PORTS

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Production of the Network Chart

Autorità di Sistema Portuale del Mar Ionio

Porto di Taranto

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Summary

Introduction

The goal of the work has consisted in a comprehensive analysis of the state of the art in the logistic Ionian-Adriatic corridor, in order to identify new potential routes between Taranto, Kotor and Durres as well as their impact in the project area.

For this purpose, an ICT (Information and Communication Technology) platform has been provided to support the management of a multimodal transport network chart. By customizing the *OpenSeaMap* and *JOSM* open source tools and technologies for the needs of the project, a Historical Geographical Information System (HGIS) has been made available to project partners, oriented toward collaborative data collection tasks along the paradigm of crowdsourcing.

The report is organized as follows. Section 1 describes features of the proposed platform. Section 2 reports on the data analysis that has been carried out and the insights that have been obtained.

1. Transport network HGIS

The proposed HGIS is designed for participatory data collection. Following the approach known as crowdsourcing, the system supports a widely distributed community of skilled and motivated users, following a decentralized organization model. This paradigm has been demonstrated in the literature to able to allow the creation of large data corpuses, where data quality keeps high levels as volume increases.

The developed HGIS is characterized by several features which make it suitable for the data collection and analysis activities in the PORTS project.

1. A general XML-based data model. The cartography data model is based on the following topological structures:

- node: point with geographic coordinates;
- way: sequence of nodes, either open-ended (polyline) or closed (polygon);
- relation: group of nodes, ways or other relations which can be assigned a common property;
- property: label assignable to a node, way or relation, consisting in a `name = value` pair.

The data model does not pose any restrictions on the expandability of the information organization. Completely customizable data annotation enables making information content as explicit as possible. At the same time, data points are endowed with complete geographical and temporal references for full information traceability.

In this way, data concerning different domains and from different sources act as superimposed layers in a single HGIS, allowing for cross-cutting multidimensional analysis. Both efficient real-time queries and massive complex intra-domain/inter-domain analytics are supported.

2. A Web-based platform for data access and visualization. Based on open and interoperable XML-based data formats, the platform has been set up in such a way as to grant distributed concurrent read/write data access for all involved research units. Data security best practices have been carefully complied with in order to trace data modifications, prevent unauthorized access and data leaks. As pictured in Figure 1, all data transfers among project partners have occurred through virtual private network (VPN) tunnels toward a server of the Information Systems Laboratory of Polytechnic the University of Bari. This guarantees data confidentiality (no snooping), integrity (no tampering) and privacy (no data is ever transmitted to third-party servers).

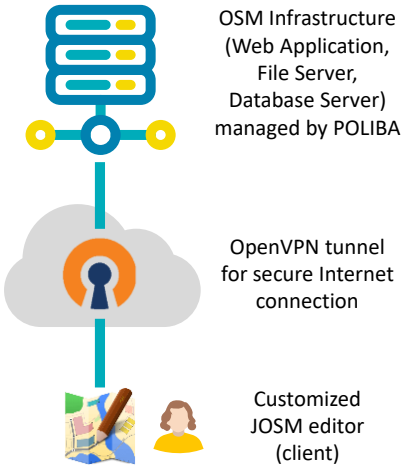

Figure 1 – HGIS platform security architecture

3. Powerful yet easy-to-use interface for data editing. A flexible Java-based editor has been provided to assisted systematic data entry. Manual data entry of nodes, ways and relations is supported, as well as single-node and batch property annotation. Bulk data import from existing sources in standard formats is supported as well. Usage of the provided tool is based on the following basic workflow:

- download a local copy of the cartography data for the portion of interest from the Web-based platform;
- edit data;
- upload changes, which are grouped in a changeset for tracing purposes.

The interface is designed to be easy to use for transport and logistics engineering practitioners with minimal IT experience, without requiring any specific IT skills.

2. Transport network chart data analysis

The data analysis work has started with a comparison of relative volumes for the three main **types of maritime traffic**:

- goods: freight transport by commercial vessels;
- passengers: transport for both ferry services and leisure vessels;
- vehicles: transport of personal and commercial vehicles by ferry.

Results are shown in Figure 2. Passenger traffic is prevalent in the Apulia – Albania – Montenegro maritime corridors. Vehicle transport is the least relevant type of traffic, suggesting that multimodal transport solutions generally rely on local transport services available in the three reference areas.

