17 The Future of Seaport Hinterland Networks

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Abstract

In this paper, a vision is developed on the future of seaport hinterland networks. The innovative concept of the Extended Gate is discussed in detail, based on the Dry Port concept which has already received considerable attention in practice and in the scientific literature. We then identify a number of business challenges related to the implementation of the Extended Gate concept. Based on a literature survey, we identify research challenges that we aim to address in future research projects, such as the Dinalog project ULTIMATE. We also assess the economic impact of the Extended Gate concept once implemented. This chapter is dedicated to Jo van Nunen, who cherished the port of Rotterdam as a laboratory for innovation and scientific research, and who has played a pivotal role in the application of scientific research in logistics and supply chain management.

17.1 Introduction

The Netherlands has been a trading nation for centuries. As a result, the country has a strong fiscal-financial infrastructure, a strong and innovative logistics industry, and, last but not least, one of the largest ports in the world – the Port of Rotterdam. It is therefore not surprising that the Netherlands plays an important role in a large number of global supply chains. Supply chain innovations often find their focal point in the Netherlands. This makes the Netherlands, and the Port of Rotterdam in particular, an excellent laboratory of logistics and transport research. Jo van Nunen, to which this chapter is dedicated, has always strongly supported the idea of the port as a laboratory where innovative practitioners and scientists could work together to develop new concepts. This chapter discusses a recent innovative concept in the port that will carry our Erasmus University tradition of strong academic, applied research in the port well into the future.

The port community in Rotterdam is continuously facing challenges in moving cargo through the port: congestion, pollution, delays due to administrative burdens, instability of hinterland connections, fierce – if not cutthroat – competition between transport operators and terminals, and a search for the relationship between added value activities and the cargo handling process.

In the years 2004 and 2005, when the unpredicted surge of containers from China reached Europe, the various container terminals became so congested that there was a strong need for a breakthrough innovation. As a response, the idea emerged that a seaport terminal should be able to push blocks of containers inland pro-actively, to alleviate congestion. The Rotterdam deep sea terminal operator ECT, assisted by various master students and researchers from Hogeschool Rotterdam and Erasmus University, developed this idea into the concept of the Extended Gate. In this concept, the terminal gate is extended to include selected hinterland locations, which allows for the movement of containers to those inland locations without prior involvement of the shipping company, the shipper, and the receiver. From 2007 onwards, this concept became operational on the link between the ECT terminals in the Port of Rotterdam and the inland terminal TCT Venlo. ECT is now, in collaboration with Erasmus University and Eindhoven University of Technology, working on the implementation of this concept into a network of inland locations.

This chapter concerns the research challenges that we face in developing the extended gate concept into a network concept. This work will be part of the project ULTIMATE (Efficient Multimodal Hinterland Networks – new concepts for design and operations) supported by the Dutch institute Dinalog. Jo van Nunen was one of the founding fathers of this national institute for logistics and

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supply chain management. This chapter addresses the research agenda for this project, and may serve as a vision paper for hinterland network structures in Europe for the next decade.

17.2 The Dry Port and the Extended Gate concepts: Business challenges

In sea port hinterland intermodal[2] transport networks, as depicted in Figure 1, different organizations, such as terminal operators, freight forwarders, information service providers, infrastructure managers, shippers, and receivers, all aim to contribute to a better performance of the overall supply chain. Terminal operators, for instance, are more and more involved in linking sea terminals with inland terminals, or linking terminals with final destinations in the supply chain, such as warehouses, and henceforth they shift their activities from being a "node operator" to a "flow operator". It enables them to better connect with shippers and receivers in the network. In this vein, ECT has developed a network of inland terminals in Venlo (NL), Duisburg (D) and Willebroek (B). ECT has been offering rail services between Rotterdam and Venlo for a number of years, and this service turns out to be reliable, fast, and cheap; trucking is only marginally faster, but more prone to congestion on the motorways, and more expensive. A major driver for this success is the high frequency of three or four daily departures. Another major driver is the administrative integration of the service across the deep sea terminal – transport – inland terminal link. Furthermore, four independent terminals in the Brabant region have set up a joint subsidiary – called Brabant Intermodal - to coordinate shipments from the deep sea terminals, again creating conditions for larger shipments with higher frequencies.

