

## Coordination in railway hinterland chains An institutional analysis

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*In the last two decades, the European railway market has been liberalized: more competition and less government involvement should lead to higher efficiencies. The central message from an economic perspective is that more market coordinates transactions more effectively and efficiently. In the rail freight market, liberalization did bring positive effects: quality improved and costs went down. However, by focusing on seaports, this chapter shows that liberalization does not in any case bring an optimal allocation of resources. In the new liberalized situation, new parties have entered the market, roles have changed and functions sometimes have split-up over several actors or even disappeared. This chapter shows that additional institutional arrangements or coordination mechanisms are needed in such a process that is highly interdependent in terms of time and capacity. This paper builds on a conceptual approach rooted in new institutional economics for analyzing coordination arrangements in hinterland chains. Based on an in-depth study into the economic organization and performance of the rail transport in the port of Rotterdam we will empirically use the framework.*

Many studies on seaport-hinterland relations indicate that containerization has expanded the hinterland reach of seaports. As a result port competition has intensified (Hayuth 1981; Slack 1993) and the relevance of smooth hinterland connections has increased tremendously. Recent empirical evidence shows that deep-sea container carriers select container ports and container terminals in the Hamburg–Le Havre based on the availability of hinterland connections, reasonable tariffs and immediacy of consumers. As a consequence coordination in hinterland transport networks has increasingly become subject of study among scholars in port economics and management (Wiegman et al. 2008). It has been studied from an operational and technical perspective (for example, Bontekoning 2006). Such studies are valuable, but the proposed hardware solutions will work in a model or process simulation; but it will usually fail when they are implemented due to organizational and process questions like distribution of costs and benefits, distrust, strategic behavior and too limited economies of scale (Van Binsbergen

2007). Coordination in hinterland networks has also been approached from a supply chain management perspective, focusing on chain configuration and integration (Panayides 2002). Van der Horst and De Langen (2008) use insights from institutional economics, with transaction costs economics playing a central role, to study coordination in hinterland networks. They come up with an analytical framework that can be used to further analyze coordination problems and evaluate coordination arrangements that can be introduced in hinterland chains.

This chapter stresses the relevance of institutional economics in analyzing coordination in hinterland transport networks. It extends the work of Van der Horst and De Langen (2008) in developing a framework for analyzing and evaluating coordination arrangements in hinterland transports networks by using Williamson's (1996) layers as an analytical framework. This study specifically stresses the relevance of taking into the account the institutional environment in the analysis of coordination in hinterland networks. This is based on an empirical analysis into the rail freight sector that has been subject of major institutional changes over the last two decades. The chapter focuses on rail transport in seaports where the coordination issue is most relevant and where the institutional changes have had severe impacts. Gouvernal and Daydou (2005) demonstrated what the effect was of European liberalization on the degree of involvement (vertical integration) of shipping lines, terminal operators and port authorities in the provision of rail services. The analysis in this chapter has a broader perspective on coordination also including horizontal forms of coordination, and the new role of rail infrastructure managers.

The chapter is structured as follows. The next section explains the principles of institutional economics and introduces the Williamson's (1996) layers as an analytical framework to analyze coordination in hinterland chains. The framework shows that coordination problems and coordination arrangements do not arise in a vacuum; but there is an influence of an institutional environment. In the third section, an overview is given of policy changes in this institutional environment linked to the liberalization of the European transport market in the 1990s. Based on an in-depth study into the economic organization and performance of the rail transport in the port of Rotterdam, the effect of this regime change on the rail freight market in the Port of Rotterdam will be discussed. Moreover, a number of coordination arrangements is analyzed and their ability to solve the coordination problems.

### Analytical framework

In analyzing ports and their hinterland networks institutional economics is scarcely used as a theoretical lens. Some scholars contributed to the institutional analysis of seaports (for example, Stevens 1997; Jacobs 2007); but institutional eco-

nomics in port-hinterland relations has received little attention. In institutional economics actors are assumed to have two human factors: opportunism and bounded rationality. Due to these actor's attributes coordination problems arise and coordination beyond price is required to ensure an efficient transport chain (De Langen 2004). Whereas neoclassical economics shows how (equilibrium) prices in markets inform actors about efficient allocation of resources, new institutional economics (nie) focuses on different organization modes and how transactions can be coordinated efficiently.

The quality of a port's hinterland chain depends on the behavior of many actors, including terminal operators, freight forwarders, container operators, and the port authority. Van der Horst and De Langen (2008) identified a set of coordination problems among these actors and analyzed and categorized different coordination arrangements. All the coordination arrangements have one purpose: coordinate economic transactions in the port-hinterland relation in the most efficient way. Efficiency deals with efficient use of resources (technical productive efficiency), satisfying of consumer's preferences (allocative efficiency) and that new processes, product and services are innovated (dynamic efficiency). Once a coordination problem in the hinterland transport chain is identified and analyzed on its specific character, coordination arrangements can be identified that should lead to the improvement of the coordination in the hinterland network. For analyzing governance in a port's hinterland chain four main categories of arrangements are distinguished: introduction of incentives, interfirm alliance, changing of scope and collective action (see Table 17.1). The four main categories include coordination

