

# REGIONALIZATION OF PORTS AS A STRATEGIC LEVERAGE TO IMPROVE COMPETITIVENESS: A STUDY ON CENTRAL ITALY PORTS AND RELATED HINTERLAND

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## ABSTRACT

Nowadays, the success of a maritime port does not depend anymore on its traditional intrinsic points of strength, such as the internal capacity, but also on its ability to effectively integrate the development of its hinterland into business relations and supply chains. Mediterranean ports can get competitive, if specific “regionalization” processes are launched and supported. Key point for this strategy is the hinterland involvement: logistics and transports integration, railways, realization and development of dryports, terminals, distribution centres. All these are core elements for this purpose. The overall focus has changed from port performances to performance of the entire supply chain in the port-hinterland relationship.

This is what it is going to do the Port of Civitavecchia, the most important port in Lazio Region, would like to become the central point into commercial, industrial and infrastructural development of central Italy. The development of railway terminal and of regional road network for the developing of intermodal logistics chain, of the industrial port activities (shipbuilding sector and oil bunkering), of trade relations with Fiumicino Airport and with the roman agroindustrial sector, of logistics relations with the dryport of Orte and with the intermodal terminal (road-railway) of Pomezia Santa Palomba, are some of the activities planned and undertaken by the port for improving the regionalization of Civitavecchia.

Aim of this paper is to show and underline how these regionalization processes can increase the development, and so benefit the entire regional hinterland and the competitiveness and attraction of the entire port system. A model to estimate the regionalization effect has been designed by the authors and implemented to make a comparison analysis between Civitavecchia and competing ports.

*Keywords: dryport, inland terminal, port hinterland, regionalization, supply chains.*

## 1 INTRODUCTION

The current trends in world and European trading patterns and the increasing economy of new developing countries are affecting Mediterranean ports operations and strategies [1]. Additional traffics are expected to come with request of lower costs and higher environmental performances and this can be fulfilled only through integrated supply chain strategies based on increased accessibility. The inclusion of these additional logistics activities around the ports will involve the reorganization of infrastructure and port performances.

In order to maintain their role as important gateway for international and internal market, ports need to focus no more only on their infrastructural or capacity weaknesses or on their strengths. Today, more than in the past, the international competitive power lies in the capacity to involve concretely the hinterland region into business relations that compose supply chain [2]. Nowadays, a port that provides a service at lowest price does not necessarily get market shares, since other factors, often out of the port control, influence the shipper decisions about the port where to dock.

This does not mean that the “port price” and the “internal performances” are irrelevant. Efforts done for increasing port services reliability can lead to considerable returns and incomes. These can also lead to reduction of the current pushing, carried out by shipping

companies, to buy and direct control port zones where autonomously manage their shore activities.

More than never the integrations and relations between the port and its hinterland are a relevant element for analysing the competition between ports. The choice of a port is no longer based only on the simple choice of network costs, the selection criteria are now linked to the entire relations composition where the port is only one ring of the chain [3]. The harbours that today are used to be chosen by shippers are those that allow to minimize the total cost of the maritime, port and shore transport component. The harbour alone and its costs nowadays are nothing more than one single component of the total performances and total costs that comprise the generalized supply chain network.

## 2 LOGISTICS, SUPPLY CHAINS AND PORTS

Globalization and global supply chains are directly affecting the role of ports [4]. These chains link strongly dispersed production and sourcing sites to more geographically concentrated consumption regions. What matters most from the point of view of shippers and customers is the performance of the supply chain in terms of price, service quality and reliability.

This focus on the chain is reflected in the efforts of the players in various segments to consolidate, vertically integrate or otherwise enter into long-term contracts, in order to drive costs down but also to increase the level of coordination and synchronization. Such concentration and restructuring carry the risk of generating excessive market power for some of the actors in the chain and it can also increase volatility, meaning that small deviations from expected or planned processes have large consequences for system performance. For limiting this operational volatility, always more shipping lines tend to vertically integrate, in some cases working towards “extended gates” where they can directly control inland transport, inland terminals and depots.

