Selection of Short Sea Shipping transport alternatives in SW Europe

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Abstract

According to the mid term review of the EU White Paper on Transport, Short Sea Shipping is expected to grow at a rate of 59% in metric tonnes, from 2000 to 2020. If we consider that the overall expected growth in freight exchanges is of 50% (also in volume), sea transport is one of the most feasible ways to reduce traffic congestion on European roads. Marine transport is a possible way to compete with road transport in certain traffics; however, mainly when assuming external costs. This paper is going to analyse what are the most efficient and effective short sea shipping routes to compete with road transport by using statistic methods to build a decision matrix before considering environmental costs that would support the intermodal decision.

Key words: short sea shipping, selection, efficiency, southwest Europe, variables

1 Introduction

The European Commission and Member States have observed that transport in Europe is growing at a high rate and that by 2020[1], the figures for inter European transport, including the EU new Member States, will show a growth of over 50% in volume, and that these values would be absorbed mostly by road transport. However, road transport poses rather more environmental problems than maritime transport, such as a higher rate of congestion, pollution, noise, or accidents. Although Europe needs all modes of transportation to ensure the necessary mobility for people and business, short sea shipping integrated into an efficient transport chain appears to be a potential choice for avoiding congestion, improving accessibility and providing seamless transport routes.

Thus, a big commitment is needed from all those involved in order to improve alternative ways to guarantee the flow of cargo. Short Sea Shipping appears to be a potential choice for the European Union and it is also one of the pillars of the community's transport policy. In short, we could observe that shifting traffic from road to sea is adopted as a main policy goal.

There are certain commodities and traffics, where the superior cost of sea transport within an intermodal transport chain (due to legal systems, infrastructure differences or less developed transport)[2] , could be assumed even by using more expensive transportation units such as high speed vessels.

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[1] Commission of the European Communities (CEC): *Mid-term review of the European Commission's 2001 White paper on transport* (2006).

[2] Blonk, W. *Prospects and challenges of Short sea Shipping*. Proceedings from the second European research roundtable conference on short sea shipping. 2003, Becker J.F.F. et al. *No need for speed in short sea shipping*. *Maritime Economic & Logistics*. Vol. 6 (2004), No.3, pp. 236-251, Mulligan R.F. *Short Sea Shipping – Alleviating the environmental impact of economic growth*. *Journal of Maritime Affaires*. Vol. 5 (2006). No. 2, pp. 181-194.

This paper has been divided in two main sections. Firstly, some previous research in this field of our research group is described. Secondly, different variables based on multimodal transport are evaluated and scoring system is established for determine short sea shipping routes in SW Europe.

2 Previous research

The previous research carried out by the TRANSMAR research group integrated in the Technical University of Catalonia was the INECEU[3] project, proposing after an exhaustive study some alternative multimodal lines against road transport. Keeping in mind the figures of road traffic passing the Pyrenean borders, the group analysed most of the volume moved between Spain and France. Among all the Spanish regions we should note the activity of Catalonia, the Basque country, Valencia and Andalusia. The French counterpart is contested by the Pyrenean regions of Aquitaine, Languedoc-Roussillon and Midy-Pyrenees together with Ile-de-France, Rhône-Alps and Provence-Alps-Côte d'Azur.

The French territory is also crossed by important traffic fluxes southbound coming from Westafalia, Baden-Würtemberg and Bayern in Germany and the northern part of Italy. From Spain it is possible to identify the main traffic towards Westfalia and Baden-Würtemberg in Germany, Lombardia in Italy and destinations more spread out up in Great Britain, Holland and Belgium. Regarding the nature of the cargo, we should note that the South and South-East part of the Iberian Peninsula, together with the Valencia coast, are big producers of fruits and vegetables, with the group of manufactured or canned food and alcoholic drinks. This is one of the larger cargo groups that are exported from Spain.

There is important traffic involving solid bulk such as building materials or scrap iron, together with oil and chemical products from ports with refineries nearby that are firmly committed to removing trucks carrying dangerous or toxic substances from the road to ships that have specifically designed containers, or Ro/Ro's, that will benefit society as a whole.

We should point out that commercial exchanges with United Kingdom and Ireland as mainly are carried out by sea are not contemplated in this paper.

