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DEVELOPMENT OF MOTORWAYS OF THE SEA IN ADRIATIC REGION

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ABSTRACT

Freight volumes are increasing worldwide, following almost the same growth rate as the GDP. This has resulted in congested sections of the road system and increase of traffic accidents. Consequently, several governments –at least in Europe- are promoting mode alternatives to road transport. Besides the use of railways, the European Union is promoting the use of maritime transport for short distances by integrated into the whole logistic chain. This initiative, the Motorways of the Sea (MoS) aims at the establishment of more efficient and frequent, high-quality maritime-based logistics services between different countries using their ports. The present paper focuses on the development of a MoS network in the East Adriatic area, linking the Greek Ports of Igoumenitsa and Patras in the Ionian Sea, the south extension of the Adriatic Sea. This is done, by identifying financially viable MoS international corridors, servicing the freight and passenger demand of the area. The paper presents initially the freight and passenger flows of MoS in the East Adriatic/Ionian Seas region, based on the application of the 4-step methodology for transport planning. This enables the identification of a potential MoS network in the area, where Italy, Greece, Slovenia, Croatia, Albania and Montenegro are littoral countries. Then, the financial viability of each MoS is elaborated, based on the estimated freight and passenger flows for each proposed MoS Hence the network of MoS services is determined for the area. Thus, the paper provides a tool that could be useful to maritime operators, port authorities as well policy makers to decide whether to develop a MoS multi-country network.

Keywords: Motorways of the Sea, supply logistic chain, freight transport, Adriatic Sea, freight flows, financial.

INTRODUCTION

The smooth flow of goods, people and investments across the different trade areas necessitates a well-functioning multimodal transport system. More efficient transport would enable countries to attract foreign direct investment, encourage exports and participate in increasingly complex cross-border supply-chains. Motorways of the Sea (MoS) is an initiative aiming at the improvement of intermodal and maritime transportation and the reduction of road traffic. MoS can provide a common ground for the development of a multi-modal transport infrastructure network across several countries.

MoS are more sustainable, and under certain conditions they could be commercially more efficient, than road-only transportation. In addition, they provide the capability to improve access to markets maintaining transport sustainability, and bring relief to an over-stretched road system by promoting freight flow concentration on sea-based logistical routes.

However, in spite of strong political backing and favorable policy initiatives, MoS projects have limited success. Establishing an MoS is complex because of its international scope and involvement of a number of public and private stakeholders from different countries, with conflicting objectives and goals (Baindur and Viegas, 2011). The cooperation among public and private sector, required for the successful implementation of MoS, still remains the most significant barrier in this effort. Another critical factor for the limited implementation of MoS is the current status of the entire transport network. The existing hinterland connections with the ports, and the respective bottlenecks, impose significant barriers towards the successful implementation of MoS concept in several areas, like the Adriatic Sea.

The multinational and multi-level character of MoS necessitates their study, in a different way than the studies of the other transport system of a specific geographical area. It is therefore, the case that a number of critical factors, related to the interaction and competition of MOS with other transport corridors are not taken under consideration. These factors influence the different level of services for each MoS, and thus they should be considered part of the entire intermodal network of the area.

The development of a financially viable MoS network presented in the paper is based on the estimation of current and future international freight flows and whether the maritime services are financially viable to attract maritime operators. The MoS network by its nature is quite dynamic, since there is interaction among the different links and modes in the area. Consequently changes in modal performance, introduction of a new mode (like MoS), freight characteristics travelling costs and times might cause potential demand changes in the future.

The paper provides a tool that could be useful to maritime operators, port authorities as well policy makers to decide whether to develop an MoS multi-country network.

STATE OF THE ART

The forecasting of freight flows of a new MoS corridor is rather limited. Several models are developed to estimate future freight intermodal flows such as the scenario analysis (Marzano and Lonza, 2010) for the Adriatic area and an analytical model for regional freight flows through intermodal terminals in Massachusetts (Hancock and Hu, 2005). As for the four-step transportation model application to intermodal freight transport, a comprehensive approach is for the Californian network (Cordon and Pan, 2005), although the main focus was data collection. Another application focused on rail transport for 23 countries is done within the European project REORIENT (Zhang et al., 2008). Another related model is the one developed for the analysis of multiproduct intermodal freight transportation systems (Mahmassani et al., 2007). As for the inclusion of a seaport in the network for forecasting freight flows, especially by trucks, a simulation model is developed (Klodzinski and Al-Deek, 2004).