Shippers increasingly demand efficient and sustainable intermodal transport services. One example is Proctor and Gamble, who have developed an environmentally friendly washing gel that can wash at 15 °C. To move this project into their sales channels in Europe, they also demand environmentally friendly (read: intermodal) transport solutions from the seaport to their various warehouse locations across the UK and the European continent. So the initiatives by ECT and Brabant Intermodal are exactly what companies such as Proctor & Gamble are looking for.

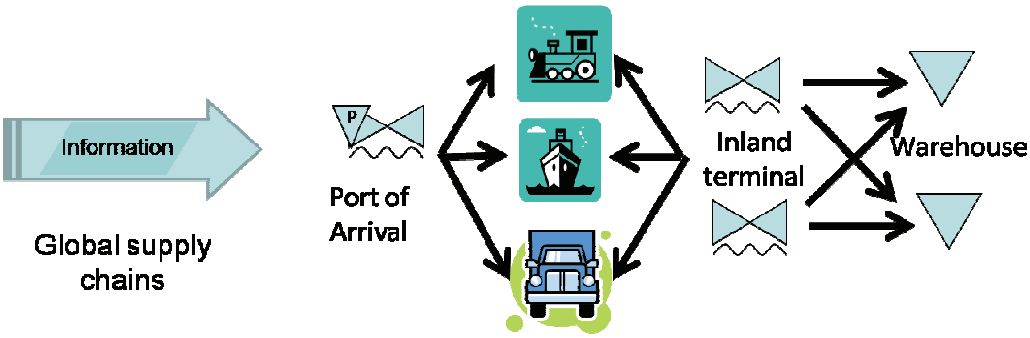

Figure 1: Sea port hinterland intermodal transport network

We now elaborate on the so-called Extended Gate concept in seaport hinterland intermodal networks. Below, we will develop the concept of the Extended Gate from the more basic concept of the Dry Port.

Next to the ongoing issue of trade growth and congestion in terminals, the development of newly industrialised countries, and their need to gain access to the global transport system, has been instrumental in the development of the so-called Dry Port concept. This concept is based on the idea that not all industrial and economic activities have to take place close to seaports (as is common practice in many developing countries), but that good infrastructure and inland nodes can help accommodate trade growth, and bring regional development inland.

[2] For ease of exposition, we refer to intermodal transport as the transport of containers using several modes of transport. However, one may reserve this term for the consecutive use of different modes along a transport lane, and refer to the use of several modes of transport in parallel on a single transport leg as multimodal transport.

As a result, UNESCAP has adopted the Dry Port development as one of their main strategic objectives; see www.unescap.org, and the work of UNESCAP economics affairs officer Wang, Tengfei.

Roso et al. (2009) introduce the Dry Port as a driver for alternative transport network configurations. They observe that Dry Ports serve to bundle cargo and mostly serve a community of cargo interests and operators. The main purpose of the Dry Port is to transfer activities from the seaport to the Dry Port to relieve congestion, and achieve other benefits. Roso et al. (2009) specifically state the potential for modal shift as one of those benefits.

The view on Dry Ports from a seaport economics point is put forward by Notteboom and Rodrigue (2005), who see the development of hinterland networks as a new dimension for competition between seaports. Much of the literature in this area, see for example (McCalla, 1999), focuses on the reasons why hinterland networks emerge, and on the relationships between the networks of various seaports that are in competition.

In the meantime, in another strain of work, much attention has been given by practitioners in seaports and related areas to develop hinterland networks, often centred around a developed, or developing Dry Port. For the European Commission (2001, p. 59), a Dry Port is “an inland terminal which is directly linked to a maritime port”. Leveque and Roso (2002) provide an alternative definition that is a bit more precise: “A Dry Port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units *as if directly to a seaport*” (our emphasis). The definition indicates the purpose of the Dry Port: it acts as an extension of the seaport, both for export and for import traffic.