Table 17.1: Four coordination mechanisms and possible coordination arrangements

Coordination mechanism	Possible coordination arrangements
Introduction of incentives	Bonus, penalty, tariff differentiation, warranty, auction of capacity, deposit arrangement, tariff linked with cost drivers
Creation of an interfirm alliance	Subcontracting, project-specific contract, standardized procedures, standards for quality and service, formalized procedures, offering a joint product, joint capacity pool
Changing scope	Risk-bearing commitment, vertical integration, introduction of an agent, introduction of a chain manager, introduction of an auctioneer, introduction of a new market
Creating collective action	Public governance by a government or port authority, public-private cooperation, branch association, <i>ict</i> system for a sector of industry

arrangements beyond price or in addition to the (neoclassical) price mechanism. The coordination arrangements include amongst other different types of contracts, both vertical and horizontal arrangements, the involvement of branch organizations, and public actors. Main goal of coordination arrangements is to reduce transaction costs.

It should be stressed coordination problems and coordination arrangements that can be chosen do not arise in a 'vacuum'. There is a strong influence of the institutional environment on the emergence and development of governance; in different sectors, regions or national environments, different governance modes emerge. This is conceptualized by Williamson (1996) in his three layer model (see Figure 17.1).

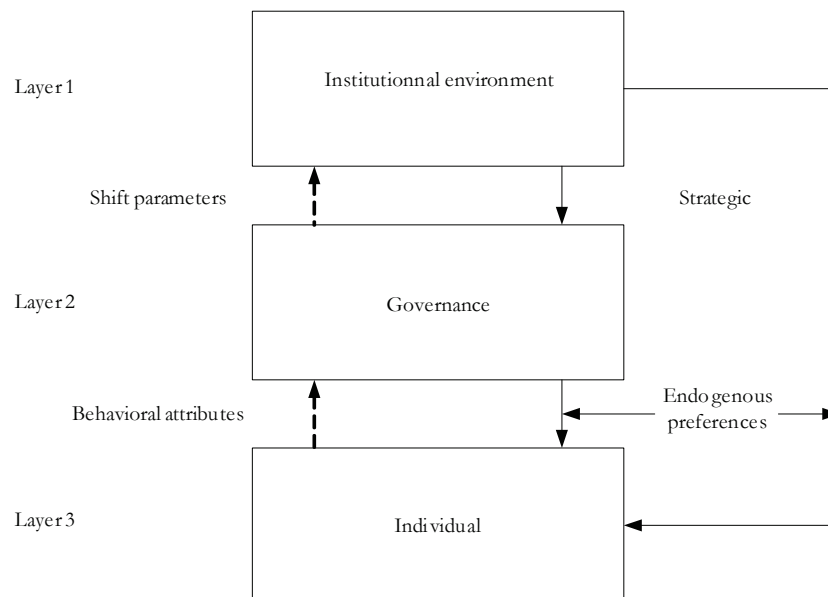


Figure 17.1: Williamson's three layer model (*Source:* Williamson, 1996). Applying Williamson's layer model to an infrastructure market with a liberalizing institutional environment like the railway market is relevant. Earlier, the model has been applied to assess road management liberalization in Nordic countries (Groenewegen and De Jong 2008).

The institutional environment is placed at the first layer. This is the area of formal and informal institutions. Formal institutions refer to national and international (eu) laws, regulations and procedures. The basic question in this layer is who owns what. In the port-hinterland relation this layer deals with ownership structure

of ports, competition rules in the field of antitrust, mergers and state aid, or the European directives on unbundling infrastructure ownership and opening international traffic to private companies. Informal institutions include traditions, norms and customs which are deeply rooted in society. Between ports and its hinterland differences in culture exist, but these differences seem to become smaller and value gets blended because of dynamics in ports and hinterland are caused by internationalization and technological innovation (De Langen and Chouly 2003).

The impact of the institutional environment on choosing a coordination arrangement (layer 2) is represented in the model with shift parameters. The influence of individual economic actors on the transactions and governance structure is represented in the three layer model with the behavioral attributes: opportunistic behavior and bounded rationality. As mentioned earlier, these human characteristics contribute to coordination problems.

Williamson also included so called secondary effects in his framework (the dotted arrows in Figure 17.1). The secondary effects are called endogenous preferences and strategic or instrumental effects. A strategic effect is the influence of the governance structure on the institutional environment. For example improvement in contract law, brought about at the request of parties who find that existing law is poorly suited. Endogenous preferences are found in the influence of the institutional environment and governance structure on the individual economic actor. Although Williamson included these secondary effects in the model, he argues that the solid arrows are more pertinent (Williamson 1996: 225).

According to the model coordination arrangements are chosen given the rules of game in the institutional environment of seaports and given the behavioral attributes of individual actors in the port-hinterland transport chain. This (linear) way of reasoning is a fundamental critical point on the model. With neglecting the interdependencies between the governance layer and both the institutional environment and the individuals the model becomes static; it compares static situations. When and how a process of selecting a coordination arrangement takes place and will really end in an efficient equilibrium is not part of the analysis. Building on Williamson's model, Aoki (2001, 2007) introduced the comparative institutional analysis (cia). One goal of cia is to understand the mechanism of institutional evolution and change in a framework. Aoki neglects the linear way of reasoning and explicitly allows for feedbacks between the actors and their environment. Aoki attempts to answer the question why on the one hand multiple coordination arrangements exist and how the process towards a coordination arrangement can be understood. Aoki's contribution lies in his analysis of the process of institutionalization (by means of evolutionary game theory); actors maximize their trade-offs in each action they take in a sort of self-organizing process. This takes the analysis a fundamental step further than nie, which only assumes a competitive selection

process of the most efficient coordination arrangements (see also Groenewegen and De Jong 2008).