The integration is not limited only in the kind of shore operation strategy, but also in the attempt to get critical mass in the competitive market. The quantity of products to be transported is increasing, together with always more performing port service requests, while maritime traffic flows and the port calls are decreasing. In last years, it is possible to notice a constant concentration of the international maritime transport players number. Partnership between companies and fusions between ship owners as ways for rationalize and for getting a wider value in the capacity of transport and of services provided are leading to a greater gathering of international maritime flows along specific routes. This means also constant reduction in the number of harbours used for docking.

The concentration and expansion of operators lead also to an increase in the size of the ships used. In the last 5 years alone, the size of the boats used for services between Europe and the Far East have seen a 35% increase in their operational capabilities.

Larger ships and fewer ports where docking mean more volumes to be landed in small time windows and greater traffic pressures and congestion along the routes used for port-hinterland transfers.

## 3 PORT HINTERLAND AND REGIONALIZATION

In the competition between ports, hinterlands have become a key component for linking elements of the supply chain more efficiently, namely, to ensure that the needs of consignees are closely met by the suppliers in terms of costs, availability and time in freight distribution. More is integrated the chain between port and its hinterland, more the focus is not only aimed to harbour side (times, costs and performances). Shippers, or their representatives, might opt

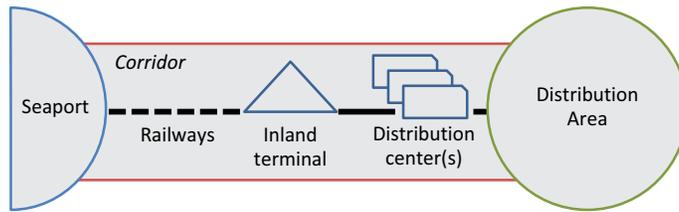


Figure 1: Elements of port regionalization. Elaborated from Campagna and Halatsis [4].

for more expensive ports or a more expensive hinterland if the additional port-related and modal out-of-the-pocket costs are more than offset by savings in other logistics costs.

The port hinterland is to be considered the place for future competition of ports. It is a driving factor in port development dynamics. Where correctly considered, it has led to the following development step, the “Regionalization”, in which the port influencing and operative area is beyond the harbour perimeter and its development is to an higher geographic scale where value added logistics services are provided to cargo, instead of simply moving containers.

In the regionalization a strong functional interdependency and even joint development is realized between ports and inland terminals leading ultimately to the realization of an entire “regional logistics network”.

The main elements of this system are (Fig. 1):

- Corridor: it models the inland accessibility to and from the catchment area of the port and the major distribution systems reachable from the port itself through transport infrastructures.
- Inland terminal: terminal activities need to be improved both at the port and in the hinterland close to the distribution facilities. Loading and unloading of cargoes requires efficient terminals located in the hinterland and connected with the port. An intermodal transport system is fundamental.
- Transport: efficient and reliable transport services should be available to connect the port with the inland terminal. For this reason, railways are fundamental. On-dock rail transshipment facilities are fundamental key in order to connect integrated inland terminals with the port.
- Distribution centres: logistics infrastructures to manage goods are required in order to make the regionalization of port completed and performing. Distribution centres should process large quantities of freight that are to be distributed/collected. Added value logistics services will be key into making attractive such facilities for business (e.g. postponement).

When an inland intermodal terminal is directly connected to seaport(s) with high capacity transport mean(s) and customers can leave/pick up their standardized units as if directly to a seaport it is defined as a “Dryport”.

According to Roso et al. [5], it differs from conventional intermodal terminals (inland terminals) for the services provided along with pure transshipment: storage, consolidation, depot-storage of empty containers, maintenance of containers, customs clearance, and so on.