As for MoS related work, there is an analysis of MoS for south-west Europe (Feo et al., 2011), where two mode alternatives (road and maritime) are compared.

Another attempt is that of a MoS network model, essentially consisting of a graph (Di Febbraro et al., 2010). It consisted of both land and maritime links among a set of seaports and it identified the several cost functions for each link and node. Thus they have identified the minimum cost path for each trip.

Besides the above presented research, there are several projects co-financed by the European Commission (mainly through the TEN-T Executive Agency) and EU member states. These are: EASTMEDMOS (2009) for East Mediterranean MoS, WETSTMOS (2009) for West Mediterranean MoS and BASIM (2007) for Baltic sea MoS.

METHODOLOGY

Geographically, the Adriatic Sea, constituting the application area of the present paper, can be considered as unique region for the development of MoS. Although it is part of the wider Mediterranean region, the Adriatic has its own specific features and is considered a distinct sub-region. It is a narrow, semi-enclosed sea, formed as a gulf deeply incised into the European mainland, and connected to the rest of the Mediterranean only by the Strait of Otranto and Ionian Sea.

The present paper applies the developed methodology for the identification of the financially viable MoS in the East Adriatic region, and more specifically to the connections with the two Greek ports of Igoumenitsa and Patras, located at the Ioanian Sea, the south extension of Adriatic Sea. The Adriatic region was chosen due to a) its geographical location, having littoral countries that are members and non members of the European Union, b) being an important maritime route, as part of the wider Mediterranean, serving tade flows from Central Europe to North Africa and Middle East, and c) its dense transportsystem of both land and maritime modes, the latter consisting mainly of of Ro-Pax/Ro-Ro in combination with Short Sea Shipping. More specifically, the Esst Adriatic area is less developed and has no established MoS services as the already established between the two Greek ports and Italy, with ports in West Adriatic.

The methodology cosists of two steps: identification of potential MoS based on forecasted traffic flows and assessment of financially viable MoS.

During the first step the estimation of future flows for target years 2020, 2025 and 2030 are carried out with the application of the well-known “four step” model for transport planning. A short description of the process and the required assumptions for its application are presented in the following sections. Initially the selection of zones and commodity groups are done and the transport network consisting of links and nodes is determined. Then the model is applied for the estimation of freight flows for MoS in the area. Since the four-step process is well documented in the literature for transport planning, no details will be presented. The output of this step is the identification of the potentail MoS for the area.

The second step consists of the elaboration of the financial viability of each potential MoS. For assessing the viability, the freight flows identified in step one, are coverted into truck-trailer combinations and unacompanied trailers. Then the type of vessel to operate the maritime service is introduced with its technical characteristics (e.g. capacity, speed fuel consuption, personnel). Furthermore for each trip voyage, the corresponding ship operating cots are estimated, as well as the revenues from the fares. Then, the maritime service for the MoS is dertermined by the frequency of service (times per week) and type of vessel. A maritime service is considered financially viable, if the revenues exceed the costs for a specific time period.

Since the methodoly is developed for the specific region, it is presented in detail through the application case.

METHODOLOGY'S STEP 1 APPLICATION

Regarding the first step of the methodology, the following items are considered with their respective values.

Definition of zones

The core study area was considered as “core area”. More specifically, it consisted of the following countries: Greece, Italy, Slovenia, Croatia, Montenegro and Albania while the rest of the European countries, Serbia and FYROM were considered as “non-core area”. Regarding the division of the area into zones, a homogeneous zoning system was used, based on NUTS 3 (regional level), as defined by EUROSTAT. The selection of the NUTS 3 level for the zoning system was necessary in order to model flows between the Adriatic ports whose closeness cannot be reflected if the NUTS 2 (country level), was chosen. Thus, using NUTS 3 level the assignment of one port for every zone is possible. The final number of zones that were used in this analysis was equal to 1442. Regarding the countries in Adriatic region, with direct access (ports) to Adriatic Sea, Greece was divided in 51 zones, Italy in 103, Croatia in 21, Albania in 3, and Slovenia in 12 zones. Montenegro consisted only of one zone. Table 1 presents the zones of the core study area with access (ports) to Adriatic Sea.