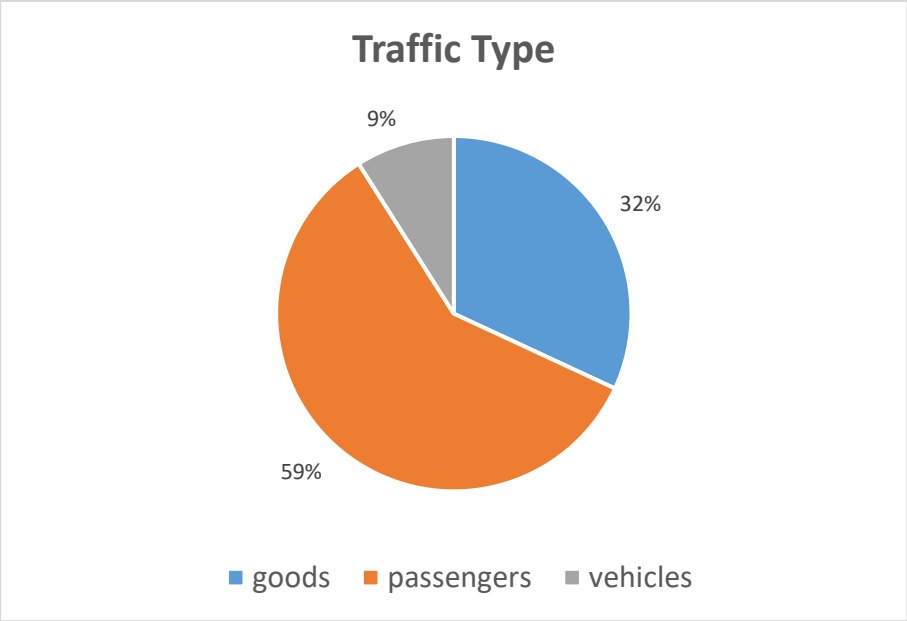

Figure 2 - Type of traffic

The other most important dimension of analysis is **import vs export** comparison. Considering the overall traffic of the three target areas, Figure 3 shows that import accounts for nearly three quarters of the total traffic volume. However, the situation is not very homogeneous among the three reference areas: as shown in Figure 4, Apulia exhibits an opposite trend, with export volumes three times larger than import volumes.