Numerous examples exist of Dry Port-like arrangements. Roso et al (2009) mention a number of examples, and the terms under which they were presented: Inland container depots (India), Güterverkehrszentra (Germany), Enhanced remote transit sheds (UK). More specifically, examples are (non-exhaustive):

1. TCT Venlo, the Netherlands with ECT container terminal in the Port of Rotterdam
2. Virginia Inland Port with Hampton Roads seaport
3. Alameda corridor between LA and Long Beach, and its connections with intermodal terminals
4. Enfield, close to Sydney Botany Bay seaport
5. Isaka Dry Port and Dar Es Salaam in Tanzania
6. Caslada, Madrid, with seaports in Valencia, Bilbao, Barcelona and Algeciras
7. Toulouse Logistics Activity Zone, and the Port of Barcelona

In Europe, the Port of Rotterdam, the Port of Antwerp, ports in the UK, and ports in Germany and Spain have all developed the Dry Port concept to some degree. In the UK, the Customs arrangements already facilitate completely paperless procedures in ports, including the pre-release of containers, but this is based on a feature of the UK Customs system that may disappear with the introduction of the new Community Customs Code. In the other cases, the implementation is mainly within a single Member State. Crossing borders with the Dry Port concept remains a challenge.

We now further develop the Dry Port concept into the Extended Gate concept. The Extended Gate concept incorporates some of the natural consequences of the Dry Port concept, such as integral network design and direct operational control in the transport network between the sea terminal and the Dry Port. However, as we will see, the Extended Gate distinguishes itself by putting more emphasis on coordination and control of the flows in the intermodal hinterland network.

Even if seaport terminals do not control the containers coming in by sea, they can develop instruments and – in collaboration with other stakeholders of the container-based supply chain – influence the flow of containers to the final destinations.

The Extended Gate concept establishes the point of delivery from the perspective of the shipper/receiver at the appropriate inland terminal or, when possible, at the final destination such as a distribution centre of the shipper/receiver. Essentially, the gate of the sea terminal is now placed at any of the inland terminals in the network (Visser et al., 2007). Cargo interests agree to pick up their containers at the inland terminal location, and the final leg of the journey is arranged according to this agreement by a terminal or another operator. This implies that the shipper/receiver will directly deal with a wide variety of inland terminals rather than with the sea terminal. This delivery at the inland terminal, or even at the distribution centre, is offered as an additional service to the customer. Basically, inland terminals located in economic centres are the most suitable for this purpose, because they could facilitate the flow of import and export containers and facilitate the flow of intercontinental cargo as well. Extended Gate terminals can also build on the function of an intermodal platform, from which containers could be carried on to other, more distant locations, by rail or inland barge. This will help these inland terminals build their service portfolio and develop into true intermodal service providers. In some cases, the customs regime is extended to the inland terminal as well, creating additional value of the service package.

The delivery of the aforementioned intermodal services comes with serious and unexplored business challenges in the areas of collaborative planning and information sharing, intermodal network management in global supply chains, and business model development.

A major challenge comes from the actual usage of newly available information. For instance, if information along the supply chain is integrated and a smaller number of parties involved decide on operational priorities, then the final destination and required timing of delivery of a container (which is typically known by the inland terminal) can be linked to the Estimated-Time-of-Arrival information at the deep sea terminal to pre-arrange containers in the stack differently, and to consolidate containers shipments. Current research has not yet addressed this coordination opportunity, as information is not shared and substantially more parties are involved with coordinating the network from the arrival in the sea port until delivery at the receiver’s warehouse.

One of the crucial conditions for the development of efficient hinterland networks in Europe is the availability of the right information on goods that are arriving from overseas to relevant stakeholders. This includes information on the nature of the goods, quality, health and origin certificates, safety and other handling instructions, destination, shipper, receiver, intended mode of hinterland transport, and required arrival date and time. This information is usually in the hands of freight forwarders, and of the owners of the goods. Currently, such information becomes available to container terminals or hinterland transport operators only at the very last moment, while they need it in advance to better plan their operations.

In addition to the availability of information, an important condition for the Extended Gate networks to function is that the inland terminals are equal partners to the seaport terminals in terms of the quality of their logistics performance, the information management capabilities, their internal terminal management systems, their account management, and customer relationship management, security, and customs status. The conditions the Extended Gate network has to comply with have to be derived from the supply chains they facilitate. A thorough understanding of the supply chain requirements for transport network integration is thus required.