Table 1- Zones of the Adriatic region (core study area)

NUTS 3 Code	Country	Region
AL2	Albania	Tirana
AL3	Albania	South Albania
GR212	Greece	Thesprotia
GR222	Greece	Kerkyra
GR232	Greece	Achaia
HR031	Croatia	Istarska zupanija
HR032	Croatia	Primorsko-goranska zupanija
HR033	Croatia	Licko-senjska zupanija
HR034	Croatia	Zadarska zupanija
HR035	Croatia	Sibensko-kninska zupanija
HR036	Croatia	Splitsko-dalmatinska zupanija
HR037	Croatia	Dubrovacko-neretvanska zupanija
ITD35	Italy	Venezia
ITD44	Italy	Trieste
ITD57	Italy	Ravenna
ITE32	Italy	Ancona
ITE33	Italy	Macerata
ITF42	Italy	Bari
ITF43	Italy	Taranto
ITF44	Italy	Brindisi
ITF65	Italy	Reggio di Calabria
ITG17	Italy	Catania
ME	Montenegro	Montenegro
SI00C	Slovenia	Obalno-kraska

Selected Commodity Groups

Regarding the selection of commodity groups to be considered in the model, data from EUROSTAT was used in order to identify the major commodity groups transported in the study area. In addition, the types of commodities were selected in such a way so they could be transported either by road, rail or sea. The simultaneous analysis of the three modes and their characteristics (network, cost, travel time) allows for the estimation of modal shift among all modes, with respect to different scenarios in the future. Table 2 presents the selected commodity groups for the purpose of the analysis, according to NST/R classification of the European Commission.

Table 2- Commodity Groups

NST/R	Description
0	Agricultural products and Live Animals
1	Foodstuffs and Animal Fodder
9	Machinery, Transport Equipment, Manufactured Articles and Miscellaneous Articles

Transport Network

The road and railway network has been developed based on the TransTools network. Concerning the road network, it includes the international road corridors and the major highways in the study area (TEN-T network), as well as the national roads and port accessibility roads connecting the ports with the main road network. Regarding the railway network, the major European railway lines were included, connecting major cities and ports. It should be noted that the network based on TransTools was updated in order to include the major infrastructure that was completed within the years 2005-2009, as TransTools network was developed for the year 2005.

TRANS-TOOLS is a European transport network model focused on passenger, freight and intermodal transport. The model combines advanced modeling techniques for traffic generation and assignment, economic activity, trade, logistics, regional development and environmental impacts towards the development of a European network-based transport model,

With regard to the maritime network, it includes the major Ro-Pax and Ro-Ro connections in the Adriatic area. The maritime network information was collected through the market and ports survey, complimented by information on maritime operators collected through desktop research. Figure 1 depicts the transport network in Adriatic region.

Estimation of freight flows

As it is already mentioned above, the “four step” model was used for the estimation of freight flows in the East Adriatic and Ionian Sea regions for forecast years 2020, 2025 and 2030. The “four step” model is a well-known methodology for transport modeling, consisting of the following steps: 1) Trip Generation, 2) Trip Distribution, 3) Modal choice and 4) Network Assignment.

Since the main aim of the paper is to identify the viable MoS in the region, the details of how the freight flows for the potential MoS are derived are not presented.