### The impact of institutional chains on coordination in the railway hinterland chain

In this next section we make the emergence of coordination problems (layer 3) and coordination arrangements (layer 2) more specific by adding developments in the institutional environment (layer 1). We will consider the working of the model with the comment on the linear approach mentioned in the section above. The economic organization and performance of rail transport in the port of Rotterdam, the Netherlands, will be used to test the framework empirically.

This section describes the changes in the institutional environment by given an overview of the policy changes that are introduced by the European Commission and adapted by Dutch government in the 1990s. The next section discusses how the changes in the institutional environment influenced the behavior of the individuals/the actors in the railway hinterland chain (see Figure 17.2) in their optimal allocation of resources in terms of technical productive- allocative- and dynamic

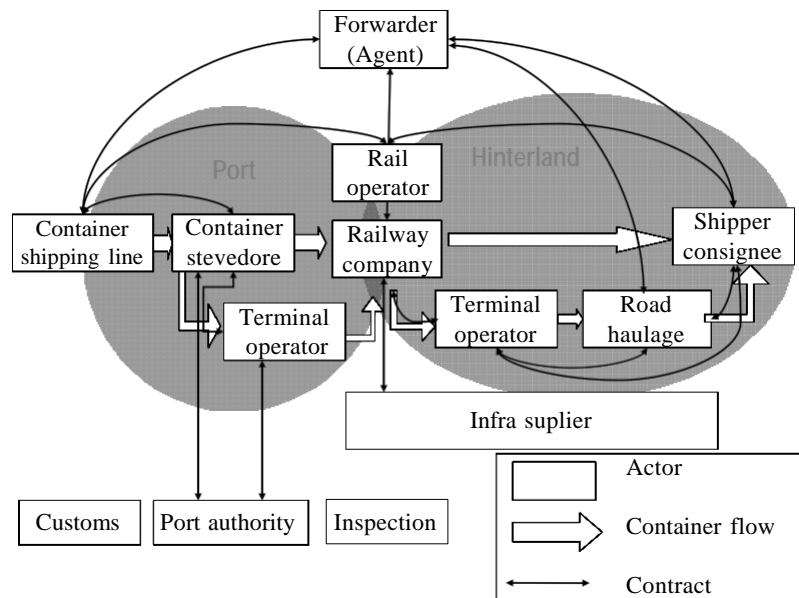


Figure 17.2: Railway hinterland chain (*Source:* Van der Horst and De Langen 2008)



efficiency, and how coordination problems in container rail transport are affected. The last section discusses the consequences of the changes in layer 1 on layer 2 where the new and additional coordination arrangements are chosen by actors in the hinterland chain. Here the four main categories of arrangements are distinguished: introduction of incentives, interfirm alliance, changing of scope and collective action

#### *Changes in the institutional environment of the railway market*

Over the last two decades the rail freight transport sector has undergone a substantial transition, initiated by the European Commission. From the beginning, the European Transport Policy has been based on a liberal market approach, resting on the Commissions' conviction—at least until recently—that the market should play the central role also in providing mechanisms (for example pricing, incentives) for overcoming problems of congestion and pollution (Giorgi 2002). The eu Commission's approach focuses on privatization, vertical unbundling and liberalization. Vertical unbundling refers to the separation of infrastructure and operations. Infrastructure remains in the hands of one (in most cases) public organization and operations are carried out by one or more other (in most cases) private organizations. Privatization means change in ownership structure from public to private. Liberalization means that legal entry barriers are removed and open access is introduced enhancing competition. These arrangements are of different nature but all contribute to the liberalization process that the European Commission has followed strongly the last two decades.

The first step in European rail freight liberalization was Directive 91/440 of 1991. It focused on vertical unbundling, based on the Commission's feel that this was the best way to introduce competition on the railroad network: where the market for rail infrastructure is seen as a natural monopoly, with little possibility for competition due to scale effects (Gruyaert 2007), competition for the provision of rail transport services can very well be introduced and should be introduced to improve performance.<sup>1</sup> The core aspect of unbundling is the separation of the financial administration of the two activities. There is no obligation to strictly separate the two activities in two distinct legal entities. In different countries, different configurations have emerged (Gouvelal 2005).

Based on a further analysis of the performance of the European rail sector, a rail

1. The rail transport sector is a network-industry, characterized by use of network infrastructure, leading to extreme high fixed costs and low variable costs. The consequence is scale economies and therewith a tendency towards a natural monopoly. Potential new entrants are confronted with high sunk costs (the investment in the infrastructure network that the existing company has done and depreciated already) and rather choose for getting access to the existing network than to develop a new one.

package consisting of three directives (2001/12//eg; 2001/13/eg; and 2001/14/eg) was developed.<sup>2</sup> The rail package permitted railway companies to offer services in all eu countries under equal and non-discriminatory conditions. To qualify for this status, railway companies have to acquire a specific license. In 2004, a second package was adopted with the following content: first, further liberalization of the market for rail freight transport, not limited only to the Trans European Corridors but operational on the whole European rail network; second, directives to ensure the safety of European civilians and create a level playing field; third, the formation of a European Rail Agency; and, fourth, measures to enhance the interoperability of the different national rail networks. In 2007, the European Parliament and the Council of Transport Ministers adopted the legislative proposals making up the Third Railway Package: market opening for international rail passenger services, rail passenger rights and obligations as well as the certification of train drivers.