In networks based on Extended Gate concepts, specific operational and analytical problems arise that have to do with the optimisation of operational activities across nodes and links in the network. Examples are the reliability of turnaround times of trains and barges in the port of Rotterdam for the performance of trains and barges in hinterland corridors, the requirement for more flexibility in stacking operations in both sea and inland terminals due to peaks in traffic, and the requirement to show efficiency benefits in operational processes in the sea terminal to offset investments elsewhere in the network.

The current examples of Dry Ports/Extended Gates, except perhaps the example of the Alameda corridor, are about one single connection between a Dry Port and one or more seaports.

There are still no examples where one seaport is connected to a network of Dry Ports. There is little experience with issues of integration, competition and collaboration within such networks.

17.3 Intermodal transport in global supply chains

Global supply chains are becoming increasingly complex; see for instance (Deloitte, 2003). Companies are relying more and more on global sourcing of semi-finished and finished goods, and are confronted with progressively more complex demands of customers in terms of reliability and timeliness of deliveries. In addition to this, there is a strong recent interest in supply chains that are both efficient, reliable and sustainable. Bowersox et al. (2005) list ten supply chain mega-trends, which suggest a transition towards collaborative business networks as flexible, dynamic, customer oriented networks in which economics, quality and sustainability are evenly matched, and in which information is managed to establish online planning, virtual communication and demand oriented processes (Vervest et al., 2009).

The supply chain management literature recognises the transport function as an element in the integration of supply chains; see for instance (Morash and Clinton, 1997). However, the development of integrative activities at the transport level receive very little attention. Stank and Goldsby (2000) discuss transportation management within the context of existing transport possibilities, while Mason et al. (2003) discuss the integration between transportation and warehousing. Rodrigues et al. (2008) present a study on taking into account transport uncertainty in supply chains. Their analysis points at a considerable sensitivity at the supply chain level due to uncertainties in the transport and logistics function, and also to the difficulties in identifying the exact source of these uncertainties. This is in line with similar statements of Rodrigues (1999), who, almost a decade earlier, observes this same phenomenon. He argues that synchronization of (container) terminal activities across supply chain networks is the main source of efficiency gains. In addition, Bruinsma et al. (2000) show that the quality of transport networks, especially the potential for intermodality, can attract new business activities.

The merits of finding a better integration of transport and logistics in the supply chain seem evident. On the integration of modal transport networks, Van Geenhuizen (2000) argues that the concept of transport network interconnectivity has not been defined very well. She also shows that a demand or user perspective is required in network interconnectivity analysis, to maintain a sufficient relevance of the interconnected networks for users. Again, from this perspective of intermodal transport economics, Roson and Soriani (2000) state that the terminals incur the largest changes.

The research field on intermodal transport networks takes concepts from network theory and applies these to the networks that emerge when seaports are connected to inland terminals or when inland terminals are interconnected. Bontekoning et al. (2004) provide a literature overview on intermodal networks, arguing for the definition of intermodal networking as a separate research field. Their work, as much of the work in this area, is restrictive because it disregards inland shipping as a mode of transport. Another example of the work in this area is Janic (2007), who develops a costing model for intermodal and road freight transport networks. The comparison between the two configurations of the model (intermodal, and road freight only), provides him with a framework for European transport policy analysis.

In addition to transport networks, there is an extensive body of literature on intermodal terminal operations. See for a recent survey Stahlbock and Voss (2008), Much of this work, while relevant and scientifically challenging, focuses on internal processes at the terminal. If connections with the logistics chain are considered, it is often an allocation process that takes place at ‘the edge’ of the terminal that is studied. An example is the relationship between a terminal and landside transportation. There are some exceptions, such as Veenstra and Lang (2009), who study the interaction between ship arrivals and terminal operations, and in particular the impact of capacity shortage of the terminal on the proliferation of delays of ships.

17.4 Gap analysis: Research challenges

There is a need to create a knowledge base in support of the development of intermodal networks that connect sea- and dry ports, and customer locations inland. The knowledge base should address a variety of issues that will arise in the design, planning, and operation of these networks, in line with the business challenges described in Section 17.2 and the available literature as discussed in Section 17.3.

