

ULTIMATE

Efficient Multimodal Hinterland Networks – new concepts for design and operations

Proposal for DINALOG

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Project Name	ULTIMATE - Efficient Multimodal Hinterland Networks – new concepts for design and operations
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Summary

Businesses in the Netherlands play an important role in a large number of global supply chains. This position has resulted from centuries of trading activities, one of the largest ports in the world, a strong fiscal-financial infrastructure, and a strong and innovative logistics industry. Chain innovations that are initiated by “supply chain owners” often find their focal point in the Netherlands. This project addresses one crucial innovation that is currently developing in the hinterland of the mainports of Rotterdam and Amsterdam: Supply chain and transportation integration through extending the sea terminal gate into the hinterland.

Different firms in multimodal hinterland networks, 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 end points in the chain, such as warehouses, and they thus shift their activities from being a “stock point” to a “flow operator”. It enables them to better connect with shippers and receivers in the network. This change comes with serious and unexplored challenges, but they are also a tremendous opportunity to develop a sustainable competitive advantage for the Netherlands as the gateway to the European hinterland. The seamless flow of goods from seaports to locations far into the hinterland will be a major enabler to prevent negative external effects from the transport, such as congestion in seaports, congestion on motorways due to too much trucking, and enhance the competitiveness of multimodal inland nodes for warehousing and value added activities.

This project will address topics in the domain of integrated multimodal hinterland networks as depicted in the following picture:

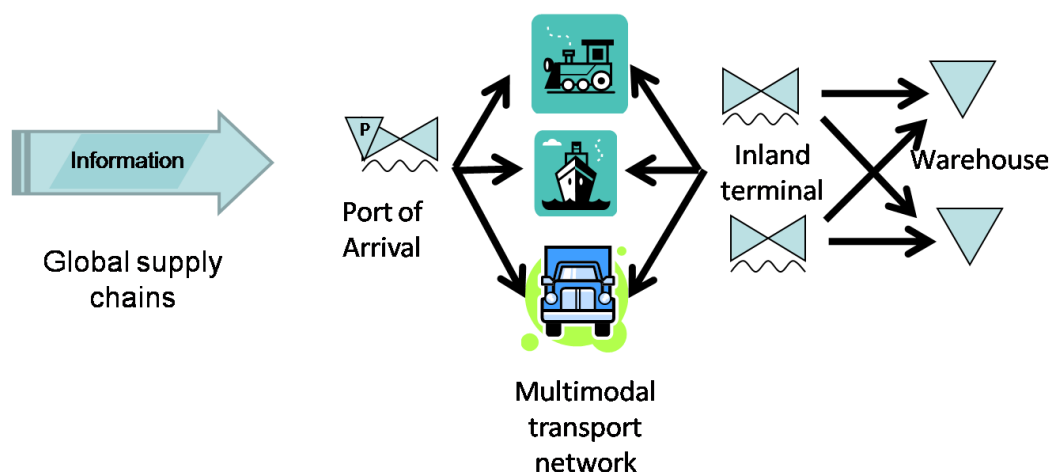


Figure 1: Project domain

A first research activity is to study the relationship between global supply chain requirements and integration in hinterland networks. The second research activity addresses the co-evolution of business partners and port authorities vis-à-vis

hinterland networks. Thirdly, we look at the design of these networks and the role of information that can be made available from the supply chain. This research will look at the network as a whole, and at solving operational bottlenecks in parts of the network. The fourth research activity deals with the assessment of legal consequences of the changing role of several partners in the hinterland network.

It is expected that these research projects will lead to concrete algorithms that can be implemented in terminal operations software and help terminal operators and other service providers to develop new and improved coordination and control services in multimodal networks. In addition, this project will offer more insight in the exact service definition, an assessment of legal consequences and suitable contractual solutions, profitable business models, and a vision on the role of port authorities as enabler of multimodal hinterland development. This will also lead to new business (for instance for law firms), and a strengthening of the competitive position of Dutch mainports vis-à-vis other ports in the Hamburg – Le Havre range.

In addition to these four research programs, a further activity in the project encompasses all project management, dissemination and valorization activities. The main expected results are a simulation environment in which a number of relevant aspects of multimodal hinterland networks can be analysed, both from a scientific and from a business point of view.

This project is innovative because it makes several steps forward to develop efficient multimodal hinterland networks. This requires the solution of a number of challenging operational, informational and infrastructural problems, some of which require scientific breakthroughs. In addition, the development of an integrated vision on the interaction between supply chain requirements, network design, legal (im)possibilities and business models makes this project pioneering and potentially ground-breaking. The concepts that will be developed in this project will shape the new role of European mainports in many years to come.

The valorization of the results of the project is guaranteed in several ways. First of all, the consortium contains many large business players in the area (Ports of Rotterdam and Amsterdam, ECT, Portbase, Keyrail, Brabant Intermodal, Modality) or represents local clusters of business partners (Brabant Intermodal, NV Regio Venlo). These parties will use the results of this project to solve some of their most serious business challenges. To facilitate the interaction between the research teams and the business partners we will develop a host of supporting actions, from internships and (short) secondments of personnel to knowledge exchange workshops at the project activity level. These activities are put in a context of common learning, which will support the development from research to implementation in the context of this project. Furthermore, we will actively manage knowledge dissemination to small and medium sized enterprises in multimodal hinterland networks, through partnerships with several schools of applied sciences and a consultancy firms. Finally, a separate activity will focus on the development of dissemination material, most specifically modern case teaching material to communicate project results and insights to an audience of university, polytechnic and professional college students.

A. Orientation and Project Goals

Motivation

This section describes the motivation for initiating this project, the real and topical issues underlying the project and the urgency to address the issues.

Businesses in the Netherlands play an important role in a large number of global supply chains. This position has resulted from centuries of trading activities, one of the largest ports in the world, a strong fiscal-financial infrastructure, and a strong and innovative logistics industry. Chain innovations that are initiated by “supply chain owners” often find their focal point in the Netherlands. This project addresses one crucial innovation that is currently developing in the hinterland of the mainports of Rotterdam and Amsterdam: Supply chain and transport integration through extending the sea terminal gate into the hinterland.

Different firms in multimodal hinterland networks, 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 end points in the chain, such as warehouses, and they thus shift their activities from being a “stock point” to a “flow operator”. It enables them to better connect with shippers and receivers in the network. ECT, a major deepsea terminal operator in the Port of Rotterdam 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 both reliable, fast (trucking is only marginally faster, but more prone to congestion on the motorways), and cheap. 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 to coordinate shipments from the deepsea terminal to these hinterland terminals, also 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: multimodal) 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 like Proctor & Gamble are looking for.

This type of service comes with serious and unexplored challenges in the areas of business models, performance across the network infrastructure, terminal and transport management, and the role of customs. All these questions require analysis, and answers, to develop more efficient multimodal transport networks

This project starts in the direct hinterland of Rotterdam and Amsterdam, but will provide concepts that are scalable to a European level. If this is achieved, there are tremendous opportunities to develop sustainable competitive advantage for the Netherlands as the gateway to the European hinterland through integrated multimodal transport networks. The seamless flow of goods from seaports to locations far into the hinterland will be a major enabler to prevent negative external effects from the transport, such as congestion in seaports, congestion on motorways due to too much trucking, and to enhance the competitiveness of multimodal inland nodes for warehousing and value added activities. In addition, the development of such networks will lead to new business and new services. The concepts that will be developed in this project will shape the new role of European mainports in many years to come. Currently, the European economy is recovering from the financial crisis of 2008 and 2009. There is a window of opportunity now where businesses are not yet overwhelmed by operational problems as they often are in periods of economic growth. Now is the time to develop, explore and implement new concepts that can structurally change the hinterland connectivity of seaports for the facilitation of global supply chains.

From a scientific point of view, the challenges lie in the analysis of integrated transport network solutions, such as the Extended Gate. Supply chain integration is a topic that has been studied extensively, as well as the optimisation of transport chains and the opportunities for modal shift. However, the integration in transport networks across transport modes, and the embedding of these (partially) integrated networks (read: Extended Gates) into supply chains is an area that is largely unexplored. This means that this project also holds great potential for scientific research. 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 deepsea terminal to pre-arrange containers in the stack differently, and to consolidate containers shipments. Current research has not yet addressed this coordination problem, 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.

Relation to Dinalog innovation themes

This section describes the relationship to the innovation program and specifically to the focus areas (Cross Chain Control Centers, Service Logistics or Transport Hubs in Control). (For more details, see www.dinalog.nl; download "Rapport Commissie van Laarhoven")

The project contributes primarily to the theme "Transport Hubs in Control", in particular to the innovation topics control of information, infrastructure, and networks:

- The control of information is covered by the research on the role of information in the design of hinterland networks, as well as in the operations and optimization in hinterland networks, where inter-organisational system play a crucial role in delivering the required information, and where the

availability of information will enable the development of new planning and control concepts (partners involved: Portbase, Modality),

- The control of infrastructure is mirrored in the research topic on integration of transport networks in supply chains, and the impact of capacity shortages in parts of these transport networks on especially the reliability of the supply chain as a whole. Solving some of these capacity and planning problems, for instance in the field of rail cargo transport, is also part of the current project. In addition, the role of key parties, such the port authority in enabling and facilitating more advanced control over infrastructure will be addressed (partners involved: Keyrail, Port of Rotterdam, Port of Amsterdam),
- The control of networks is covered by research topics on the legal and business environment in efficient and effective multimodal transport services, where the commercialisation of the services, the formulation of multimodal service demand at the supply chain level, and the legal restrictions and possibilities are addressed (partners involved: ECT, Brabant Intermodal, NV Regio Venlo).

Furthermore, when we study the collaboration between the hinterland terminals we study horizontal collaboration in the supply chain, which is part of the theme “Cross chain control centers”.

Objectives and goals

This section describes the project objectives and goals in terms of SMART: Specific, Measurable, Acceptable, Realistic and Timing.
The goals have to be linked to the goals as described in the innovation program (For more details, see www.dinalog.nl; download “Rapport Commissie van Laarhoven”)

The objective of the partnership in this project is to develop a viable multimodal hinterland network concept, based on the Extended Gate, that fits with global supply chain requirements, optimizes the use of all available information in that supply chain, removes all operational and administrative bottlenecks in sea ports and builds on new concepts of cooperation between operators. This concept is a real business concept, with quantifiable revenue, customer base, operational requirements and responsible, identifiable company officers.

The goal in this project is further to develop a research program that will help achieve the central objective. This program consists of four research paths, all four built around a research team consisting of PhD students, master students, and a supervisory team. The project management structure will ensure that the knowledge generated in these teams will be made available to the business partners who are developing and implementing the multimodal hinterland network concept, and that topical bottlenecks and challenges in this implementation process will be addressed with scientifically relevant research. This process is made measurable by monitoring milestones on the business side, and by cataloging academic output on the academic side.

The Innovation program of the Commissie van Laarhoven describes the following goals:

1. New Business: this will be achieved by developing integrated Extended Gate services in multimodal hinterland networks as a new business activity, generating new revenue in addition to the revenue of existing, fragmented services in those networks. The business proposition is that control through innovative concepts will generate a better performance on supply chain level KPIs (reliability, lead time, costs) than what the current service offering can deliver.
2. Efficient, smart chains: the multimodal integration of hinterland networks requires innovative concepts of control, and also new ways of using information that is available in global supply chains. This will make the chains smarter, and activities better measurable. This provides more control, which results in better utilisation of resources, more effective use of infrastructure and assets, and generally more efficient networks.
3. Leading position for the Netherlands: This project is initiated in the Netherlands, by Dutch parties. The concept developed in this project will be implemented in the hinterland of the Mainport of Rotterdam. The successful implementation will put the Netherlands in the lead in terms of multimodal transport integration, and will make the Netherlands much more attractive as a European Gateway.
4. More employment, higher added value: The integrative multimodal transport concept will consist of a new type of service, requiring the development of new units within existing firms, and possibly completely new businesses that will fulfil crucial elements in the integrative concept. This will generate new employment and added value. In addition, in relationship to the increased competitive position of the Dutch seaports, new business will be generated across the board in the seaport business cluster. This also generates new employment opportunities and added value.
5. Lower environmental footprint, less transport kilometers: the central idea of the integrated multimodal hinterland transport network concept is the integration of decision making across modes of transport. Combined with the improved availability and use of information, and improved performance on network reliability, more opportunities will emerge for the use of environmentally friendly modes, such as rail and barge. This will result in a better environmental profile across the hinterland network, as well as less truck kilometres, and all associated effects, such as less congestion on the motorways, less noise and vibration pollution, and so on.
6. Attractiveness: The introduction of this concept, and its benefits in terms of logistics performance, integrated control and environmental profile, will make the immediate hinterland of the seaports, and the Netherlands as a whole more attractive as a location for logistic activities, but more importantly, of logistic control for European distribution networks. The nucleus of knowledge that will reside with Dutch companies and Dutch knowledge institutes, and the continued development of this knowledge, will play an important role in anchoring foreign businesses in the Netherlands.

Expected results

This section describes the targeted final results to be expected by executing the project, both project results for the project partners, but also the contribution to Dinalog economic goals (long term and timing to achieve these goals). Indicate what your project as a business case will contribute to the ambition to increase the Dutch added value (GDP) in supply chain control and logistics from € 3 billion in 2007 to over € 10 billion in 2020. What possible concrete tools and instruments can be expected from the project?

The main result of this project will be a new concept of integrated multimodal networks, that will encompass new solutions for information management and operations, a clear legal structure for all parties involved, suitable service definition and business models, and the balanced adoption of requirement at the supply chain level that translate into performance standards in the network. During the development of this concept there will be results in terms of practical analytical tools, solutions, algorithms, and requirement formulations, as well as academic output in terms of journal articles, PhD theses, master theses, and educational cases. The exact expected deliverables will be discussed in more detail in the next section.

Concrete tools and outcomes that will result from this project will be:

1. A multimodal hinterland network design tool in the form of a simulation model, which allows the calculation of the value of reliability, and the distribution of reliability, and other benefits.
2. Operational decision support tools for both vertical coordination along the supply chain and horizontal coordination between the hinterland terminals
3. A business model for integrated multimodal hinterland services
4. A legal advice on the position of terminals in multimodal hinterland networks

Contribution to economic goals

In general, we are aiming at using the current infrastructure (in terms of road, rail, and water), transport vehicles (along the same three modalities), and terminals (both deepsea and inland) more efficiently, thus being able to offer services against a higher added value. More specifically, with the services that are further developed in this proposal, we can better align the transport with the supply chain requirements of shipper and receiver, and thus offer a higher added value to the shipper/receiver.