The introduction of a new rail market regime has not run smoothly. It took almost two decades from the first discussions and negotiations in the European parliament and Council of Ministers. Now the packages are accepted and all directives needed for a free open market are there, implementation is still far from completed and differs strongly in the different countries (see Table 17.2).

Table 17.2: Results of liberalization policy in the European member states

Degree of separation	Degree of competition	
	No open access	Open access, freight competition
Vertically integrated (with accounting separated)	Greece, Ireland	Belgium, Germany, Austria
Separate public infrastructure manager	France, Finland, Spain	Sweden, Netherlands, Denmark, Italy, Portugal
Separate private sector infrastructure manager		United Kingdom

*Source:* Nash 2006

One of the problems that Europe is facing in this is the embedding of the European Policy in the National Transport Policy schemes of the different Member states. These schemes differ strongly, both in background as in outcome. Besides, some Member States still show a rather nationalistic and opportunistic attitude when it comes to policy measures that affect their economic growth. A rough estimate is that up to now only 35 percent of the eu rail legislation is correctly imple-

2. See the White paper on European Transport Policy to 2010.



mented (erfa 2007), with limited share of new entrants in various countries and state aids still given in some countries.

In 1995, the Dutch government implemented legal separation of the infrastructure management and operations into two different organizations. Before liberalization, all railway activities were concentrated in one single organization, the Nederlandse Spoorwegen (ns). After a couple of years of start-up in 2003, ProRail was granted a ten-year concession to maintain the Main Line Network. It was decided to have a separate organization responsible for the exploitation of the Betuweroute, the dedicated rail freight connection running from the Port of Rotterdam to the German border and also for the exploitation of the Ports' Rail Line. There is open access for rail freight companies to offer their services on the Dutch rail network. After that the former freight subsidiaries of ns (ns Cargo) and that of the German railway company Deutsche Bahn merged to create a new firm called Railion, several private firms entered the freight market, including Rail4Chem, acts and ers Railways.

Many studies show that the Dutch rail freight market is highly liberalized compared with other European Countries (Gleave 2005; Ministry of Economic affairs 2008; ibm 2007). As a result in terms of allocative and dynamic efficiency the rail market in the port of Rotterdam developed well. New entrants have stepped into the market. In 2009, 14 railways are active at the Dutch railway market. Also the number of national and international rail operators increased substantially (see Table 17.3).

Table 17.3: Number of market players in rail transport in 1995 and 2009

	1995	2009
Railway companies	1	14
National rail operators	3	6
International rail operators	3	15
Rail terminals in the port of Rotterdam	3	8

Source: Railcargo 2009, revised by the authors.

As a consequence of the new entrants that have stepped into the market prices declined and efficiency went-up. The market communicates a fall in rates of between 15 percent and 25 percent (kim 2007). An effect of the liberalization process was the introduction of the shuttle concept by operators. The development of shuttle services increased substantially the last decade. From 1995 to 2007, the

number of shuttle trains per week doubled till more than 200 (see Table 17.4). Also the number of origins and destinations increased from 29 in 2001, to 53 in 2006.

Table 17.4: Market share of railway companies in providing traction for container shuttles

Railway companies	Shuttle services per week	Market share (%)
acts	41	20
ers Railways	49	24
Rail4Chem	32	15
Railion	62	62
sncf	3	1
Veolia	21	10
Total	208	

*Source:* Railcargo 2008.

In terms of technical productive efficiency the Dutch Ministry of Economic Affairs (2008:184) conclude that the productivity of the rail infrastructure for cargo transport increased strongly the last decade, mainly forced by an increased utility rate of trains.<sup>3</sup>

Besides the positive effects mentioned above, we state that, focusing on ports, liberalization does not bring an optimal allocation of resources, like train paths, terminals (cranes), locomotives and wagons. Earlier identified coordination problems in container rail transport (see Table 17.5) are intensified, or become worse.

The allocation of rail tracks gives rise to coordination problems between ProRail and the railway companies. The new infrastructure managers ProRail and Keyrail allocate train paths on a yearly basis. This method is rigid and is not aligned with the market demand for flexibility in the allocation of railway tracks. With the market entrance of more railway companies, planning of slot allocation became even more difficult: railway track and rail yard capacity needed to be precisely allocated to the 14 different railway companies nowadays (see Table 17.3). In such a situation dealing with uncertainty of arrival and departure of trains is only possible if complete integrated real-time information on train positions, expected arrivals, rail terminal availability and rail track and yard occupancy is available. Where the

3. It can be questioned whether an increase of productivity an effect is of liberalization and with that has lead to an increasing transport demand. The causality could also be the other way around, namely that increased demand has lead to economies of scale and caused an increase of productivity.

