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# DECISION FRAMEWORK FOR DEVELOPING TRANSPORT LOGISTICS HUB

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## ABSTRACT

Freight transport and logistics play a key role in economic and social development by ensuring the competitiveness, economic growth and employment. Intermodal transport has received an increased attention due to problems of road congestion, environmental concerns and safety. Strategic importance of speed, reliability in the supply chain is forcing for investments in new logistics transportation hubs. Therefore, the decision assessment framework is an essential challenge linked with the key decision factors meet the stakeholder and decision makers expectations. This paper examines the decision process for developing logistic transportation centers, where a wide range of stakeholders with different expectation is involved. According to a consequences analysis systemic approach, the relationship of logistic transportation hub development, economic system development and stakeholder expectation is analyzed. Adopting a strategic decision making framework with variable defined, the key shareholder's role and expectations are highlighted. The application provides the methodology outputs presenting the proposed decision framework for a strategic logistics transportation hub in North Greece.

**KEYWORDS:** Decision making framework, logistics transportation hub.

## INTRODUCTION

Intermodal transport has been set up to promote a better coordination between decisions makers and stakeholders to increase the competitiveness of the alternatives to road transport, especially the potentials of the sea and ground multimodal logistics cooperation. Continuous growth of global container volumes causes increasing needs on the inland road, water and rail connections, especially in developed countries with financial restrictions for new infrastructure development (Dimitriou et al.2016). A strategic decision framework to develop a logistics transportation center will target to achieve territorial cohesion in regions and strengthen the competitiveness of intermodal transport system. Simultaneously, cross border connections require more reliable connections because their supply chain demands for just-in-time delivery. In this paper, a decision support system for developing in new logistic hub is developed.

Transport infrastructure development is a decision making process that involves multiple stakeholders, specifically: Government and governmental authorities, investors, and operators. The highest level goal of the decision making process is the delivery of cost effective, reliable, sustainable, efficient, convenient and safe rail connection and other services to the state's population. A decisions making system approach framework developed will link all key transport infrastructure stakeholder concerns in different levels of the transport infrastructure development decision making process. The application is for a logistic center in North Greece near to borders.

## INTERMODAL TRANSPORT AND LOGISTIC HUBS

International transports are based on complex networks of services that involve many factors and transport nodes in order to make possible efficient origin – destination connections and networks. As Tongzon, 2009 claims all routes between a port and its own hinterland represent strategic links able to foster the port efficiency and its competitiveness.

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Crainic and Kim (2007) defines intermodal freight transport as "the transportation of a load from its origin to its destination by a sequence of at least two transportation modes, the transfer from one mode to the next being performed at an intermodal terminal." These single-mode transport networks connect each other at intermodal terminals or logistic hubs. Intermodal freight transport involves multiple stakeholders e.g., shippers, carriers, terminal operators, producers, consumers.

The decision making framework in order to develop a logistics hub aims to reduce transport time and costs and improve domestic and regional connectivity. Through investments in rail, road and intermodal facilities that support land, sea and air transport, decision makers aim at multi-modal network that will support integration of domestic and international markets. By developing a logistic hub regions achieve access to regional- and world-wide trade opportunities.

## DECISION MAKING FRAMEWORK

One of the most important issues of the decision making process in order to invest in new infrastructures in transports by funding agencies is which projects they should spend their limited resources on. These decisions can be supported by Decision Support Systems and frameworks which synthesize appropriate techniques of decision analysis and optimization techniques based on evaluation criteria. Methodologically, there is a variety of models, from simple multi-criteria decision analysis and prioritization models to complex models of portfolio optimization. Multicriteria decision analysis is increasingly used for decision-making in environmental policy evaluation due to the complexity of issues and the inadequacies of conventional tools such as Cost Benefit Analysis (CBA) or Cost-Effectiveness Analysis (CEA) for capturing the full range of impacts of a policy or capital project (Dimitriou et.al 2016).

