



# PORT AND RAILWAY CONNECTIONS AND THE HINTERLAND CONCEPT

**Selcuk Duranlar**

Trakya University, Edirne Vocational School of Social Sciences, Edirne, Turkey

<https://orcid.org/0000-0001-7743-5916>

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## **Abstract**

*Intermodal transport began in the early twentieth century with railroad cars loaded onto carrier ships. At that time, only a few systems were available as standard freight units suitable for intermodal transport. By the middle of the twentieth century, the carriage of road vehicles, known as piggybacks, using car carrier ships or flat car trailers, became more common. Considering that that mode of transport will always play a role in the transport of containers, one can conclude that congestion problems in ports burden the infrastructure near the ports also. The deficiency of space forces ports to improve solutions for port tasks such as filling, storage, and congestion, using the new port concepts with the port entrance shifted to the interior. The increasing volume of container transport in ports has also led to a general increase in the transport volume in ports, increased the geographical coverage of the market, and significantly transferred ports into hinterlands. Ports have played a vital role not only in terms of domestic activities and the provision of exports and imports but also in other transport networks. In this study, the author emphasized the importance of hinterland logistics and proposed some solutions.*

**Keywords:** *Hinterland, logistics, port, railway, transportation, management*

## **1 INTRODUCTION**

Road transport remains primarily the most common hinterland transport system in many ports. Road infrastructure is reaching the ports' capacity limits, so heavy traffic jams are frequent in the terminals. The environmental and social impacts of road transport are also the subject of strong debates about the future role of road transport. Many ports also face different constraints in their hinterland and expanding rail capacity.

While before the XIX century, hinterland transport consisted primarily of sailing ships, in the XIX century canal operations became more common by rail.

Hinterland logistics consists of activities that combine the hinterland transportation system and related logistics. Combining large and global maritime networks with hinterland transportation networks is crucial for transportation systems. The expansion of the hinterland also contributes to increasing the port's potential. Close cooperation and coordination between actors in the supply chain and hinterland logistics enable more effective and efficient hinterland systems.

*Address of the author:*

**Selçuk Duranlar**

[selcukduranlar@trakya.edu.tr](mailto:selcukduranlar@trakya.edu.tr)

Various scholars have argued that hinterland access is crucial for the competitiveness of seaports. (Langen & Chouly, 2004, p. 362) The authors made a distinction between captive and contestable hinterlands. Captive hinterlands are areas where a port has such a competitive advantage because of low generalized transport costs to those regions and handles most cargoes. For most ports, captive hinterlands are less prevalent. Contestable hinterlands consist of regions with no single port having a clear cost advantage over competing ports. If the vast majority of cargo originates from or destinates for the contestable hinterland, economic rents are small or non-existent. A similar distinction applies to primary hinterlands, the area where the port is well established, and secondary hinterlands, with competition among ports. (Pallis, 2022)

There are great challenges for container ports and terminals to remain competitive and for anticipated growth, increasing their productivity to reduce spatial pressure, thus reducing congestion and improving hinterland accessibility (Nemoto, Browne, Visser, & Castro, 2006).

## **2 PORTS IN THE EUROPEAN UNION**

Although most ports of the two main European transportation networks connect to national rail systems, they are not sufficiently optimized to ensure uninterrupted service. Therefore, more and more countries are implementing and planning construction projects, line dubbing, infrastructure electrification, and signaling system installation to provide a reliable connection that meets their transport demands and the level of integration with the entire transport system and facilitates access.

The European Union has a network of more than 1,400 inland and seaports, with 329 ports and 103 inland ports on TEN-T, of which 104 are main ports. It provides 75% of European trade to the rest of the world and more than a third of intra-European trade. It also provides mobility to 400 million passengers.

Ports are essential gateways for access to international markets as they are part of an extensive global network that enables the mobility of goods. Using links with other modes of transport

shipments reach their destination hubs which deliver goods further to consumers.