The economic impact of the work in the current project consists of the following components:

- Offering Extended Gate services implies offering at-request high-frequency services to customers of the network, implying a *premium service* for customers, and hence providing a higher added value.
- The approach to improve coordination in intermodal transport chains will lower *generalised transport costs* for Dutch consumers and companies.
- The approach to develop multimodal hinterland networks will help *shift cargo from road to rail and inland shipping and achieve a better use of existing road infrastructure during non-peak times*,
- The approach to develop seamless hinterland flows of, especially, containers, will *alleviate congestion* around terminals in the seaport,
- The improved intermodal chains will allow the Netherlands to capture a *larger market share in North-West Europe's container flows and logistics activities*.

- The development of hinterland nodes as key logistics platforms will have a positive impact on *employment creation in logistics hotspots*.

Below, some relevant data and crude estimates of the impact of this R&D project is provided:

- 6.5 mln TEU transit Dutch seaports. Expected growth to 12.5 mln TEU in 2020. Total generalised transport flows: €500 per TEU (Ecorys, 2003): total €3.25 bln. We expect a reduction of 5% on total generalised costs.
- Modal split: 57% road, 30% barge and 13% rail¹. We expect a modal shift of 15% towards rail and barge.
- Congestion costs (A15) €10 mln per year (2007). 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.
- 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 beginning of 2010 this is 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.
- Employment in Transport and Logistics in the Netherlands was 746.000 persons, added value: € 40.2 bln. We assume that employment will growth proportionally with increases in value added.

The economic impact can be estimated as follows:

	Impact (€ - 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

Relation to government policy

If applicable, this section describes the relation to government policy and how interaction between the project and government bodies (which?) is pertained before and during the project.

In a recent strategy document of the Ministry of Economic Affairs², one of the three pillars for long term development of the Mainport Rotterdam is the 'network agenda', in which the main challenges are identified as control and coordination in network development, spatial expansion of networks, and intensifying cooperation. The

¹ Different figures are used, these figures include all container flows, also shortsea.

² Ministerie van EZ (2009). Economics visie op de langetermijntwikkeling van de Mainport Rotterdam.

development of a single national port community system (Portbase) is part of this long term strategy as well.

An important government party that plays a role in the success of an integrated multimodal hinterland network, with seamless flows of containers through seaports, is Customs. In fact, this project will work in parallel with another Dialog project (Single Window) where the customs issues are addressed in detail. The combination of innovative transportation concepts (such as integrated multimodal transport), and advanced information management for customs compliance fits very well with the long term strategy as formulated by DG TAXUD³ (Taxud 2008), and adopted by Dutch Customs.

A further important policy area that this project touches, when the scalability of the concept to the European level is considered, is the integration of the European market, removing boundaries between Member States and providing open market access across the European Union. The main bottleneck for multimodal integration is the difference in interpretation of transport and customs regulation between Member States. Removing these kinds of bottlenecks is specifically part of the European policy goals for the common market.

Orientation

This section describes how the consortium oriented on similar projects and the state of the art on the subject. It clearly states what makes this project new, unique and innovative compared to existing research and other projects. State the relation of the proposed scientific research work in the proposal to the international state of the art.

Scientific State of the Art

The relationship between supply chains and container operations in the hinterland International supply chains are becoming increasingly complex⁴. 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)⁵ list ten supply chain mega-trends. These trends can be translated as a development:

from:	to:
Products	Services
Supply	Demand
Supply Chain	Business Network
Channel	Multi-channel
One Organisation	Multi-organisations

³ DG Taxud (2008). Electronic Customs Multi-Annual Strategic Plan 2008, yearly revision Rev. 9. TAXUD/477/2004 - Rev. 9 - EN

⁴ See for instance Deloitte (2003) Supply Chain Complexity. Deloitte Research Global Manufacturing Study.

⁵ Bowersox, D.J., Closs, D.J. and Stank, P.T. (2000). Ten Mega-trends that Will Revolutionize Supply Chain Logistics. Journal of Business Logistics 21(2).

Profit	Balance 3 P's (People-Profit-Planet)
Planning	Online
Hierarchical Organizations	Virtual-Organizations
Local	Global
1 dimension (price)	Multiple dimensions (price, time, quality)

This table suggests a transition towards business networks as flexible, dynamic customer oriented networks in which economics, quality and sustainability are evenly matched, and in which information management for online planning, virtual communication and demand oriented processes⁶.

The main business network innovation that this project will address is the development of so-called Extended Gateways (or gates) in seaport hinterland networks. Below, we will develop the concept of Extended Gates from the more basic concept of Dry Ports.

The Dry Port concept

In parallel to the developing issue of 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 launch 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. As a result, UNESCAP has adopted the Dry Port development as one of their main strategic objectives⁷.

Roso et al. (2009)⁸ 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 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 & Rodrigue (2005)⁹, 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 1999¹⁰), focuses on the reasons why hinterland networks emerge, and on the relationships between the networks of various seaports that are in competition.

⁶ See for more background on business network development and an overview of the state of the art in research on this topic: Vervest, P. and Li, Z. (2009). *The Network Experience – New value from smart business networks*. Berlin: Springer.

⁷ See www.unescap.org, and the work of UNESCAP economics affairs officer Wang, Tengfei.

⁸ Roso, V., J. Woxenius, K, Lumsden (2009). *The Dry Port Concept – Connecting Seaports with their Hinterland*. *Journal of Transport Geography* 17, 338-345.

⁹ Notteboom, T. and J-P. Rodrigue. (2005). *Port regionalization: towards a new phase in port development*. *Maritime Policy and Management* 32(3), 297-313.

¹⁰ McCalla, R. 1999. *Global change, local pain: intermodal seaport terminals and their service areas*. *Journal of Transport Geography* 7, 247-254.

In the meantime, in the other 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. 59¹¹), a *Dry Port* is “an inland terminal which is directly linked to a maritime port”. Leveque & Roso (2002)¹² 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 underlined section 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 (op cit) 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):

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

In Europe, the Port of Rotterdam, the Port of Antwerp, ports in the UK, ports in Germany and Spain have all developed the Extended Gate 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 roll-out is mainly within a single Member State. Crossing borders with the Extended Gate concept remains a challenge.

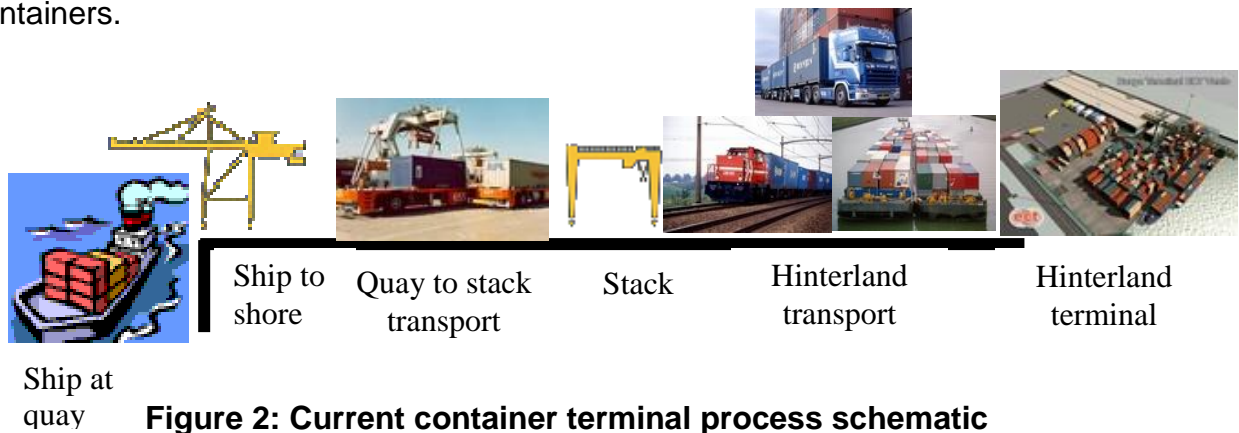
The Extended Gate concept

While the central idea of a Dry Port that acts as if it is a seaport is already embedded in the Dry Port concept introduced above, it is interesting to elaborate on the concept in some more detail. 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. As a distinguishing feature, it puts more emphasis on coordination and control of the flows in the multimodal hinterland network.

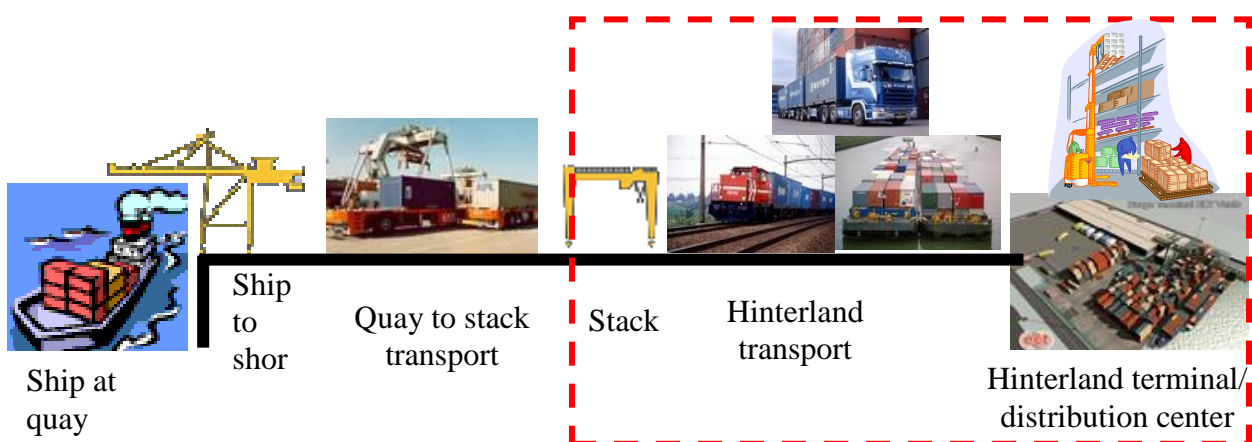
¹¹ European Commission (2001), “Freight intermodality”, Transport RTD Programme of the 4th Framework Programme, Luxemburg

¹² Leveque, P., Roso, V., 2002. Dry Port concept for seaport inland access with intermodal solutions. Masters thesis. Department of Logistics and Transportation, Chalmers University of Technology.

This hinterland network solution is called the extended container terminal gate concept. Even if seaport terminals do not control the containers coming in by sea they can develop instruments and – in co-operation with other stakeholders of the container-based supply chain (see below) - influence the hinterland flow of containers.



The central idea is to extend the delivery point from the perspective of the shipper/receiver from seaport terminal along a corridor to an inland multimodal terminal and, possibly, the final destination such as a distribution center of a logistics service provider or shipping. Essentially, the gate of the sea terminal is now placed at the inland terminal¹³. 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 center, 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 a multimodal 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 multimodal service providers as well. In some cases, also the customs regime is extended to the inland terminal.



¹³ See Visser, J. and al. (2007). A new hinterland transport concept for the port of Rotterdam: organisational and/or technological challenges?

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. This includes information on 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. Currently, such information is not regularly available to container terminals, or hinterland transport operators, until the very last moment. Information is usually in the hands of freight forwarders, and of the owners of the goods.

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 analysis of the supply chain requirements for transport network integration is thus required.

Transportation in the supply chain

At the beginning of this exposition, we started with supply chain developments and business network dynamics. The supply chain management literature recognises the transport function as an element in the integration of supply chains (see, for instance, Morash & Clinton 1997¹⁴). However, it is often transportation management that is considered¹⁵ (within the context of existing transport possibilities), or integration across transport and other activities (see for instance Mason et al 2003¹⁶ on integration of transport and warehousing), never the development of integrative activities at the transport level.

Rodrigues et al (2008)¹⁷ present a study on taking into account transport uncertainty in supply chains. Their analysis points at a considerable sensitivity at the supply chain level 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)¹⁸, who, almost a decade earlier, observes this same interrelationship. 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)¹⁹ show that the quality of transport networks, especially the potential for intermodality, can attract new business activities.

¹⁴ Morash, E.A. and Clinton, S.R. (1997). The Role of Transportation Capabilities in International Supply Chain Management. *Transportation Journal* Spring, 5-17.

¹⁵ See for instance Stank, T.P. and Goldsby, T.J. (2000). A Framework for transportation decision making in an integrated supply chain. *Supply Chain Management* 5, 71-77.

¹⁶ Mason, S.J., Rivera, P.M., Farris, J.A. and Krik, R.G. (2003). Integrating the warehousing and transportation function of the supply chain. *Transportation research* 39E, 141-159.

¹⁷ 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.

¹⁸ Rodrigue, J-P. (1999). Globalization and the synchronization of transport terminals. *Journal of Transport Geography* 7, 255-261.

¹⁹ Bruinsma, F., Gorter, C. and Nijkamp, P. (2000). Multimodal Infrastructure, Transport Networks and the International Relocation of Firms. *Transportation Planning and Technology* 23, 259-281.

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)²⁰ 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)²¹ state that the terminals incur the largest changes.

Inter- or multimodal transport²²

The field of multimodal 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 connected between themselves. Bontekoning et al (2004)²³ 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)²⁴, 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.

Terminal operations

In addition to transport networks, there is an extensive body of literature on terminal operations. See for a recent survey Stahlbock & Voss (2008)²⁵, Much of this work, while relevant and scientifically challenging, focuses on processes on 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 & Lang (2009)²⁶, 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. This project aims to

²⁰ Van Geenhuizen, M. (2000). Interconnectivity of Transport Networks: a Conceptual and Empirical Exploration. *Transportation Planning and Technology* 23, 199-213.

²¹ Roson, R. and Soriani, S. (2000). Intermodality and the Changing Role of Nodes in Transport Networks. *Transportation Planning and Technology* 23, 199-213.

²² This project will make a clear distinction between intermodal transport and multimodal transport. Intermodal transport is the use of more than one mode of transport in a sequence of transport solutions, for instance: sea transport – rail – road transport. Multimodal transport is the use of more than one mode of transport in parallel on specific links in transport chains

²³ Bontekoning, Y.M., C. Macharis, J.J. Trip (2004). Is a new applied transportation research field emerging? – a review of intermodal rail-truck freight transport literature. *Transportation Research* 38A, 1-34.

²⁴ Janic, M. (2007). Modelling the full costs of an intermodal and road freight transport network. *Transportation Research D12*, 33-44.

²⁵ Stahlbock, R. Voss, S. Operations research at container terminals: a literature update, *OR Spectrum* 30, 1-52.