Being strategically and consciously implemented jointly by several actors, the dryport goes beyond the common practice in the transport industry. Besides, the general benefits to the ecological environment and the quality of life by shifting flows from road to rail, the dryport

concept mainly offers seaports the possibility of securing a market in the hinterland, increasing the throughput without physical port expansion as well as better services to shippers and transport operators. The seaport cities, and also often the port authority, benefit from less road congestion and/or less need for infrastructure investments. A dryport in order to be efficient requires high quality road and rail accessibility, as well long as high quality terminal performances. Finally, flows from port should be large enough to facilitate efficient terminal and rail operations, the latter with satisfactory speed and frequency.

## 4 REGIONALIZATION OF THE PORT OF CIVITAVECCHIA

### 4.1 The overall context

The Mediterranean ports have always suffered a lack in competitive compare to ports of North Europe as Rotterdam, Bremen, Antwerp and Hamburg. These harbours understood since the beginning the importance of hinterland, of its influence on the port, regional and national development and competitive.

Logistics integration, of transports, of railways, realization and development of dry ports, inland terminals, distribution centres, these are all infrastructures and strategies that led to be more interesting for shipping companies, coming from far east, sailing directly to North Europe ports even if it is more time and money consuming than using the Mediterranean harbours.

Making the Mediterranean an area capable of competing in international maritime challenges needs, first of all, the increase of transport connections in order to guarantee better and more reliable transit times compared to the transit ranges of northern ports.

At the present situation, the Italian network for freight transport and logistics is divided in two main regions: North and Centre-South (Fig. 2). It reflects also the economic status of the nation, with a North developed, close to European standards and up-to-date, and a Centre-South more underdeveloped and not competitive in the international markets except for some local spots where there are and there can be points of interest and excellences.

The Port of Civitavecchia is a perfect example from this point of view. It is considered the Port of Rome but, until few years ago, it was not managing freight transport and, still now, it is not able to satisfy the regional demand.

It is the second port in Europe for cruise traffic but regarding container and commercial traffics it is substituted and bypassed by the ports of Livorno and Naples.

In the following paragraphs it will be demonstrated how the Port of Civitavecchia can be more attractive and competitive in the freight transport sector realizing the internal and external infrastructures able to increase the port capacity and accessibility.

### 4.2 The regional context

The Lazio Region actually represents the second consumption market in Italy and it is a national relevant area for logistics and transport sectors (Fig. 3). Despite the importance, different regional logistics and transport actors express the local gap in terms of intermodal capacity in the area. The scarcity of efficient logistics infrastructures with customs services and close to main consumption and production areas oblige often companies to work with out of region actors and entities (like Livorno and Naples) [7].