Table 17.5: Coordination problems in container rail transport

Coordination problem	Actors involved
Unused rail tracks because of insufficient tuning	Railway company, infrastructure manager
Peak load on terminals; spread of terminal slots is not realized	Container terminal operating company, Rail terminal operator in port, rail terminal operator in hinterland, railway company, infrastructure manager
Limited planning on rail terminal causes regularly delays	Container terminal operating company, Rail terminal operator in port and hinterland, railway company, infrastructure manager
Limited exchange of traction	Railway company
Limited exchange of rail cargo	Railway operator, forwarder

*Source:* Van der Horst and De Langen 2008.

infrastructure manager has problems with the allocation of railway infrastructure, it could be said that railway companies lack incentives to use it efficiently. An analysis of the timetables of railway companies with a total market share of 80 percent in container transport shows that about 40 percent of the container trains make two or more stops in the port. The turnaround time of these multi-stop trains is between 8 and 30 hours. Nonetheless, also the average turnaround time of direct trains is in general high, namely 12 hours. In most actual pricing regimes railway companies do not pay for inefficient use of infrastructure. As a consequence they request train paths that they might not use; they park their assets at the place that is most convenient to them, but maybe not efficient from a systems perspective; they do empty repositioning in a way that is most convenient to them, but may not efficient from a systems-perspective; they use train paths at times that is most convenient to them and create peak hours.

There are 17 coordination problems that also arise on the interface between rail terminals and railway companies in ports. Terminal operators draw up a daily terminal-handling plan with time slots for each train on the terminal. However, because of the lack of contractual relations between the rail terminal operators and railway companies (see Figure 17.2), there is often mismatch between the operations of the several different railway companies and the terminal operator.

The planning of rail operations through the port is not only a complex matter because of lacking contractual relations, there are also many actors (functions)

involved, namely one or more terminal operators, the infrastructure manager, a railway company and a rail operator.<sup>4</sup> Together there are at least six actors that in a joint effort must make an integrated planning followed by a smooth execution of operations in line with the planning. With the increase of the number of market players planning became even more complex.

The exchange of traction (for example, through a pool of locomotives) between railway companies or the exchange of cargo between railway operators and/or forwarder would increase efficiency, because the utilization of locomotives could increase substantially. Exchange of traction is particularly required on the last kilometers of the rail track, because of the many small shunting activities that lead to idle time for locomotives. However, the strategic considerations of the several railway companies impede the exchange of traction. This hindrance is partly explained because the local offices of some railway companies do not have the autonomy to take such decisions. In the future, with the extension of the port of Rotterdam, Maasvlakte 2, the number of rail terminals in the port area will increase. Bundling of container flows to arrange direct shuttle trains makes exchange of traction or cargo more necessary

#### *Coordination arrangements in the railway hinterland chain*

This section gives an overview of arrangements to enhance coordination between actors in the container railway transport in the port and hinterland of Rotterdam. The arrangements to enhance coordination are classified into one of the four categories of coordination arrangements (see Table 17.6). The arrangements are derived from a literature and Internet search and stored in a database. This database consists of 90 coordination arrangements from railway transport, barging and trucking. In the database the following information is recorded: transport mode, actors involved, number of actors involved, solution type, the coordination problem solved and involvement of the port authority.

This section will show whether coordination is brought with additional arrangements to solve coordination problems that are worsened due the regime change or that new arrangements are introduced due to the given room enabled by the regime change.

The first category is the introduction of incentives or changing the incentives structure. Incentives can be used to align the interests of individual firms within an efficient overall transport chain. In general, incentives internalize the harmful or beneficial effects (externalities) of a firm's decision on other firms. In our analysis we found two arrangements in which incentives are changed or introduced. In

4. In a multi-stop shuttle concept a train visits two or more terminals in the port area.

Table 17.6: Coordination arrangements in container rail transport

Coordination mechanism	Examples of coordination arrangements
Introduction of incentives	Differentiation tariffs on use of rail tracks and yards (parking) Service level agreement between stevedore <b>ect</b> and railway companies
Creation of an interfirm alliance	Cooperation between rail terminals Eindhoven and Tilburg, Agreement on the exchange of locomotives/train drivers between 5 Dutch railway companies Dedicated shuttle Rotterdam-Hamburg by carrier Geest North Sea line Intra-Port Shuttle by rail operator <b>gto</b> , stevedore <b>ect</b> , rail way company Rotterdam Rail Feeding, terminal operator Pernis Container Terminal
Changing scope	Establishment <b>ers</b> Railways by carrier Maersk Establishment Rail4Chem Benelux by Bertschi, Hoyer, <b>bas f</b> and <b>vtb</b> Lehnkering Rotterdam-Mannheim shuttles with risk-bearing commitment of terminal operator Triport Forwarder Bertschi establishes rail terminal Stevedore <b>ect</b> operates train to its hinterland terminal Venlo (extended gate) Rotterdam Rail Feeding Carrier Maersk investments in inland terminals
Creating collective action	Quality Rail Rotterdam Association of Inland Terminal Operators Port infolink-rail planning Platform rail capacity extension Pilot project 'Chain Management'—introduces rules of the game to improve punctuality

2009, infrastructure manager Keyrail introduced a new tariff system for the use of rail infrastructure, including rail lane and rail yards. Before 2009, railway companies did not have the right incentives to use the rail infrastructure in the port efficiently. They requested train tracks that they might not use, they parked their locomotives and cars for longer periods at rail yards and they used train tracks at times that are most convenient to them and create peak hours. Given the entrance of new railway companies (liberalization), and given her new role as infrastructure manager (vertical unbundling), Keyrail is obliged to allocate train tracks and rail yards in an efficient and fair way. New conditions in the Dutch Railway Law give room to the infrastructure manager to introduce a system with tariff differentiation and enable better allocation of rail tracks and yards. Conditions on how Keyrail should allocate and price the infrastructure are verified by the Netherlands Competition Authority. Keyrail has an instrument to solve the coordination problem that scarce infrastructure capacity in the port is not used efficiently. The new tariff system is primarily based on the type of train lane that is reserved and the moment of reservation. This system stimulates early bookings.