Based on breakdown analysis and System of system approach the concept is based on the identification of the key parameters that stakeholders and decision makers set in order to invest in transport infrastructures. Many different parameters and structural features of transport infrastructure projects conceptually represent how those features can enhance performance. The different parameters that are critical to logistic centers are identified. The aim is to characterize the competing objectives and parameters that stakeholders and decision makers face worldwide.
The process for considering various forms of investing in logistic hubs involves a multi-step process starting with identification of the different stakeholder's goals and objectives, comparison of those goals, identification of ways to mitigate stakeholder risks, review of the transaction's complexity and risk. Decision making theory and strategic planning generally involve setting targets and determine critical issues and key parameters to achieve these targets. Stakeholders want to ensure the project is developed in a manner that promotes regional economic development and create an operating environment that encourages increased cargo demand. Systems of System approach is an approach with complicate interactions between the various independent systems. A system, in general, is a combination of the different independent systems to define a function or set of functions. Each system of system has distinguishing traits. A successful analysis of projects using systems thinking is contingent on correctly identifying these distinguishing traits. Dimitriou et al. 2016 described analytically a system approach framework for cross border railway infrastructure projects.

An intermodal transportation logistics hub consists of large networks of interrelated components which produce and transport resources. Like other engineering systems, they are large-scale, high-cost, and long living, motivating strategic decisions for the develop, design and operation to maximize life-cycle value. The most significant distinguishing traits of SoS framework in decision making in order to develop new logistic center is infrastructure planning, financial issues and operation. For each objective an agent as Government and Authorities, Construction Agencies, Investors and Carriers is responsible as described analytically in Fig. 1.

Assessing concrete steps across a logistic center decision making process can be a way of making it more resilient and ultimately more profitable for all of the stakeholders and agents across the value chain. Fig. 1 provides an example of a generalized System of System framework.

First Pillar: Strategic Planning: Governments and authorities are responsible for the strategic planning in order to develop projects with correct forecasts and assumptions. Government and authorities aim at planning and management of future interface risks, caused by early-stage decisions regarding project structures and design. In addition, the risk of contractors, and private investors, who are essential, has to be taken into account in the phase of strategic planning.

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Second Pillar: Determine financial issues: Because governments take financial risks in public-procurement structures, they should structure their investment and manage their risks as private investors do. This could clarify their knowledge and application of available alternative risk-allocation models (for example, outsourcing of operations and maintenance activities), but could also result in a changed approach to how public funds are "allocated" within the government. Overestimating revenue and growth potential while underestimating risk results in note efficient designed projects may deliver lower-than-expected returns or, in the worst case, may cause cancellation after significant up-front investment.

Third Pillar: Infrastructure construction: The stakeholders in the construction phase that have to do with engineering and construction contractors are responsible for on-time, low-cost, and high quality construction and financing. Many problems may arise when stakeholders in the construction phase have cost overruns and delays, or are not able to perform their contractual obligations due to their low profitability.

Fourth Pillar: Operation management: In this phase of a project, asset owners and investors or concessionaires are the stakeholders that are related to the operation and maintenance contractor monitoring, while operational and maintenance contractors are responsible for ensuring on-time, on-budget, and on-quality operation and financing, through KPIs efficiencies in order to avoid delays and increased costs.