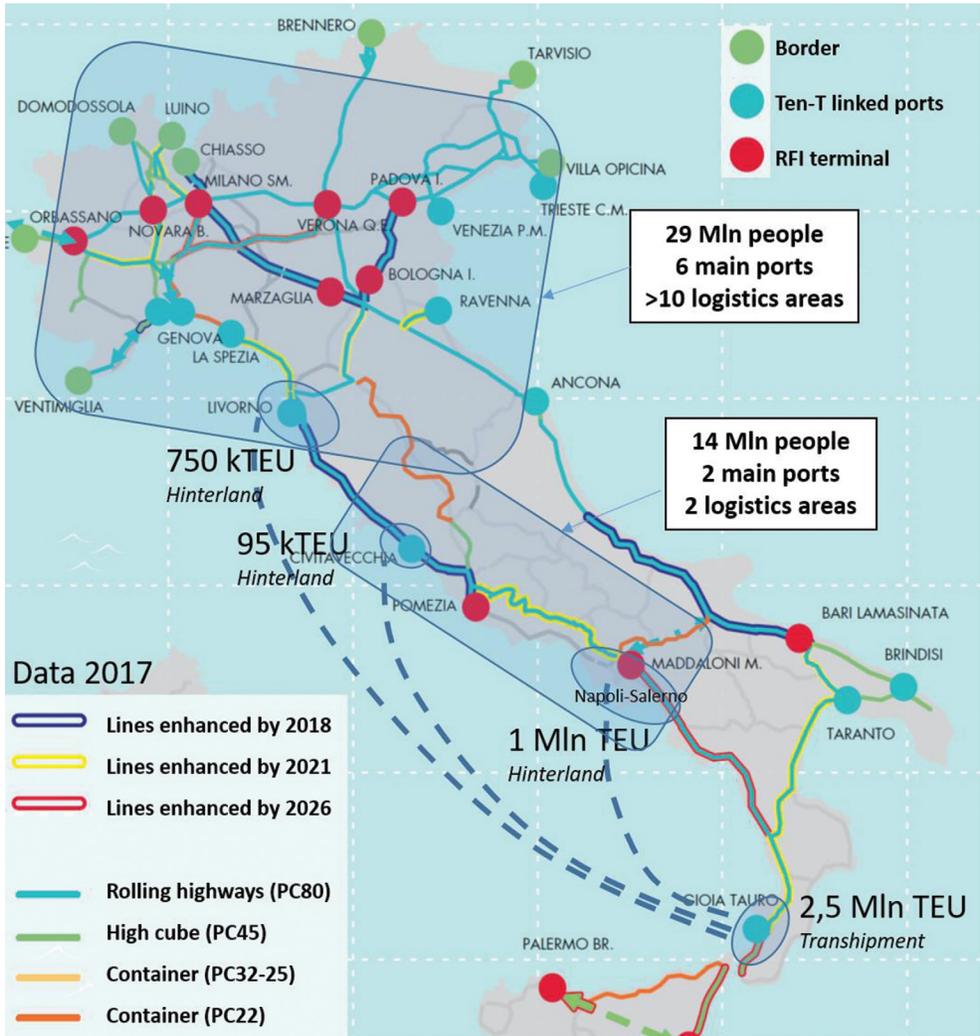


Figure 2: Italian main traffic regions and enhancement of railways according to RFI [6]. Our elaboration.

The Lazio Region actually is crossed by the Scandinavian-Mediterranean Corridor of the TEN-T network both for road and rail transport.

The freight railway network in Lazio is based on 7 terminals, none of them respecting the present European standards regarding the intermodality. Two of them are located in Rome and one close to the Port of Civitavecchia:

- Roma Smistamento;
- Roma San Lorenzo;
- Civitavecchia;
- Pomezia – Santa Palomba;