In addition to their key role in securing goods, ports are significant economic and energy hubs and currently employ more than 1.78 million European port workers in the EU-28.

In their own right, ports are industrial locations as they encompass power generation, refining activities, port operations at terminals, and securing transport links for mobility, delivery, and cargo picking-up. Therefore, ports form an ecosystem of transport, energy, and industrial systems that contribute to the strategic corridors with added value for the European economy and mobility creation. Ports are also a significant component in achieving the Green Deal goals to create a sustainable society and economy. They are in urban areas. The pollution level in these complex facilities affects residents and the environment in the region.

In their development strategies, EU members should consider projects focusing on multimodal connections between ports, airports, railways, and roads. The new, advanced strategies try to shift traffic to sustainable modes of transport. We expect railway transportation to increase by 50% and inland waterway transportation by 25% by 2030. Therefore, new infrastructure needs to be developed.

Analysis of European Union member states estimates that by 2030 an investment of around 750 billion euros is required to build a core network and make it truly work in terms of performance, speed, connections, and sustainability. Regarding the percentage of project types for port infrastructure, the most relevant is basic infrastructure at 37%, followed by sea access, equipment and superstructure, and infrastructure for smooth transport flows within the port at 8% each.

Ports are much more competitive to serve the same inland areas, and this is especially true for major Western European ports (Le Havre, Antwerp, Rotterdam, and Hamburg), where the distances of these ports from the main freight producing inland areas are not a very distinguishing factor. These conditions provide hinterland accessibility and become increasingly important for a port's competitiveness. The

requirements to be successful are the competitive hinterland transport system, and the ability to provide cost-effective services. The system must be able to serve. The interface between many destinations and port terminals as part of these criteria hinterland modes must be efficient, fast, and reliable. With the development of intermodal hinterland transport (rail and barge), large-scale transport services are gaining importance to shift the cargo route and make the port accessible (Nemoto 2005-17).

Container activities in the port of Rotterdam are spread over the port area, but there are three clusters: Eem/Waalhaven, Botlek, and Maasvlakte. The distance between these clusters is about 40 km. While they are three separate activities, they are highly interconnected. The port should develop activities simultaneously to ensure efficiency (Visser, Konings, Pielage, & Wiegman, 2009).

### 3 HINTERLAND TRANSPORTATION SYSTEMS AND MODES

The objectives of the hinterland transport system are achieving accessibility and low total cost. The transport system consists of modes, either alone or in combination. Cost-effectiveness and successful logistics highly depend on the probability of a good match with quality and demand. Characteristics of the material flow and design components of the hinterland are crucial. Therefore, it is significant to understand the transportation system characteristics.

Transport modes have different costs. Its main operational features are high speed and limited loading capacity. The existence of intermodal transport depends on combinations.

From the point of view of road infrastructure, fixed costs are high, but from an operational point of view, road transport is characterized by variable prices with a high share. Other important features are high flexibility, usability, and speed but limited loading capacity compared to other modes.

Railroad encompasses high fixed costs and relatively low variable costs. High fixed costs are locomotives, wagons, and transport equipment. Variable expenses are mainly personnel, fuel and maintenance, and repair expenses. Its general operational features are fast and high capacity.

#### 3.1 Hinterland Transportation System Design

Design of a transportation system; It aims to match demand (material flows) with supply through transport. Choosing which mode of transportation(s) to use is based on features such as freight volumes, distance, time constraints, product value, availability of services, etc. (Mangan, Lalwani, & Butcher, 2008, p. 22). The interior transport system design can be defined through its service components.