The study concluded that:

1. The industry in the Mediterranean basin accepts the concept of Short Sea Shipping in destinations further to 800 kilometres and using Ro/Ro ships;

2. The Atlantic bulk traffics should take advantage of the SSS funding and official policies using multi purpose ships for accepting different kinds of traffic;

3. Fast ships could be justified when serving trips less than 12 hours away and when cost is not so important provided a minor time of delivery can be guaranteed;

4. The conditions shown in the first phases of the study can be submitted to change that, we are convinced, will be more advantageous to the ship.

3 Most suitable routes choice based on selected variables

The proposed study is based on a previous state of the art[4] coming from available data from statistics and previous research, where 15 routes were found based on estimated time and cost between multimodal and road transport. The objective of this paper is to analyse and further to reduce these 15 proposed routes to 5.

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[3] Intermodality between Spain and Europe. Project funded by the Spanish Ministry of Transport.

[4] Olivella Joan et alt. *Las autopistas del mar como alternativa al tráfico de los Pirineos* (Barcelona, Barcelona Digital SL Ed., 2006)

In a second phase a group of parameters affecting the cargo flows balanced are considered depending on the importance empirically considered by the researchers. Every parameter has been an individual project with his results. All information collected for every individual project requires finally a careful evaluation to link the analytical results with the initial objective. In a third phase the preliminary results are going to be obtained from the previously defined algorithm. (SWOTH ANALYSIS)

The parameters considered in this work, which relevant to multimodal and road transport, are summarized as followed:

Table 1. Selected variables (Source: own)

Variable
1. Difference of multimodal and road transport transit time
2. Difference of multimodal and road transport costs
3. Freight Flows by road
4. Meteorological factor
5. Hinterland GDP
6. Hinterland population
7. Intermodality ports adequacy

The selected parameters are briefly explained below:

3.1 Difference of transit time

The main goal of this variable is to evaluate savings in terms of transit time between multimodal and direct road routes. Data for maritime distances is obtained from *BP Marine, Worldwide Marine Distance Table, and version 1.2.1 software* while data for road distance is obtained from *AutoRoute of Microsoft software.* Some assumptions in load/unload port time has taken into account in maritime journeys. The loading and unloading time taken to port varies relying on the types of ship used and handling operation in the ports. Therefore, studies in terms of time have been conducted and finally, 3 hours minimum has been considered (1.5 hours in each port) per loaded truck in a regular service line served by Ro/Ro ships. A final difference between road times less intermodal time is obtained in hours.

3.2 Difference of costs

In order to calculate the generalized costs, all other parameters are required. For calculating freight road transport cost, a start off charge in time unit and a cost by weight or transport unit; both need to be estimated. According to the data from, *Road freight transport costs observatory of Catalonia Regional department of Transport*, the cost amounts to 252.9€ per working day (nine hours per day) and 28.11€ per hour for 25 tonnes of long haul road unit have been considered together with a cost per kilometre of 0,337 with tolls. Some statistical research has been studied on maritime transport costs, which consider charges from various maritime companies on different kind of fleet. Consequently, an average of unitary cost of maritime transport has been considered for a 12 meters trailer in agreement with the road haul truck. Cost is 39.16 € per linear meter of transport[5], including port operation costs. Truck cost is 469.92 €, and associated cost for the port operations is estimated to be 120 € for each port. An average calculation of the maritime distance between both ports of the studied services is 352 miles.

[5] Olivella Joan, Martínez de Osés Xavier. *Intermodalidad entre España y europa. El proyecto INECEU.* (Barcelona: Barcelona Digital, SL. Ed, 2005).

Maritime haul cost per mile by truck is 0.653€/mile. A difference in euros is obtained subtracting the unimodal minus multimodal chain costs.

3.3 Road freight total flow

The hinterlands of each port area are defined within the Spanish Autonomic Communities framework. This allows freight flow statistics to be taken into account on the hinterlands, providing an accurate means of comparison between the routes. Statistical data is obtained from the *French-Spanish Pyrenena permanent enquiry on road freight transport in 2004*, undertaken by the Spanish Transport Ministry. Road Freight flows have been calculated for each Autonomic Community. Two parameters are provided as follows:

- Total freight volume movement: Total of international volume received and issued.

- Flow Imbalance: The difference in the movements of freight between received and issued flows. A high value of this parameter gives a negative indication for Short Sea Shipping. Various assumptions are made to determine this parameter. After studies being conducted on some references in new short sea shipping routes[6], 60% for total freight and 40% for imbalance have been selected.

