integration.

In Spain public port authorities are involved in inland terminal development, yet despite heavy marketing, in none of these sites do the port authorities own a majority shareholding or direct the operations. By contrast, ECT is a private port terminal operator actively integrated with the inland site, thus representing perhaps the only genuine case of structural transformation of the above examples. In both Sweden and Italy it can be observed that public authorities build a site in order to attract port integration that in most cases was not forthcoming. The two US examples provide an opportunity to explore the effects of scale. The Heartland Corridor is a large undertaking involving numerous shareholders across a large distance, thus being less integrated than the above examples but with perhaps the largest effect on the freight distribution network, giving the port improved access to large markets in time for an expected increase in traffic. Local shippers also gain improved access to global opportunities. By contrast, the smaller spatial scale (but higher traffic flows and higher cost due to the engineering works) of the Alameda Corridor shows the ports integrating to the extent that it achieves their short term goals, while creating potential problems for one of the two rail operators.

While in all the cases above a port actor is involved to some degree, what is striking is their low level of integration in most cases, reflecting the difficulty for a port authority to exert influence beyond the port's perimeter. The underlying theme is that port actors want improved inland access to further their business aims but they can rarely be said to be driving these developments, even in the cases of Outside-In development. In most cases the port actor is a partner in someone else's plan. Similarly, all inland terminals in the above sample are independent from the port except for Venlo.

Rather than exerting influence on the ports, the inland terminals are generally aiming to make themselves more attractive destinations by seeking some kind of partnership with key ports in their bids to improve their transport links through corridor development projects. While relations between inland nodes and shipping lines will remain of vital importance in arranging routes for carrier haulage, the ability of the inland site to exert power on the port remains limited by the operational considerations of the port actors.

Recently, Ng & Cetin (2011) and Ng & Padilha (2011) have suggested that the regionalisation concept has limited application in developing countries. Ng & Cetin (2011) concluded that Inside-Out development is the common model in developing countries, as opposed to Outside-In in developed countries. The cases presented in this paper challenge this finding, as Inside-Out development is shown to be common in developed countries also.

Port actors can be motivated (forced?) to integrate inland to overcome operational issues such as congestion (e.g. LA/LB), whereas strategic involvement is less successful (e.g. Spain). Inside-Out strategies for logistics poles therefore do not always align with operational or strategic aims of port actors. Potential exists for closer relations between transport and supply chain functions (e.g. Venlo), however the "co-location" of such services is more the focus of the regional economic development agencies or land-focused logistics actors. However it may be that the need for better container management may drive a closer relation between these two functions, as has been shown in the Venlo example. Whether these two functions can truly be integrated is a question that will need to be answered before such strategies of location splitting can achieve their potential of a true structural transformation of ports.

## **5. Spatial discontinuity and structural transformation**

Cullinane and Wilmsmeier (2011) suggested that the spatial discontinuity represented by Outside-In inland terminal development may be a way for ports to extend their life cycle, based on the product life cycle of development, introduction, growth, maturity and decline. As noted above, other writers have discussed the port's declining influence in the transport chain. However a strategy of location splitting can only be successful if the transport link between the port and its subsidiary locations is of significant enough quality that it allows for a sufficient level of throughput; to increase the efficiency of this link further requires some level of integration of operations, independent of whether the development is Inside-Out or Outside-In. Achieving this quality of linkage is challenged by the fact that all nodes in the chain compete for their market share, thus the levels of integration and cooperation in each instance will be context-dependent. In particular, the geographic location of ports, while no longer guaranteeing a captive hinterland, nevertheless provides a massification of flows unequalled by inland gateways.

Since the port represents a physical and functional link between logistic and transport networks, they will need to meet certain requirements in the future, influenced by a number of restrictions and external drivers (Cullinane and Wilmsmeier, 2011). Among others, these include capacity restrictions within the port area, capacity restrictions in the seaport access and the related environmental challenges, and increasing competition in the hinterland due to other ports extending their area of influence. The conceptualisation presented in this paper underlines the necessity for decision makers to develop a clear understanding of the complexity of port development; such knowledge can potentially reduce risks and allow decision makers to see port development in the context of wider impacts on other systems. Ports with spatial development constraints are required to pursue a strategy of spatial discontinuation to remain competitive.