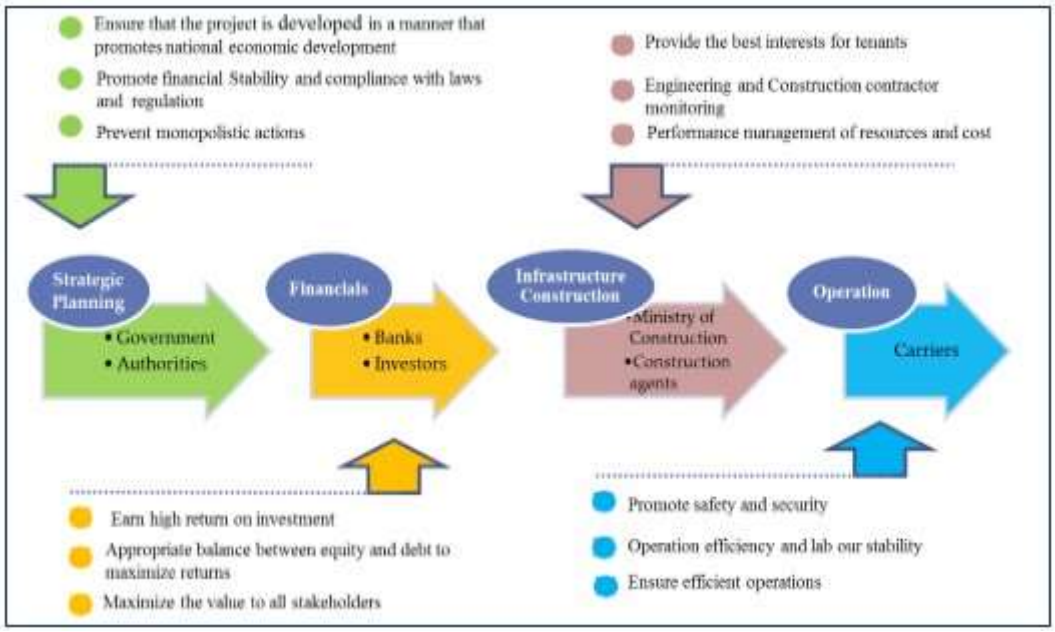


***Fig. 1 Phases in the strategic decision making along a logistic center project development (Source: Dimitriou et al.2016)***

## EVALUATION FRAMEWORK

An evaluation of the development of a new transportation logistics hub is defined as an engineering project which has attributes that qualifies it about four main factors:

1 Economic/financial
2 Transportation/logistics
3 Social
4 Environmental

In Fig. 2 the factors and the sub factors that affect the different scenarios of development in the case study are depicted analytically. The 3 scenarios are described as:

Scenario 1: Do nothing
Scenario 2: Development of Logistics center by using existing Land and facilities
Scenario 3: Development logistic Center with Railway infrastructure investments

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Impact Factor: 4.116
CODEN: IJESS7

Railway infrastructure investments have, in general, difficulties in attracting private risk capital due to the often large uncertainty associated with these investments. In order to improve the financial situation for both rail operators and rail infrastructure managers, it is - independently of the choice of investment option - recommended to carry out specific analyses to assess if present rail access and rail tariffs are optimal for infrastructure managers, rail operators and users, respectively. The most important risks elements, which can influence both investment costs and timing simultaneously in transportation logistics hub development and rail infrastructure improvement, are:

- Investment costs escalation
- Funding schemes
- Traffic demand
- Environmental risks
- National strategic planning risks
- Trans-national co-ordination risk may be high