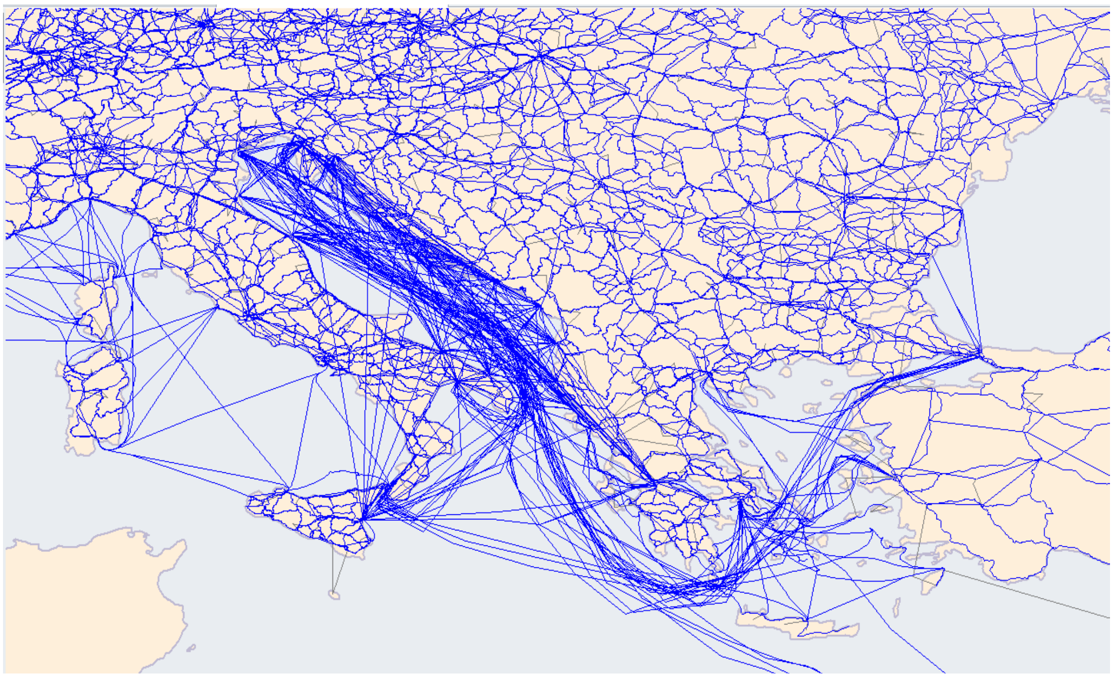

Figure 1- Transport Network in Adriatic region

For the estimation of freight flows the following was taken into consideration:

- Data from EUROSTAT was used as an input for base year (2009).
- Regarding the GDP in forecast years, it is assumed a GDP growth of 3% per year, except Greece where no growth was assumed until 2020.

The generalised cost was used for the distribution of traffic flows and the modal split, resulting to the estimation of the amount of freight flows transported among zones by mode. The equation of generalized cost was developed appropriately in order to represent the whole study area and was based on data provided by logistics companies, ship companies and rail industry. More specifically, it included the following parameters: travel costs and travel time for every link and transport mode, delays at border stations and ports, specific coefficient related to the frequency of maritime services. Three transport modes were considered: road, rail and MoS.

Regarding the distance among zones, the road, rail and maritime distance was estimated separately. The total length of a MoS route includes the maritime distance between ports and the road distance from each zone to the port. The total length of routes is calculated in kilometres.

For rail and maritime transport, the tariff cost was used which is related to the distance. Questionnaires were sent to the participating ports and rail companies in order to identify the cost of loading and unloading and the cost of temporary storage at the ports and major yards.

Regarding the travel time, the time impedance for road trips was calculated using the link length (distance) and the free-flow speed adjusted for trucks (increase of travel time by 30%). The travel time of rail routes was calculated using the length of tracks and an average speed for freight trains equal to 50km/ h. The travel time of sea trips was calculated using the distance between ports and an average speed, assumed equal to 20 knots for Ro-Pax ships and 16 knots for Ro-Ro ships.

The application of the model produced the estimation of the freight flows in the region for years 2020, 2025 and 2030. Table 3 presents the forecasted freight flows for the potential Mos between East Adriatic and the ports of Igoumenitsa and Patras. Figure 2 depicts the forecasted flows for 2025 regarding the potential MoS between the ports of Igoumenitsa in Greece and Trieste in Italy, as well where they are coming/going to and Figure 3 between Patras in Greece and Durres in Albania.

Table 3-potential MoS links and forecasted freight flows for year, 2025 (tons)

Number of link	Potential MoS	Countries	Freight Flows
1.	Patra- Trieste	Greece-Italy	1.544.650
2.	Igoumenitsa- Trieste	Greece- Italy	1.237.435
3.	Patra-cluster of ports Zadar/Split	Greece- Croatia	887.033
4.	Igoumenitsa-cluster of ports Zadar/Split	Greece- Croatia	673.097
5.	Patra- Koper	Greece-Slovenia	290.293
6.	Patra- Durres	Greece- Albania	107.213

In addition, since the MoS could serve passenger traffic and private cars with the operation of Ro-Pax vessels, the passenger flows have been forecasted as well, and they are presented in Table 4. The additional passenger traffic might render some of the potential MoS financially viable.