Second, the system contains penalties for both Keyrail and railway companies. Keyrail should assure good connections with national (non-Keyrail) and international rail networks. Railway companies are obliged to cancel already reserved trains tracks as soon as possible. For example, in case of cancellation more than 30 days before departure 25 percent of the fare should be paid; cancellation 4 hours before departure leads to a penalty of 90 percent of the fare. In 2008, another coordination arrangement based on incentives has been launched. Deep-sea terminal operator *ect*, railway companies and the infrastructure manager started to develop service level agreements. The agreements deal with operational issues like exchange of real-time information on position of trains, expected times of arrivals/departure and terminal and train lane availability. Failures are linked to penalties. These agreements can be seen as additional arrangements to solve an already existing coordination problem that is worsened due to liberalization, but also due to the fact that deep-sea terminal capacity in Rotterdam was scarce at that moment. Although such agreements are an attempt to internalize the harmful effects of decisions of the actors involved; it doesn't overcome the missing contract between the deep-sea terminal operators and the railway company. Compliance of the service level agreement could yield high transaction costs. But moreover, there is a danger for free rider behavior.

The second mechanism for enhancing coordination is the creation of an interfirm alliance between several actors in the hinterland chain. Alliances are arrangements like subcontracting and or offering a joint transport service. Alliances are a better instrument than incentives, especially in cases where coordination requires invest-



ments in new equipment or in new services, but benefits are unclear and uncertain. In 2007, rail companies Railion Nederland, *ers* Railways, *acts*, Rail4chem Benelux and Veolia Cargo agreed on the exchange and the use each others locomotives for the removal of wagons of other railway companies. The agreement is a solution to use rail tracks and rail yards more efficient. In the new situation, railway companies sometimes distort the operation of the other by obstructing the rail tracks and yard. The agreement gives the possibility to remove each other trains in case of obstruction. History shows that it is hard to establish and even harder to maintain distrust between partners and liability issues, due to differing interests. It can be questioned if an interfirm alliance between railway companies is good a coordination arrangement to improve usage of the train lanes in the future. Introduction of a right incentive structure might be enough. With the new tariff system of Keyrail (in 2009), the infrastructure manager has the right instrument to stimulate efficient usage, but lacks the assets (because of vertical unbundling) and jurisdiction to remove obstructing locomotives.

The exchange of cargo to increase the utilization of locomotives and infrastructure is a serious coordination problem. Bundling of container cargo to arrange direct shuttle trains remains necessary in the future. The shuttle concept of cargo resolves not only the coordination problem of limited exchange of cargo, but also the coordination problem concerning the inefficient use of railway infrastructure in the port. Our study in the Port of Rotterdam shows that railways companies and/or rail operators do not exchange cargo mutually in interfirm alliances.<sup>5</sup> Interfirm alliances to create direct shuttle trains do exist, but are mainly founded with the involvement of carriers and railway terminals in the hinterland. An interfirm alliance with involvement of a carrier is for example a shuttle service created by carrier Geest North Sea line and rail operator Hupac. They offer a joint shuttle to Hamburg; both parties are commercially responsible for the shuttle train. In 2006, a large inland terminal operator in the hinterland of the port of Rotterdam, namely Rail Terminal Tilburg, agreed a long-term contract (four years) with railway company *acts* to establish frequent rail services (two times per day) between the terminals of Tilburg and Eindhoven and the port of Rotterdam. The inland terminal operator guarantees the cargo for the train. Cargo is collected in the region of Tilburg and Eindhoven by the inland terminal operator (via truck and barge).

Besides interfirm alliances many coordination arrangements are found in which containers shuttle services are established by actors who changed their scope, be-

5. This is an important difference with container barging. An earlier analysis of Van der Horst and De Langen (2008) on the barge industry shows that the interfirm alliance is chosen more often to enable exchange of cargo. Because of the strong strategic differences interfirm alliances seem to be more effective arrangement than complete vertical integration (changing scope) in container barging.