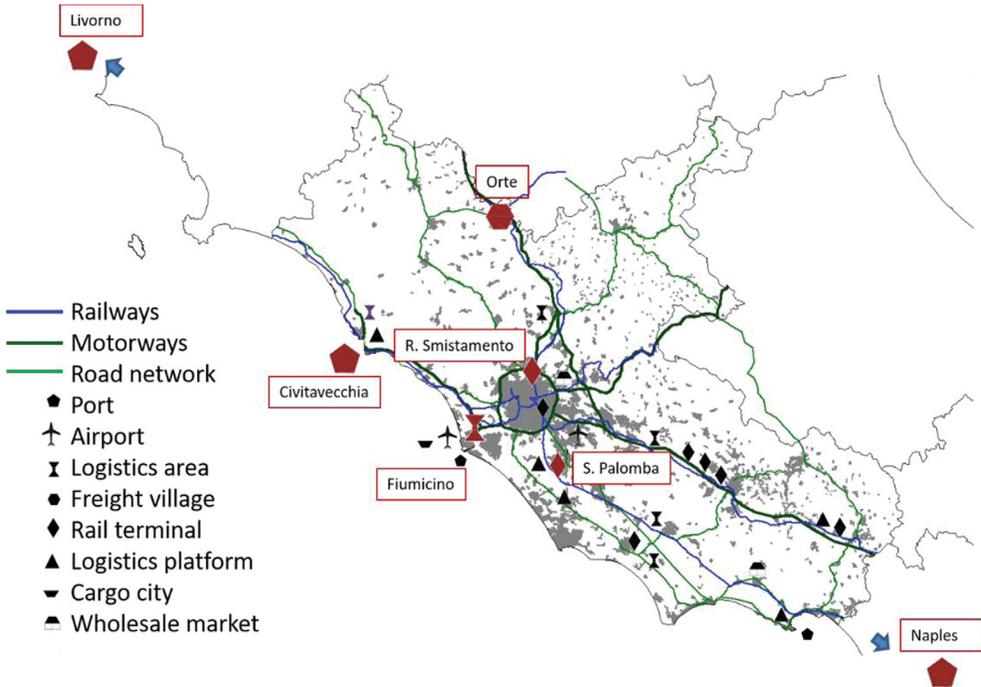


Figure 3: Transport and logistics infrastructures in Latium. Our elaboration.

- Anagni;
- Frosinone;
- Piedimonte San Germano.

The intermodal terminal of Pomezia – Santa Palomba is the main one, with the highest number of goods and trains handled, and it is the only one actually considered “core” by the EU.

Long the Lazio section of the road European Corridor is situated the Dryport of Orte, main freight village in the centre of Italy and crucial node for the interchange of goods between Tyrrhenian sea and Adriatic sea.

In Lazio Region there are two airports: Roma Fiumicino and Roma Ciampino. Together the two airports managed in 2018 around 49 million of passengers (data: Aeroporti di Roma Spa annual report). Regarding the cargo transport, with a total value of 205,879 tons handled in 2018 (data: Assaeroporti), Fiumicino is the second main air cargo terminal in Italy after Milano – Malpensa.

#### 4.3 Modelling of regionalization

Basing on the model realized by X. Feng et al. [8] it was studied and implemented an allocation model where there are considered not only costs and distances between ports and dry-ports as impedance parameters, but also port traffics, services provided and infrastructures available as attractive elements.

The transport and logistics costs for handling cargo between ports and dryports are:

$$Z = Q_{ij} \times \frac{(C_{ij} \times L_{ij})}{m_j}, \quad (1)$$

where  $i$  is the port of origin;  $j$  is the dryport of destination; and  $Q_{ij}$  is equal to:

$$Q_{ij} = D_i \times P_{ij}, \quad (2)$$

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{ij} e^{V_{ij}}}, \quad (3)$$

where  $D_i$  is the total volume of freight generated in the port  $i$ ;  $V_{ij}$  = composition of parameters indicating interest, attractiveness and disadvantages of choosing port  $i$  for going to dryport  $j$ ;  $C_{ij}$  is the transport cost for unit of volume and unit of distance between port  $i$  and dryport  $j$ ;  $L_{ij}$  is the transport distance between port  $i$  and dryport  $j$ ;  $m_j$  is a parameter indicating seaport  $j$ ' attractiveness to shippers.

In this analysis for composing parameters reported in  $V_{ij}$  were chosen as attractive elements and disadvantages: distances and travel costs, presence of depots, presence of veterinary inspection, possibility to empty and refill containers, flexi tank set up, banana weighing, containers weighing, dangerous goods areas, docks length, maximum draft, storage surface, number of STS cranes, number of RTG cranes, presence and length of railway infrastructures. For the evaluation of parameter  $m_j$  it was used the quantity of goods handled by the port.

For the analysis conducted in this paper, together with Civitavecchia, there were used the ports of Livorno and Naples. While as freight destination sites for the transports were considered: the dryport of Orte, the Intermodal road-rail terminal of Pomezia Santa Palomba, the railway terminal of Roma-Smistamento and the International Airport of Fiumicino. All the destinations selected are technically closer to Civitavecchia than to Livorno and Naples (Table 1).