²⁶ Lang, N., Veenstra, A.W. (2009). A quantitative analysis of container vessel arrival planning strategies. *OR Spectrum*, available in *OR Spectrum Online First™*. See for a network analysis also Dekker et al (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.

build on this work to analyse the position of terminals in the context of their networks, and solve operational problems by considering this network context explicitly.

Implementing Extended Gate concepts in practice

The Extended Gate concept can be explained in a fairly concise manner, but is actually quite complicated to execute in practice. There are many issues to consider: which party initiates transport and decides about transport modes and inland terminal locations, what is the liability arrangement during transportation on public networks, how is customs supervision filled in, what are the required security and safety measures, what limits are set by privacy protection regulations, what operational information is required and when, what business models are viable, and what is the involvement of the port authority in the seaports?

If, based on this concept, containers can be transited through the seaport terminal and cleared as quickly as possible a number of economic and social benefits could be achieved:

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 otherwise already crowded port area²⁷.
3. Container hinterland transport could rely much more than today on inland waterways and rail. 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 or even by road at non-peak times. This solution therefore creates a new demand for more environmental-friendly modes of transport and contributes to a better spread in the use of existing transport infrastructure
4. The Extended Gate concept would contribute to decongesting seaport terminals, which could operate more efficiently if their storage yards are less full²⁸.
5. A decreased use of trucks for container hinterland movements also reduces the road congestion around the seaport areas especially during peak times²⁹.
6. Efficient multimodal 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 clients³⁰. This requires more skills and knowledge, and may create more jobs in the hinterland.

²⁷ See Visser, J. and al. (2007). A new hinterland transport concept for the port of Rotterdam: organisational and/or technological challenges? It specifies that a lot of activities usually done in the seaports such as the customs clearance could be shifted to the hinterland port.

²⁸ The shift of the entry gate from the seaports to the hinterland ports allows the shift of a lot of other activities too. It contributes to decongest the seaports. Woxenius, J., Roso, V. and Lumsden K. (2004). The Dry Port Concept-Connecting Seaports with their Hinterland by Rail.

²⁹ See Roso, V. (2007). Evaluation of the Dry Port concept from an environmental perspective: A note.

8. Logistic Service Providers/shippers in the hinterland will gain more visibility and can therefore increase the reliability in their supply chains

Problem definition

The research field reviewed above suffers from some serious gaps:

- 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 of real network analyses, where one seaport is connected to a network of Dry Ports. Thus issues of integration, competition and collaboration within the network are unexplored,
- The existing literature does not address how Extended Gate connections are formed. That is, what mechanism is used to select the inland endpoints. 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,
- While 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 of Hoeks 2009)
- 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 modalities, while the use of multiple modalities *in parallel* is paramount to the success of these networks.
- 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.
- Finally, the business case for Extended Gate-type concepts, and possible **business models** need further attention. 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

³⁰ The supply chains are becoming complex. So the clients logistics needs integrated services and capabilities to respond to this increasing complexity. Notteboom, T. and Rodrigue, J. P. (2004). Interland Freight Distribution and the Sub-harborization of Port Terminals

ports, the **governance** of innovation and the solving 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.

Ongoing developments and projects

The issues addressed in this project are also part of several other, ongoing and prospected projects. The first of these is the EU/FP7³¹ project INTEGRITY. This project attempts to build a basic information collection and integration infrastructure for secure container transport in global supply chains. The project contains a long term demonstration on tradelanes from China, via Yantian International Container Terminal to ECT in Rotterdam and the Port of Felixstowe in the UK. This project could potentially be an important source of the information for the optimal design of multimodal hinterland networks. INTEGRITY will run until Spring 2011.

In the 7th framework of the EU, several new projects have been formulated that will also fit with the theme of the current project. CASSANDRA, in the FP7 Security sub-program, is the follow up of INTEGRITY, where further efforts will be made to integrate data in the supply chain, and demonstrations on other corridors will be organised. CASSANDRA will start in Spring 2011. A smaller project in the Transport sub-program is on efficient interfaces in multimodal networks. This project focuses specifically on border crossing challenges in multimodal hinterland transport.

In Dinalog, one of the projects, Customs Single Window, will concentrate on the customs dimension in multimodal hinterland transport. The current project will maintain close contact with this project for the exchange of knowledge and insights, and to avoid doing double work.

Finally, several of the business partners in this project have ongoing development projects that build on the work in the current project, or extend this work into a real implementation. **ECT** is developing their internal management structure for Extended Gate services through a department called European Gateway Services. The main task of this department is currently to build up the IT infrastructure to manage Extended Gate services, and to do business development to build a client base. **Modality** is one of the IT partners of both ECT and the terminals cooperating in Brabant Intermodal. **Brabant Intermodal** is developing new cooperation models in an important part of the Port of Rotterdam hinterland, between a cluster of inland terminals. This entails innovative collaboration models and sharing mechanisms for costs and benefits, new inland shipping concepts, and possibly new inland terminal operational concepts. **Portbase** is in the process of renewing its port community infrastructure and building an additional platform, the Logistics Service Portal, that will help facilitate the demand for information services in the Dutch hinterland. One important feature of this portal is that it will have interfaces with all commercial players (agents, freight forwarders, logistics service providers, terminals) in the hinterland. **Keyrail** needs control and coordination mechanisms on the railway system between the Port of Rotterdam and the German hinterland. The reliability of the current rail services is in need of improvement, and Keyrail is developing a host

³¹ The 7th framework program is the integrated research program of the European Commission. Important sub-programs in this program are Transport, ICT and Security.

of solutions to remove existing sources of service disturbances: better information management, and real time operational control mechanism, innovative peak pricing schemes, real time re-planning in case of disturbances. **NV Regio Venlo** is developing the position of Venlo as a logistics center by improving the connectivity of the region Venlo (which is one of the largest logistics hotspots in the Netherlands) to the ports of both Rotterdam and Antwerp. Its focus is mainly on the connection between local inland terminals and distribution centers and warehouses in the region, and the removal of any administrative or operational bottlenecks in order to make the flow of goods between terminals and warehouses as smooth as possible, and to create advantages for further in-/outbound continental flow of goods.

B. Activities and Work Packages

1. From problem definition to research questions

This project combines the development of efficient multimodal hinterland networks that can be observed in practice in the Dutch mainport hinterland, and state of the art scientific research in multimodal hinterland networks. In this section, we will translate the problem definition as formulated above into research questions that will be addressed in this project.

The development of multimodal hinterland networks in practice is currently undertaken by the participants in this project: ECT (the largest container terminal operator in the Netherlands), Brabant Intermodal (a subsidiary of four inland terminals in Noord-Brabant), Portbase (the port community system in Rotterdam and Amsterdam), Keyrail (the rail infrastructure manager in the Port of Rotterdam and on the Betuwe route), the Ports of Amsterdam and Rotterdam and NV Regio Venlo (the development company of the logistics activities around Venlo in Noord-Limburg).

Research Questions that need to be addressed as part of these developments, and that are in line with the observed gaps in the scientific domain, are³²:

- What are the requirements at the supply chain level for the design of partially integrated transport networks and what are workable business models?
- How does the Extended Gate concept affect the legal position of the terminal operator in terms of his risks and liabilities? What is the legal framework in which seamless intermodal transportation can take place and what strategies are available to deal with these risks and liabilities?
- What is the role of information availability for hinterland network design?
- What is the role of the port authority in developing multimodal hinterland networks for seaports? What are the business models for efficient multimodal hinterland transport?
- Which operational optimization and control mechanisms are required to make Extended Gate concepts work in practice? What pricing schemes exist in Extended Gate networks?
- How can the supply chain owner (shipper or receiver) take advantage of the existence of Extended Gate services to improve its supply chain operations,

³² These topics have been explored between the knowledge partners (EUR/TUE) and ECT in two workshops in July and September 2009.

for instance by increasing lead time reliability or deploying postponement or floating stock concepts?

As was identified in the previous section, very little scientific research exists to provide answers to these questions. Furthermore, we are unaware of any more advanced practical implementations than those applied currently by the various partners in our consortium.

We translate this in the following PhD projects:

New PhD projects:

1. Supply chains and partially integrated transport networks
2. Design of hinterland networks and the role of information
3. The legal implications of logistics innovation

Ongoing PhD projects

4. Optimization of operational processes in seaport hinterland networks (end date: 2012)
5. The role of the port authority in developing hinterland networks (end date: 2012)
6. Business models innovations in intermodal hinterland networks (end date: 2014)

The latter three PhD projects are ongoing projects. They are integrated into the present project to strengthen the integrative nature of this project. The candidates in these three projects will remain available for the project until the end date, and play an important role in the valorization of their research results in this project.

To enhance the exchange of knowledge between the various PhD projects and research teams, we have devised a structure of **co-supervision**, whereby faculty of one of the other Schools is involved in the supervision of the PhD candidates. This is indicated below in the Work Package descriptions.

2. Project activity structure

The research project is divided into five work-packages and associated activities:

1. Supply chains and partially integrated transport networks (Leader: Eindhoven University, School of Industrial Engineering, Professor Jan C. Fransoo)

Research activities are:

- a. Vertical collaboration between the service providers and the supply chain owner
 - b. Horizontal collaboration between the hinterland terminals
2. Governance and business models (Leader: Erasmus University, Rotterdam School of Management, Department of Strategic Management, Professor Suzana Rodrigues)

Research activities are:

- a. The role of the port authority in hinterland networks
 - b. Business model innovations in the hinterland
3. Design and operations in hinterland networks (Leader: Erasmus University, Rotterdam School of Management, Department of Information and Decision Sciences, Dr Rob Zuidwijk)

Research activities are:

- a. Design of multimodal networks and the role of information
- b. Operations in multimodal networks
4. The legal position of terminal operators in hinterland networks (Leader: Erasmus University, Erasmus School of Law, Professor Frank Smeele)
5. Project management and knowledge exchange (Leader Erasmus University, Rotterdam School of Management, Dr Albert Veenstra)
 - a. Project management
 - b. Valorization
 - c. Knowledge dissemination
 - d. Knowledge exchange

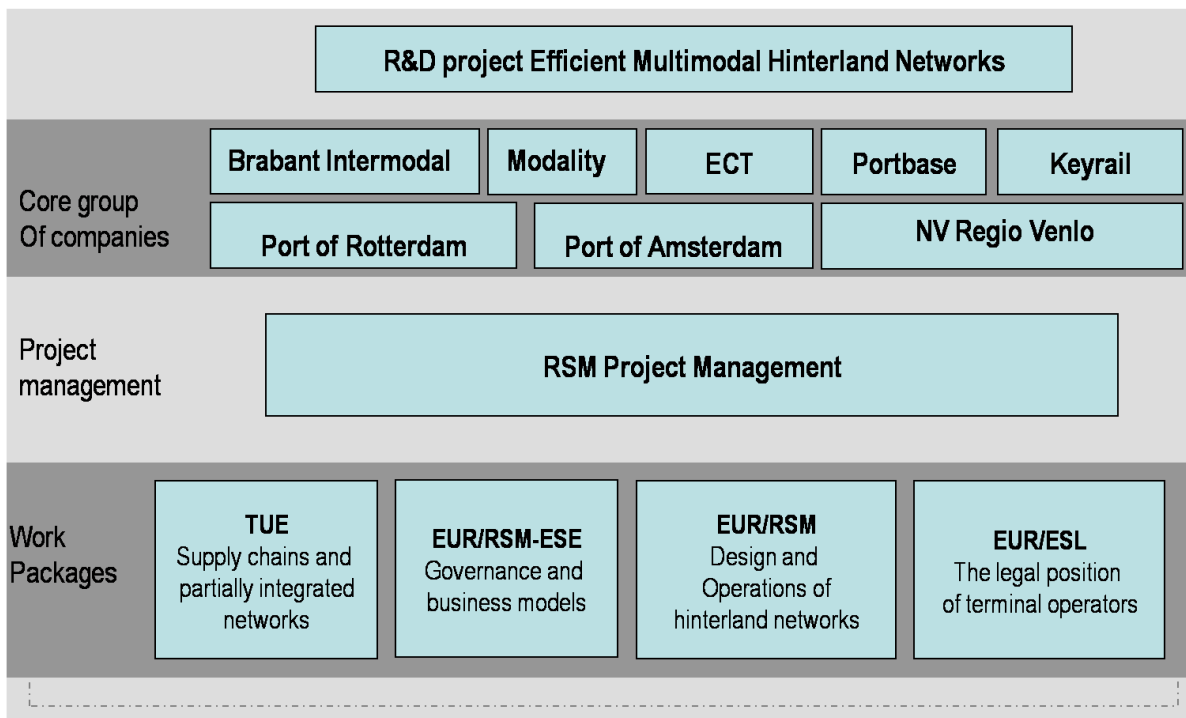


Figure 4: Project structure

3. Work package descriptions

Workpackage 1 Supply chain requirements for integrated transport networks
Workpackage leader: professor Jan Fransoo (University of Eindhoven)
Description: This is a four year PhD project, combined with the input from a current research project (PhD student), MSc students and three involved faculty members.
Extended Gate services are currently being developed in the container supply chain. These services are eventually designed for the final customer: shipper or receiver (consignee). Container-related transportation has grown very fast over the last ten years. An increasing share of global transport is being containerized, primarily to

reduce handling cost and to increase flexibility in the use of multiple modes of transportation. This implies that more and more industries have been using container transport as an important means of transportation.

In container supply chains, substantially more players are involved than in supply chains not involving containers. This is because in these supply chains the load carrier is decoupled from the transport service provider, is not owned or operated by the shipper, and serves as storage service provider. Consequently, coordination in this supply chain is difficult, leading to unnecessarily long and unreliable lead times. Moreover, poor overall coordination of this supply chain causes a lot of pressure on using road transport at short notice rather than more economical and more environmentally friendly forms of transport such as intermodal; intermodal transport typically requires more advance and more advanced coordination actions on behalf of the owner of the goods (Kiesmüller *et al.*, 2005). In this work package, we therefore focus on two types of coordination: (1) coordination along the supply chain; we will denote this as *vertical collaboration*, and (2) coordination between the hinterland terminals, that collaborate to serve the consignee; we will designate this as *horizontal collaboration*. Figure 5 further clarifies these concepts. We will limit the scope of this work package, in line with the scope of the project, to the hinterland network, i.e., from the moment that the container approaches the deepsea port until delivery at the shipper or consignee.