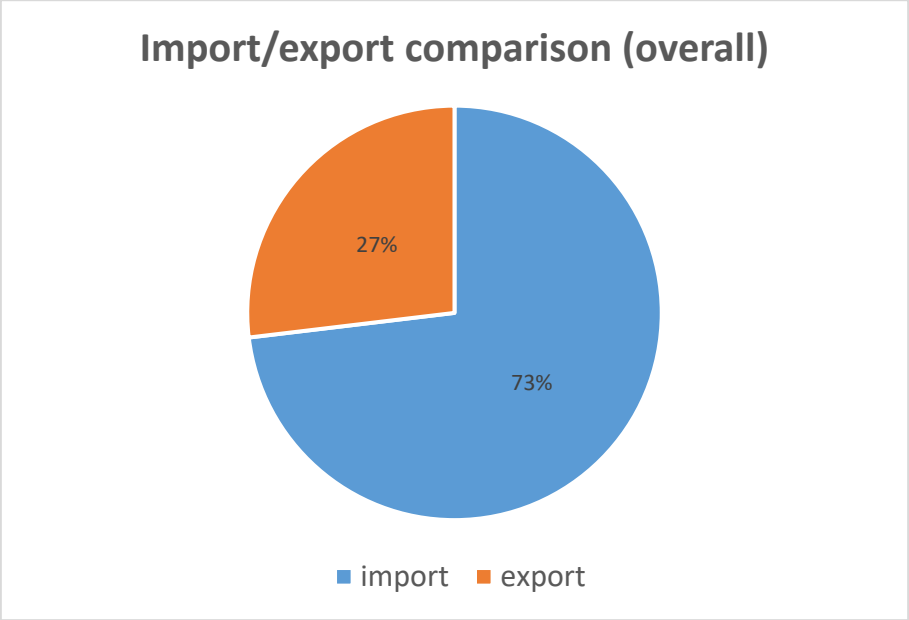

Figure 3 – Overall import/export comparison

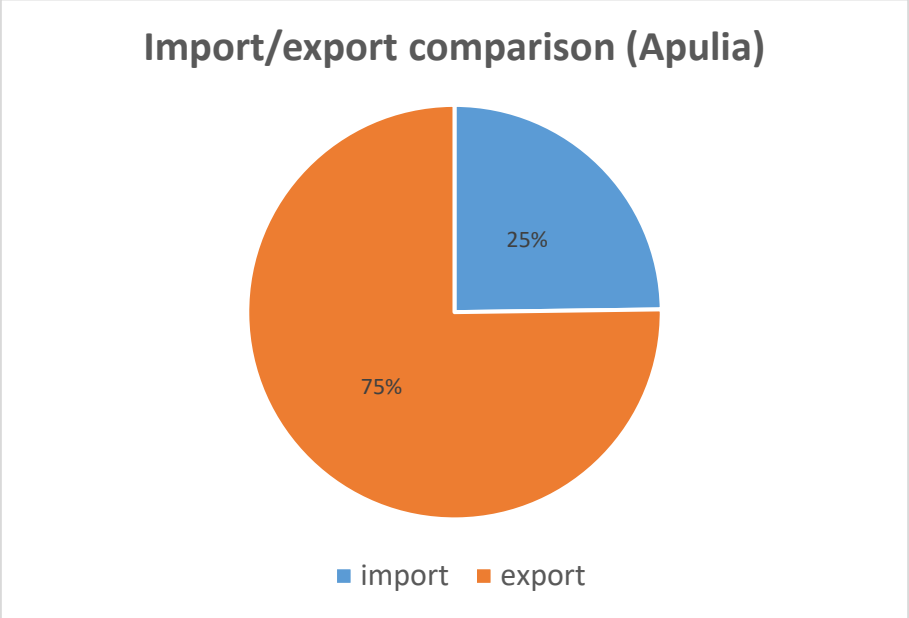

Figure 4 - Import/export comparison for Apulia

Another kind of analysis that stakeholders may benefit from concerns the concentration of traffic through main ports (local hubs). For example, from the available data in the HGIS platform, Durres

results as the main Albanian port by traffic volume. In particular, it accounts for the 58% of all the maritime exports from Albania, as plotted in Figure 5.

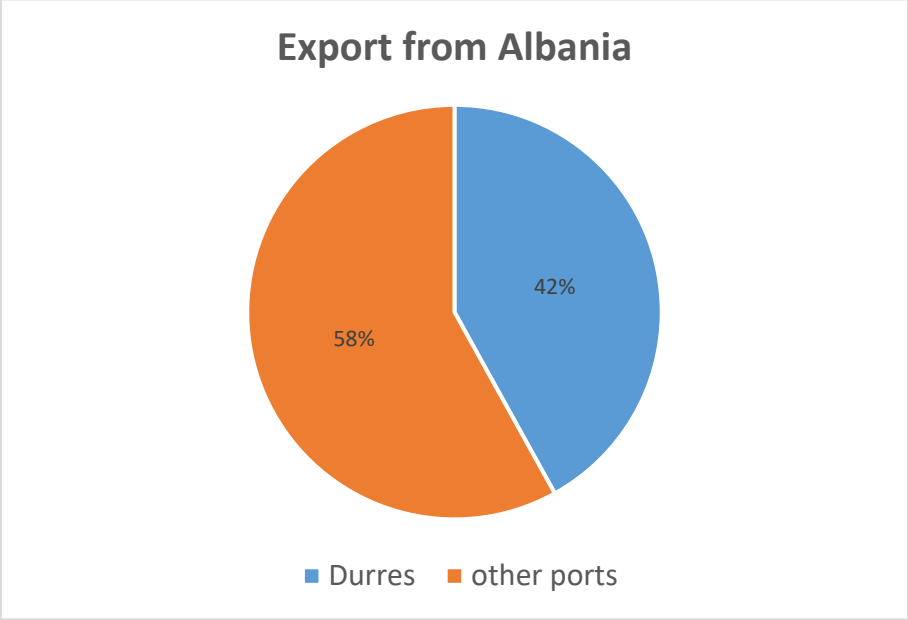

Figure 5 - Export in Durres with respect to other Albania ports

From an economic and social standpoint, passenger traffic is of particular relevance in the Ionian-Adriatic corridor. In fact, it may be correlated with the performance of the tourism sector and other added-value tertiary activities, which are a key for the development of advanced economies.