Table 1: Distances between ports and hinterland destinations.

Origin	Destination	Road distance (km)	Railway distance (km)
Pomezia SP	Civitavecchia	90	103.7
Roma Smist.	Civitavecchia	84	91.2
Interp. Orte	Civitavecchia	86	163.0
Fium Aeroport.	Civitavecchia	66	71.3
Pomezia SP	Napoli	228	194.0
Roma Smist.	Napoli	230	224.0
Interp. Orte	Napoli	275	295.8
Fium Aeroport.	Napoli	242	243.5
Pomezia SP	Livorno	343	338.7
Roma Smist.	Livorno	354	326.2
Interp. Orte	Livorno	286	398.0
Fium Aeroport.	Livorno	318	306.3

Table 2: Present ports features.

Facility/service	Civitavecchia	Livorno	Napoli
Depots	Yes	Yes	Yes
Veterinary inspection	Yes	Yes	Yes
Empty/refill containers	Yes	Yes	Yes
Flexi tank	Yes	Yes	No
Banana weighing	Yes	Yes	No
Containers weighing	Yes	Yes	Yes
Dangerous goods area	No	Yes	Yes
Docking length (m)	730	1,910	1,002
Max draft (m)	15	13	14
Storage surface (sqm)	148,000	302,000	206,000
STS cranes	2	8	6
RTG cranes	3	14	9
Railway length (m)	0	1,750	0

The analysis has been conducted for both the road and railways transport system.

For the first model application, the present situation was analysed (Table 2):

As first result of the application, it was found that despite the shorter distance to the selected destinations, Civitavecchia suffers the infrastructural weaknesses.

In the road application of the model, Civitavecchia looks to be the most preferable option for transporting goods only to the Airport of Fiumicino.

For all the other destinations the best options is always Naples and Civitavecchia, even if for a short distance, looks always to be the second in the ranking (Table 3).

In the railway application of the model to the present situation, it was found out that Civitavecchia looks to be the best choice for transporting goods to Roma Smistamento and, again, Fiumicino Aeroporto.

Table 3: First model application.

Road transport (euro)			
	Pomezia SP		Roma Smist.
Civitavecchia	3,834,817.5	Civitavecchia	2,199,086.4
Napoli	2,933,722.5	Napoli	1,789,701.5
Livorno	6,356,571.7	Livorno	3,473,862.4
Interp. Orte		Fium Aeroporto.	
Civitavecchia	2,864,979.3	Civitavecchia	1,196,143.5
Napoli	2,346,256.6	Napoli	1,390,396.6
Livorno	3,169,687.6	Livorno	2,569,994.2

Table 4: First model application.

Railway transport (euro)			
Pomezia SP		Roma Smist.	
Civitavecchia	203,011.41	Civitavecchia	49,780.30
Napoli	232,749.97	Napoli	204,367.87
Livorno	116,575.05	Livorno	68,769.88
	Interp. Orte		Fium Aeroporto.
Civitavecchia	804,000.50	Civitavecchia	3,389.10
Napoli	466,506.48	Napoli	185,034.79
Livorno	78,053.84	Livorno	41,517.39

Naples is never the best alternative while for transporting goods to Orte and Pomezia Santa Palomba the favourable port is Livorno (Table 4).

For the second application of the model, again regarding road and railway transport, there were considered the planned, and sometimes under developing, infrastructural and accessibility improvements for the Port of Civitavecchia (Table 5).

The purpose of this second application is to demonstrate, in a real situation, how the infrastructural and accessibility development can improve the regionalization of the port hinterland and, consequently, the economic development of the entire region.

Regarding the road transport, after the measures implementation, Civitavecchia results to be the best alternative options for handling goods with Roma Smistamento, Orte and Fiumicino Aeroporto.

Table 5: Civitavecchia features after implementations.