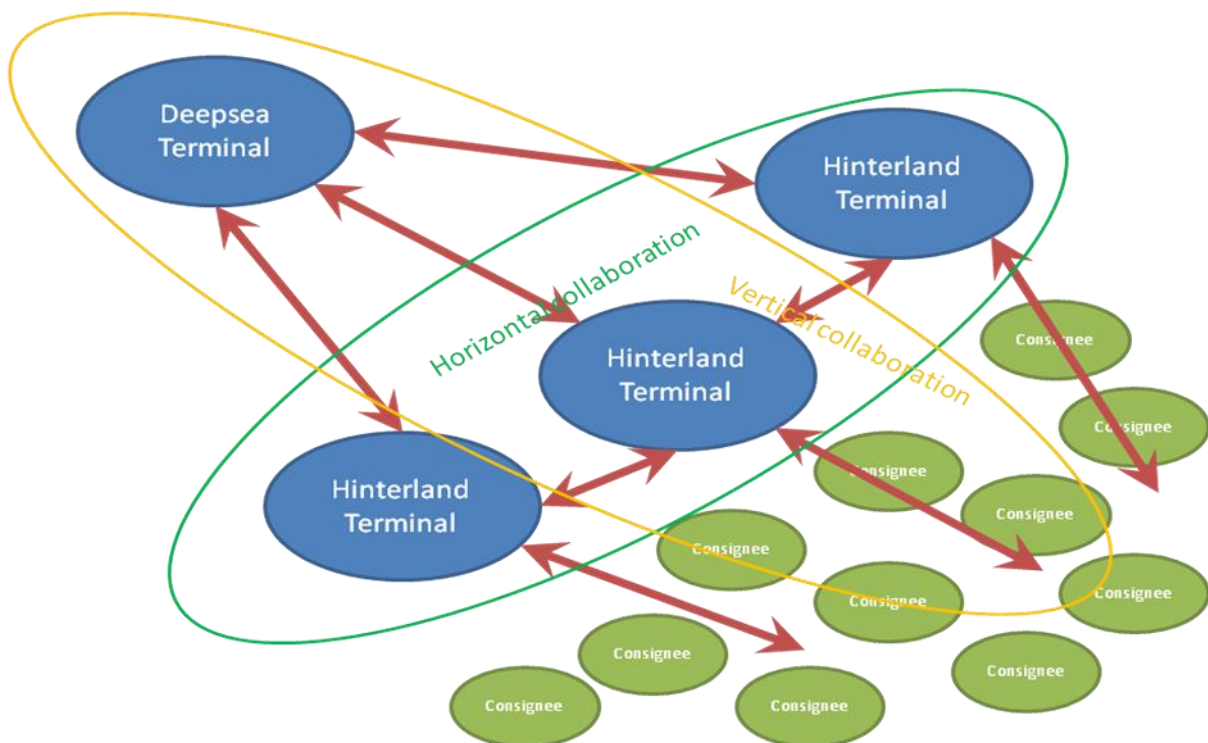


Figure 5: Scope of work package 1, and positioning of horizontal and vertical collaboration.

Vertical collaboration

In order to design a service that facilitates vertical collaboration, the perspective of the owner of the goods, whether shipper or consignee, needs to be taken into

account when designing the Extended Gate service. In this supply chain, there is generally not a party who really controls the end-to-end transport of the container. While this argument can be put forward for any supply chain, the fact that the load carrier (the container) and the transportation service provider have been decoupled substantially adds to the complexity. While this decoupling is the primary driver for productivity increase (container cargo reduces handling costs as compared to break bulk cargo), this also causes coordination problems that are inherently more complex than in traditional supply chains. Moreover, the containers are also effectively used as warehousing capacity, which further increases the complexity of interactions (Fransoo and Lee, 2010).

The high capital intensiveness of both the ocean liner industry and the terminal operators lead to generally poorly controlled systems with extensive queuing characteristics under complicated priority settings at each of the stages that the container needs to pass. Transit time has become more and more important, and has become one of the dominating factors in selecting the ocean liner company (Notteboom, 2006). From a supply chain management perspective, the transit time is the most important variable determining the lead time in supply chain models. Roughly speaking, transit time consists of hinterland transportation (on the sending and receiving end), terminal dwell time (on both ends and on the transshipment points) and ocean sailing time. In the sailing time, there are two types of reliability: schedule reliability and transit reliability (Notteboom 2006). A schedule is a published timing of a round-voyage of a specific ship. Liner companies may adjust schedules to increase transit time reliability while affecting schedule reliability. Notteboom (2006) mentions an example where a carrier reroutes ships to avoid congested ports, and then using inland transport to transport the cargo to the required destination to maintain transit time reliability. Obviously, substantial cost may be involved for the carrier. He mentions that – based on a survey among shipping lines - by far the most important cause for schedule unreliability is port and terminal congestion. Vernimmen *et al.* (2007) argue that schedule reliability is also heavily affected by the position that the port takes in the sequence of ports that the vessel calls. Schedule reliability is likely to be higher in those ports that are first port of call (for import cargo). On the other hand, schedule reliability in a port that is only fifth or sixth port of call in a certain loop is heavily dependent on time delays experienced in the previous four or five ports.

Saldanha *et al.* (2006) analyze the sailing time performance of ocean container carriers based on data from a large shipping movements database. The main purpose of their study is to show that substantial differences exist in sailing time performance between different carriers; and in fact substantially larger than is generally subsumed. From a supply chain perspective it is interesting that they have also explicitly measured the standard deviations of the sailing time, in addition to determining the averages. Their data suggest that in the estimated sailing time a standard deviation of up to 3 days exists, depending on the carrier and the route. Leachman (2008) in a study on California ports concludes that from a supply chain perspective reliability is important, but may not justify substantial additional costs. His study is one of the few in which he analyzes the costs of infrastructure and service providers and compares them to the costs that the shippers and consignees make in terms of keeping extra safety stock.

To our knowledge, Leachman's work is the single published study that models operational container flows (including stochastic behaviour) and taking the perspective of the container. In the maritime economics literature models exist that also take the container perspective, but these typically fail to take the operational coordination problems into account (see, e.g., Luo and Grigalunas 2003). The transit time of the container is relevant for the user of container transportation services, and as Notteboom (2006) indicates, it has developed to be one of the primary reasons for selecting a carrier. It is therefore even more remarkable that so little empirical and modelling research exists taking this perspective.

In the context of vertical collaboration, we will consider the following research questions:

1. What is the actual distribution of transit times along this supply chain?
2. What is the cost of variance in transit times to the shipper and does this affect the shipper's decision making to pay for a premium Extended Gate service?
3. How do postponement strategies deployed by a shipper or consignee benefit the use of the Extended Gate concept?

The first question will involve an empirical/econometric study to better understand the current variance in the transit times from the perspective of the container. We will use actual container tracking data to measure transit time variance, and dissect this into the various elements of the transit time. Some preliminary studies have been conducted in the field to map transit times (Ham, 2010), but so far, these studies have focused on averages rather than variance of transit time. As discussed above, reliability of the Extended Gate service is one of the supposed benefits. The outcome of this study will be a set of transit time distributions for the various stages of the transit time, starting with the difference between Expected Time of Arrival of the maritime vessel and the Actual of Arrival, and continuing down to handling times at the various terminals and transportation times between the terminals and between the hinterland terminal and the consignee. It is our hypothesis that due to lack of coordination at the container level, the transit times of the containers will show substantially more variance than the transit times of the maritime vessels (and probably also the other carriers) as suggested by Saldanha (2006).

After having obtained the empirical distributions, we will start to model these while explicitly taking the inventory costs of the shipper/consignee into account. The owners of the goods will hedge the variability in transit times by maintaining higher inventory levels. Research that takes stochastic lead times into account is relatively scarce. Some initial results have been obtained by Karaman and Altioek (2009) and Simchi-Levi and Zhao (2005). We will use their results to construct a model by which we can estimate the costs of variance in the transport system. An important characteristic to take into account however, is the dual supply option: if a delay occurs, and an alternative transport mode exists to reduce the variance. In the container supply chain this could be using a truck rather than a barge for a specific leg to reduce the overall variance in the transit times. While dual sourcing has been widely studied, again few papers address the dual sourcing problem with stochastic lead times. We refer to Thomas and Tyworth (2006) for an overview.

The third stage of the study will entail the "transplant" of the postponement concept, as deployed by many shippers, on the Extended Gate concept. Many manufacturers

postpone localization of products to a moment further down in the supply chain, closer to the consumer, to reduce product variety in supply stages with long lead times (Lee and Tang, 1997). It seems obvious that the Extended Gate service would offer extra flexibility if the shipper could decide on which Extended Gate to send the product when it arrives at the deepsea terminal, following developments where OEMs are positioning Regional Distribution Centres further into Europe. Using this concept, the inventory in the container would be a floating stock in the supply chain of the OEM.

Horizontal collaboration

In the third part of this work package, we will focus on the horizontal collaboration between the hinterland terminals. The relationship between the various hinterland terminals within the network is complicated. On the one hand, they compete for the same customers in the hinterland. By attracting more customers, they can increase the utilization of the transport vehicles (barges, trains) to the deepsea terminals (and hence decrease cost) and furthermore they can then increase the frequency of service. On the other hand, when collaborating they can jointly operate transport services to the deepsea terminal and also reach these objectives. Furthermore, by collaborating, they can more easily reposition empty containers within the hinterland.

In this study, we will collaborate with a set of hinterland terminals that have decided to collaborate in organizing their transport to the deepsea terminal. The rationale is that they can then deploy larger barges with fewer destinations in the sea port, and potentially reduce waiting times. Also, they are able to increase the frequency of service and hence better serve the customers in the hinterland. In a previous study (Sharypova et al, 2010), we have started to build a model to analyze the benefits and we have (Van Rooij, 2010) collected data on costs structures to quantify the benefits. It is important to realize that a relatively large share of the costs are fixed costs and the variable costs are relatively small. In this proposed study, we will develop insights and heuristics on how to distribute the benefits to the various hinterland terminals participating in the collaboration. The study will consist of two parts: a theoretical analysis that will deliver the main insights and a design-oriented approach in which we will develop a heuristics implemented in a spreadsheet that will distribute concrete benefits.

We will use concepts and analytical techniques from the field of cooperative game theory. In the theoretical model, we will model each of the hinterland terminals as players, and model the potential gains based on the load offered to the coalition and the discrete steps (barge sizes) that will drive the benefits. Due to the cost structure, utilization of the resources will be a key driver, but this also has a discrete nature. We are looking for stable allocation rules that will keep the coalition together. A specific characteristic we will take into account is the uneven size of the partners in the coalition. We can build on previous work conducted in the research group at Eindhoven (see, e.g., Ozen et al, 2009). In the second part, we will develop a number of heuristic allocation rules.

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Planning: 1/9/2010 – 31/8/2014

Work distribution: to be executed by a PhD student at TUE, a researcher, various master students

Supervision is in the hands of professor Jan Fransoo, dr Tom van Woensel, and dr Marco Slikker. Co-supervision by RSM (professor Rene de Koster).

Deliverables:

- 1 PhD Thesis
- around 5 scientific papers in international journals
- contributions to international and national conferences

Expected results, in addition to the deliverables:

- prototype software and/or spreadsheet models for the two main problems: (1) identification of the value of reliability and (2) distribution of benefits over horizontally collaborating hinterland terminals

Milestone 1/9/2011: finalized PhD proposal by PhD student
Milestone 31/8/2014: finalized PhD thesis in BETA Research School
Milestone 31/8/2014: all activities completed

Workpackage 2: Governance and business model innovations in the hinterland

Workpackage leader: Professor Suzana Rodrigues (RSM)

Description: This is a four year academic research project, carried out by two existing PhD students, one of which is based at the Port of Rotterdam, and one at the Erasmus School of Economics.

The central concept in this workpackage is the co-evolution of ports with their hinterland networks. While the co-evolution as a concept has been studied extensively (see for instance Volberda and Lewin (2003), and the other articles in the same special issue of the Journal of Management Studies on Co-evolutionary dynamics within and between firms), it has not been applied in the freight transport industry. Rodrigues and Child (2003) have set out the structure for such an analysis, and Kenneth Tse later (2008) applied this to the case of the Port of Yantian in China. This research shows, among others, that the port, and particularly its main strategic actor, the port authority is faced with a complex task of letting a network of governmental agencies and business parties evolve jointly, or at least more or less towards a common goal. An important dimension in this research is also to identify the dynamics in business models of the various actors within multimodal networks.

Within this context, this workpackage studies two topics:

1. the role of the port authority vis-à-vis multimodal hinterland networks
2. new business models in multimodal hinterland networks.

The role of the port authority vis-à-vis multimodal hinterland networks

The key question of this part of the research is: what is the (co-)evolution of the role and position of port authorities and terminal operators in hinterland networks? How can we relate innovations in the business models of port authorities to the development of an efficient and effective hinterland network?

Preliminary literature research into the issue of the strategy of port authorities observations allows the following conclusions:

- Port authorities increasingly become commercially driven organisations and are accounted for their performance both in economic and in social terms. This results in a need for a clear strategy.
- A core strategic question is the scope or business domain of port authorities. Port authorities do develop activities in hinterland transport networks, but often without a clear strategy. Furthermore, conceptual and empirical research in this field is lacking (but see de Langen 2009 for a first step in this analysis).
- In the last decade academics have made valuable contributions to the field of port governance and the role of the port authority in the hinterland (for an overview see Pallis et al 2010). Port authorities are facing changing environments and new

challenges, and consequently re-assess their role. But most academic contributions do not go beyond descriptive cases. Structured research on this issue, based on clear theoretical underpinnings and tested with sound empirical data is missing.

This research aims at empirically investigating the strategic scope of the port authority on the basis of theoretical concepts from strategic management and economics. Key literature that forms the base for this thesis originates both from strategy research and economics and relates to the boundary of the organization issue. Key lenses with their key contributors are: Strategy Configuration (Miles et al 1978), Business Ecosystems (Lansiti and Levien 2004), Co-Evolution (Volberda and Lewin 2003), Resources and Capabilities (Barney 1991) and Institutional Economics (Williamson 1986). We envision five papers, each addressing a specific research question:

- 1) Build and test empirically a typology for the strategies of PA's regarding their position and scope, including their role in hinterland networks. Relate the strategies chosen to performance. The statistical techniques of cluster analysis and regression analysis will be used. (Paper 1).
- 2) Study specific explanatory variables for the development of the business model of the port authority.
 - a. Ownership structure and strategic cognition (survey based regression analysis) (Paper 2)
 - b. Value capture possibilities (multiple case study approach) (Paper 3)
- 3) Select specific scope-related strategies of PA's and apply theoretical lenses
 - a. PA's hinterland strategies: a co-evolutionary governance approach (multiple case study approach) (paper 4)
 - b. PA's developing internationalisation strategies: a resources and capabilities perspective (single case study approach) (Paper 5)

This industry oriented research will provide port authorities with more insight in what strategies they can develop regarding their position and scope, the underlying logic of these strategies and what specific conditions apply while implementing these strategies.