1. Intermodal networks that incorporate a sea port and multiple dry ports have some specific characteristics that should to be recognized and exploited in their design. Moreover, the existing literature does not address by what mechanisms such inland networks are developed. The network design problem, and the role of major drivers and determinants such as supply chain requirements, and the use of information have not been studied in this context.
2. Quantitative models developed so far that support the design of intermodal networks and services on the network are focused on design principles that are physical in nature, such as transport infrastructures, transport mode characteristics, frequency of service, etc. Apparently, the information infrastructures requirements are considered to be a derivative of network service design and are assumed to be fulfilled. There is a need to further understand how the extent to which information infrastructures are available impacts the design of intermodal services on networks; see for example (Zuidwijk and Veenstra, 2010).
3. The performance of the network may benefit from the integration of the planning of operations at the seaport and dry ports, and the planning of intermodal services on the network. There is a need for methods that quantify the benefits of integrating these planning processes. However, the integrated planning in transport networks across transport modes, and the embedding of these partially integrated networks (read: Extended Gates) into supply chains is an area that remains largely unexplored.
4. The design, planning, and operation of an intermodal network have considerable impacts on the societal and natural environment. On the other hand, stakeholders such as port authorities and governments may impose e.g. environmental requirements that need to be complied with, and in the design, potential regulations need to be anticipated. The modal split requirement for container flows from Maasvlakte 2 is an example. There is a need to incorporate such stakeholder requirements in the modeling that aims to support decision making in the intermodal network.
5. The logistics and supply chain literature deals extensively with the managerial consequences of integration, the legal consequences of integration of (transport) activities and the shifting roles of business parties have only been studied in isolation of logistics and transport practice. Legally very complex situations can occur when a terminal operator also engages in transportation, and in freight forwarding activities, which is the case in Extended Gate concepts. In the intermodal transport literature, topics such as the legal framework for international intermodal transport are in urgent need of further research; see the recent PhD thesis by Hoeks (2009).
6. Most of the Dry Ports use rail as the alternative transport mode. Inland shipping hardly plays a role. In addition, in many cases, the aim of Dry Port concepts is to (only) replace road cargo with rail cargo. Tri-modality does not play a role in the existing examples, nor in the academic literature, but is an important core competence to achieve all potential benefits of Extended Gate concepts. Furthermore, the existing literature takes an “either/or” approach when considering alternative modes, while the joint use of multiple modes is paramount to the success of these networks.
7. Finally, the business case for Extended Gate-type concepts, and possible business models need further attention.
8. The current scientific contributions on the interrelation of transport markets for various modes, on pricing models for multimodal services and on the definition of and demand for network coordination services are quite marginal. Another complicating factor is that in ports, the governance of innovation and the solution of collective action problems rests with a separate entity called the port authority. Thus, the role of port authorities in the development of new multimodal hinterland services, that influence the competitive position of the port in the long run, also deserved attention. The methods that support the design of the intermodal network services

should incorporate the business models through which intermodal services create value. For example, demand for transport should not be considered a given but dependent on the pricing of service packages. Moreover, the demand for transport should be recognized as heterogeneous, notwithstanding the standardization of the physical processes of container transport.

17.5 Economic impact assessment of the Extended Gate concept

We anticipate that the following economic and social benefits can be achieved when the Extended Gate concepts is put in place:

1. The integrated networks with Extended Gates will lead to a more reliable, predictable, and possibly quicker service that facilitates that part of global supply chains where time pressure is the main driver.
2. If the efficient flow of containers into the hinterland is facilitated by Customs, it will also contribute to a better distribution of customs inspection activities to hinterland locations, instead of concentrating those activities in an already congested port area. Visser et al. (2007) also argue that a lot of activities in the sea ports, such as the customs clearance, could be shifted to a hinterland port.
3. Compared to the current situation, container hinterland transport could rely much more on inland waterways and rail services. Given that there is usually enough time to move the container to the inland location, they can be shipped in large quantities by block trains and – if feasible – by barges to inland intermodal terminals. The alternative of road transport can be reserved for the cases under time pressure. Zuidwijk and Veenstra (2010) have developed a model to study the economic, security, and environmental impacts of such solution directions. These solution directions create new demand for more environmental-friendly modes of transport, and contribute to a better spread in the use of existing transport infrastructures.
4. The Extended Gate concept would contribute to decongesting seaport terminals, which allows these terminals to enhance their performance (Woxenius et al., 2004).
5. A decreased use of trucks for container hinterland movements also reduces the road congestion around the seaport areas especially during peak times; see (Roso, 2007).
6. Efficient intermodal hinterland networks will play an important role in location decisions of foreign companies. Making these networks more efficient will therefore increase the relative market share of the Netherlands in the Hamburg-Le Havre range.
7. Inland terminals are required to develop the scope of their operations to satisfy logistics needs of their clients. The supply chains are becoming more complex, so the final customers will need integrated services and capabilities to respond to this increasing complexity (Notteboom and Rodrigue, 2004). This in turn requires more skills and knowledge in the logistics sector, and may create more jobs in the hinterland.
8. Logistic Service Providers/shippers in the hinterland will gain more visibility en can therefore increase the reliability in their supply chains.