3.4 Meteorological factor

Weather factor has been considered from current Mediterranean and Atlantic meteorological buoys data of Governmental Meteorological Institutions[7]. Conventional and high speed craft has been considered. Conventional ships do not present any mandatory regulation related to weather factor, authors have considered significant height wave related to seaworthiness and crew/passage comfort. HSC Code and Classification Societies establish operational limits for high speed craft. Meteorological factor is more critical in fast ships and high speed crafts than in conventional ships[8][9].

3.5 Hinterland net domestic product

NDP measures economic activity for an area. 2003 Autonomic Community NPD, which used in this research, is obtained from Statistics Government Data[10].

3.6 Population within the hinterland

Data collected by *National Statistics Institute*[11] has gathered population for every Autonomic Community.

3.7 Adequacy of each port to the intermodal transport

Current conditions for Spanish ports are evaluated for all routes in this section. The following points are considered:

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[6] ShortSea Promotion Center – Spain: *Tipología y volumen de las mercancías captables por el transporte marítimo de corta distancia.* (2003).

[7] Meteorological buoys information: www.puertos.es [12/02/2006], http://www.bsh.de [12/02/2006], http:// www.cetmef.equipement.gouv.fr/ [10/02/2003], www.meteofrance.com [12/02/2006], www.idromare.com [16/02/2006], http://www.eurometeo.com [08/02/2006].

[8] Napier University, Heriot-Watt University and Industry Partners. *UK Marine Motorways study*. Funded by EPSRC and Dft. (2003).

[9] Martínez de Osés Xavier, Castells Marcel·la. 2007. *Wave height incidence on Mediterranean Short Sea Shipping routes*. http://tethys.cat Vol. 3.

[10] Spanish Ministry of Education and Science. http://www.ince.mec.es/ [19/10/2005]

[11] http://www.ine.es/ [14/10/2005]

- Intermodal Traffic: Container and Ro/Ro are ideal traffic for Short Sea Shipping since these cargoes types allow shifting between different types of intermodal transport. Container and Ro/Ro traffic volume and their evolution from 2003 to 2004 are taken account in Spanish ports.

- Intermodal communications: Port should exhibit good interior and exterior accesses by both, road and rail. These accesses must guarantee good communication between port, wharfs and terminals and also with other external port and its hinterland. It is necessary to guarantee good link between all modes of transport within an intermodal chain.

- Intermodal port infrastructures: Ports have to present container and Ro/Ro terminals for short sea shipping traffic. If not, it would be necessary another non-specific terminal with minimum equipment necessary. Moreover, ports must have wharf with sufficient length to harbour difference ships simultaneously. It would be necessary to consider a ship is capable of embarking several categories of unitised freight: containers, road trailers or complete trailers. The size of the ships is subject to constraints in terms of the traffic potential considered and the average characteristics which are: length of 141.52 meters, beam of 21.56 meters, draught of 7.35 meters, mean GT 14722.64 and average speed 18.27 knots[12].

Up to 10 Spanish ports have been evaluated in this work. Four of them lead the total traffic in 2004 since they have more adequate equipment, terminals and made up of good infrastructure. However, they encounter congestion problem. Evaluation of secondary ports for short sea shipping traffic has been conducted at least in Catalonia for the intention of promoting these ports alleviating the main ports[13].

4 Preliminary results

A scoring system that takes into account seven variables has been chosen. The importance of each variable was obtained from an enquiry made to selected marine stakeholders and indicated by a weight. The weight of each variable is calculated based on different perspectives, according to the following assumptions. From the point of view from shipper/customer a high level of service must be offered. A high degree of frequency with a short transit time is the quality expected by the shipper but also distance and time / cost are considered important variables. The point of view from general transport is dealing with the effect of the road congestion on the transit time. A 5 % weight is applied to Hinterland GDP, Hinterland Population and ports adequacy variables. By considering all assumptions and by making comparison with actual scenario of short sea shipping traffic, the following scores are used. Before applying the weighing factor we decided to separate the own dependent variable called internal from the external or scenario variables and then normalising all of them, affording to compare all of them in a unique scoring system.

