Efficient Transport Planning and Port Operation/Management in the Eastern Mediterranean through Geo-informatics

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Abstract

Nowadays, countries on a macroscale and cities/neighbourhoods in a microscale, face many challenges associated with high population density and the protection of the environment. Transportation planning is one challenge that is directly linked to congestion-oriented problems such as traffic delays, greater fuel consumption, air pollution, investments in new infrastructure and is somewhat connected directly with our everyday life. One of the fundamental aspects that is always studied at the early stages of transportation planning is land use/land change. This affects transportation in general but more specifically in terms of transport planning, it affects greatly the stages of "trip generation" and "trip distribution", i.e. the number of trips that is generated at and attracted by a specific area under study. Changes in land use or changes in distribution of land use in cities over time can lead to changes in transportation/traffic trends. Obtaining information regarding the evolution of land use over time in a specific area of interest has become easier lately with the new Copernicus Sentinel missions, as data are obtained on a regular basis as optical or SAR satellite images and can be processed and used in the benefit of the greater good. In Cyprus and the eastern Mediterranean in general, due to their geographic location, many cloud-free optical satellite images are available. In the present study, archived and more recent images from the Sentinel missions were employed to show how the changes of land uses have affected transportation over time.

In the case of maritime logistics, transport planning affects wider regions, as Europe's ports are vital gateways, linking its transport corridors to the rest of the world. Approximately 74% of goods entering or leaving Europe are transported by sea. The operation of ports depends on many factors that characterise them. Therefore, in the area of maritime transport some concepts, such as productivity and reliability, are very important as they determine the dynamic of ports. Different stakeholders such as decision makers, users, port authorities and port cities are affected of the port´s use and thus port performance is of great importance. It is usually measured via a comprehensive set of Key Performance Indicators (KPIs) that cover substantially all port characteristics. There appears to be a variety of KPI systems in the literature used in research projects. During the present study, a comparison of six KPI systems is carried out. The nature of indicators and the methodology applied are investigated in each case to identify their strengths and weaknesses regarding the calculation of ports performance and efficiency. To have a common basis for comparison, a "universal" set of 5 KPI categories was defined and all KPIs were classified, based on their nature and description, accordingly, to the respective KPI categories. More specifically, these indicator categories are: (a) Environmental /Sustainability, (b) Financial /Economic, (c) Governance, (d) Operational and (e) Traffic. Collection of quantitative data

for the financial/economic; governance; operational; and traffic indicators is more accurate through questionnaires, however most of the environmental information, such as air pollution, COx emissions, etc., can be collected via optical or SAR satellite images, which are nowadays widely available through the Sentinel missions.

Geographic Information Systems (GIS) were employed in order to give a valuable mapping representation of all the different parameters and collected data, providing a spatial representation of the various findings of the evaluation procedure (see Figure 1). This spatial representation could also justify strengths and weaknesses for ports, as well as opportunities for future growth. The findings may further develop our understanding of transportation requirements, logistics and port operations. These data can be used not only to showcase the present status of ports and transportation networks in the eastern Mediterranean region, but they can be included in the decision-making process by port operators/authorities, transport system managers and many other public authorities.
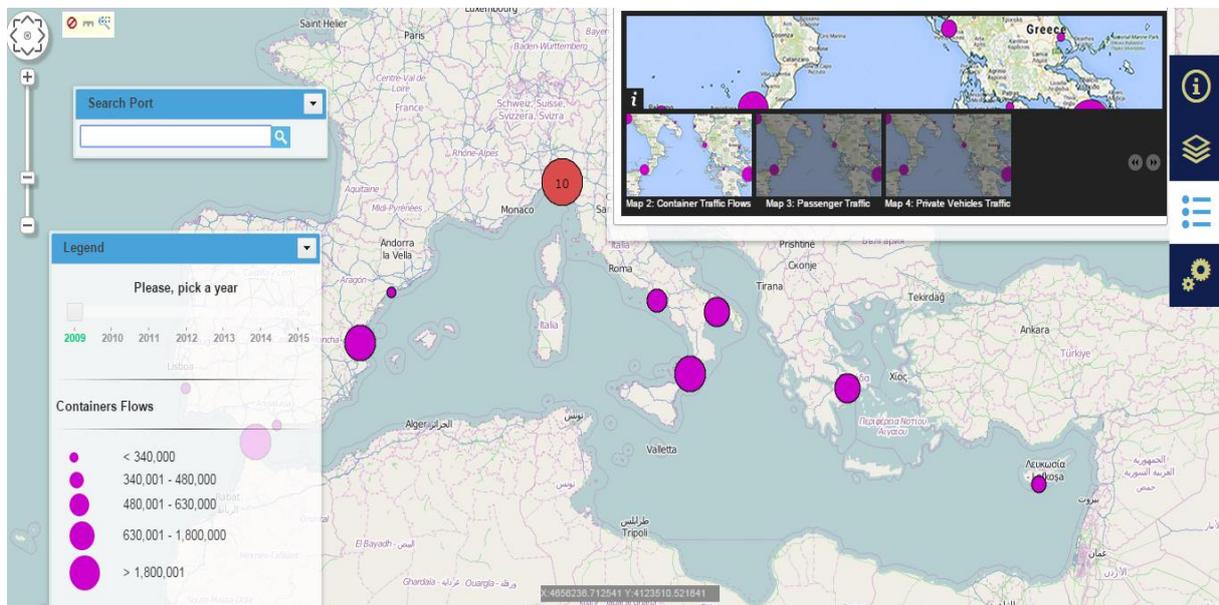

Figure 1. Container flows per year in GIS environment