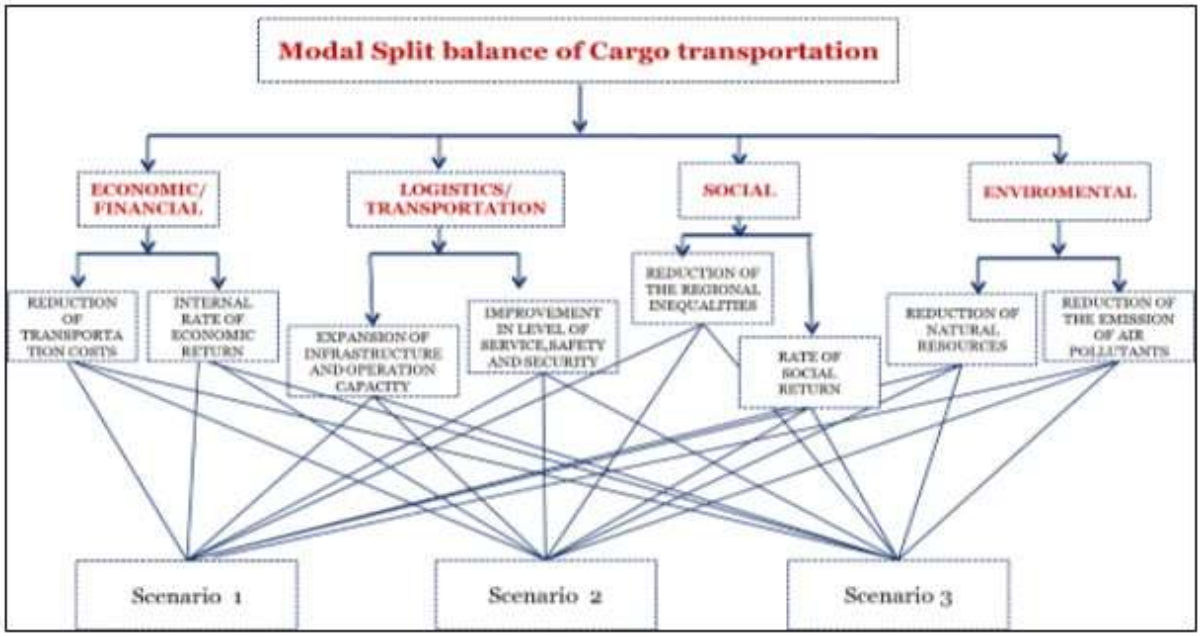


***Fig 2: Factors influence the different scenarios for logistic center development***

The most important factor analyzed in the evaluation of the decision making strategic framework in the case of a logistics hub developed in case of Scenario 3 which is the most efficient is the Environmental issues, because CC is likely to have essential implication for transport industry infrastructure. The need and the budget for the inclusion of adaptation measures in the transport industry are highlighted by UNECE (2013) Dimitriou et al. (2014) review the CC adaptation strategies and environmental mitigation actions for 15 European airports, highlighting the low performance of Greece and South Europe. Taking all these factors into account, a mitigation/adaptation chart (Fig. 3) is constructed to demonstrate that the supply/demand elements are two sides of the same coin. This is because mitigation and adaptation will impact the supply/demand relationship differently in the short and long-run.

The following Fig. 4 divides the variables between classical (those which are used in existing tourism demand models in European destinations) and the new climate related variables which need to be included in the models. Therefore, as the climate stabilizes towards mid-century, transport demand could continue to be viable into the 22nd century. Mitigation will also hopefully promote research and development policies that will drive technological development so that aviation becomes carbon neutral (without offsetting) and is therefore not constrained by CO2 abatement targets, which can help overcome one of its major challenges to growth. This could counteract the medium-term (5-10 years) demand shock for existing attractive tourist destination such as Greece and other attractive Mediterranean destinations (Dimitriou et al.2016).