Table 4-potential MoS links and forecasted passengers flows for year, 2025

Number of link	Potential MoS	Countries	Passenger Flows
1.	Patra-Durres	Greece- Albania	695.016
2.	Igoumenitsa- Trieste	Greece- Italy	263.324
3.	Patra- Trieste	Greece- Italy	166.440
4.	Igoumenitsa- cluster of ports Zadar/ Split	Greece-Croatia	40.706
5.	Patra- cluster of ports Zadar/ Split	Greece-Croatia	26.373

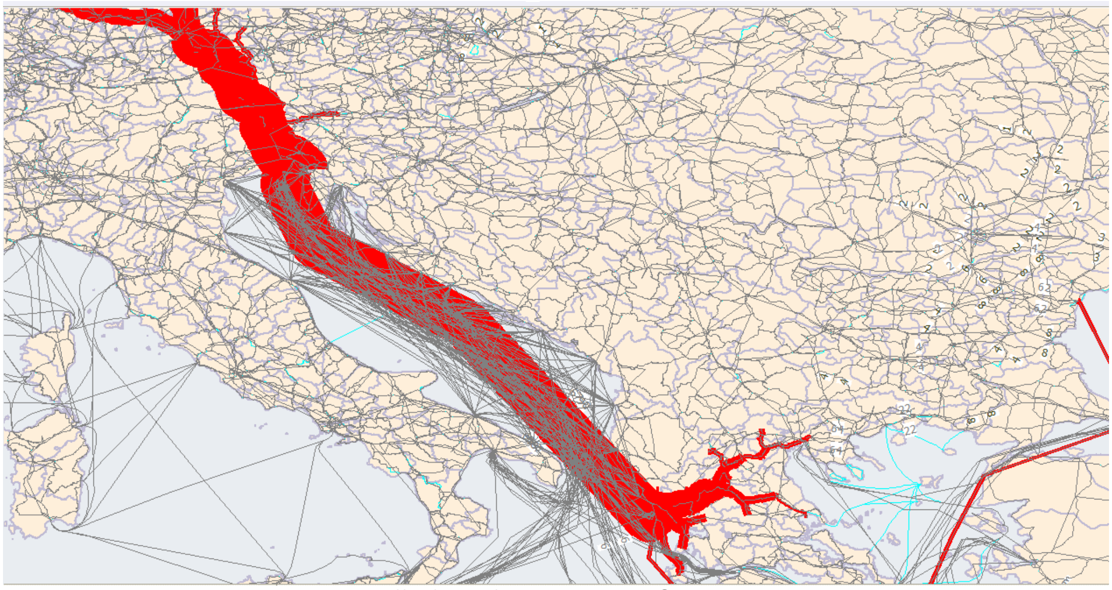

Figure 2-Forecasted Traffic flows for potential MoS Igoumenitsa-Trieste (2025)

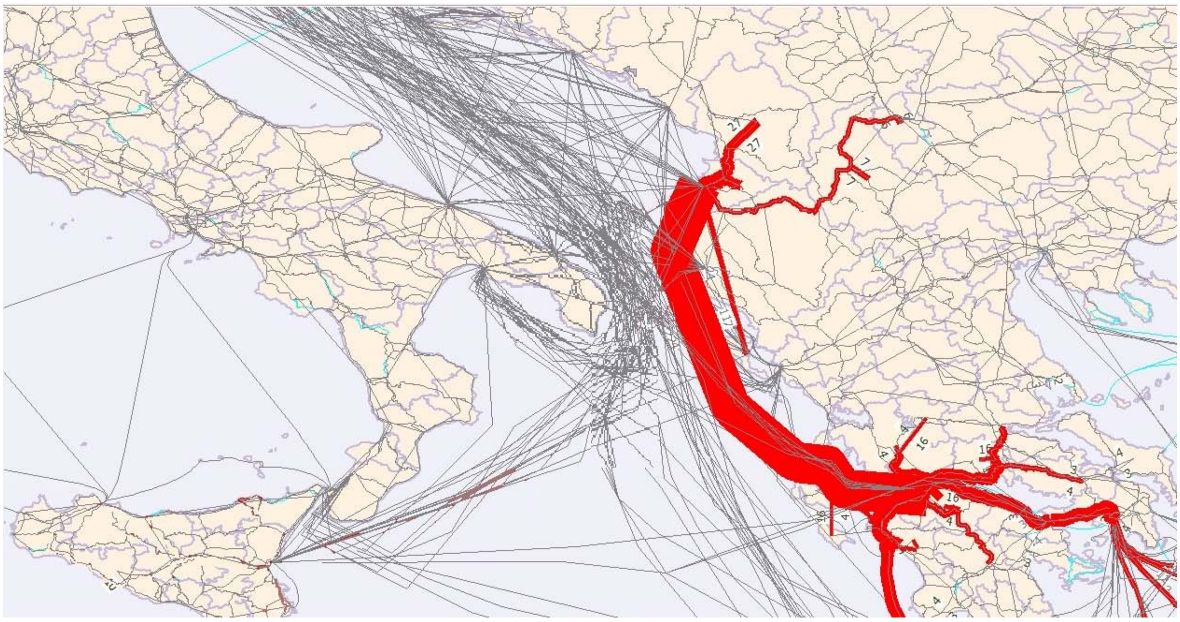

Figure 3- Forecasted traffic flows for potential MoS Patra-Durres (2025)