Available data suggests passenger flows do not exhibit a clear trend. This can be noticed by comparing Taranto, Durres and Kotor as representative ports for the three areas involved in the project. As shown in Figure 6 and Figure 7, Apulian (Taranto) passenger traffic is significantly lower than both the Albanian (Durres) and Montenegrin (Kotor) ones. Furthermore, Apulian passenger traffic is quite irregular over the course of consecutive years. Figure 8 shows an example extracted from the available data for years 2017-2019: year over year, Taranto traffic went down sharply and then up again. This can be explained by observing that Taranto passenger traffic is mostly due to cruise vessels, which depend on strategies of the various cruise operators and may be affected by seasonal and other external factors. Market analysis should be performed on this business sector to determine the most important factors contributing to sustained success.

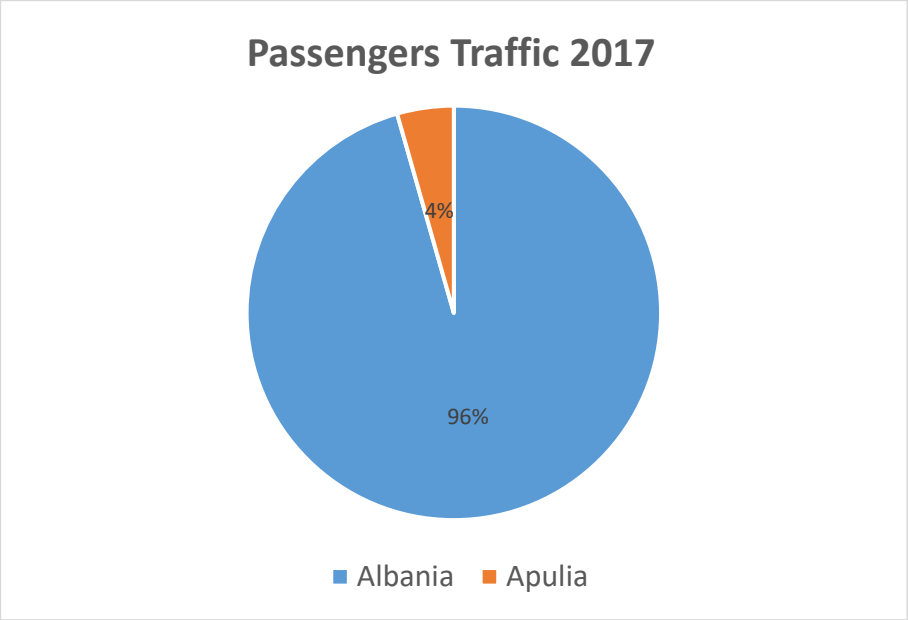

Figure 6 – Albania-Apulia comparison of passenger traffic

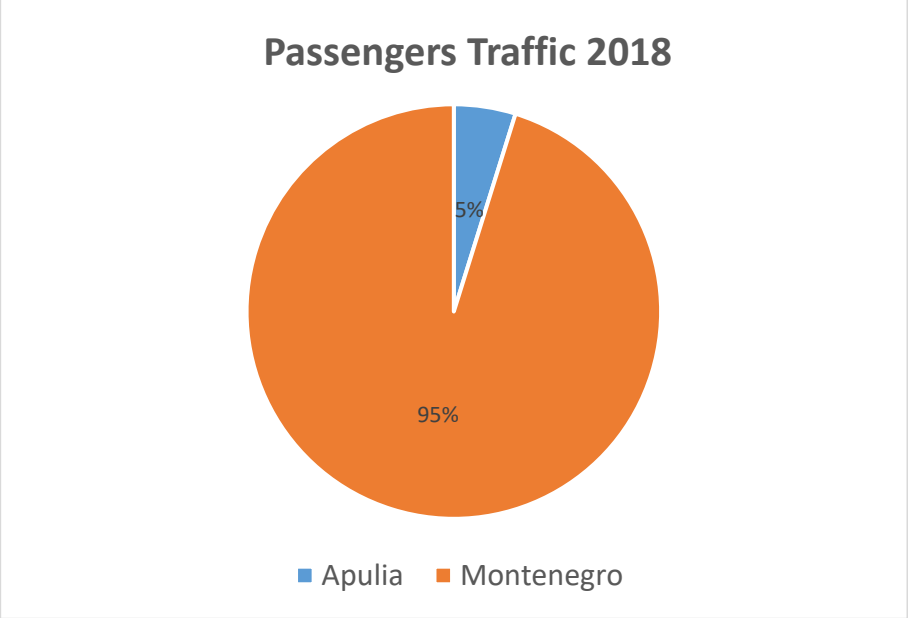

Figure 7 – Apulia-Montenegro comparison of passenger traffic