A conflict can be identified between two broad conceptual groupings: on one hand an Outside-In, port-driven, operationally focused, potential satellite terminal/extended gate concept and on the other, an Inside-Out, logistics-oriented, public-sector driven load centre concept. The distinction drawn by Rodrigue et al. (2010) between the transport and supply chain functions of an inland node can be widened further based on evidence presented in the case studies above. While more case studies of alternative practice are required, the case studies in this paper show that even in instances where port-inland integration is desired the actuality is rare and only focused on the transportation function, whereas the logistics and supply chain functions are more the interest of regional and public development bodies. Whether these two functions can be integrated is a question for further research. Even the success of the Venlo example requires further legal and practical barriers to be overcome before its potential can be reached.

Logistics practice remains fragmented amongst a variety of actors. As one indicative example, how can inland distribution be coordinated and rationalised amongst a network of load centres when carriers require empty containers to be returned immediately to ports, adding movements and expense to the overall transport cost? Such operational arrangements can affect the viability of transport corridors and inland terminals and thus constrain the strategies of ports and other transport actors, but institutional structures (in terms of ownership, regulation and development of transport services such as carrier, merchant or "terminal" haulage) can make it difficult to resolve these operational limitations.

## 6. Conclusion

Traditional ports and port systems are under pressure to find new solutions to cope with competition, capacity constraints and the requirements of logistics and supply chain management. “Location splitting” as part of the port’s lifecycle has been explored in the case studies above, and a number of important issues are raised with regard to the spatio-temporal transformation represented by this strategy. Comparison of various concepts on how inland terminals and the connecting corridors are planned, controlled, owned and operated have shown that “location splitting” is frequently driven Inside-Out.

Port devolution and deregulation of transport services in general has opened wider possibilities for the private sector, public sector and varying forms of cooperation between the two. Land use and transport planning require integrated approaches across local, regional and national boundaries to be able proactively to influence and direct port development in this type of spatially discontinuous system.

The success or failure and source of “location splitting” and whether it represents true “structural transformation” can commonly be attributed to the existence of institutional barriers that prevent the efficient and effective operation of an integrated port-inland system. These can relate to policies of regulation (either over-regulation of transport services or under-regulation of inland terminal planning regimes), or operational aspects such as consolidation of market demand across political boundaries or finding space to marshal trains or transload cargo within two competing private rail networks.

This paper demonstrates that focusing attention on the driver and direction of intermodal corridor development enables a more nuanced understanding of the process of port regionalisation. However it is recognised that additional case studies will be required to gain an understanding of regionalisation strategies in further contexts.

The findings give way to the question: what is port development? Firstly, physical, as evidenced by most of the earlier models: infrastructure, superstructure and spatial development. This stream of models leads towards location splitting as spatial discontinuity. The aim of this strategy is to support the core business of port throughput. Secondly, operational and strategic. These are the aspects sought by the regionalisation model, which focuses on relations between the port and the hinterland, through a variety of interdependent relationships. This could have the potential of true structural transformation of port operations, but only if accompanied by a move beyond the same aim of supporting the port’s core business. While the regionalisation model does discuss this break from the traditional understanding of the port’s role, it does not elaborate sufficiently on how it is done, in particular which actors direct the process and from which direction.

A trend may be observed, beginning with the port’s core business of container throughput, and developing towards hinterland actions and investments (either physical or operational/strategic) with an aim of supporting this core business. However as can be seen from the case studies in this paper, these developments struggle to succeed if they are viewed merely in this supporting role. Greater integration with the supply chain requirements of the cargo inside the containers is required, even if this integration relates only to visibility of the cargo in the supply chain, so that more efficient movements may be scheduled within the port’s operational hinterland links. This will be the next challenge for ports.

In order to succeed in an increasingly competitive environment, ports can only achieve the required efficiencies in their hinterland links if they no longer make a clear distinction

between core and supporting activities. A true structural transformation is required to achieve the full potential of location splitting, and the ports that break free of their competitors will be those that achieve this goal. Therefore the emerging stage in port development theory must understand relations between port authorities, port terminal operators, inland terminal operators (including the transport link between the two) and logistics providers who can provide visibility of the supply chain requirements of the cargo in the boxes. Cargo movement and box movement must be aligned more closely, and the direction of vertical control and the drivers of these developments can help reveal these relationships and linkages.

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