[12] Martínez de Osés Xavier, Castells Marcel·la. 2006. *Análisis de los buques en el Short Sea Shipping Español*, http://hdl.handle.net/2117/554. (Mean particulars of ships operating on Spanish Short Sea Shipping routes)

[13] Martínez de Osés Xavier. (2006). *Análisis de los puertos de Palamós, Vilanova i la Geltrú y Sant Carles de la Ràpita como alternativas a los puertos de Barcelona y Tarragona*. (Barcelona: CGC, SL. Barcelona 2006).

Table 2. Scoring system (Source: own)

Variable	Variable weight (%)	Variable category
1. Difference of multimodal and road transport transit time	25	Internal variable
2. Difference of multimodal and road transport costs	25	Internal variable
3. Freight Flows by road	20	External variable
4. Meteorological factor	15	External variable
5. Hinterland GDP	5	External variable
6. Hinterland population	5	External variable
7. Intermodality ports adequacy	5	External variable

The information coming from all the variables is normalised in order to be included in a unique graphic, prior to do a SWOTH analysis. In a first step we normalized the internal variables, showed in the following graphic:

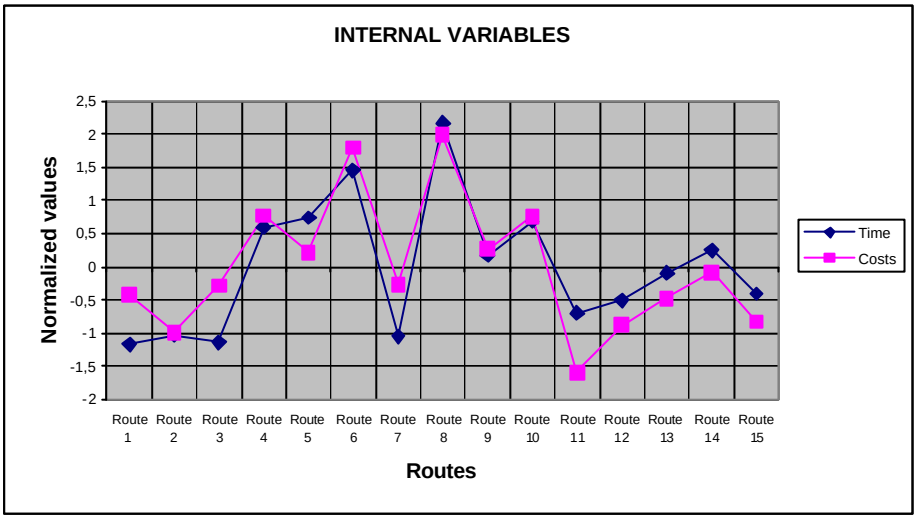

Figure 1. Normalized internal variables of each route (Source: own)

Following we applied the described weight percentages obtaining a unique result for internal variables:

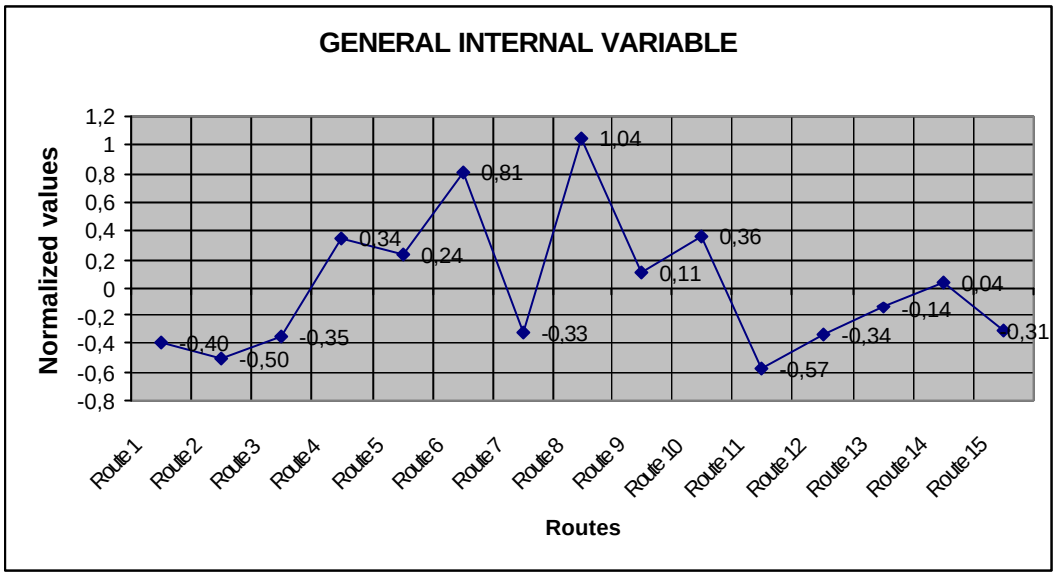

Figure 2. General weighed internal variables of each route (Source: own)

