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## Analysis and viability of railway exportation to Europe from the south of Spain

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### Abstract

More and more companies nowadays are opting to broaden their horizons in order to offer their products or services abroad. The need for the export arises from the current economic situation, not only in the Andalusian region but also throughout the rest of Spain. While domestic demand is at a standstill, foreign trade is often the best or the only alternative to safeguard the financial survival of the company. The trading of a product beyond national borders implies requirements or demands in which risks and costs occur. This paper is focused on an important challenge, the transport, particularly the freight transport by rail. Railway transport presents interesting advantages, but also some constraints in reaching every place and potential customer. At this point, its combination or intermodality with the road system has a great value, since the road is the nexus between companies and intermodal chains where the trade takes place. This paper defines the options for the railway transport of freights from the south of Spain to Europe, and studies one particular case, to be used as a guidance for companies interested in exports.

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### 1. Introduction

Means of transport are nowadays essential in the trade of products as a backbone of the economy. A poor transportation system would entail a lack of customer confidence and a decrease of sales, which is an important business conditioning for the company.

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The most common means of transport in Spain and Europe is by road. Some of its disadvantages are related to accidents, pollution, climate change, noisiness and problems of congestion or associated infrastructure (use of space, barrier effect, environmental harm, etc.) more and more unsustainable nowadays (Martínez and Astals, 2010). It is, moreover, driven by fluctuations in fuel prices.

In this context, the rail transport of freights and its intermodality with the road turn out to be the best alternative. Since not every country or region has a maritime or river access, rail transport is inherently intermodal because of the impossibility of door-to-door concept, except from private sidings (Medrano *et al.*, 2012). Its greater capacity, lower cost per transported tonne, high flexibility in carrying different materials, lesser risk of accident and pollution are among its advantages, but it has also some limits, such as the dependence of specific infrastructures, the differences in the road width in Spain and Europe and the loading gauge for the freight transport.

## 2. Objective and methodology

The aim is to define and analyse the possibilities of rail transport of freights from the south of Spain to the rest of Europe. A particular case is studied to deal with its real needs and problems. The result can be seen as guidance for exporting companies.

For this purpose, we realise a comparative cost analysis between containerized road-rail transport and the predominant unimodal road mode. These costs are considered from the point of view of the charger and take into account all the variables that influence the final cost such as distance, fuel costs, cargo handling, etc. This analysis allows us to evaluate in which cases the intermodal chain is more competitive and profitable than the unimodal case.

Finally, we describe the profile of company or trading activity that would adjust best to such way of transportation from both technical and business perspectives.

## 3. The freight transport by rail. Intermodality

### 3.1. The boost to rail from the administrations

Spain is the fourth European country with a lowest rate of rail transport of freights (Eurostat, 2013). This traffic represents 4,5% of land transportation (period 2011). Although it has experienced a decline for more than a decade, it has lightly increased from 2009 (Figure 1).

When comparing to other ways of freight transport, we observe that rail is significantly below the road and maritime modes (Figure 2). The modal distribution of freights indicates that the European target of re-equilibrated and stabilized modal split is not close to be achieved. Even if recession effects have reduced every mode of freight transport (OSE, 2011), the transport by rail has particularly decreased up to 2,6% (MFOM, 2012). This situation has pushed the administrations to promote the rail mode.

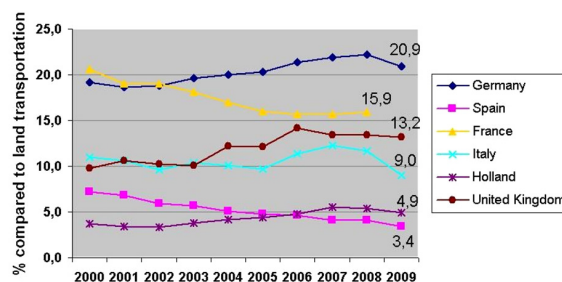


Fig. 1. Evolution of the modal rate of freight rail transport in EU countries.