New business models in multimodal hinterland networks

The goal of this research is to be able to understand the business models and business model innovations of firms in intermodal transport networks. While the term business model is widely used in practice, it has only recently been studied academically. See Johnson et al (2008), Shafer et al (2005) and Osterwalder et al (2005) for some recent papers.

We follow the definition of a business model by Shafer and colleagues: a firm's underlying core logic for creating and capturing value within a value network. The core logic refers to the coherence of core strategic choices. For example: the business model of a non-asset-based logistics service provider is to minimize investments in assets, whether they are ships, locomotives, warehouses or containers. See for another example, Graf (2005). Capturing value refers to the revenue streams and pricing structure. Interesting question in this context are: does

a terminal operator provide services to shippers or to shipping lines? And does a terminal company charge for cargo handling only, or also for storage? The value network refers to the position of a company in the supply chain, and its network relationships with other companies. For example, some national road companies have developed European partnerships to be able to provide services on a European scale.

A quite special feature of intermodal transport services is the fierce competition between players with different market positions and business models, see van der Horst and de Langen (2008). Competition through business model innovations is a very important –perhaps the most important- form of competition in intermodal freight transport. Three kinds of business model innovations can be distinguished:, enterprise model innovation: changing the ‘scope’ of the company by outsourcing or providing in-house, revenue model innovation: new revenue streams or important changes in the pricing structure and finally industry model innovation: develop a new industry (e.g. the Apple iPod) or redefine an industry (e.g. Dell)

Companies whose business models are best aligned with an overall efficient transport system will perform better than those whose business model is less well aligned. Business model innovations that improve overall system performance can therefore give companies a competitive edge. In current intermodal transport chain structures, the interests of different companies are not aligned. So the analysis of potential business model innovations is practically relevant and can inform strategic decisions of firms in intermodal supply chains.

The research should deliver at least four articles in scientific journals. Starting with an article on the impact of the modal split agreements on business model innovations of firms in the intermodal chain. The first article is followed by a case study research on business model innovation of the Port Authority of Barcelona regarding the development of their intermodal hinterland network. An extensive survey among carriers and forwarders will provide input for articles focussing on port-to-port and ILT-to-ILT shipments. The results should provide new insights on business model innovations. Furthermore, when carriers and/or forwarders innovate their business models other possibilities for business model innovations might arise for related transport companies within the supply chain.

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Planning: 1/9/2010 – 31/12/2014

Work distribution:

The part on the strategic scope of the port authority is executed by a PhD researcher at ESE (Larissa van der Lugt MSc), the part on new business models is executed by a PhD researcher at HBR (Roy van den berg MSc).

Supervision is in the hands of professor dr. Peter de Langen at TUE/OPAC. Co-supervision by RSM (professor Suzana Rodrigues).

Expected deliverables:

- Five peer reviewed papers, resulting in a PhD thesis on the strategic scope of the port authority
- A PhD thesis on new business models in multimodal hinterland networks

Expected results in addition to the deliverables:

- An overview and evaluation of port authority strategies and business model innovation, that will input for the strategy development of the port authorizes of the Ports of Amsterdam and Rotterdam

Milestone 31/12/2012: PhD thesis on the strategic scope of the Port Authority

Milestone 31/12/2014: PhD thesis business models in multimodal hinterland networks

Milestone 31/12/2014: all research activities finished

Workpackage 3: Design and operations in hinterland networks

Workpackage leader: Dr Rob Zuidwijk (RSM)

Description: This is a four year PhD project, combined with additional research staff consisting of a researcher (post doctoral) and a third year PhD student.

The management of intermodal container transport is being challenged by a number of important developments. The dynamics of emerging and declining markets has a large impact on transport demand. Moreover, customers have extended their expectations with regard to operational excellence, while other stakeholders are concerned with the environmental and social impacts of container transport (Janic 2007; Lee and Whang 2005). Providers of services on intermodal networks need to develop innovative concepts to meet these challenges. The Extended Gate concept is such an innovation.

Although the principle of the Extended Gate as outlined in this proposal seems straightforward, the planning of the land transport of the containers remains a challenge. This is caused by uncertainties in, amongst other things, the times the containers are available for transport and the travel times. As a result, the planning of containers is often characterized by a conservative approach where slack times are built in to avoid late arrivals at the customer's premises. Moreover, the use of transport modes other than truck is discouraged for several reasons, such as longer transit times, limited connectivity of river and train networks, and low frequency of services. Since barge and train have less negative environmental and social impacts than road transport, there is a need to address these discouraging factors. The offering of co-modal transport services (Groothedde et al. 2005), where slow and less costly transport modes such as barge and rail are offered to carry the bulk of containers, next to the fast and flexible trucking option to execute shipments under time pressure, may help to do so.

Network design and the role of information (core staff: PhD project)

New concepts such as Extended Gate need to address these challenges by the design of an intermodal network and the services on the network, but also by the development of value propositions to customers and other stakeholders. As a result, the concept also involves the design of information systems that guide information flows between organizations in the support of planning and execution on the network (Baalen et al. 2008). Moreover, its performance is measured not only in terms of logistics efficiency and effectiveness, but also in terms of environmental impacts and security risks. In particular, the design of information and physical transport services should be intertwined in order to reap the potential benefits (Lee and Wolfe 2003). This is also an important driver of the EU project INTEGRITY.

In the literature, the design of intermodal networks is predominantly driven by physical characteristics of the infrastructure, transport modes, and services (Crainic and Kim 2007). The impact of information infrastructures as an enabler of services on the design of intermodal networks requires further research.

An important aspect of value propositions that could be made to shippers and other stakeholders such as customs authorities and governments is the fact that containers

are different in many aspects. They contain different types of cargo, require different logistics services, represent different levels of value, and entail different security and social risks. As a result, the transport market is segmented not only in terms of origin and destination, but also in terms of additional service requirements. On the other hand, the level of available resources may also be different. Next to the availability of physical resources, the amount of information a shipper is willing to share and to invest in may depend on e.g. the value and due date of the cargo. The security and social risks associated with different types of cargo (dangerous goods) have been recognized and have driven requirements, but there are opportunities to further support security and safety measures, for example by means of information services.

The research challenges relate to the questions of how to provide network design methods that incorporate the fact that (1) information infrastructures that support information flows need to be co-designed with physical infrastructures that support physical flows, and (2) these networks need to be evaluated in terms of economic performance measures, such as efficiency and service levels, but also in terms of environmental performance levels, such as emissions, and social performance levels, such as the occupation of public infrastructures and safety and security risks.

A concrete research avenue will focus on the Extended Gate concept and be concerned with the question how decision tools can support the development of differentiated services on the network that incorporate the diversity of containers in terms of cargo and service requirements, while using physical and information resources, in such a way that economic, environmental, and social performance are improved. A first step in this direction is made in Zuidwijk et al. (2010).

Operations in multimodal hinterland networks (core staff: part-time PhD and post doctoral researcher)

When multimodal networks are designed and implemented, various operational challenges emerge. These have to do with the difficult task of joint optimization of terminal activities across the network (for instance, pushing containers into the network to free up capacity at the sea terminal), the need to increase the reliability of transport operations, as a result of supply chain requirements, or the alignment of decision making processes to develop an optimized trimodal transport service. The insight that links these operational problems with the design problem that is also studied in this workpackage is that *information* is a key driver for the successful solution of operational challenges. These operational problems in the context of containerized transport remain virtually unexplored, although the work will build on previous work in railway scheduling and optimization, and warehouse storage optimization.

This activity will study two quite different operational problems, that share this requirement of information availability:

1. **Rail Cargo operations on the seaport rail track system.** The management of rail infrastructure for cargo in the Port of Rotterdam and the dedicated track to the German border is the responsibility of Keyrail (the so-called Betuwe line). Keyrail allocates space on the rail track to transport service providers who commercially operate trains to fixed destination in Europe.

Since its start, Keyrail has been developing the governance structure of the rail

infrastructure to enable reliable and predictable rail transport services into the Rotterdam port hinterland. Recently, several operational bottlenecks have been identified that require further analysis to achieve more reliable cargo rail services in the Rotterdam hinterland. These are:

- Train turn around time in the port area is the main performance indicator for the transport service providers. This train turn around time is currently very unpredictable. Further research is required to identify the determining factors of this KPI indicating when a train is in the port area. A relevant issue here is also the prevention of congestion of rail cargo vehicles in the port area.
- The operational control of the train movements in the port area could be improved by having more pipeline information on approaching trains on the Betuweline track. The data capture systems are in place, but the collection, processing, and effective utilization for decision support of these data requires further research. Especially the evaluation of the costs of gathering the data versus the valuation of the operational benefits requires some detailed modeling of the operational processing of trains in the port area.
- Current solutions for disruption management of the general, public railway system in the Netherlands are based on shuttling trains on both sides of the disrupted track. This is a solution that is not suitable for cargo trains. Alternative disruption management solutions for freight rail transport are urgently required. A possible solution could be re-routing, but this requires real time re-planning solutions specifically adapted for cargo rail traffic.

2. **Advanced stacking solutions for container terminals.** Container terminals decouple demand from supply in time and quantity, and are crucial nodes in the supply chains of many companies. See for a review, Vis and De Koster (2003).

However, the space needed for buffering these containers has become short (Midoro et al 2005). Lack of space has driven companies to stack containers higher, saving much footprint. Still containers need to be accessed individually, which often results in reshuffling the containers. Reshuffling containers is time consuming and may increase a departing ship's makespan, or increase waiting times of other modalities such as barges, trains or truck. As a result, container terminals differ substantially in performance (De Koster et al. 2010).

This situation occurs especially in integrated hinterland networks, where sea terminals can choose to push containers into the hinterland to free up space at the ocean quay for the purpose of operational efficiency. These containers will end up in much smaller inland terminals, where capacity may become a bottleneck, but only for the duration of the pushing process. Flexible procedures in these inland terminals to handle these temporary capacity shortages are therefore required.

This project addresses questions such as:

- how to store and retrieve containers in container stacks?
- how to sequence storage and retrieval jobs to timely satisfy customers orders?
- how to design robust stacks, taking into account berthing positions of the vessels?

Models will be proposed for response time determination as a function of storage and retrieval strategies (probabilistic models), reshuffling minimization (dynamic programming), and storage and retrieval job sequencing (integer programming models and simulation models). These models can in turn be used for terminal design and optimization.

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Planning: 1/9/2010 – 31/8/2014

Work distribution: to be executed by research team consisting of a PhD student, a part-time PhD students and a post-doctoral researcher at RSM.

Supervision is in the hands of dr Rob Zuidwijk, professor Rene de Koster, Professor Leo Kroon.

Co-supervision by TUE (dr Tom van Woensel).

Expected deliverables:

- 2 PhD Thesis
- around 5 scientific papers in international journals
- contributions to international and national conferences

Expected results in addition to the deliverables:

- multimodal transport network design approach and tool
- rail operations operations support tool
- compact storage algorithm that is suitable for practical application in terminal software

Milestone 1/9/2011: finalized PhD proposal by PhD student

Milestone 31/12/2012: finalization of part-time PhD project on compact storage systems

Milestone 31/12/2012: finalization of research on rail operations

Milestone 31/8/2014: finalized PhD thesis in ERIM

Workpackage 4: The legal position of terminal operators in hinterland networks

Workpackage leader: Professor Frank Smeele (ESL)

Description: This is a four year PhD project, combined with additional research staff consisting of a researcher (post doctoral).

For the terminal operator, the Extended Gate concept implies the integration of transport services into a business model traditionally based on stevedoring, storage and customs related operations. Within the framework of this concept the terminal operator will typically contract as sub-carrier with ocean carriers to perform inland transport (whether by barge, rail or road) from sea-ports to hinterland terminals. This inland transport may be performed by employees of the terminal operator himself or be sub-contracted further to barge carriers, road hauliers and rail carriers.

From a legal perspective the Extended Gate concept gives rise to a number of problems and/or challenges.

- 1) Transport law tends to differentiate between the legal position of various kinds of logistic service providers (e.g. carriers, sub-carriers, successive carriers, forwarding agents, customs agents, customs warehouse sub-carriers, storage-keepers and independent contractors).
- 2) Further differentiation follows from the fact that transport law is fragmented per mode of transport as is illustrated by the various uniform law conventions (e.g. CMR 1956 for international road transport, CMNI 2001 for inland navigation, Cotif-CIM 2001 for rail transport) and from the distinction made between international transport which is governed by said conventions and purely domestic transport governed by national law.
- 3) In view of the legal differentiation discussed under 1) and 2) the when and where of a modal shift or a storage interval between two modes of transport may have great significance for the terminal operator's liability and burden of proof.
- 4) The 'mixed' nature of the contractual obligations undertaken by the terminal operator under the Extended Gate concept may give rise to problems and uncertainty as well in particular where his legal position varies significantly depending upon the role (i.e. stevedore, storage keeper, carrier, forwarding or customs agent) performed by him at the time that problem arose.

5) Depending upon the applicable rules, the terminal operator's legal position will mostly be governed by private law rules, although some aspects (e.g. customs related services) may be subject to administrative law. Either way this means that part of the operator's legal position is subject to mandatory law, while in other areas he may use his freedom of contract to shape his legal position through contractual arrangements with his customers, sub-contractors and others as he sees fit.

6) Various options (e.g. through contractual risk allocation and liability insurance) are open to the terminal operator to deal with his risks and liabilities. However, it is a peculiarity of the terminal operator's position under the Extended Gate concept that he is a spider in a web of contractual relations connecting him directly or indirectly to his customer (usually the ocean carrier), the cargo interests, his agents and sub-contractors and third-parties such as banks, underwriters, brokers, customs and security and health authorities etc. In order to make good use of the available options, not only a thorough analysis and evaluation of these options is required, but also co-ordination between the various contractual and other arrangements.

For these reasons, it is safe to conclude that the new duties assumed by the terminal operator under the Extended Gate concept will affect his risk profile and liability exposure (especially in case of loss of or damage to cargo or delay in delivery) considerably. This makes a fundamental reassessment of his legal position necessary against the background of the latest developments in transport law legislation (e.g. the signing of the Rotterdam Rules in 2009) and international case-law.