METHODOLOGY'S STEP 2 APPLICATION

The second step of the presented application investigated the financial viability of the proposed MoS, the type of vessels, the frequency of service etc., based on the forecasted flows, as estimated in the previous step.

Characteristics of typical vessels

The characteristics of the typical Ro-Pax vessel, operating on the examined transport network and servicing passenger and freight flows (trucks), as well as the characteristics of the typical Ro-Ro vessel, servicing only freight flows (unaccompanied trailers), are presented in Table 5.

Table 5- Main characteristics of typical Ro-Pax and Ro-Ro vessel, operating on the potential MoS maritime links

Characteristics	**Ro-Pax**	**Ro-Ro**
Lenght [m]	120.00	165.00
Width/ Beam [m]	19.00	26.00
Hollow [m]	8.00	10.00
Vessel Draft [m]	5.00	6.50
Displacement [t]	6500	16500
Speed [kn]	20	16
Main EnginePower/ Operating power [kW]	16500	5000
DWT [t]	1900	7000
GRT [t]	10000	18000
Number of passengers	1000	-
Cabins	350	-
Lane Length [m] (average)	1 800	3000
Capacity (average)	300 (trucks and private vehicles)	200 (only unaccompanied trucks and trailers)

Potential maritime links

The potential MoS links in Adriatic Sea were identified based on the forecasted freight and passenger flows. Table 6 presents the potential MoS links and the respective types of vessels.

Table 6- Freight flows and vessel type for the potential MoS links- Time Horizon 2025

Number of link	Potential MoS LInk	Countries	Flows		Vessel Type
			Freight	Passenger	
1.	Patra- Trieste	Greece- Italy	1.544.650	166.440	Ro-Pax & Ro-Ro
2.	Igoumenitsa-Trieste	Greece-Italy	1.237.435	263.324	Ro-Pax & Ro-Ro
3.	Patra- Durres	Greece-Albania	107.213	695.016	Ro-Pax & Ro-Ro
4.	Patra- cluster of ports Zadar/ Split	Greece-Croatia	887.033	26.373	Ro-Pax & Ro-Ro
5.	Igoumenitsa- cluster of ports Zadar/ Split	Greece-Croatia	673.097	40.706	Ro-Pax & Ro-Ro
6.	Patra- Koper	Greece-Slovenia	290.293	24.342	Ro-Ro

Financial Analysis

The financial analysis focused on the estimation of the total cost for the implementation of maritime links. The total cost includes:

- The investment cost
- The operating cost

The financial analysis was accomplished separately for each one of the 6 potential MoS links, presented in Table 6. The maritime tariff (€/nm), representing the amount that passengers and truck owners should pay for the respective trip, is usually estimated based on the financial analysis. However, the estimation of the maritime tariff is beyond the aims of this study.

Cost of Maritime Links

The cost of the potential maritime links constitutes of the following categories:

A. Annual cost, including:
   1) Maintenance
   2) Depreciation
   3) Insurance
   4) Other cost and contigency
   5) Management cost

B. Operation cost, per roundtrip, incuding:
   1) Fuel cost and cost of lubricants (tons/ trip)
   2) Crew wages
   3) Cost for supplies

4) Port charges

The maritime links are usually implemented and operated by the ship owners that expect an acceptable – in banking terms- return on their investment. The percentage of this return is usually estimated with the method of the internal rate of return (IRR).
Within this evaluation, a financial analysis of the expected cash flows was elaborated, in order to identify the viability of the potential MoS links.
For the financial analysis the following assumptions have been considered:

- Average payload for trucks: 16.69 tons.
- The portion of vessel's capacity used (load factor) during a trip is equal to 70%.
- The ratio of passengers' vehicles to campers is considered equal to 3.2:1.
- The required itineraries (frequency of service), in the case of Ro-Pax ships, are based on the low demand scenario for cargo and passengers.
- The fuel consumption for the vessels (in gr/kW/ hours) is estimated equal to 175 gr/kWh with indicative cost equal to 640 €/ton.
- The crew for Ro-Pax vessel, including the crew for "hotel" services, is 70 people with an average monthly salary (including insurance) equal to 4,000€. The crew for Ro-Ro vessels is 20 people with an average monthly salary equal to 4,500 € (including insurance).
- With regard to the allocation of trucks on Ro-Pax and Ro-Ro vessels, in cases that both types of vessels are operating on the same maritime link, it is assumed equal to 1:5, i.e. the Ro-Ro vessels would transfer 5 times more trucks than Ro-Pax vessels.
- The Ro-Ro vessels could accommodate up to 12 truck drivers, a limit set by regulations.

Travel Time

Regarding the travel time of maritime trips, it was calculated using the distance between ports and the average speed for Ro-Pax and Ro-Ro ships, as presented in Table 7. In addition, time for loading/ unloading and waiting time at ports were added to the total travel time. Table 7 presents also the time for loading/ unloading and the waiting time at the ports, participating in the study.
In addition, in cases that the port of Igoumenitsa is included as an interim stop in a trip, the overall travel time of the trip is increased by 2 hours. Consequently, in case that the port of Igoumenitsa is included as an interim port in a roundtrip, the overall increase of travel time is equal to 2*2=4 hours.
The cost- benefit analysis was elaborated separately for each maritime link, based on the above. Table 8 presents such a detailed financial analysis for each of the potential MoS link. In addition, an aggregated synthesis for all the potential MoS is presented in Table 9.

Table 7- Travel time for the potential MoS maritime links

Total Travel time for maritime links		
Travel time at the sea: Distance/ speed		
Average speed for Ro-Pax ship	22 knots	
Average speed of Ro-Ro ship	16 knots	
Time for loading/ unloading and waiting time (trucks)		
Port	Loading and waiting time (hours)	Unloading (hours)
Port of Patras	3	1
Port of Igoumenitsa	3	1
Port of Trieste	2	0.5
Port of Koper	2	0.5
Port of Zadar/ Split	3	1
Port of Bar	3	1
Port of Durres	3	1

Table 8- Cost- Benefit Analysis for the potential MOS maritime links

Maritime Link	**Patras-Trieste**	**Igoumenitsa-Trieste**	**Patras-Zadar/ Split**	**Igoumenitsa-Zadar/ Split**	**Patras- Koper**	**Patras-Durres**
Cost of Ship	37.200.000	37.200.000	37.200.000	37.200.000	37.200.000	37.200.000
Capacity of ship						
Line (in meters)	2,525	2,525	2,525	2,525	2,525	2,525
Tons/ truck	16,69	16,69	16,69	16,69	16,69	16,69
Number of passengers	959	959	959	959	959	959
Number of trucks	110	110	110	110	110	110
Number of unaccompanied trailers	150	150	150	150	150	150
Number of cars and campers	160	160	160	160	160	160
Demand per direction						
Number of trucks	809	666	505	432	146	53
Number of passengers	1459	2317	243	376	228	1918
Number of cars and campers	456	724	76	117	71	599
Service						
Frequency: No of itineraries / week	4	3	2	2	1	2
Distance among ports (nm)	611	488	466	343	607	286
Total distance of roundtrip trip (nm)	1222	976	932	686	1214	572
Average speed of ship (nm/h)	20	20	20	20	20	20
Total travel time (h)	61,1	48,8	46,6	34,3	60,7	28,6