We have valued these impacts with some preliminary calculations. The purpose of these calculations is to see how much value added could be generated if the extended gate concept is adopted widely in the port hinterland. The economic impact of the work in the current project consists of the following components:

1. Offering Extended Gate services implies offering high-frequency services to customers of the network upon request, implying a premium service for customers, and hence providing a higher added value.
2. The improved coordination in intermodal transport chains will lower generalised transportation costs for Dutch consumers and companies.
3. The development of intermodal hinterland networks will help shift cargo from road to rail and inland shipping and achieve a better use of existing road infrastructures during non-peak times.
4. The approach to develop seamless hinterland flows of containers will alleviate congestion around terminals in the seaport,

5. The improved intermodal chains will allow the Netherlands to capture a larger market share in North-West Europe's container flows and logistics activities.
6. The development of hinterland nodes as key logistics platforms will have a positive impact on employment creation around logistics centres.

Below, some relevant data and crude estimates of the impact are provided:
1. About 6.5 mln TEU transit Dutch seaports, with an expected growth to 12.5 mln TEU in 2020. Total generalised transport flows: €500 per TEU (Ecorys, 2003), which amount to a total of €3.25 bln. We expect a reduction of 5% on total generalised costs.
2. Modal split: 57% road, 30% barge, and 13% rail[3]. We expect a modal shift of 15% towards rail and barge.
3. Congestion costs on the A15 highway as estimated in 2007: €10 mln per year. Strong growth is expected if no action is taken. This project aims at reduction of congestion costs, but also at improved coordination of trucks which will increase value added per driver.
4. Lock in market share increases of at least 1 percent point for Rotterdam due to efficient hinterland networks. The current market circumstances show market share volatility of up to 5 or more percent points; in 2008, Rotterdam had a container market share of 24%, and in the beginning of 2010, the market share was above 30%! The Extended Gate concept is expected to lock a substantial share of this otherwise dynamic market share. This then becomes a sustainable contribution to the Dutch economy.
5. Employment in Transport and Logistics in the Netherlands was 746.000 persons, with an added value of € 40.2 bln. We assume that employment will grow proportionally with the increase in value added.

Type of impact	*Value (€ - unless otherwise stated)*
Reduction generalised transport costs	162.5 mln
Modal shift	24.38 mln
Reduce congestion	1.5 mln
Lock in market share (1%)	216.67 mln
Create employment	4000 jobs
Total Impact	**405.05 mln**

Table 2: Economic impacts Extended Gate concept

17.6 Conclusion: A vision on future intermodal networks

We finish this chapter with the formulation of our vision on future hinterland networks. The analysis of the Extended Gate concept and the envisaged results of the Dinalog project ULTIMATE, as well as the planned redevelopment of the Port Community System in the Port of Rotterdam will have consequences for the structure of hinterland networks in Europe. The main characteristics of our vision are:

1. Hinterland networks will connect seaports selectively with main transport and logistics hubs in the hinterland. The selection of these hubs, and the characteristics and requirements for hubs to qualify for inclusion in hinterland networks is one of the main challenges for the regions in Europe.
2. Seaports will rely heavily on these networks to move cargo into the hinterland, primarily by barge and rail. This means that trucking in and around seaports can be reduced substantially, if there is

[3] We acknowledge that different figures are used in different sources; these figures include all container flows, also short sea transport flows.

political will to develop barriers for trucks to enter the port. Pay as you go systems on motorways into the ports for trucks, dedicated truck taxation, minimum driving distance requirements, and other schemes can be adopted for this purpose. See also the Clean Truck Program in the ports of Los Angeles and Long Beach; see www.polb.com and www.portoflosangeles.org.