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CODEN: IJESS7

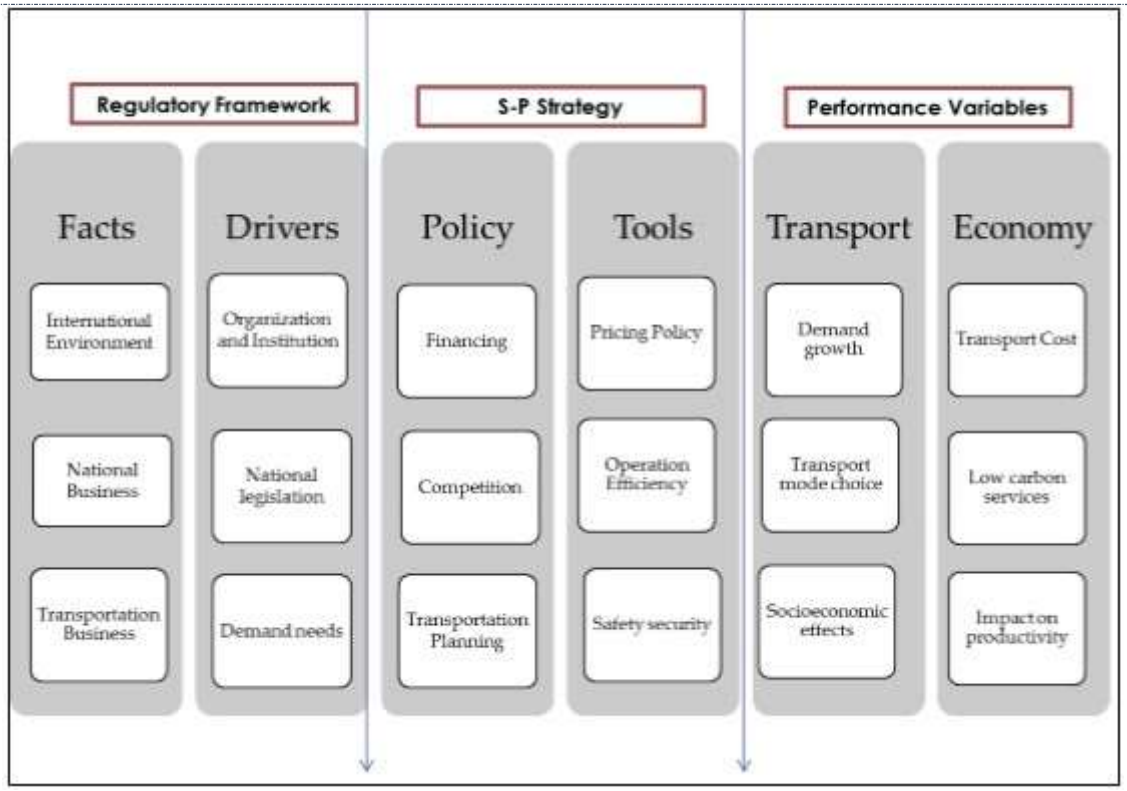


***Fig 3: Demand -Supply variables influence the Transport Logistics Hub- Regional economy equilibrium***

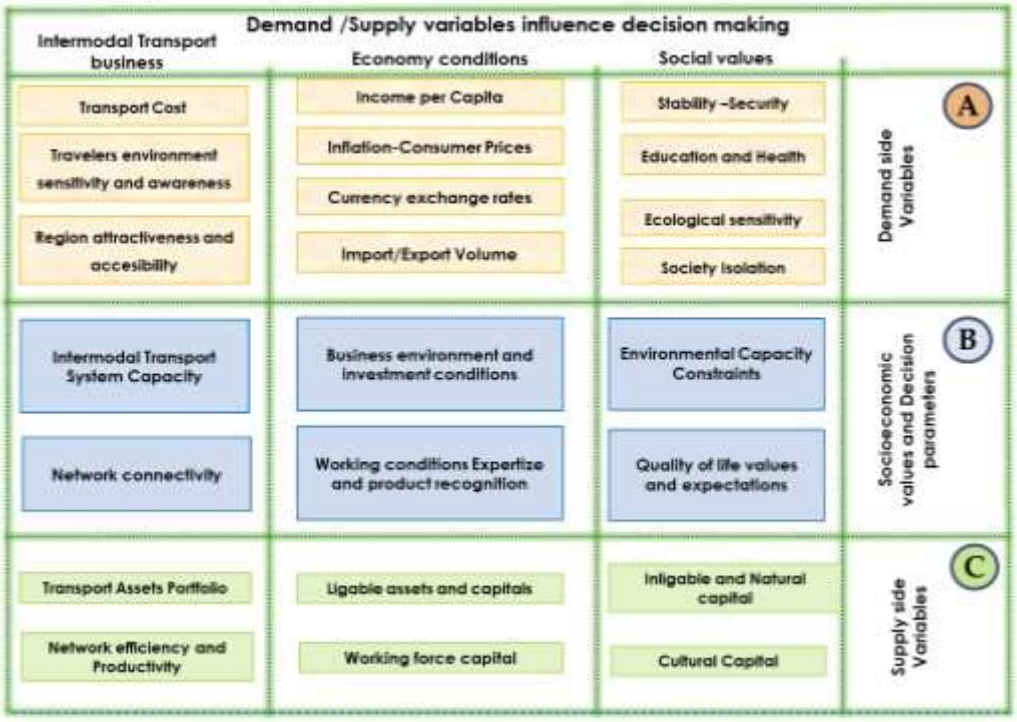


***Fig 4: Demand -Supply variables influence the Transport logistics hub development decision making (Source: Dimitriou et al.2016)***