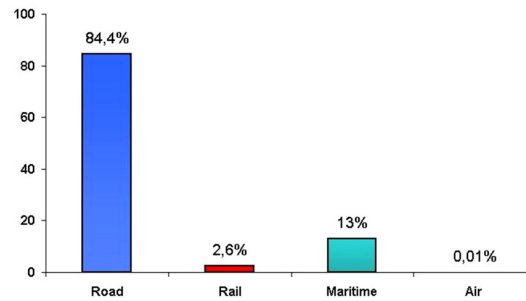


Fig. 2. Distribution of national freight traffic according to means of transport in Spain (2011).

In the EU context, the new White Paper on Transport (COM, 2011) is aiming to transfer 30% of current road transportation to rail or ship by 2030, and more than 50% by 2050, by developing an appropriate infrastructure of efficient and ecological corridors.

In Spain, the Strategic Plan for infrastructure and transport, PEIT (MFOM, 2005), promotes the strengthening of railway in an integrated intermodal system, both for freights and passengers, in such way that the rail system becomes progressively the central element, aiming a more efficient modal balance for business and environment. Also, the Strategic Plan to promote freight rail transport in Spain (MFOM, 2010) suggests the strategical increase of rail transport of freights by improving its quality and competitiveness to a modal rate between 8% and 10%. The recent Plan for infrastructure, transport and housing, PITVI (MFOM, 2012b) enhances several specific targets referring to rail transport which are focused on the improvement of conventional networks and the promotion of freight rail transport.

At a regional level, the Plan of Infrastructures for sustainability of transport in Andalusia, PISTA (COPT, 2008) includes different aims promoting intermodality and prioritization of more sustainable modes of transport, such as railway.

One more initiative benefitting the future of the rail network, both national and European, is the creation of the Trans-European Transport Network, a planified set of priority transportation networks which would help the flow of passengers and freights all along the EU. The corridors are multimodal, so every harbour, airport, hub, logistic platform and production centre will be connected to a road and/or rail -or even river- axis of passengers and freights, what means complete interoperability. Most of the projects are focused in railway. Besides, Spain is definitely involved in two of the priority corridors of the “basic network”, the Mediterranean and Atlantic corridors (Nexotrans, 2013). The operating of this network will boost the development of a railway stretch connecting Algecires, in the south of Spain, to the north, as well as to the rest of Europe.

As far as intermodality is concerned, the Marco Polo II programme for the period 2007-2013 represents an extended version of the first programme, created in 2003. Its aims are the reduction of congestion, the improvement of environmental aspects of the intermodal system, and the reaching of an efficient and sustainable transportation system which avoids overcrowded occupation of the road freight transport sector, to confer a greater value to the EU (Europe, 2011).

### 3.2. Railway operators for freight transport

On the other hand, since the railway sector in Spain was liberalized in 2005, ADIF has assumed the management of infrastructures and the Ministry of Public Works has provided 15 national licences of railway undertaking and 6 qualification approvals as well as 11 safety certificates for circulating throughout the lines of the railway network.

Going into the detail, there are currently two different kinds of services for freight traffic:

- Rail customer service. It is the intermodal rail transport service for containers, designed according to the customer's needs (national or international origin and destination, dispatch volume and frequency, etc.). They are complete return trains.

- Multicustomer network service. It is the standard alternative for intermodal railway transportation. It is based on a regular service of container trains. The date and time of dispatches, as well as the admission and delivery of containers are scheduled and it provides the possibility of shipping from one container (20', 30', 40', 45' or similar size).

Most of small and medium-sized enterprises reject the option of rail customer service. Since trains have approximately 25 coaches, they allow the transportation of quantities of freights much bigger than those which such companies generate or export. So they tend to use the multicustomer network service.

However, private operators which entered this market after it was liberalized do not currently offer the multicustomer option. Instead, they usually offer the setting of regular routes between two places in order to make the rail customer service profitable. Such limitations makes Renfe Operator the only private operator offering the multicustomer service in a regular way.

There are four specialized trading societies from the Renfe-freights group: CONTREN, IRION, MULTI and PECOVASA. CONTREN is the one which assumes the activity of the intermodal business area, specially the shipping of intermodal transport units (containers). It has more than 3.200 coaches available and more than 800 containers for tailor-made offer (rail customer service) and regular offer with a wide extent (multicustomer network). However, they do not deal with exportation, but make connections by means of undersigned agreements with companies in other countries like Portugal or France, (Contren, 2012). Due to that fact, if exportation to Europe was required, for example, to Germany, it would be accomplished throughout one of its customers as a forwarding agent (usually Combiberia).