Key aspects to be covered in this assessment are:

- an analysis of the services performed and duties assumed by the terminal operator under the Extended Gate concept,
- a 'translation' of these services and duties by reference to the conceptualization of logistic service providers in transport law,
- an analysis of risks and liabilities involved for the terminal operator under the Extended Gate concept,
- an analysis of the wider network of mostly contractual relations within which the terminal operator operates under the Extended Gate concept.
- an analysis of the options available to the terminal operator to deal with these risks and liabilities effectively and efficiently and to improve his legal position towards his client, the ocean carrier, cargo interests and other third parties.

Some Relevant Literature:

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Planning: 1/9/2010 – 31/08/2014

Work distribution: to be executed by a PhD student at EUR/ESL and a post doctoral researcher

Supervision is in the hands of professor dr. Frank Smeele
Co-supervision: RSM (dr Rob Zuidwijk).

Expected deliverables:

1 PhD on the legal position of container terminal in multimodal hinterland networks
Several articles in international journals

Expected results:

Practical recommendations and strategies for terminal operators to deal most effectively and efficiently with legal risks and liabilities involved in the Extended Gate concept.

Milestone 1/9/2011: finalized PhD proposal by PhD student

Milestone 31/8/2014: finalized PhD thesis in ESL

Workpackage 5: Project management and knowledge exchange (Leader: EUR/RSM)

Workpackage 5: Project management and knowledge exchange

Rotterdam School of Management is the applicant. Dr Albert Veenstra of RSM will be the project leader.

Project Management

The approach to the management of this project is discussed in section C. Consortium and Project organization. This description will focus on the identifiable activities.

The project manager will invite representatives of the business and research partners to make up the project management committee (PMC), and ask the PMC to choose a chairperson.

The project manager will call regular meetings with the PMC and report on the meetings.

The project manager will prepare progress reports for the PMC, based on the identified milestones.

The project manager will initiate and coordinate all dissemination activities, knowledge exchange activities and valorisation activities.

The project manager will organise the inception and editing of all reports in the project, in cooperation with the various research teams. These reports will be discussed in PMC meetings.

Valorisation

The valorisation approach in this project are described in detail in section E. Valorization and Implementation Strategy. The project manager is in charge of this activity, and will coordinate all valorization initiatives with the research teams, business partners and external support partners (consultant and universities of applied sciences).

Knowledge dissemination

The dissemination approach in this project is described in detail in section E. Valorization and Implementation Strategy. The dissemination of knowledge in this project will take place via

1. project communication material (presentation, brochure, and other material)
2. educational material (cases), development and teaching activities
3. an annual conference for the Dutch business community
4. a blog and contributions to various media

5. meetings and road shows for the business community, especially small and medium sized enterprises.
6. Setting up a special interest group

For the initial communication with the SME business community in the area of transport and logistics, Capgemini Consulting has been approached to support this process and maximise exposure to SMEs. An event is planned for the first year of the project.

Knowledge exchange

The knowledge exchange approach in this project is described in detail in section E. Valorization and Implementation strategy. The exchange of knowledge in this project is supported as follows:

1. internal: developing internships and secondments for the researchers, and students with the business partners, and possibly vice versa as well.
2. External: partnering with research groups in other parts of Europe and the rest of the World that are working on multimodal hinterland networks. This is facilitated by organising visits and organising joint workshops.
3. External: reporting results and progress at international scientific conferences.

Planning: 1/9/2010 – 31/08/2014

Work distribution: The project management is in the hands of RSM (dr. Albert Veenstra)

Chairman of the PMC is Paul Ham (ECT)

Deliverable:

- Project plan
- Annual financial reports
- Final report
- Communication materials
- Education cases
- Conference papers

Expected results:

- Regular financial and progress reports to Dinalog
- Meeting minutes of the Project Management Committee
- Communication material
- Meetings and roadshows for a wide business community
- Access to students with modern educational material
- A secondment arrangement between knowledge and business partners
- International partnerships with top-universities, and joint workshops
- A series of conference papers

Milestone 1/9/2010: New PhD projects started

Milestone 28/2/2011: communication material ready

Milestone 31/08/2014: All activities finished

Milestones -regular-: financial and progress reports

Planning

This section describes planning of activities / work packages and the timing of deliverables. This can also be included in the previous section. A summary of the planning (schedule) must be part of the project plan.

For the timing related to all deliverables and milestones, see the work package descriptions.

Project planning

	2010		2011				2012				2013				2014	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1 Supply chains and partially integrated transport networks																
a Vertical collaboration																
b Horizontal collaboration																
2 Governance and business models																
a The role of the port authority in hinterland networks																
b Business model innovations in the hinterland																
3 Design and operations in hinterland networks																
a Design of multimodal networks and the role of information																
b Operations in multimodal networks																
4 The legal position of terminal operators in hinterland networks																
5 Project management and knowledge exchange																
a Project management																
b Valorization																
c Knowledge dissemination																
d Knowledge exchange																

C. Consortium and Project organization

Project organization

This section describes the project organization; roles, tasks and responsibilities are described, including diagram.
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Project organization

Rotterdam School of Management is the applicant. Dr Albert Veenstra of RSM will be the project manager.

The Project Manager is responsible for the overall supervision of all work. The Project Manager will ensure that deliverables are realized on time and within budget and ensure the quality and efficiency of all processes.

The Project Management Office (PMO) is the hub of the project and accountable for:

- Formulation of the overall project plan and monitoring this plan;
- Harmonisation across the teams;
- Risk and quality control;
- Identification and assessment of issues, and proposing solutions;
- Financial support (e.g. administration and reporting).
- Reporting towards Dinalog

The main decision making body in the project will be a project management committee (PMC), consisting of one representative of each partner. This PMC will be chaired by a representative of the business partners. It serves as the supervising body of the PMO. The PMC will meet at least 4 times a year, or as many times as is necessary for the project. The project leader will act as the secretary for the PMC.

In the beginning of the project, stakeholders from Dinalog Friends and other interested parties will be invited to join an advisory group for the project. This advisory group will meet at least once a year to discuss the research results and progress, and to give advice on future directions of the research. This group will consist of 5-7 members.

The project is closely related to the Dinalog-proposal *Single Window* that focuses on information and governance models to allow goods transshipment via the Netherlands with reliable and coordinated government inspections. The participants of the projects Extended Gate and Extended Single Window aim to strengthen the links between these projects by establishing a joint program management. The program management also seeks collaboration with other (future) Dinalog projects.

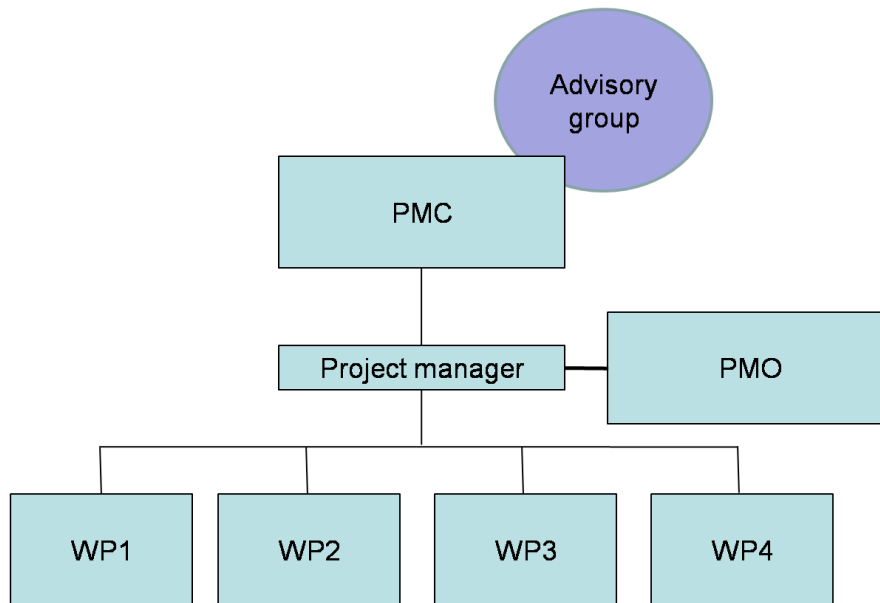


Figure 6: Project organization structure

Research Team

This section describes the research team, each specific role and input in the project (if necessary per activity / work package) and their quality / specific expertise.

Short CV's (max ½ page A-4) of the scientific researchers should be included as Annex, along with a shortlist (titles and sources) of their 5 most relevant publications or relevant project experience.

Also describe the relevant past performance of the other consortium partners.

Name partner	Role and input	Specific competence
Rotterdam School of Management	Project manager-work package 5 (Veenstra), leader of Work package 2 (Rodrigues), co-supervision in Work package 2 (Rodrigues), leader of Work package 3 (Zuidwijk), co-supervision in Work package 4 (Zuidwijk)	Veenstra: Project management, port management, multimodal transport Rodrigues: strategy and governance, co-evolution Zuidwijk: network analysis, multimodal transport, information management Kroon: railway operations and optimization De Koster: terminal operational and optimization
Eindhoven University of Technology, School of Industrial Engineering	Leader Work package 1 (Fransoo) ; co-supervision of work package 3 (van Woensel); main research in work package 1 (PhD student , MSc students, Sharypova, Van Woensel, Slikker)	Fransoo, van Woensel, Slikker: Supply chain management, transportation planning, game theory, inventory management
Erasmus School of Law	Leader Work package 4 (Smeele); main research in	Smeele, Hoeks: Transport law, multimodal transport law

	Work package 4 (PhD student, Hoeks).	
Erasmus School of Economics	Research activity WP 3 (van der Lugt)	Strategic scope of port authorities
ECT	Involvement in WP 1, 3, 4 (Ham, Nater, Zoeter)	Terminal management, Extended Gate services
Brabant Intermodal	Involvement in WP 1, 3, 4 (van Dijk)	Terminal management, inland shipping
Modality	Involvement in WP 1, 3 (van Hoven)	Inland terminal operations, IT systems
Portbase	Involvement in WP 3 (Swaak, van der Velde)	Port community systems, information management
Keyrail	Involvement in WP 3 (van der Nat, de Mol)	Railway infrastructure management, railway operations
Port of Rotterdam	Research activity in WP 2, involvement in WP 2, 3 (de Langen, Merckel, van den berg)	De Langen, Merckel: Port authority strategy, Van den berg: business model innovation
Port of Amsterdam	involvement in WP 2, 3 (Hes)	Port authority strategy
NV Regio Venlo	Involvement in WP 1, 2, 3, valorization and implementation (Tenhagen)	Logistics clustering, regional development, SME involvement

Short cvs of all key personnel of all research partners as well as lists of key publications can be found in the annex to this proposal.

D. Evaluation and monitoring

Evaluation

This section describes how the consortium will evaluate the project (in terms of innovation process, cooperation and results) during and after finishing the project. The results of this evaluation will be submitted to Dinalog.

Describe how often measurements have to be made to be able to make project adjustments in time. Describe how will be monitored, using which criteria and who will execute the evaluation.

The evaluation by the consortium of this projects' activities will take place along two main dimensions:

1. The progress and quality of project milestones and project deliverables. The milestones and deliverables are listed in the workpackage descriptions in section B. Activities and Work Packages. The project manager will prepare regular progress reports, and these will be discussed and evaluated in the regular meetings of the PMC.
2. "Business partner satisfaction". This dimension covers the evaluation of the usefulness of the results from the various scientific research activities for the fulfillment of the objective of this project: to develop "a new concept of integrated multimodal networks". This dimension can be measured by the following indicators:

Business partner involvement

- a. Regular attendance of project workshops and meetings.

- b. Time spent by business partners on implementation activities resulting from research output
- c. Initiation and involvement of business partners in dissemination activities

Implementation viability

- d. Identification of implementation activities by business partners
- e. Implementation progress of specific concepts, solutions and tools
- f. User satisfaction from specific concepts, solutions and tools
- g. Sustained revenue generation from implemented concepts, solutions and tools

For the measurement of these indicators, the project manager will prepare regular reports, which will be discussed with the business partners individually, and, with the consortium at the PMC. Data on the indicators will be collected from the individual meetings with business partners, and by other means when necessary (item f. for instance could be measured using a survey among users and customers of business partners). The frequency of these meetings will coincide with the regular meeting schedule of the PMC.

The outcome of the internal evaluation process will be reported regularly to Dinalog.

E. Valorization and implementation strategy

Valorization and knowledge dissemination

This section describes the way the consortium plans to organize valorization and dissemination activities (what, who and when), plans to make project results and knowledge widely available and plans to implement the project results (leading to what results). How do these activities enable the transfer of (intermediate) project results, outcomes and possible tools in practice beyond the project to other companies, regions, sectors etcetera (potential up-scaling effects). For instance can a business start-up be realized? What do the outcomes and results mean for the social networks?

Valorization

Several activities in this project have the potential to result in new or extended business for the business partners in this project. In the course of this project:

- ECT will further develop its Extended Gate services, refine the business model, and solve potential operational bottlenecks. This will result in more revenue for this service,
- Portbase will participate in the development of information driven multimodal hinterland networks, and develop subsequent services to satisfy the new demands for information that emerge in these networks,
- Keyrail will remove operational bottlenecks, which will facilitate the utilization of their rail infrastructure to a break-even volume of trains on the A15 track (Betuwe line),
- Brabant Intermodal will implement a revenue and cost sharing mechanism that will facilitate the cooperation between several inland terminals, and allow the growth of volume handled in these terminals within the same capacity,

- Modality will adopt algorithms developed in this project and implement them into their inland terminal operating system. In addition, Modality is looking for other optimization solutions for the optimization of handling of barge traffic in ports.
- Port of Rotterdam and Port of Amsterdam will strengthen their position as leading port authority, generating export possibilities for its management capabilities.

The requirements that from these new business activities will serve as input for the research teams and will help define the research activities. This process will be organized by the project manager, and supervised by the PMC. The joint formulation of these research activities with business partners will ensure the satisfactory adoption by business partners of the resulting research outcomes. The success rate of this process will be monitored in the (self-)evaluation activity (see section D above). The PMC will have a regular agenda item identifying potential applications for the research results among the business partners. These progress to develop these applications will then be monitored by the Project Manager and the PMC.

These project results will lead to additional revenues for the business partners, but also for a larger group of companies who will become involved in offering the various new services or extended activities. This concerns freight forwarders, rail transport operators, inland terminals who benefit from the Brabant Intermodal network and Modality's software, as well as other logistics service providers and software providers who are active in multimodal hinterland transport and storage services. Under the subsection 'Implementation' we will describe the strategy to reach out to this wider community of stakeholders.