## CASE STUDY

Greece stands on the crossroad of three continents (Europe, Asia, Africa), connecting, since early antiquity, people, goods and cultures. For that reason, Greece has long been a strategic node for the development of

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CODEN: IJESS7

transportation in the greater region. More specifically, maritime transport is the most important mode of global freight transport, accounting for 80 per cent of global trade by volume and over 70 per cent by value. According to UNCTAD 2012, container throughput in European ports is growing at 6% annually, while traffic through South-East Mediterranean ports has been growing at more than 8% annually. Trade flows between Asia and S.E. Europe are expected to increase by 7% annually for the years to come. (UNCTAD 2012).

The geographical position of North Greek port allows the offering of competitive sea freight cost for transported containers, while offering access to a set of growing economies in the broader region. Continuing investment in road and rail infrastructure means that Greece's major ports are now directly interconnected with modern road and rail links, facilitating intermodal transport of cargo onwards to their final destination quickly and cost-effectively. Finally Greece is part of the EU's Orient/East-Med Corridor that connects the maritime interfaces of the North, Baltic, Black Sea and Mediterranean.In this environment, Greece's geographical position as a gateway between East and West render it highly attractive for investments in logistics and transport to take advantage of these increasing trade flows in an efficient and cost-effective manner.

The Region of Eastern Macedonia and Thrace [REM-T] (Anatoliki Makedonia - Thraki) is situated along the crossroads of Europe and Asia and is predominantly an agricultural area. It is a border region which gradually transforms into a gateway of the country and the European Union. The structure of the production model of the region displays concentration trends in lowland areas, large agricultural holdings and monocultures where the production is done vertically, and urban centers as centers of trade and services. East Macedonia and Thrace has invested strategically to a large extent on inclusion in the International transport networks.

Regional development policy in the wider study area sets as a key priority the development of transnational partnerships and collaborative networks for evaluating policies, strategic planning but also the development and management of infrastructure. Accessibility is the basis for economic competitiveness, social and regional cohesion and cultural development. The intermodal transportation and logistics between Bulgaria and Greece can play an important role in the socioeconomic development of the two countries and the wider region.

The decision framework is applied in a strategic logistics hub in north Greece. The objective of the decision making framework has been to assess strategically the overall need and potential for developing a logistics hub in North Greece to support multimodal transportation between Greece and Bulgaria.