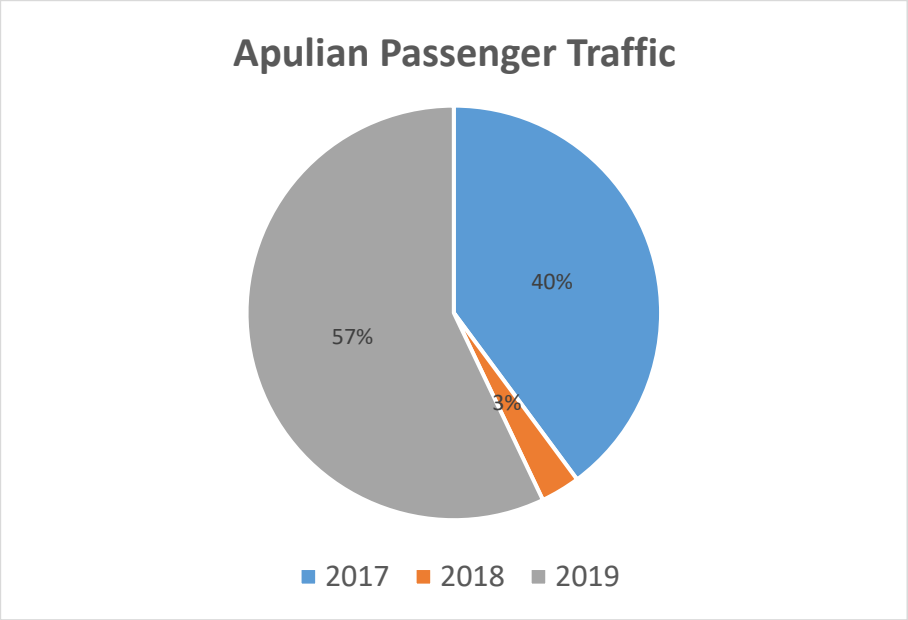

Figure 8 - Apulian passenger traffic by year

By combining the pairwise evaluations reported in Figure 6 and Figure 7 and extending them on the 2017-2019 time frame, the results reported in Figure 9 have been obtained. They show that passenger traffic in the reference Albanian port (Durres) is significantly larger than the reference Apulian (Taranto) and Montenegrin (Kotor) ones. This outcome can be interpreted as Durres having a large network of maritime exchanges, well beyond the ties with Taranto and Kotor.

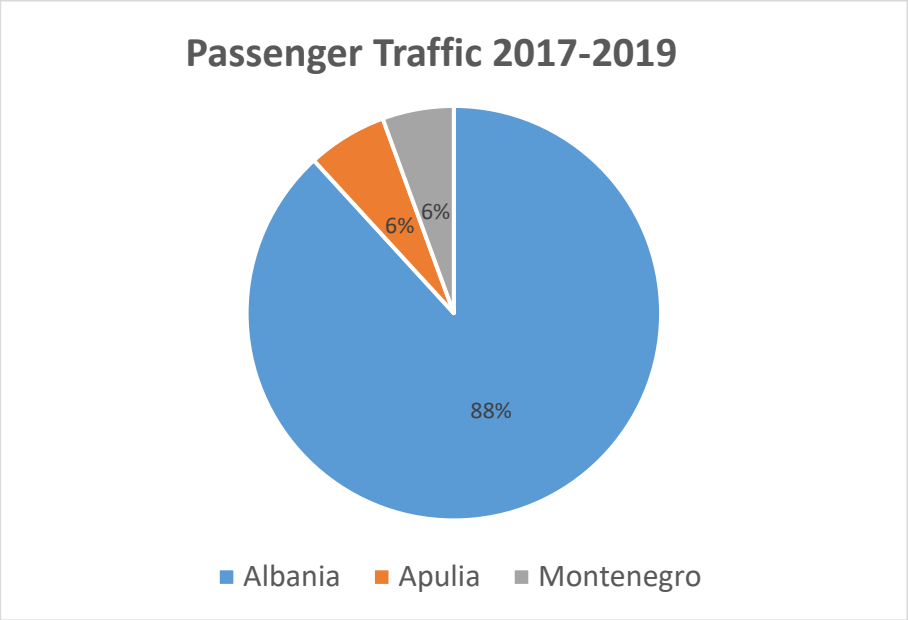

Figure 9 - Passenger traffic between 2017 and 2019

This interpretation is confirmed by the analysis of freight traffic to/from Albania. Taking 2017 as reference year, Figure 10 shows global import data into all Albanian ports. It can be noticed that Italy (including Apulia) accounts for a mere 7% of the overall imports and the rest of geographical Europe (including Montenegro) for 27%; Asia and Middle East have the the first and third largest shares, respectively, and together they account for the majority (51%) of imports.