Knowledge dissemination

In this project, the results will be disseminated to the business and academic community in the Netherlands and the rest of the world through two types of activities:

1. The development of project communication material
This entails the development of a standard project presentation, brochures, flyers and other communication material that can be used to inform a larger audience about the project, the main outcomes and the project's contribution to problems in multimodal hinterland networks.
In addition, this activity will also cover the facilitation of communication within the project group about progress, results and new opportunities for research. This will be done using modern project management tools, such as document sharing facilities and a social network site. Furthermore, we will develop material in internet-publishable format that can be published on the Dialog website
2. The development of education material.
The result of the project should not only be made available to a relevant business community, but also to students in both professional and academic education institutes. This requires special modern education material in the form of research project briefs and teaching cases about selected topics with the area of multimodal hinterland networks.

In addition to regular dissemination activities for a wide audience, this project aims to set up an interest group on innovative business models in multimodal transport.

Dissemination will take place through:

1. An annual conference for the extended business community of Dinalog
2. A blog, and other contributions in various media
3. Events, meetings and roadshows organized by the business partners in the project.

In addition to regular dissemination activities for a wide audience, this project aims to set up an interest group on innovative business models in multimodal transport.

Further dissemination of the results will be achieved by presenting the research results to an audience of students in universities and polytechnics via the various higher education chairs that address ports and logistics. Two polytechnics that are closely related to the topics addressed in this project, and involved in demonstration and other project in hinterland network projects are Hogeschool Rotterdam, and NHTV (Breda). These schools will be facilitated in the current project to participate in the dissemination of the project results, especially with the aim to bring the result to the attention of SMEs, and make the translation of the project results into teaching material that are suitable for their teaching environment and student population.

Knowledge exchange

Knowledge exchange in this project consists of three components:

1. Internal in the project (internships, secondments, and regular meetings and workshops)
2. External: partnering with research groups in other parts of the world
3. External: reporting at scientific conferences

An important condition to facilitate exchange of knowledge between the project partners is not only to have internal meetings and workshops, but also to allow the researchers and business partners to develop close working relationships. Secondments and internships will be an effective means of achieving this goal. The secondments apply to PhD students, who will be invited by business partners to spend several months, or longer when required in the companies to learn the business from first hand experience. The PMC will supervise these secondments to make sure they are always in support of and related to the research activities as defined in this project plan. The internships are available for master students. Organising a regular flow of student internships, and a formalised way of supervising the students within the consortium will save time for business partners and knowledge institutes to define and arrange each internship individually.

In other parts of the World, the development of seaport hinterland networks is also being initiated. This is evidenced by the many Dry Port examples listed in the State of the Art overview in this proposal. Specifically in Brazil, India and China, contacts have been established with government bodies, universities and business operators who have expressed an interest in knowledge exchange and the definition of common research threads. In Brazil, these contacts are part of the network of professor Suzana Rodrigues, who is originally a Brazilian citizen. In India, these

contacts are facilitated by the Scientific Counselor at the Dutch Embassy in New Delhi, and in China, contacts exist with Tsinghua University, Beijing Jiaotong University, and, for instance, SIPG (terminal operator) and E&P International (port community system) in Shanghai.

Finally, an element in the exchange of knowledge about the research results is the presentation of papers at scientific conferences. Suitable high level conferences will be identified in the regular PMC meetings.

Relationship with other projects

In parallel to this project, several demonstration initiatives will be started up (by others), with Dinalog or in Pieken in de Delta. These demonstration projects will most likely contain regional initiatives in the area of hinterland network development. There are no financial relationships between this project and these demonstration projects, nor is the progress in this project dependent on the development and success of these demonstration projects. However, if the demonstration projects are actually started up, the project management committee of this project will aim to maintain a close relationship with these demonstration projects.

Implementation

This section describes the way the consortium plans to implement the results of the project (how, who and when), what (additional) budget is needed and to what results this will lead.

Above we have described the research activities in this project (section B) and the activities that are currently undertaken by business partners in which new insights and research results will be absorbed (See under Valorization above). The exchange of knowledge required for this 'absorption' and the further organization of this process are the responsibility of the project manager, while the PMC will maintain the final responsibility. The monitoring and evaluation process that was described in section D. Evaluation and Monitoring is geared to keep track of suitable avenues of valorization among project partners and measure its progress and success.

In addition to this, the project will also facilitate the adoption of the project results, concepts and tools by a wider audience of small and medium size enterprises. For this purpose, the consortium will bring in external expertise from Capgemini and several polytechnic (Hogeschool Rotterdam and NHTV) to help organize a proper set of activities to reach a large number of relevant SMEs and to be able to sustain the follow up among these SMEs by means of polytechnic student internships, joint student projects, and coaching projects by polytechnic staff.

Furthermore, the cooperation of the business partners with the members of the research teams in this project will play an important role in actually transforming the research research into workable solutions that are implementable in practice. The Project Manager and the PMC have the distinct responsibility to actively identify potential applications of research results. Due to the continuous dialogue that is established and facilitated in this project between 'science' and 'practice', we aim to avoid the development of ivory tower solution, or reinventing the wheel. In addition, actual implementation of solutions is often a process of trial and error, requiring re-

design, re-testing and re-development. This also requires a continuous dialogue between design team and implementing parties.

The internal workshops, meetings, secondments and co-supervision structures that we have devised, as well as the monitoring responsibilities of the Project Manager, are thus a key element in achieving the right setting to develop, test, implement and apply practical solutions for efficient multimodal hinterland networks.

ANNEX 1: Company profiles and CVs



Erasmus University/Rotterdam School of Management

RSM Erasmus University Rotterdam (RSM), part of the Erasmus University Rotterdam (EUR), is a research-driven business school located in the Netherlands. The overall mission is to be a leading international business school, acquiring, disseminating, transferring and applying knowledge, guided by the future needs of international business. The School is member of two leading international networks: CEMS (Community of European Management Schools) and PIM (Programme International de Management). In 1999 the school was awarded the EQUIS accreditation, the quality label of the European Foundation of Management Development (EFMD). Today, the RSM offers a diversified portfolio of accredited teaching and research programs, ranging from pre-experience MSc to postgraduate Master and executive development and from fundamental research to applied research and business support, which are renowned throughout the world. The RSM is rated as one of Europe's leading business schools and is up fronting the application of Information Technology to business and modern management techniques.

The research program of the department Decision and Information Sciences on business processes focuses on concepts from management science, information systems and business telecommunication and their role in enabling and managing intra- and inter-organisational collaboration and coordination.

Key personnel

Dr Albert Veenstra studied econometrics at the Erasmus University Rotterdam, which resulted in a degree in econometrics in 1994. In 1999, he obtained a PhD from the Erasmus University Rotterdam on a thesis entitled 'Quantitative Analysis of Shipping Markets'. His research Interests include supply chain management and security, forecasting shipping variables, modelling shipping markets, port management and container terminal operations.

Professor Rene de Koster; professor of Logistics and Operations Management

Dr René (M.) B.M. de Koster is a professor of Logistics and Operations Management at Rotterdam School of Management, Erasmus University since 1995. He holds a PhD from Eindhoven University of Technology (1988). After his PhD he worked as a consultant, responsible for designing and implementing logistics and information systems. He chaired the department Management of Technology and Innovation 1997-2004, and currently chairs the school's Program Committees (3). He is involved in teaching at all levels, bachelor, master, post-experience, and executive development. He also lectures at Eindhoven University of Technology, Université Catholique du Louvain, TIAS, and the University of Pretoria. His research interests are warehousing, material handling, container terminal operations, supply chain management, and retail operations. He is author / editor of 8 books and over 100 papers in books and academic journals. He is in the editorial boards of 6 academic journals and fellow in two research schools. He is member of the ELA R&D board, member or chairman of 3 national logistics awards, and also the chairman of Stichting Logistica.

Professor Leo Kroon; professor of Quantitative Logistics

Dr Leo Kroon is a part-time professor of Quantitative Logistics at RSM Erasmus University Rotterdam (RSM/EUR). He studied Mathematics at the Free University in Amsterdam (cum laude). In 1990, he defended his Ph.D. thesis at RSM/EUR. After having been an assistant professor at RSM/EUR, he has been since 1997 a part-time logistic consultant in the department of Logistics of NS (Netherlands Railways), the main operator of passenger trains

in the Netherlands. His main research interest is the development of decision support tools for planning and real-time operations control of logistic systems, in particular railway systems. He has published numerous papers in journals like Operations Research, Transportation Science, Transportation Research B, and Interfaces. Leo Kroon was one of the members of the NS team that won the 2008 INFORMS Edelman Award for its model based contributions to the development of the 2007 timetable of NS. Moreover, he was one of the winners of the 2008 ERIM Impact Award. Leo Kroon was a coordinator of the RSM/EUR team in the EU-funded projects AMORE and ARRIVAL.

Professor Suzana Rodrigues; Professor of International Business and Organisation
Professor Rodrigues' work has developed in the interface between three areas of research - international business, corporate governance and corporate strategy evolution. Her current research focuses on the international strategy of multinationals and small firms. Her most recent project concerns internationalisation and social innovation.

Prior to joining ERIM, Suzana was Professor of International Management and Organisation at Birmingham University, UK and at UFMG, Brazil. At Birmingham, Suzana was one of the founders and Director of the MSc International Business. She was also a founder and Director of CIBOR – Centre for International Business and Organization Research at the University of Birmingham.

Professor Rodrigues has published several books and articles in peer reviewed journals in international business, corporate governance and organization studies. Her work has appeared in Human Relations, Journal of International Management, Journal of Management Studies, Management and Organization Review, Management International Review, and Organization Studies. She is a co-editor of the Organization and Strategy Series published by Edward Elgar and member of the editorial board for Organization Studies and several peer reviewed journals in Brazil.

Dr Rob Zuidwijk; Rob Zuidwijk is an associate professor of Logistics Management at the department of decision and information sciences of Rotterdam School of Management. His research interests are the value of monitoring information on customers, products and processes in closed loop supply chains, in particular management of the installed base. Supply chain coordination issues in retail chains and intermodal transport chains. He is currently based in UCLA in the USA.

Dr Gabor Maroti; tenure track researcher in scheduling and optimisation. Gabor Maroti obtained his PhD from Eindhoven University of Technology in 2006 on Operations research models for railway rolling stock planning.

Amir Gharehgozli; PhD student. Amir Gharehgozli is a PhD student at the department of Management of Technology and Innovation on the topic 'Efficient Management of 3D storage systems'.



ERASMUS SCHOOL OF LAW

Erasmus University Rotterdam/Erasmus School of Law

The Erasmus School of Law currently hosts around 4000 Dutch and 120 foreign students. As well as providing instruction, 40 professors, 10 associate professors, 24 senior university lecturers, 58 university lecturers, and 36 doctoral students conduct scientific studies within six research programmes. Science and practical training go hand-in-hand: for example, at the Rotterdam Institute for Shipping and Transport Law. RISTL is intended as a centre for

both academic and practical research in shipping and transport law. Through its network of members and associated members, RISTL brings together legal scholars in these fields and stimulate both junior and senior researchers from The Netherlands and abroad to contribute to the international academic debate on issues in shipping and transport law through high quality publications both in the English and Dutch language. Finally, RISTL is a useful instrument in achieving closer international co-operation between Universities and Research Institutes active in the fields of shipping and transport law.

RISTL was launched at the conference on the new *United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea*, aka the Rotterdam Rules 2009, which were signed in Rotterdam on 23rd September 2009. At that time, ESL and RISTL host a two day international conference under the title “The Rotterdam Rules Appraised” on 24th and 25th September 2009 at the campus of Erasmus University at Rotterdam.

Key personnel

Professor Frank Smeele

Frank Smeele (1966) graduated in European Studies and in Dutch Law at the University of Amsterdam in the year 1991. Before his graduations at the University of Amsterdam, Frank Smeele graduated in English Law at the University of Kent in 1990. After several years as a university lecturer he obtained his Doctoral degree in 1998 at the Erasmus University Rotterdam for a PhD-thesis on the identity of the carrier under bills of lading written under the supervision of Prof. Dr. Haak. In 1998 Frank Smeele was appointed as a lawyer at the Van Traa Advocaten Law firm. From 2004 to 2007 he was at partner at this law firm. Along side his work as a lawyer he was appointed Professor in Internationaal Zeerecht (International Law of the Sea) at the Erasmus University. In the year 2007 he was appointed Professor in Commercial Law at the Erasmus University and he held this chair ever since.

Dr Marian Hoeks

Marian Hoeks graduated with a Master of Laws in 2002 from University of Leiden. During 2002 and 2003 she worked as a notary at law in Breda. Since 2004 she has been attached to the department of Commercial and Company Law of the Erasmus University Rotterdam where she started a doctoral thesis under the supervision of Professor K.F. Haak in 2005. She obtained her doctoral degree in 2009 with a thesis on Multimodal Transport Law. Her research has been published in journals such as *European Transport Law*, the *Journal of International Maritime Law* and *Transportrecht*.



ERASMUS SCHOOL OF ECONOMICS

Erasmus University/Erasmus School of Economics (RHV BV)

The Erasmus School of Economics is a leading academic institution in the world. Our school has a long-standing tradition of high-quality education and research. The best of our graduates have made outstanding contributions to science, government and business.

The Chair Port Economics is one of the roughly 10 chairs in the Department Applied Economics at Erasmus University Rotterdam. This research group, organised in RHV BV, a limited company under Erasmus Holding BV, provides under-graduate and post-graduate education and carries out applied scientific research in various fields, including ports, transport, infrastructure and logistics. The group carries out contract research for a wide range of organisations.

The research group's specialisation on port studies is largely explained by the fact that Rotterdam is the largest port of Europe and one of the leading ports in the world. Such an environment is very conducive for world class port research. The business community (represented by, among others, Rotterdam Port Authority and Deltalinqs) also supports the Chair of port economics, through financial contributions and through a cooperative attitude towards port research.

Key personnel

Larissa van der Lugt. Larissa .M. van der Lugt has project management and research experience for close to a decade in the field of ports, transport and logistics. At present at the Department of Port Economics of the Erasmus School of Economics she a senior researcher involved in research projects in the field of port economics, port management and port related logistics development. She is writing a PhD thesis on the strategy of port authorities.