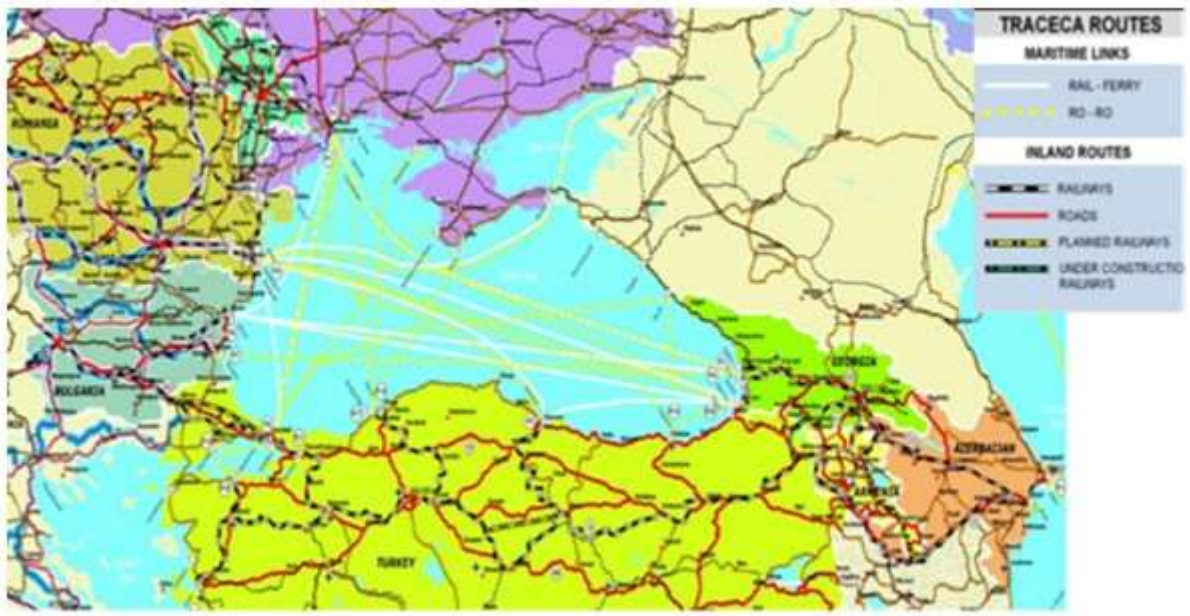


***Fig 5: Connection of the new logistic center with Bosporus***

The strategies of enhancing the interoperability and railroad network port in the region targeting the effective interconnection of the region with the Pan-European Corridor VII. The development of transit hubs include infrastructure development of integrated management of goods and connect them through multimodal land (road

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Impact Factor: 4.116
CODEN: IJESS7

and rail) with the network of international ports in the region. In Bulgaria the largest transit hub is the capital (Sofia) in conjunction with the port SEE network and container management stations: a) in ports Varna and Burgas on the Black Sea, b) to the cities Plovdiv (Plovdiv) and Dimitrovgrad and c) in the inland ports of Rouse and Lom. Railway axis can fully serve the needs of mobility to address East-West cross-border links with all of the poles of development and with the Pan-European corridors in the direction North-South. Finally it should be noted that cross-border countries, Greece and Bulgaria identified significant deficiencies in each of these priority areas, and this makes the upgrading of the rail axis a step near to the integration of the competitiveness of the country.

The Sea2Sea corridor – under the concept of Bosporus bypass – today does not exist. Also, there is lack of the necessary infrastructure to undertake the work in the terminal ports, while it is unknown the railway infrastructure capacity.The corridor of this project will be able to gain advantage over the Bosporus in matters of transit time and against the line Thessaloniki-Sofia with respect to contact with markets (since they are in direct contact with the Black Sea, the Mediterranean and the Interior)· long delays and high costs of transit the Bosporus.

The strategies of enhancing the interoperability and intermodality in the two countries targeting the effective interconnection of the region with the Pan-European Corridor VII. The development of transit hubs include infrastructure development of integrated management through multimodal land (road and rail) with the network of international ports in the region.

Applying Porter's five forces analysis, a framework adopted that attempts to analyze the level of competition within the transport industry and business strategy development, figure 5 derives five forces that determine the competitive intensity of transport system in the cross border region and therefore the attractiveness of the intermodal transportation an logistics hub in North Greece.

Porter’s analysis includes freight supplier’s power which is high and it can be even greater if they will try to create freight centers and industrial zones in order to increase their power and offer more services to their customers. Railway infrastructure provider’s power is high, too. Nevertheless, there are many opportunities and one of them is to participate in funded programs as for example in Sea2Sea in order to achieve their aims with lower costs. In addition to this, they can invest in infrastructure in order to offer lower cost and carbon services, electric traction and as a result they can be even more competitive and offer an even better quality of services.

The transport system competition is high because of the road and especially because of the Egnatia highway. However, competition can be even more intensive if the railway infrastructure providers would emphasize in interoperability. In other words, this could happen if there would be intermodality with the ports of the region which are Burgas’ and Alexandroupoli’s, too. This could also lead to the entry of new freight suppliers and maybe the demand from the East would be increased. A good and cost-effective intermodal transport system will lead to high economic growth and improve the European integration and increased accessibility to Asia.