ing a matter of hierarchical coordination of the chain. Remarkable is that mainly terminal operators are active in changing their scope activities towards establishing rail shuttles. Inland terminal operator Triport in Ludwigshaven, Germany, took a risk-bearing commitment in the operation of shuttle from and too Rotterdam. By bypassing the rail operator or forwarder Triport despatches freight for railway company. Deep-sea terminal operator ect changed their scope into railway activities by operating highly frequent (more or less 15 times a week) a train shuttle to the inland rail terminal Venlo, also owned by ect. The fact that ect owns an inland railway terminal in Venlo since 1991 is not the result of the regime change in the railway transport market. It fits in the earlier identified phenomenon of port rationalization, characterized by a strong functional interdependency between ports and multimodal platforms in the hinterland as a market-driven process that mirrors the increased focus of market players on logistics integration (Notteboom and Rodrigue 2005). Through commercially operating a train ect tries to extend the gate of its deep-sea terminal to inland terminals (extended gate concept). The hierarchical coordination of the hinterland chain by ect reduces long stay of trains in the port due to limited planning between terminals, infrastructure manager and railway companies. The extended gate concept can be seen as an additional arrangement to improve more complex terminal planning due to the increase of the number of market players. Another factor why ect hierarchically coordinates the railway chain are local constraints in the port of Rotterdam. First, the lack of available land for expansions is an acute problem. Second, as mentioned earlier, liberalization substantially increased the development of shuttle train services. The increased port traffic has lead to diseconomies of the port's rail network. Extended gates thus enables to partially limit local constraints by externalizing them (see Notteboom and Rodrigue 2008). Besides vertical integration of terminal operators we also observed change of scope of a trucking company.

The liberalization of the railway market offered room to trucking company gto to operate a port shuttle from ect Delta terminal (western part of the port area) to Pernis Combi Terminal (eastern part). Pernis Combi Terminal acts as port gate. The shuttle improves usage of the port rail and track and it relieves the road infrastructure in the port region where congestion in rush hours can also be considered as a coordination problem. Also container carrier Maersk invests heavily in an inland terminal network. The Danish carrier plans to build 20 container terminals (including barge terminals) in South Germany and Eastern Europe. Partially to improve efficient use of rail assets, partially to manage the empty container flow, because of the high share of merchant haulage in Rotterdam (more or less 70 percent) and shipping lines do not control container returns. The regime change offered room for deep-sea carriers to start railway activities. For instance, in the early 2000s

Mærsk established *ers* Railways. This form of hierarchical coordination is positive in a sense that rail cargo of a container carrier is bundled within the firm.

The fourth and last mechanism for enhancing coordination is collective action. This category contains public governance by government or port authority, branch organization, and public–private cooperation. This mechanism is especially relevant in situations of high complexity, and when investments have collective rather than individual benefits. An example of collective action is the port community system Portinfolink that developed the application Rail Planning, an internet application for information exchange between rail operator, railway company and terminal operators. The system makes it possible for the rail operator to give a pre-notification for containers at the rail terminal in the port; the system also provides real-time information about the status of containers at the terminal (charged/discharged). In general, this kind of applications may contribute to coordination in the railway chain; it can improve the planning at the rail terminals, and so stimulate spread of terminal slots and avoid regularly delays. A positive and essential part of the Rail Planning application is the inclusion of the Customs Administration (Lee et al. 2000). However, it can be discussed if Rail Planning is an efficient coordination arrangement after the regime changes, because the infrastructure manager is not included in the application. Port infolink is a public-private partnership between the Rotterdam Port authority and the Port Industry Association Deltalinqs. Such a public–private partnership is an efficient governance mode given the high investments of such a system and the many and relatively small parties that (should) participate. These parties do often not have the resources to invest in information exchange systems and especially with information exchange systems there is a danger of distrust between the firms. A private partnership between the Rotterdam Port authority and the Port Industry Association reduces transaction cost given the distribution of the relatively large collective benefits, and moreover it assures trust between the firms involved. It should be mentioned that the involvement of port authorities in the establishment of port community can also be observed in other ports like Antwerp, Barcelona, Valencia and Singapore.

Another example of collective action is the pilot project Chain Management Port Rail Track that started in 2007. The purpose of the pilot is to improve the punctuality of trains in the short run by introducing (new) rules of the game. These new rules concern about information exchange on estimated time of arrivals, number of containers and real-time reservation of train lanes. Also reduce of the number of multi-stop trains is an important goal in the pilot. Besides the two largest terminal operator (*ect* and Rail Service Center Rotterdam), 3 railway companies (*ers*, Railion and Veolia Cargo—with a total market share of about 75 percent) and 3 rail operators (*ers*, Hupac and Intercontainer) participate. Infrastructure

manager Keyrail is coordinator of the pilot, and the Rotterdam Port Authority facilitates the project. The new rules are not made and enforced by the infrastructure manager, but are made in a process of mutual consultation between the parties involved. The involvement of the port authority and the infrastructure manager is explainable because complexity is high; voluntary negotiation between the parties could lead to distrust. Keyrail's role as coordinator is in line with conclusions of the Dutch Scientific Council for Government Policy on the impacts of the liberalization of network industries (wrr 2008). This study argues that there is a high need for system coordination, especially functions like information collection and provision, fair allocation of infrastructure, but also efficient and sustainable use of infrastructure by users. The pilot can be considered as a process where new norms and rules (at layer 1 of Williamson's model) are formed within a group to prevent for inefficient use of the rail infrastructure and terminal capacity (at layer 2 of the model). The pilot is a relatively cheap way for reciprocal information exchange. The infrastructure manager, railway companies, rail operators and terminal operator cooperate to establish and maintain a collective culture, in which new rules for efficient usage of rail infrastructure can be internalized.