Eindhoven University of Technology, School of Industrial Engineering



The School of Industrial Engineering at Eindhoven University of Technology is the longest established IE School in the Netherlands and one of the oldest in Europe. It has a particularly strong reputation in the area of Operations Management & Logistics. About 50 faculty members are employed in the school, and annually about 15 PhD students, 150 Master students, and 100 Bachelor students graduate.

Current research topics include service logistics, transportation planning, supply chain planning, retail operations, and green transportation. Apart from its research and teaching programs, the School of IE is internationally recognized for its close collaboration with industry, both in the immediate vicinity of Brainport Eindhoven and internationally by the leadership of the Eindhoven-based European Supply Chain Forum.

Key personnel

Professor Jan Fransoo. Jan C. Fransoo is a professor of Operations Management and Logistics in the School of Industrial Engineering at Eindhoven University of Technology in the Netherlands. He holds an MSc in Industrial Engineering and a PhD in Operations Management & Logistics from Eindhoven University of Technology. He also serves as Research Director of the European Supply Chain Forum, a collaborative effort with about 25 large multinational companies, and is part of the leadership team of the Operations Management research group OPAC in his university, which counts about 50 researchers. He is currently also vice-president of Dinalog (*Dutch Institute for Advanced Logistics*). Professor Fransoo held various visiting appointments at US universities, including Clemson University, Stanford University, and the University of California at Los Angeles. He currently serves as Senior Editor of *Production and Operations Management* and is editorial board member of five other journals. He has published over 50 papers in academic journals and presented at many academic and industry conferences. He has also been co-chair of a successful action of COST, funded by the European Science Foundation. As part from his academic activities, Professor Fransoo has conducted dozens of projects with industry. He also serves on various governmental and nationwide committees in the Netherlands, such as the *Strategisch Platform Logistiek (Strategic Platform on Logistics)* and the *Innovatieberaad Mobiliteit, Transport en Water (Innovation Council on Mobility, Transport, and Water)* of the Ministry of Transport, Public Works, and Water Management.

Dr Tom van Woensel. Tom van Woensel is Associate Professor of Operations Management and Logistics (Chair in Transportation Planning under uncertainty). He is an Executive Board Member European Supply Chain Forum and a Member of the BETA Research School for Operations Management and Logistics.

His research is mainly focused on transportation planning under uncertainty and retail operations. Despite numerous publications dealing with efficient offline routing scheduling methods, very few addressed the inherent stochastic and dynamic nature of reality. Consequently, we mainly work in a priori setting, with a strong focus on adding stochasticity and dynamics related to traffic congestion, customer demand, etc. into the company's transportation decision problems. He published over 30 papers in academic journals (including Management Science, Production and Operations Management, Computers and Operations Research, Transportation Research, European Journal of Operational Research, Journal of Mathematical Modeling and Analysis, and International Journal of Production Economics) and several chapters in international books.

Dr Marco Slikker. Marco Slikker is an assistant professor at the department of Operations, Planning, Accounting, and Control at the Technische Universiteit Eindhoven. He is a member of the BETA Research School for Operations Management and Logistics and an Extramural Fellow of CentER, Tilburg University.

The research of Dr. Slikker is mainly focused on the analysis of strategic and cooperative interactions in various settings. Holding, maintaining, and extending a strong background in game theory is combined with a more applied approach on interfaces with, for example, operations management and operations research. He published over 25 articles in academic journals (including Manufacturing and Service Operations Management, Games and Economic Behavior, International Journal of Game Theory, Operations Research Letters, Naval Research Logistics, and Journal of Economic Theory), several chapters in international books, and is co-author of a book on social and economic networks in cooperative game theory.



Port of Rotterdam

The Port of Rotterdam Authority is manager, operator and developer of Rotterdam's port and industrial area. The Port Authority is a public limited company (N.V.) with two shareholders: the Municipality of Rotterdam and the Dutch State. The Roles of the Port of Rotterdam Authority are:

1) Port Authority:

As manager and developer with regard to nautical matters, the Port Authority ensures that the docks are maintained at the right depth, so that ships can enter the port and moor safely. Port Authority staff in traffic centres and on patrol vessels closely monitor and supervise all movements on the water. This is in order to maintain order from a nautical point of view.

2) Port infrastructure:

As developer and manager, the Port Authority ensures that sufficient space is available for companies in the port. It is for this reason that the Port of Rotterdam Authority supports the construction of Maasvlakte 2. The Port Authority also invests in the improvement and construction of new roads, rail, inland waterway connections and underground pipelines.

3) Port operator:

As operator and developer of commercial activity in the port and industrial complex, the Port Authority encourages sustainable economic development. The Port Authority ensures, for instance, that there is an attractive climate for establishing business. To this end, we maintain plenty of contact with politicians and businesspeople both at home and abroad. The Port Authority also undertakes a variety of promotional and marketing activities (such as events and trade fairs) to interest companies in Rotterdam.

Key personnel

Prof. Peter de Langen; dr Peter de Langen works at Port of Rotterdam Authority, department Corporate Strategy as senior advisor and is involved in various strategic renewal

projects. Peter de Langen also holds a part-time position as professor Cargo Transport & Logistics, at Technical University Eindhoven. From 1997-2007, Peter worked at Erasmus University Rotterdam (EUR). At Erasmus, he was engaged in research, education and consultancy in the field of transport, port and regional economics

Peter de Langen publishes articles on port selection, port policy, and international transport & logistics chains in various scientific journals, provides guest lectures at various universities abroad and participates as speaker/ session chairman, in (industry) conferences.

His main scientific contributions are: 1) application of cluster theories to (maritime) transport, ports & logistics, with specific attention for governance in clusters, 2) the analysis of coordination in (multimodal) hinterland transport chains, 3) analysis of the effects of concession policies, entry barriers and intra-port competition in seaports and, 4) the analysis of strategies of port authorities.

Roy van den Berg is a business manager of logistics at the Port of Rotterdam, and is writing a PhD on Business Model Innovation on the port hinterland.

Port of Amsterdam

The port of Amsterdam is the 4th largest port in Europe. The port encompasses an area of more than 1,900 hectares and includes terminals, quays, roads, rail lines and green spaces, the waterways make up an additional 600 hectares. The port authority, Port of Amsterdam, has the mission to be a reliable mainport and to manage the economic activities and employment in the Amsterdam Seaports (Amsterdam, IJmuiden, Beverwijk, Velsen and Zaandam) in a sustainable manner.

The Amsterdam Ports handle a total cargo throughput of around 86 million tons and generates an added value of around €4.4 billion annually. The Amsterdam Ports have an excellent hinterland access by rail, water and road. The Port of Amsterdam has made it a priority to achieve a modal shift from road to rail and water. The main goal for the next ten years is to further develop the Port of Amsterdam as a smart, sustainable logistic hub with a doubling of the throughput by 2020 (compared to 2006).

To reach these goals, the port focuses on improving hinterland access by investing in ICT (e.g. Portbase), rail (participation in Keyrail and electrification of the existing/new port rail infrastructure), and water (IJsselmeer Shuttle, AMSbarge and inland trimodal terminals).

ECT PARTICIPATIONS BV



Since its foundation in 1966, ECT has expanded rapidly, growing into the largest and most advanced container terminal operator in Europe, handling 60% of all containers in the port of Rotterdam. In 2009, ECT handled 6 million TEU. Operating 24 hours a day, seven days a week and 52 weeks a year, ECT operates the ECT Delta Terminal at Rotterdam's Maasvlakte along the North Sea and the ECT Home Terminal & ECT Hanno Terminal in the Eemhaven/Waalhaven area (near the city center). Container handling involves serving a large number of shipping lines and hinterland transport operators. Moreover, massive data flows must be efficiently managed. ECT's terminals are at the crossroads of visible container flows and invisible information flows. Visible are the growing number of ocean-going vessels, feeders, trucks, trains and barges carrying containers. The obvious and tangible tools of ECT's business are a huge fleet of cranes and hi-tech automated vehicles. Invisible, but no less significant, are the vast data flows generated by container transport and the massive amount of planning and organisation INTEGRITY – Project 218588 Version 16/Jun/09 Page 88 of 119 required to make the whole operation work reliably. ECT's highly skilled staff is permanently on 24 hours standby for its customers.



Expansion

Feeders and inland barges will gain their own terminal at the tip of the Delta peninsula on the Maasvlakte at the beginning of 2008. The Delta Barge Feeder Terminal has the capacity for 950.000 container movements. On the north side of the Maasvlakte the Euromax Terminal will be fully operational in 2010. Handling will utilise an advanced version of the automated concept in use at the ECT Delta Terminal. The Euromax Terminal will have a capacity of 5 million TEU.

Shareholders

Hutchison Ports Netherlands, (98%) belonging to Hutchison International Port Holdings Stichting Werknemersaandelen ECT, (2%) a foundation for the benefit of ECT employees ECT is a member of the Hutchison Port Holdings (HPH) Group, the world's leading port investor, developer and operator with interests in 22 countries throughout Asia, Middle East, Africa, Europe and the Americas. Today HPH operates a total of 45 ports together with a number of transportation related service companies.



Modality Software Solutions BV

Modality Software solutions is specialized in software development for companies active within container logistics. As an internationally operating software specialist, Modality has gained a lot of experience on the field of container stevedoring and container transport and related information logistics.

Modality combines her up-to-date knowledge and experience in automation with a thorough knowledge of logistics. The use of professional state-of-the-art programming and database tools results in user-friendly software with a full graphical user interface. Every Modality software solution is therefore unique both functionally as well as on technical level.

The software of Modality has been developed for companies in different fields of the logistic world, e.g. container terminals (sea/inland), inland transport operators (barge/rail/road), shipping companies and forwarding agents.

Modality has automated the majority of the inland container terminals in the Netherlands, including the inland terminals of ECT and the terminals involved in Brabant Intermodal.

Modality is also active in Belgium, Germany, Switzerland, France and Sweden.



Portbase BV

Portbase is the neutral and reliable 'spider in the web' for all logistics information in the ports of Rotterdam and Amsterdam. Via Portbase's port-wide Port Community System, companies can benefit from a multitude of intelligent services. This package guarantees the efficient and simple exchange of information, both between companies and between the public and

private sector. This enables all the participants to optimise their logistics processes, thereby improving their own competitive position and that of the ports.

Portbase was created by a merger between Rotterdam's Port infolink and Amsterdam's PortNET. The new organisation was set up in 2009 by the Port of Rotterdam Authority and Port of Amsterdam and enjoys the wide support of the port business community. Its aim is to develop a national Port Community System within the foreseeable future. Portbase also wants to play a key role in European port-related logistics networks.

Portbase currently offers 25 different information services to around 1300 clients in every port sector. Every month, more than two million electronic messages are sent via the Port Community System. Portbase's head office is in Rotterdam, and there is also a branch in Amsterdam. In total, Portbase has a staff of just over 70. Portbase belongs to and serves the port community and is a non-profit organisation.

Keyrail BV



Keyrail is the commercial manager of the Betuwe railtrack in the Netherlands, which is the dedicated cargo track from the Rotterdam Port to the German border at Zevenaar. We offer cargo rail operators a direct, non-stop connection to the European hinterland. Our core activities are: capacity management, traffic management and management and maintenance of the rail infrastructure.

The Dutch Ministry of Transport and Waterworks has entered into an agreement with Keyrail for a period of 5 years (2008-2013). Within this period, Keyrail aims for a breakeven exploitation of the Betuwe route.



Brabant Intermodal BV

Barge Terminal Tilburg, Oosterhout Container Terminal, ROC Waalwijk en Inland Terminal Veghel founded the daughter company Brabant Intermodal to ensure their development within the changing world of container logistics and to remain an active player in these developments. First results are:

- Joint development of a procedure for secure and safe treatment of gasholding containers;
- start up joined planning of barges;
- minimalizing empty traffic
- start up research project for fair distribution of costs and savings between partners (activity based costing v.s. activity based saving);
- partnership in realization project pro-active supply chain in container logistics;
- joined procurement of assets and commodities.

Main goal of Brabant Intermodal is optimization of the intermodal supply chain towards more quality of services and higher appreciation of the customer. Brabant Intermodal aims for a more reliable intermodal supply chain which will provide the customer tools to reduce costs and realize operational excellence and environmental goals.

NV Regio Venlo

The Venlo Regio, in cooperation with the NV Industrybank LIOF and other Northern Limburg municipalities have set up NV Regio Venlo. Its purpose is to generate a strong push for the North Limburg economic structure, by supporting innovative projects in the area of manufacturing and logistics.



The Regio Venlo itself is a cooperation arrangement between six municipalities in Limburg: Beesel, Gennep, Horst aan de Maas, Peel en Maas, Venlo en Venray. A joint entity is stronger than the sum of its parts. For the strengthening of the region, Regio Venlo facilitates a network of business partners.

ANNEX 2: Academic partner key publications

Dr Albert Veenstra

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- A.W. Veenstra (2005). Empty container repositioning. *Reverse Logistics – business cases* (S.D. Flapper, L. van Wassenhove, J. van Nunen, eds.). Springer Verlag, p. 65-76.
- A.W. Veenstra, H.M. Mulder & A. Sels (2005). Network analysis in the Caribbean. *Transport Geography* 13, 295-305.
- A.W. Veenstra and A.S. Bergantino (2002). *Networks in Liner Shipping - interconnection and coordination*. *International Journal of Maritime Economics* 4(3), p. 210-229.
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Professor Rene de Koster

Some recent papers:

- Quak, H.J., de Koster, M.B.M. (2009), Delivering goods in urban areas. How to deal with urban policy restrictions and the environment?, *Transportation Science* 43(2), 211-227, forthcoming.
- De Koster, M.B.M., Balk, B.M. (2008), Benchmarking and monitoring international warehouse operations in Europe, *Production and Operations Management* 17(2), 1-10..
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Professor Leo Kroon

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- L.G. Kroon, D. Huisman, E.J.W. Abbink, P.-J. Fioole, M. Fischetti, G. Maróti, A. Schrijver, and A. Steenbeek, and R.J. Ybema. The new Dutch timetable: the OR

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Professor Suzana Rodrigues

- Suzana Rodrigues and John Child (2008). *Corporate Co-evolution: A Political Perspective*. Oxford: Wiley.
- Child J. and Rodrigues S.B (2008). The Process of SMEs Internationalization: British Firms Entering Brazil. *Economia e Gestão*, 17, 3 :31-55
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Dr Rob Zuidwijk

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Dr Gabor Maroti

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Professor Frank Smeele

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Dr Marian Hoeks

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Professor Jan Fransoo

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Dr Tom van Woensel

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Dr Marco Slikker

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Professor Peter de Langen

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