Combiberia was created in 1992 by some road hauliers from ASTIC and joined by the first combined transport group from RENFE. Its target was to be a wholesale supplier of combined transport by rail, by acquiring trains and selling market gaps exclusively to professionals in the sector -road hauliers, logistics, specialized companies, etc. The social capital is owned by RENFE, two sister companies, Novatrans (France) and Kornbiverker (Germany), and some more road transportation companies (CCP, 2013).

The shipping of freights in Spain implies the use of ADIF infrastructures and, since Combiberia is a Contren customer, it uses the same intermodal facilities or logistical centres that the company does in their national movements. For instance, in Andalusia, even if ADIF possesses some more terminals, the operator Contren uses the intermodal exchange facilities of San Roque-La Línea, Sevilla-La Negrilla and Córdoba-El Higuérón.

#### 4. Practical case

In this part of the paper, we study a concrete case of rail export from Málaga, in the south of Spain. Some conditionings are established in order to face reality in an adequate way.

Our reference will be an exporting company, a small or medium-sized one, which is currently the most common type of company in Spain. It is intended to expand its market as an alternative to the current inoperating national business situation.

Such export will be carried out by using a 20' maritime container, whose volume is 32,6 m<sup>3</sup> and with a weight of 26 gross tonnes (Tare+cargo). The tare for this type of containers can be about 2,4 t. Containers of this type are characterized by its international standardization and flexibility of adaptation to the rail-road intermodal transport. Its most common use is for dry standard cargo: bags, pallets, boxes, drums, machinery, furniture, etc.

The supposed company belongs to the textile sector so their goods are capable of being transported in containers.

Since the main target is the distribution to other markets, specially to the European market, we will create a trade connection with a company in Hamburg, Germany. Hamburg has more than 120.000 enterprises and the second most important sea harbour in Europe. It is situated 380 km from the intermodal export terminal of Duisburg, where Combiberia, the forwarding agent in this case, can operate.

After having set the conditionings, an economic analysis of viability for this export is required. In order to compare the options, we have considered the costs of the main systems, road and railway, and observed the role of railway in such kind of exports. Every cost is subject to eventual modifications, as they are simply a reference of the most important companies in each sector, depending on the services we hire.

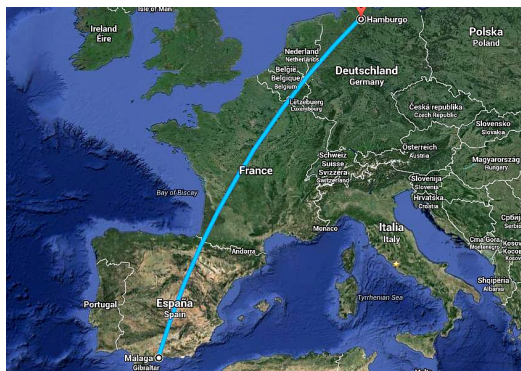


Fig. 3. Exportation between Málaga-Hamburg.

4.1. Containers

The purchase or renting of the container makes a difference, since it can significantly influence the price. Regarding 20' containers, the nearest and most important provider operating in Málaga, Titan Containers, which is located in the harbour of Algeciras, gives the following options.

- Purchase. 20' DV used c/w (cargo worthy) ex Algeciras, 1.460€. Transport to the city of Málaga, 210€. (The cost of returning the empty container must be added to the price of the purchase). Total: 1.670€
- Rent. Since there is a location where the mentioned company can leave the container in Hamburg, there is no need to return it to Algeciras. So, for the delivery: Handling OUT depot Algeciras: 28€/ctr. 20' DV: 10€/ctr. per day. Transport to the city of Málaga: 210€. We will use for this case a period of 30 days: 538€. Then, for the return: Handling IN depot Hamburg: 28€/ctr. Positioning fee of 20' ctr. DV returned to the depot in Hamburg: 350€/ctr. Total: 378€. Total delivery and return: 538€ + 378€ = 916€

Considering the two available options and given the fact that we study an individual shipping in the city, we will opt for renting, while the purchase will remain an alternative lacking the study of the evolution of sales in Hamburg.