3. Seaports will revert back to nodes for cargo handling and transhipment, and will lose their role as logistics nodes. Distribution parks in port areas will disappear, and the available space can be used for other, more directly port related activities.
4. The inspection and supervision regimes of Customs, phytosanitary services, and other inspection agencies will also be moved into the hinterland. This is already the case for many of these inspections, but the administrative processes in the port are not completely optimised with this development in mind. This is an ongoing process.
5. Inland terminals in the hinterland will bear the brunt of the challenges that remain in efficient multimodal hinterland networks: they will sometimes face considerably more serious operational pressure than heretofore, and part of the congestion and other negative effects from the seaports will now materialise around inland terminal locations. It is up to regional authorities to play a role in the mitigation of these effects.

This vision is depicted in Figure 3 below. This figure portrays a conveyor belt system between seaports and inland terminals, where the conveyor belt is secured entirely with appropriate technology. Quality standards exist for the selection and performance evaluation of the inland terminal locations.

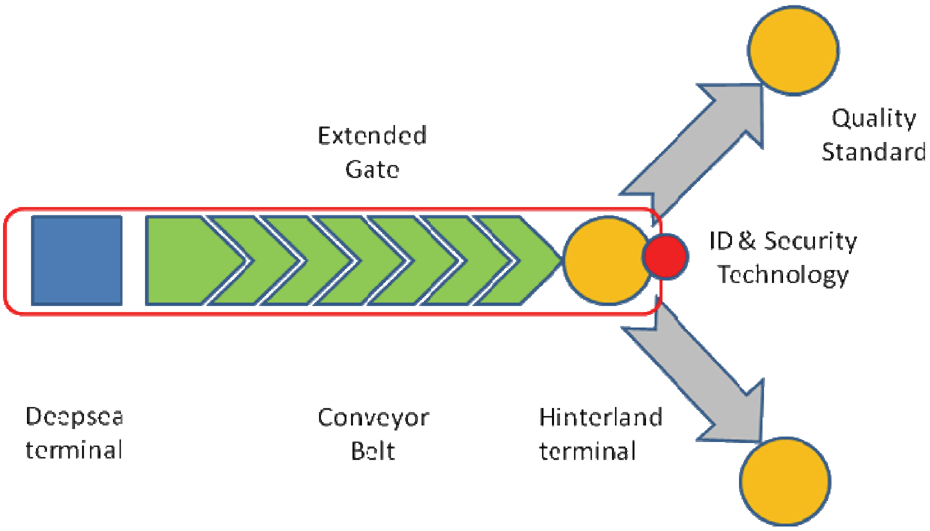

Figure 3: Representation of the industrialised extended gate concept (courtesy of dr R. Mertel, Kombiconsult GMBH, Germany)

If this development will dominate hinterland transport in European seaports, then this sets an agenda for inland terminal managers, transport service providers and policy makers.

The quality of performance of inland terminals in Europe will have to be raised to the level that they become equal partners of seaport terminals. In addition, local governance structures will have to be adapted to be able to deal with some of the seaport problems that will emerge in the hinterland. National and European authorities will have to have another look at their supervision arrangements to be able to optimise personnel and resources to keep a check on incoming cargo of all kinds. Additional measures that rely on pre-arrival checks in countries of origin (see for instance the current development vis-à-vis the Import/Export Control System) would need to be implemented and extended. New business partnerships between terminal operators and multimodal transport service providers will have to be established that fit in the current and future legal frameworks for transport in Europe, but that also create new flexibility to offer integrated services in the multimodal hinterland networks.

References

Bontekoning, Y.M., Macharis, C., Trip, J.J. (2004). Is a new applied transportation research field emerging? – a review of intermodal rail-truck freight transport literature. Transportation Research Part A 38: 1-34.

Bowersox, D.J., Closs, D.J., Stank, T.P. (2000). Ten Mega-trends that Will Revolutionize Supply Chain Logistics. Journal of Business Logistics 21(2): 1-15.