### Conclusions

In this chapter, we explored the relevance of taking into the account the institutional environment in the analysis of coordination in hinterland networks of seaports by using Williamson's three layer model. Taking this environment into account is relevant; coordination arrangement to improve the efficiency of hinterland chains do not take place in vacuum.

In the first layer the institutional environment is placed. In the new liberalized environment of seaports, many new railway companies entered the market. Also the number of rail operators increased and the new role of the infrastructure manager was established. It can be concluded that the implementation of the European directives for a free open market is still far from completed and differs strongly between the different countries. In this respect the Dutch rail freight market is highly liberalized. It can be concluded that there is a liberalization paradox in the railway market; especially if we focus on the port of Rotterdam. On the one hand, the changes in the institutional environment has lead to a positive development: new entrants have stepped into the market, new train services have started and freight rates fall (allocative and dynamic efficiency). On the other hand, this chapter shows that technical efficiency developed badly: liberalization doesn't bring an optimal allocation of resources in a port's rail system, like train paths, terminals (cranes), locomotives and wagons.

At the second layer in the model, the coordination arrangements are placed in order to solve coordination problems. It was demonstrated that a lot of coordination arrangements are developed in the port of Rotterdam. Given the fact that coordination problems have become worse, additional coordination arrangements were developed. The regime change also gave room for the introduction of these arrangements. For example, on one hand there was a need for an additional coordination arrangement because the allocation of the train track in the port to 14 railway companies became very difficult. On the other hand, given her new role as infrastructure manager, Keyrail has room to introduce an incentive system with tariff differentiation to enable better allocation of rail tracks and yards. Also a lot of interfirm alliances are developed in which cargo exchange takes place to create new train services. The liberalization gave room to develop these new services. The chapter showed that railways companies and/or rail operators do not exchange cargo mutually, but shuttle train services are mainly founded with the involvement of carriers and railway terminals in the hinterland. The liberalization of the railway market also offered room to actors in the hinterland chain to change their scope of activities. For instance, shipping line Mærsk established *ers railways*. This form of hierarchical coordination is positive; rail cargo of one single container carrier is bundled within the firm.

The model used in this paper has a very linear way of reasoning: the most efficient coordination arrangement is chosen given the institutional environment and given behavioral attributes of individual actors in the port-hinterland transport chain. A new dynamic layer model should be introduced to understand the mechanisms of institutional evolution and change in bringing coordination in hinterland transport chains (see Figure 17.3). The dynamic layer model allows for feedback between the several layers. First, we observed that the institutional change at layer 1 directly affects the allocative behavior of the individual actors at layer 3. Earlier identified coordination problems have been deteriorated due to the regime changes. With the market entrance of more railway companies, planning of a port's railway system became more difficult: railway track and rail yard capacity should be allocated to 14 different railway companies. Moreover, the several rail terminal operators in the port should make good agreements with the railway companies who visit the terminals. In the new designed competitive railway market actors in the railway chain could impede better coordination due to strategic considerations. They are not familiar (yet) with the new market situation. Second, from the empirical analysis it became clear that there is a feedback from layer 2 to layer 1. This can be seen for example in the coordination arrangement Chain Management Port Rail Track where terminal operators, railway companies and rail operators discuss together, on a voluntary basis, about new norms and rules to prevent for inefficient

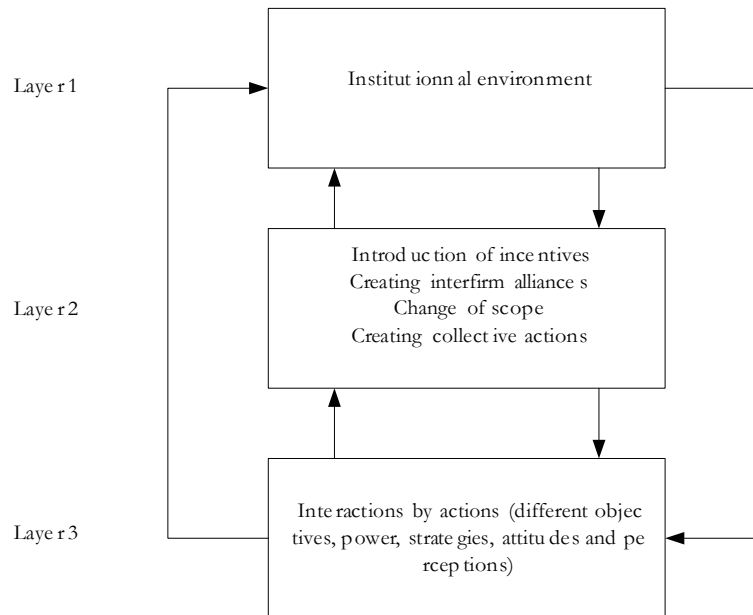


Figure 17.3: Dynamic layer model (*Source:* adapted from Williamson 1996)

use of the rail infrastructure and terminal capacity. In other words, arrangements are not only chosen given the institutional environment, actors also want to influence the institutional environment in which the rules of the game are formed. The dynamic framework for the analysis of coordination in a port's hinterland provides a basis for further research. The framework proposed deserves further theoretical testing by using the insights of Aoki's (2001) *cia*. From an empirical point of view, a promising line of research would be to carry out the same analysis in other port-hinterland chains in Europe where the railway market has also been liberalized. The analysis will evaluate to what extent liberalization brought coordination in other railway hinterland chains.

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