4.2. Transportation options

The main exporting options are shown in Figure 4. Nevertheless, the direct rail connection is rejected in this case because there are no companies with their own intermodal stopovers in Málaga. Because of that, there will always be a road trip from the company to the intermodal station where the exchange road-rail will take place. So we analyse the two remaining options: direct connection by road and railway connection.

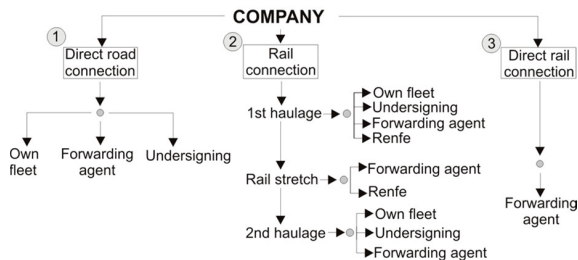


Fig. 4. Diagram of the company's decisions in the intermodal chain.

4.2.1. Direct road connection



Fig. 5. Direct road connection between both of the cities.

The various factors involved in the cost structure of a trucking company can be classified into (MFOM 2011) indirect costs (infrastructure, administration / management and commercial) and direct (fixed and variable-kilometer) costs. To determine the cost of containerized transport by road, the source of information has been the Observatory of the road freight transport market (MFOM, 2012c). As the diagram shows in Figure 5, according to this source, direct costs for an articulated container truck are, the 31<sup>st</sup> July 2012, 1,151 €/km and 1,354€/km if charged. The margin of benefit depends on the transport company.

In this study, the margins are fixed as follows: 10% of the price given by the costs observatory will be for the undersigning company and 10% of the undersigning cost for the forwarding agent. It is important to notice that the prices above are relative, and there can be important differences with some real cases.

Table 1. Costs for an articulated container truck.

	Cost/Km (€)	Cost/Km if charged (€)	Delivery and return cost	Total cost distance 2.807 Km (€)	Total cost including rent (€)
Own vehicles	1,151	1,354	2,505	7.032	7.948
Undersigning	1,266	1,489	2,755	7.733	8.649
Forwarding agent	1,392	1,637	3,029	8.502	9.418

According to the costs in the table, the most cost-efficient option is the use of the own truck fleet for this kind of transport.

The connection times between both of the cities would be about 33 hours for any of the three options, considering an average speed of 85 km/h. These times are estimated and subject to a variety of factors, such as roadblocks, breakdowns, drivers' strikes, etc.

4.2.2. Rail connection

The only possible railway option for freight transport is shown in Figure 6. It is an intermodal transport consisting of 3 main phases: the first haulage, the railway stretch and the second haulage.

4.2.2.1. First haulage

It includes the transport from Málaga to the intermodal terminal enabled by Adif. The designed intermodal terminal will be San Roque-La Línea, about 125 km from Málaga, since it is the closest one.

Such haulage involves several agents: the company's truck fleet, the undersigning of the transportation services, the forwarding agent or Contren. The prices with Contren can be observed in Table 2.

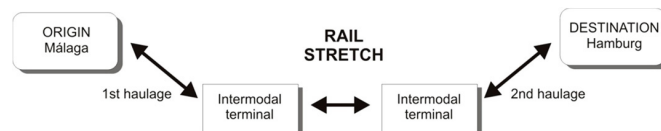


Fig. 6. Rail connection.

Table 2. First haulage costs.

	Cost delivery and return (€/km)	Cost first haulage, 125 km (€)
Own fleet	2,505	314
Undersigning	2,755	345
Forwarding agent	3,029	379
Contren	476 (between 121-150 km)	476

#### 4.2.2.2. Railway stretch

Rail containerized transportation costs can be classified as (MFOM 2011)

1. Direct costs. They are subdivided in two types:

- Costs of infrastructure use. They are fees to be paid for access to infrastructure (reserve capacity and circulation) and for other services rendered (handling, intermodal handling units, etc.).
- Operating costs of the service. They are related to traction and rolling stock. They can be fixed (depreciation of the locomotive and rolling stock, and their financing; conductors staff; other as insurance overhead and taxes) and variable (fuel; diets, costs of maintenance and repair).