Bruinsma, F., Gorter, C., Nijkamp, P. (2000). Multimodal Infrastructure, Transport Networks and the International Relocation of Firms. Transportation Planning and Technology 23: 259-281.

Dekker, R., Asperen, E. van, Ochtman, G. (2009). Floating stock in FMCG supply chains: using intermodal transport to facilitate advance deployment. International Journal of Physical Distribution and Logistics Management 39: 632-648.

Deloitte (2003). Supply Chain Complexity. Deloitte Research Global Manufacturing Study.

European Commission (2001). Freight intermodality. Transport RTD Programme of the 4th Framework Programme, Luxemburg.

Hoeks, M.A.I.H. (2009). Multimodal transport law. PhD thesis, Erasmus School of Law.

Janic, M. (2007). Modeling the full costs of an intermodal and road freight transport network. Transportation Research Part D 12: 33-44.

Lang, N., Veenstra, A.W. (2009). A quantitative analysis of container vessel arrival planning strategies. OR Spectrum 32(3): 477-499.

Leveque, P., Roso, V. (2002). Dry Port concept for seaport inland access with intermodal solutions. M.Sc. thesis. Department of Logistics and Transportation, Chalmers University of Technology.

Mason, S.J., Rivera, P.M., Farris, J.A., Krik, R.G. (2003). Integrating the warehousing and transportation function of the supply chain. Transportation research Part E 39: 141-159.

McCalla, R. (1999). Global change, local pain: intermodal seaport terminals and their service areas. Journal of Transport Geography 7: 247-254.

Morash, E.A., Clinton, S.R. (1997). The Role of Transportation Capabilities in International Supply Chain Management. Transportation Journal, Spring: 5-17.

Notteboom, T., Rodrigue, J.-P. (2004). Inland Freight Distribution and the Sub-harborization of Port Terminals. In Licheng, S., Notteboom, T. (Eds.), Proceedings of the First International Conference on Logistics Strategy for Ports (pp. 365-382), Dalian Maritime University Press, Dalian (China).

Notteboom, T., Rodrigue, J-P. (2005). Port regionalization: towards a new phase in port development. Maritime Policy and Management 32(3): 297-313.

Rodrigue, J-P. (1999). Globalization and the synchronization of transport terminals. Journal of Transport Geography 7: 255-261.

Rodrigues, V.S., Stantchev, D., Potter, A. and Naim, M. (2008). Establishing a transport operation focused uncertainty model for the supply chain. International Journal of Physical Distribution and Logistics Management 38, 388-411.

Roso, V. (2007). Evaluation of the Dry Port concept from an environmental perspective: A note. Transportation Research Part D 12(7): 523-527.

Roso, V., Woxenius, J., Lumsden, K. (2009). The Dry Port Concept – Connecting Seaports with their Hinterland. Journal of Transport Geography 17: 338-345.

Roson, R., Soriani, S. (2000). Intermodality and the Changing Role of Nodes in Transport Networks. Transportation Planning and Technology 23: 199-213.

Stank, T.P., Goldsby, T.J.(2000). A Framework for transportation decision making in an integrated supply chain. Supply Chain Management 5: 71-77.

Stahlbock, R., Voss, S. Operations research at container terminals: a literature update, OR Spectrum 30: 1-52.

Van Geenhuizen, M. (2000). Interconnectivity of Transport Networks: a Conceptual and Empirical Exploration. Transportation Planning and Technology 23: 199-213.

Vervest, P., Li, Z. (2009). The Network Experience – New value from smart business networks. Berlin: Springer.

Visser, J., Konings, R., Pielage, B.-J., Wiegmans, B. (2007). A new hinterland transport concept for the port of Rotterdam: organisational and/or technological challenges? Proceedings of the Transportation Research Forum, North Dakota State University.

Woxenius, J., Roso, V. and Lumsden K. (2004). The Dry Port Concept – Connecting Seaports with their Hinterland by Rail. In Licheng, S., Notteboom, T. (Eds.), Proceedings of the First International Conference on Logistics Strategy for Ports (pp. 305-319), Dalian Maritime University Press, Dalian (China).

Zuidwijk, R., Veenstra, A. (2010). The Value of Information in Container Transport: Leveraging the Triple Bottom Line. Working paper, Erasmus Research Institute for Management, Rotterdam.