After that, we have carried out the same steps for external variables:

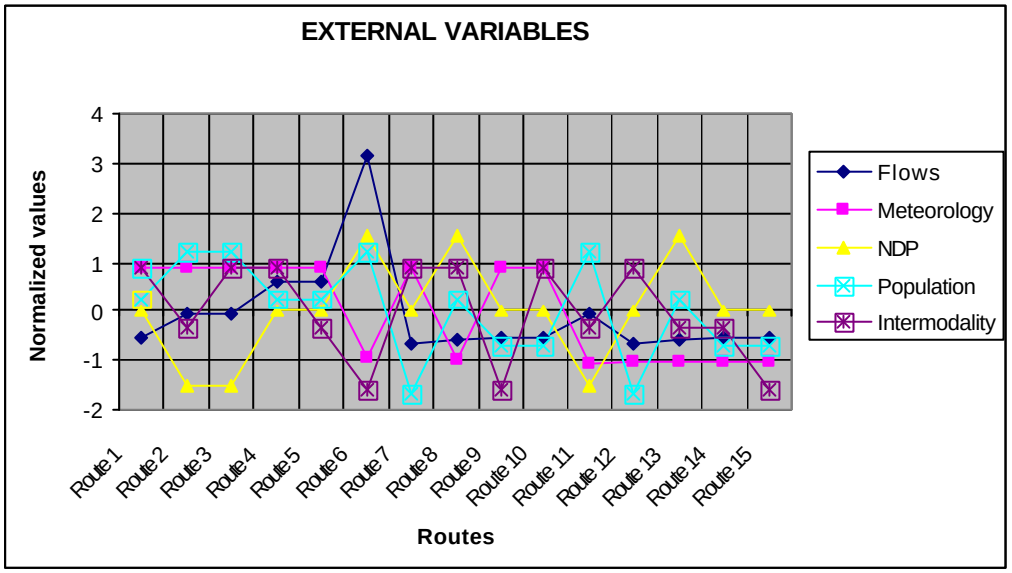

Figure 3. Normalized external variables of each route (Source: own)

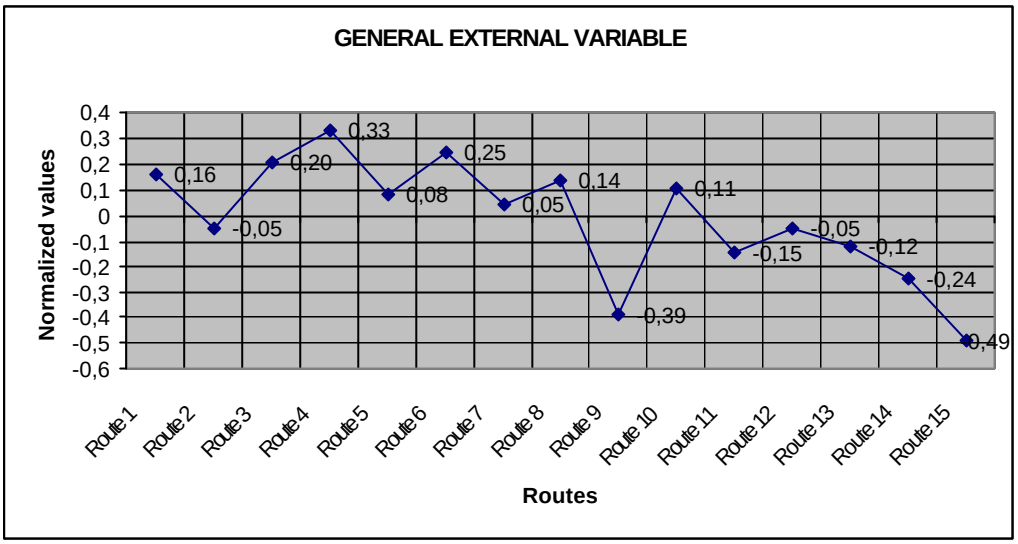

Figure 4. General weighed external variables of each route (Source: own)

Once obtained both variables, a SWOTH analysis has been made for the 15 routes, in order to further analyse the best ones:

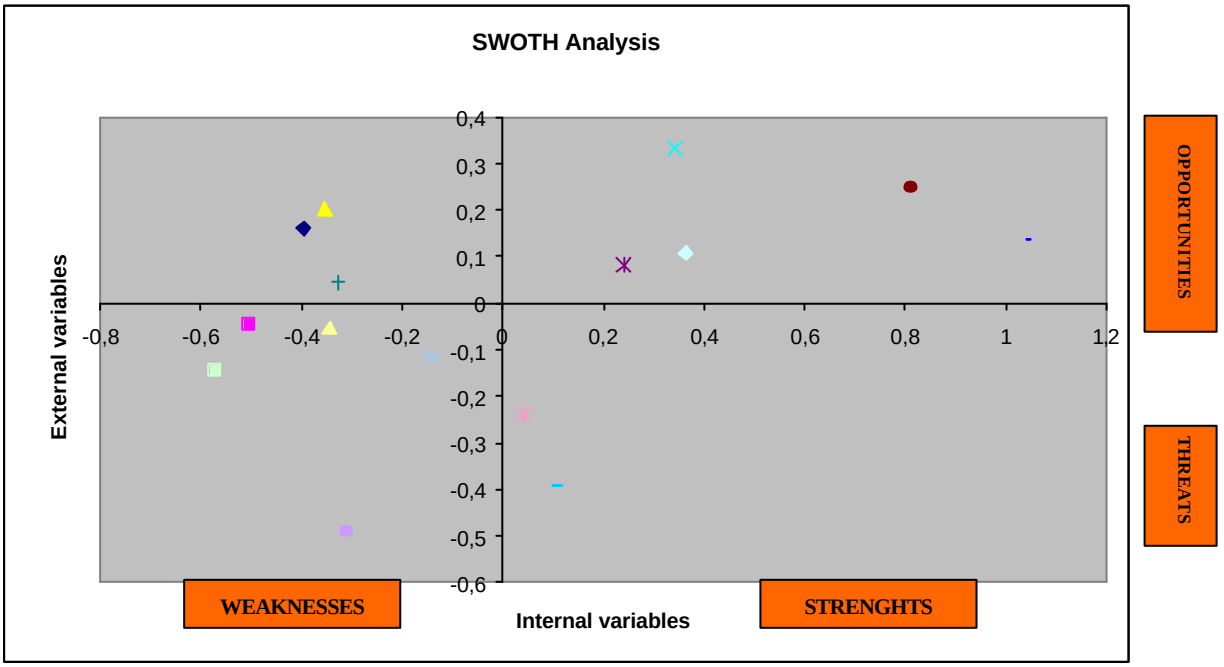

Figure 5. Final evaluation of each route through SWOTH analysis (Source: own)

In the right upper square are the optimal routes keeping in mind the considered data, because there are the ones showing opportunities and strengths. In the opposite sense the lowest left corned indicates the position where are placed the less viable routes after applying the balancing factors.

Following are identified the more viable routes.

Table3. Final selected routes (Source: own)

Routes	Origin	Port embark	Port discharge	Destination
Route 8	Azuqueca (Madrid)	Valentia	Naples	Naples
Route 6	Barcelona	Barcelona	Civitavecchia	Rome
Route 4	Alicante	Alicante	Genoa	Milan
Route 10	CETABSA Burgos	Tarragona	Genoa	Milan
Route 5	Seville	Cádiz	Genoa	Milan

5 Conclusions and further research

Scoring model and hypothesis have been applied to 15 possible routes. Five feasible and viable routes have been identified and the potential to avoid the road transport problems and shift freight from road to sea, will lead to more integration of the economy between the regions of the Spain coast and Europe. It serves as a starting point in creating possibility for new regular short sea shipping lines.

Spain is a peripheral country that makes the short sea shipping a viable option for avoiding roads congestion. This would contribute in limiting the saturation of the main transport routes and thus could preserve the environment. Further research in short sea shipping is necessary. Although Short Sea Shipping is not a new option for transport, studies on making possible improvements for it is crucial such that it could be the best option of transport. Improvements could actually be carried out in all parts of the transport chain. Further research intends to evaluate routes described above in more details. In addition different kind of ships will also be evaluated (which include fast and high-speed ships) together with their environmental friendliness. Some technical criteria will be looked into such as the ratio of time at se