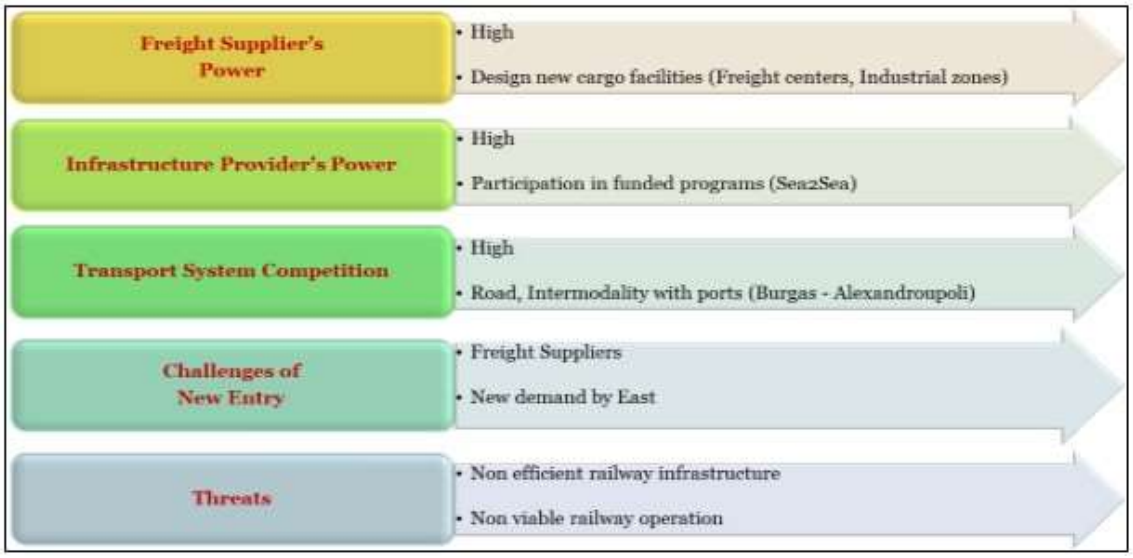


***Fig.5 Porter analysis for Intermodal transportation and logistic center project development***

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## CONCLUSIONS

Developing intermodal and logistics transport hub is a complex enterprise involving many stakeholders; Government and planning agencies, finance organizations, private contractors, system operators. As the target of the decision making process is the delivery of cost effective, sustainable, efficient, transportation logistics hub, a decision making system framework was developed in order to describe and link all key transport enterprise stakeholder concerns and involvements in the intermodal and logistics transportation logistics hub project delivery process.

The trans-national agreed strategy for development of new transportation logistics hub in the region of North Greece (Port of Alexandroupoli) needs to balance:

- The economic efficiency of investments
- Funding constraints and Risks
- The technical consistency within rail networks
- Environmental considerations

A three level analysis facilitated a bottom-up approach for evaluation assessment by aggregating the multiobject decision makers as analytical described at the level of network planning, taking into account all the social values and economic conditions and especially environmental as the best case scenario is the simultaneously development of the logistics hub with the improvement in the rail infrastructure in the region.
The interactions between stakeholders and the analysis and composition of their different perspectives lead to the business sustainability optimization, hub evaluation and economic productivity optimization of a new transportation logistics hub.

Conclusions show the need, importance and objectives of development of logistics and intermodal transport. Logistics and intermodal transport have long been the main factors of economic development, spatial connectivity and market integration. Inclusion of Port of Alexandropoulis in the European transport and logistics system, international goods and transport flows is not possible without the development of a new logistics hub and the use of intermodal technologies. Development of intermodal terminal in North Greece is very important initiator of the development of the entire intermodal transportation system in Greece and hence in economic growth. In this regard, it is necessary to take a series of measures and recommendations that support the further development of logistics and intermodal transport improvement and railway infrastructure investments in wider region.

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