Waiting time in ports (h)	3	3	3	3	3	3
Total time for roundtrip (h)	64,1	51,8	49,6	37,3	63,7	31,6
Required ships for frequency	1,52	0,92	0,59	0,44	0,38	0,37
Number of ships for the maritime line	2	1	1	1	1	1
Annual Cost						
Maintenance	2080000	2080000	2080000	2080000	2080000	2080000
Depreciation	5580000	5580000	5580000	5580000	5580000	5580000
Total Annual Cost	7660000	7660000	7660000	7660000	7660000	7660000
Operational Cost for Roundtrip						
Fuel cost (tons/ day)	73.70	73.70	73.70	73.70	73.70	73.70
Operation cost per day	18705	18705	18705	18705	18705	18705
Port charges per roundtrip (€)	1.000	1.000	1.000	1.000	1.000	1.000
Total operational cost per roundtrip	47619,8125	38033,5	36318,875	26732,5625	47308,0625	22290,125
Overheads (10% of total operation cost)	4761,98125	3803,35	3631,8875	2673,25625	4730,80625	2229,0125
Total cost per trip	53.382	42.837	40.951	30.406	53.039	25.519
TOTAL COST FOR ALL SHIPS OPERATING IN THE LINE	26.423.413	14.342.549	11.918.879	10.822.205	10.418.021	10.313.990
REVENUES PER TRIP						
Tariff for trucks(€/mn)	1,117	1,117	1,117	1,117	1,117	1,117
Tariff for passengers (€/mn)	0,35	0,35	0,35	0,35	0,35	0,35
Tariff for private cars/ campers(€/mn)	0,24	0,24	0,24	0,24	0,24	0,24
Revenues from trucks	138071,741	121092,527	131635,304	82835,7228	99021,6484	8501,146345
Revenues from passengers	78046,5109	131924,935	19884,8697	22590,755	48465,1563	95995,9
Revenues from private cars/ campers	16724,2523	28269,6288	4261,04351	4840,87608	10385,3906	20570,55
Total Revenues per trip and direction	232842,504	281287,09	155781,218	110267,354	157872,195	125067,5963
Total Annual Revenues	96862481,7	87761572,1	32402493,3	22935609,6	16418708,3	26014060,04
Earnings before Interest, Taxes, Depreciation and Amortization	**70.439.069**	**73.419.024**	**20.483.614**	**12.113.404**	**6.000.687**	**15.700.070**

Table 9 - Cost- Benefit Analysis- Summarized Results

Maritime Link	**Total Annual Cost for all ships operating in the potential MoS maritime link**	**Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA)**
Patras- Trieste	26.423.413	70.439.069
Igoumenitsa- Trieste	14.342.549	73.419.024
Patras- Zadar/ Split	11.918.879	20.483.614
Igoumenitsa- Zadar/ Split	10.822.205	12.113.404
Patras- Koper	10.418.021	6.000.687
Patras- Durres	10.313.990	15.700.070

Viable MoS

Based on the above financial analysis, the financial viable MoS services for which a maritime operator might invest are:

1) Igoumenitsa-Trieste
   - Serves freight and passenger flows among the following regions:
     - West and North Greece with North Italy, Austria, Germany and Hungary
     - Turkey with North Italy, Austria and Germany
2) Igoumenitsa- Zadar/ Split
   - Serves mainly freight and to a less extent passenger flows among the following regions:
     - West and North Greece with Croatia, Slovenia, Bosnia & Herzegovina and Hungary
     - Turkey with Croatia, Slovenia, Bosnia & Herzegovina.
3) Patras-Trieste
   - Serves freight and passenger flows among the following regions:
     - West and South Greece with North Italy, Austria, Germany and Hungary
4) Patras- Zadar/ Split
   - Serves freight and freight and to a less extent passenger flows among the following regions:
     - West and South Greece with Croatia, Slovenia, Bosnia & Herzegovina and Hungary
5) Patras- Durres
   - Serves freight and passenger flows among the following regions:
     - West and South Greece with Albania, FYROM

The Patras-Koper potential MoS was found to be not financially viable, due to the short distance with Trieste, where two financially viable MoS have been identified.

CONCLUSIONS

The development of an efficient transportation system, servicing the increased freight and passenger demand, constitutes a priority for the European Union. Motorways of the Sea are a quality transportation initiative, whose main objectives are improved intermodal options, modal shift and increase of economic and social cohesion. One of the main requirements for the successful implementation of MoS services, apart from the attraction of freight and to a less extent passenger flows, the proof of their financial viability.

The present paper focuses on presenting a methodology for the development of a MoS network in the East Adriatic area and the Ionian Sea, linking the Greek Ports of Igoumenitsa and Patras with the ports in the area. The first step of the methodology identifies the potential MoS based on the forecasted traffic flows, whereas the second step assesses the financial viability of the potential MoS, and identifies the financially viable ones.

With the methodology application, five viable MoS are identified in the area linking Igoumenitsa and Patras ports with the ones in East Adriatic.

The outputs are very useful to maritime operators, since are the ones that provide the service. Thus, only if the MoS is financially attractive to them they will operate the service, regardless of investments that the ports will make to attract traffic, most of which is co-financed by the European Commission.

Therefore, the present paper could be used as a tool by maritime operators, port authorities and relevant stakeholders, towards the identification of economic viable MoS links and the development of a MoS network, avoiding any unnecessary investments.

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