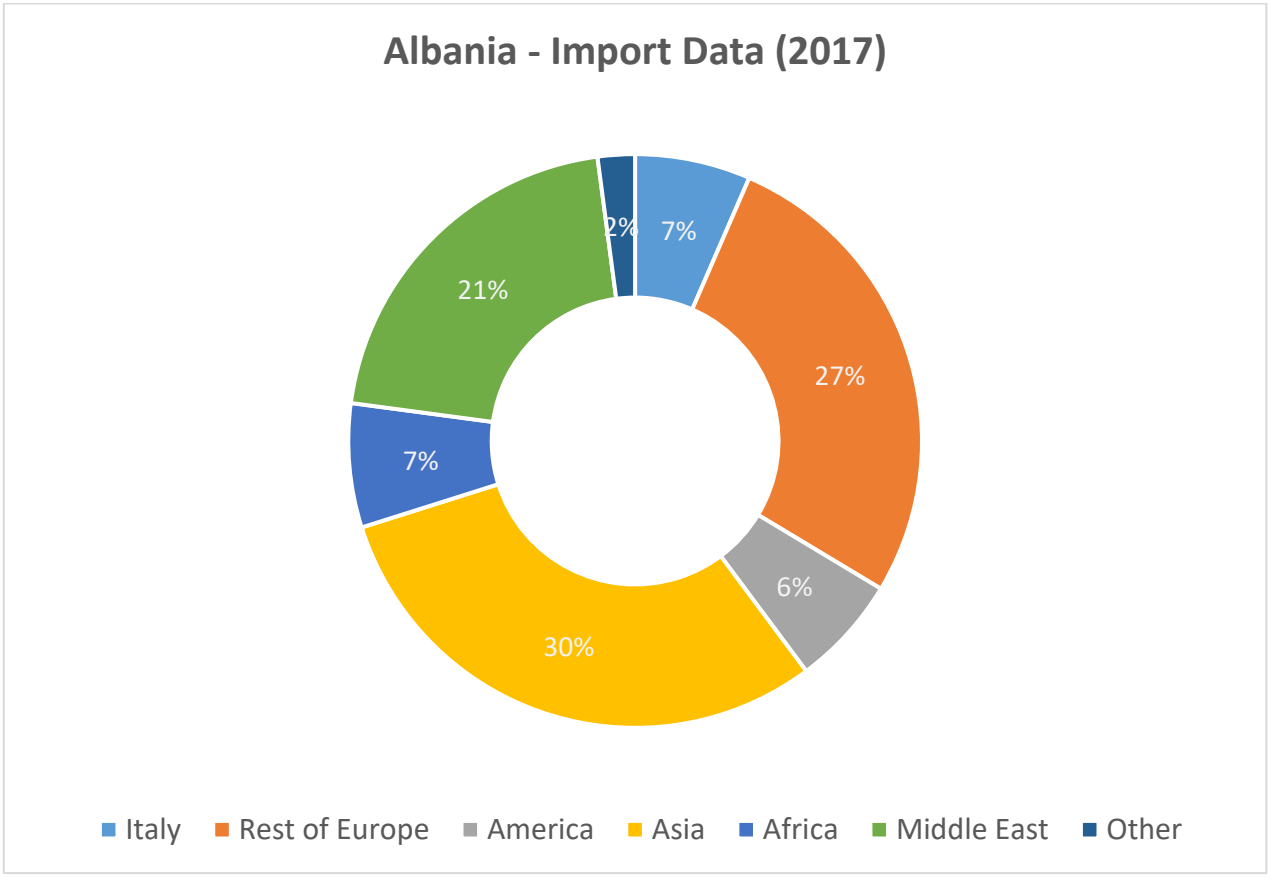

Figure 10 - Global import data by area

Albanian maritime export data, however, paint a different picture. As shown in Figure 11, Italy is the largest single destination, with 35% of freight tonnage, and the rest of Europe aggregate data account for the majority (54%) of exports. The remainder of the exports targets closer destinations like near Asia and Africa, while the Americas are practically absent. This imbalance of import vs export routes may be linked to the different kinds of imported and exported goods; the analysis that has been carried out on the available data therefore suggests further economics investigations can be useful to provide more fine-grained results.