	Civitavecchia
Depots	Yes
Veterinary inspection	Yes
Empty/refill containers	Yes
Flexi tank	Yes
Banana weighing	Yes
Containers weighing	Yes
Dangerous goods area	No
Docking length (m)	910
Max draft (m)	17
Storage surface (sqm)	185,106
STS cranes	6
RTG cranes	6
Railway length (m)	2,400

Table 6: Second model application.

Road transport (euro)			
Pomezia SP		Roma Smist.	
Civitavecchia	4,095,803.57	Civitavecchia	2,348,749.549
Napoli	3,960,756.488	Napoli	2,416,238.096
Livorno	8,852,887.86	Livorno	4,838,097.635
Interp. Orte		Fium Aeroporto.	
Civitavecchia	3,059,961.058	Civitavecchia	1,277,549.377
Napoli	3,167,631.34	Napoli	1,877,144.927
Livorno	4,414,469.002	Livorno	3,579,267.426

For the transport of containers with Pomezia Santa Palomba, the port of Naples still results to be the optimal solution (Table 6).

Finally, with the railway application of the model after the Civitavecchia improvements, it was found out how much Civitavecchia now results to be the best alternative for handling goods and container with Pomezia Santa Palomba, Roma Smistamento and Fiumicino Aeroporto.

For the transport of goods with Interporto di Orte the Port of Livorno is still the optimal alternative (Table 7).

As it was expected to be, now, after the implementation of measures and implementations in favour of regionalization process, the Port of Civitavecchia results to be the optimal and best alternative for handling goods and containers using railway and road transport with three out of four hinterland destinations.

## CONCLUSIONS

The actual trends in economic and trading patterns are changing the way in which ports need to face with transport and logistics markets. In order to maintain their role as important gateway for international and internal market, ports need to focus no more only on their

Table 7: Second model application.

Railway transport (euro)			
Pomezia SP		Roma Smist.	
Civitavecchia	107,673.47	Civitavecchia	26,402.55
Napoli	314,230.81	Napoli	275,912.72
Livorno	198,301.74	Livorno	116,982.03
Interp. Orte		Fium Aeroport.	
Civitavecchia	426,426.91	Civitavecchia	1,797.52
Napoli	629,820.51	Napoli	249,811.55
Livorno	132,774.65	Livorno	70,623.78

infrastructural or capacity weaknesses or on their strengths, but also in their capacity to involve concretely the hinterland region into business relations that compose supply chain. The port-hinterland interface and relations need to be considered the place for future competition of ports. It is a driving factor in port development dynamics. Where correctly considered, it has led to the following development step, the “Regionalization”, in which the port influencing and operative area is beyond the harbour perimeter and its development is to an higher geographic scale where value added logistics services are provided to cargo, instead of simply moving containers. This is what happened in the ports of North Europe (Rotterdam, Bremen, Antwerp and Hamburg) where the importance of hinterland was understood since the beginning and, for improving the regional and national development and competitive, it was realized a deep “regional logistics networks” with specific corridors, inland terminals, dryports, distribution centres, etc. The Mediterranean ports have always suffered a lack in competitive compare these ports and the Port of Civitavecchia is a perfect example of this situation. It is considered the Port of Rome but, until few years ago, it was not managing freight transport and, still now, it is not able to satisfy the regional demand. It is the second port in Europe for cruise traffic but regarding container and commercial traffics it is substituted and bypassed by the more complex and developed ports of Livorno and Naples. Basing on the model realized by Feng et al., it was studied and implemented an allocation model able to demonstrate how developing infrastructures and features useful for the Regionalization process can improve the attractively and accessibility of a Port and hinterland. The application of this model together with the planned infrastructural and accessibility improvements for the Port of Rome demonstrates how Civitavecchia can become an interesting alternative for freight distribution inside Lazio Region and a logistics core element for the Centre–South of Italy both for road and rail transport.

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