2. Indirect costs. They are not directly attributable to the operation of each train but necessarily occur in the normal operation (infrastructure, administration/management, commercial).

In this study the costs have been provided directly by the actors involved.

Once the 20' container is charged to the rail in San Roque-La Línea intermodal station, the options are:

1. Contren deals with the cargo to Madrid Aboñigal, an intermodal station where Combiberia takes the cargo and carries it to Duisburg. The price of Contren is structured as follows:

Handling in the facilities of San Roque-La Línea, to charge the container to the rail: 21,00 €

Transport San Roque-La Línea to Madrid Aboñigal: 230,59 €

Total of Contren service: 251,59 €.

From Madrid Aboñigal station, the forwarding agent Combiberia is responsible for costs and cargo handling, both in Madrid and Duisburg. It provides a fixed price of 1,696 €. So, the combined service of Contren and Combiberia would be: 1.947,59 €

2. Combiberia is responsible for handling costs in every intermodal station, including changes of train or intrinsic cargo transportation costs. Once the container is in San Roque-La Línea terminal, it will be in the care of Combiberia until it arrives to Duisburg, or the intermodal terminal where it will be unloaded.

Full cost (San Roque-La Línea) – (Intermodal terminal of Duisburg): 2.054€

#### 4.2.2.3. Second haulage

It is accomplished from the intermodal terminal of Duisburg (DIT) to the city of Hamburg, about 380 km from there. Such connection can not be undertaken by rail throughout the forwarding agent Combiberia, but on the road. Since this trip is not in Spain, it can not either be done by Contren.

Table 3. Second haulage costs.

	Cost delivery and return (€/km)	Cost second haulage, 380 km (€)
Own fleet	2,505	952
Undersigning	2,755	1.047
Forwarding agent	3,029	1.152



#### 4.2.3. Total cost of intermodal transport

Then, Tables 4 and 5 show all the costs generated in the intermodal route, with all possible combinations.

Table 4. Costs (€) of intermodal route with rail stretch Contren+Combiberia.

Rail stretch with Contren + Combiberia				1947,59
1 <sup>st</sup> haulage		2 <sup>nd</sup> haulage		Total
Own fleet	314	Own fleet	952	3214
		Undersigning	1047	3309
		Forwarding agent	1152	3414
Undersigning	345	Own fleet	952	3245
		Undersigning	1047	3340
		Forwarding agent	1152	3445
Forwarding agent	379	Own fleet	952	3279
		Undersigning	1047	3374
		Forwarding agent	1152	3479
Contren	476	Own fleet	952	3376
		Undersigning	1047	3471
		Forwarding agent	1152	3576

Table 5. Costs (€) of intermodal route with rail stretch Combiberia.

Rail stretch with Combiberia				2054
1 <sup>st</sup> haulage		2 <sup>nd</sup> haulage		Total
Own fleet	314	Own fleet	952	3320
		Undersigning	1047	3415
		Forwarding agent	1152	3520
Undersigning	345	Own fleet	952	3351
		Undersigning	1047	3446
		Forwarding agent	1152	3551
Forwarding	379	Own fleet	952	3385
		Undersigning	1047	3480
		Forwarding agent	1152	3585
Contren	476	Own fleet	952	3482
		Undersigning	1047	3577
		Forwarding agent	1152	3682

These results show that, amongst every possible combination to accomplish the freight transport from Málaga, including the intermodal rail option, to Hamburg, the most cost-efficient for businesses is:

1<sup>st</sup> haulage: Own fleet. Cost: 314 €

Rail stretch: Contren + Combiberia. Cost: 1.947,59 €

2<sup>nd</sup> haulage: Own fleet. Cost: 952 €

Total cost: 3.214 €

Concerning the freight delivery time from Málaga to Hamburg, Germany, schedules dealt with Contren and Combiberia indicate that we need an average time of a week in advantageous conditions, which can be 10 or 11 days



in the most unfavourable case. In the best possible conditions (7 days delivery), the schedule would be as shown in Table 6.