#### 3.2 Hinterland Logistics - Strategy

When evaluating hinterland logistics design, it is often necessary to choose which one is appropriate. The features related to the services offered by the current logistics service providers are:

- *A large number of users.* The system can benefit from economies of scale as a result of many users. Many users can also contribute to the reliability of the system because it is generally more resilient to changes in the market.
- *Simplicity of application.* The service has been operational since it is very easy to use when starting. There are well-developed routines and shipping times, reliability, security issues, etc.
- *Strategic connection with the providers.* Strategically tied to the provider for a long time, it is free to change logistics service providers connected to a hinterland.
- *Pricing.* Marginal costs of hinterland transport solutions due to economies of scale can be very low
- It is possible to choose whether or not to open the system to other users. This option can be invaluable when it comes to the strategic advantages of the hinterland. The transportation system is so large that it has a significant overall impact.
- Its solution requires long-term commitments and large investments. Their cost is high and there is a significant payback period.
- There are exit opportunities from secondary markets, but they are often associated with significant exit costs. In addition, the investments made, creating human resources for the design, implementation, and

- management of the system significantly influence the payback period.
- When a person manages a hinterland transport system, in many cases there is total control of costs which can be very important such as when the market prices of hinterland services rise significantly or imbalances between supply and demand, if any. When the owner controls the system and costs, he can limit risks of highly fluctuating costs and prices for hinterland transport.
- The system is fully adaptable. A self-managed system depends on schedules, load units, transport techniques, storage facilities, IT systems, etc. provides flexibility.
- *Incentives*; By introducing incentives, the collaborative structure is balanced. Incentives can be, for example, bonuses, penalties, tariff differentiation, guarantees, and capacity and deposit regulations.
- *Formalization*; facilitates communication, trust, and commitment by formalizing cooperation and bringing actors closer together,
- *Creating collective action*. It means the promotion of public governance by the government, port authority, public/private partnership, branch associations, etc., and focus and stability in a context that would be otherwise uncertain and unstable

### 3.3 Hinterland Logistics - Management

There are only a few studies on coordination and management in hinterland transport. However, the supply chain management literature has long recognized the need to address inter-organizational coordination challenges (Van der Horst & Langen, 2008, p. 109).

We can identify three general arguments about why coordination problems exist. They are:

- *Lack of resources or willingness to invest*. It may be difficult to obtain the necessary financial commitment for collaborations with small companies.
- *Strategic considerations*. Regarding coordination, actors may be reluctant if competitors also benefit from improvements.
- *Risk-averse behavior and short-term focus*. If implementation costs and efforts are high, cooperation is high, and the benefits are uncertain, actors may be reluctant,

These are the factors that must be kept in mind when designing and implementing a hinterland transport system.

After identifying the key factors and common points of coordination problems, it is possible to solve coordination problems in the hinterland transport chain. Managers can apply the set of concepts to deal with the most common coordination problems to identify appropriate solutions to address coordination issues (Vander Horst 2008:110).

Increasing interest in hinterland transport will likely lead to more investment. There will be a general improvement in integration and coordination. However, some ports may cause a decrease in competition due to their competitive advantage in the hinterland. In cases of financial support for the infrastructure provided by national or supranational bodies, the state can enact regulations on port accessibility and provide third parties with access.

## 4 CONCLUSIONS

Hinterland logistics and transport systems have become a significant and integrated part of global supply chains.

Shippers must focus more on logistics service providers and their simple and efficient design skills. But at the same time, supply chains that are environmentally friendly and of high logistics quality should be the focus. Well-designed hinterland transport systems are not enough alone.

The hinterland transport system is an essential part of the supply chain. When designing an effective and efficient hinterland transportation system, the issue to be considered is the supply chain strategy. Making the right assessments requires unique features and dynamics to understand what hinterland logistics has.

As a logistics service provider, the hinterland is not separate from the ports. It is an integral part of the supply chain. It is part of the network, offering port services.

The logistics service provider must be able to manage both horizontal and vertical coordination with cooperation in the supply chain.

Horizontal coordination takes the form of combinations of single and multiple modes of transport.

Keeping the different actors in the supply chain - shippers, ports, terminals, infrastructure

managers - together is challenging, with its advantages and disadvantages.

As a result, hinterland logistics has become an integral part of globalization. An in-depth understanding and knowledge of supply chains and their management, hinterland logistics, and unique circumstances are crucial for effective design and strategy.

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