Table 6. Container route.

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
City	San Roque	Madrid	Hendaye-Irún	Trip in France	Duisburg	Hamburg	

This schedule can be affected by variations due to different causes like strikes in the different countries, waiting time in intermodal terminals, breakdowns, container handling, etc.

4.2.4. Comparison with road

In order to compare that system to road transport in this particular case, we will observe the costs of both of the solutions and the price of container renting.

Table 7. 2<sup>nd</sup> haulage costs.

	Total cost of transport (€)	Container renting cost (€)	Total cost (€)
Direct connection by carretera	7.032	916	7.948
Undersigning	3.214	916	4.130

As we observe, the intermodal rail-road connection is the most profitable solution, since its costs are almost 50% lower. On the other hand, the inclusion of the intermodal transportation system represents an opportunity for the company to open new routes and expand their services offering, even operating in places they only could get by road (as, for instance, connecting Duisburg to the East of Europe).

The costs of intermodal transportation decrease in so far as the distances are longer, in contrast to road transport (Janic, 2008). According to data from the Observatory of intermodal land and maritime transport, (MFOM, 2011), the intermodal option is the most cost-efficient from 600 km on (Figure 7).

We also observed that for long or intercontinental routes, even if intermodality is advisable for long distances, it might be influenced or delayed by unproductive waiting times when the freights and transportation means are temporarily useless. In order to avoid the negative influence of these factors, it is important to optimize the interconnection of data, the schedules compatibility, the standardization of transportation systems, coordination between agents and cargo handling, etc.

The mentioned factors indicate that the basic constraint for the intermodal system is not related to costs, but to eventual waste of time, which is particularly noticed in our practical case in the connection between the cities (direct road transport lasts 33 h. whilst intermodal may last 6 days).

When the rail connections (in the case of Spain, the width of railway) standardise to other countries and with a progress of the Trans-European Network, intermodality will prevail over other systems as the most efficient and inexpensive option. This solution will allow small and medium-sized companies to enter the EU global market to be able to find new opportunities and market niches to develop their business activity, in our case, in the German market.

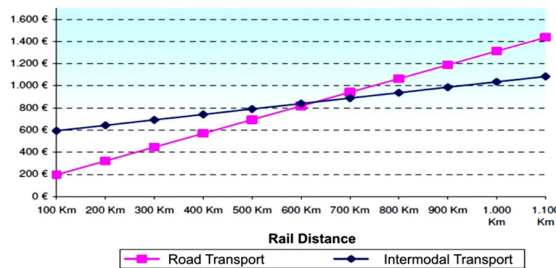


Fig. 7. Price and competitive distance of intermodal transport against road transport.

## 5. Conclusions

Freight transportation by rail is a key activity contributing to an efficient and low-carbon economy (more efficiency of energy consumption, reduction of external costs, regulated CO<sub>2</sub> emissions and decrease of local pollution).

Rail should be the axis of a logistic model combining every means of transport to optimally adapt to the customer requirements. However, its possibilities of flexible logistic services are reduced, so it needs the combination with other modes, specially the road.

Small and medium-sized companies in the south of Spain do not have many options of rail transportation for the freight delivery, but they must consider its advantages according to the type of cargo, flexibility in shipping times, final price and distance, which might make this alternative more favourable than road. As a result, nowadays the use of rail transport is restricted to (or attractive for) companies.

- Owning a stopover, or placed near intermodal terminals.
- Flexible in delivery times and availability of freights.
- Interested in trading with distant companies (more than 600 km). The farther, the more profitable it is.
- Operating with heavy materials, dangerous freights or bulk (chemical products, iron, coal, automobile...).
- Dealing with destiny companies, to get the containers back with materials or goods that they may need, to enable a complete and profitable trading activity and avoid the costs of returning empty containers.

On balance, we can conclude that railway transport is undervalued as regards its great capacity for freight shipping. Besides, facilities to enable intermodality are not plentiful, so it is important to optimize the available resources and promote the running of intermodal platforms and land strategical hubs.

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