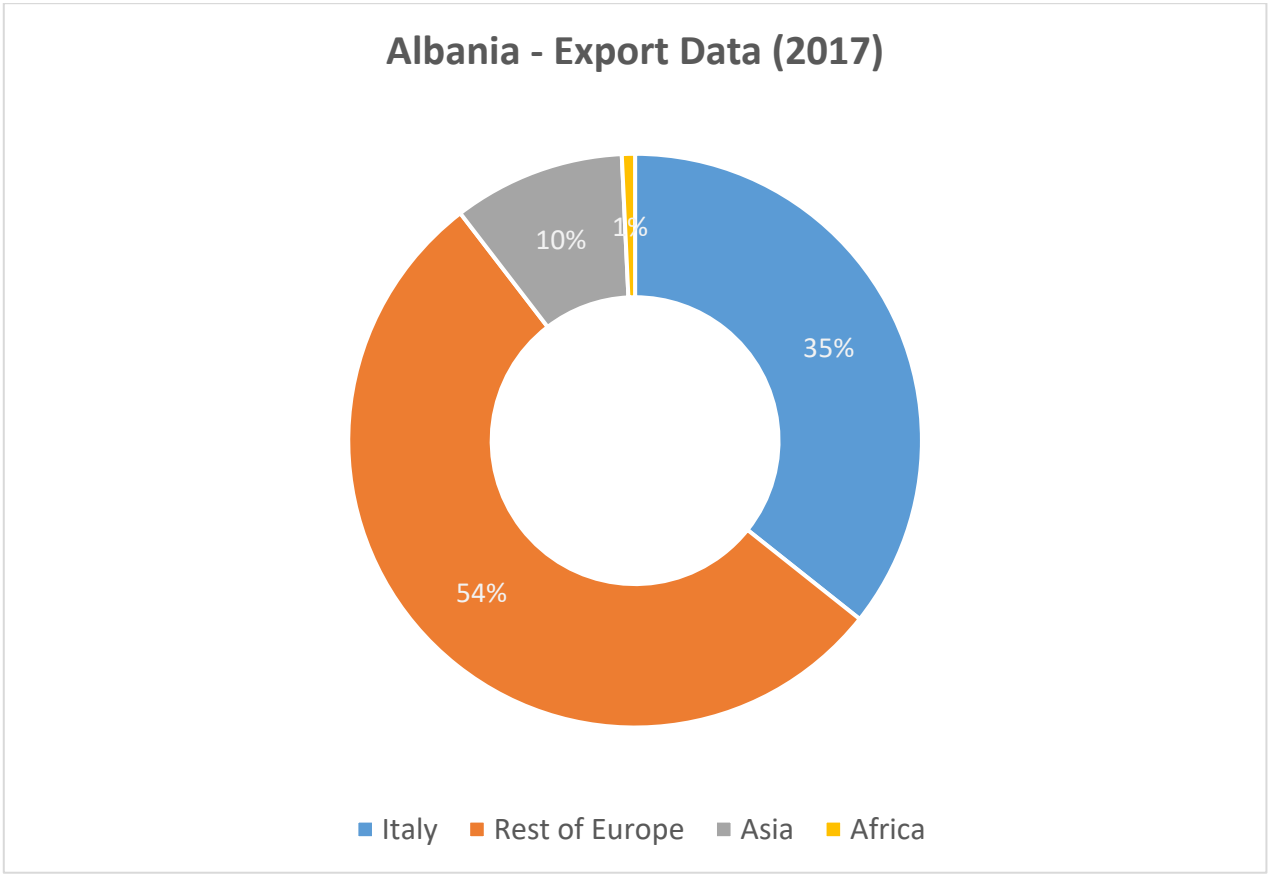

Figure 11 - Global export data by area

Finally, Figure 12 compares the relative impact of imports and exports by area, in order to provide a comparative evaluation of the two previous analysis results. The plot highlights Europe as the most relevant commercial partner for Albania, and thus the strategic importance of Mediterranean seahighways for the economic development of the country.

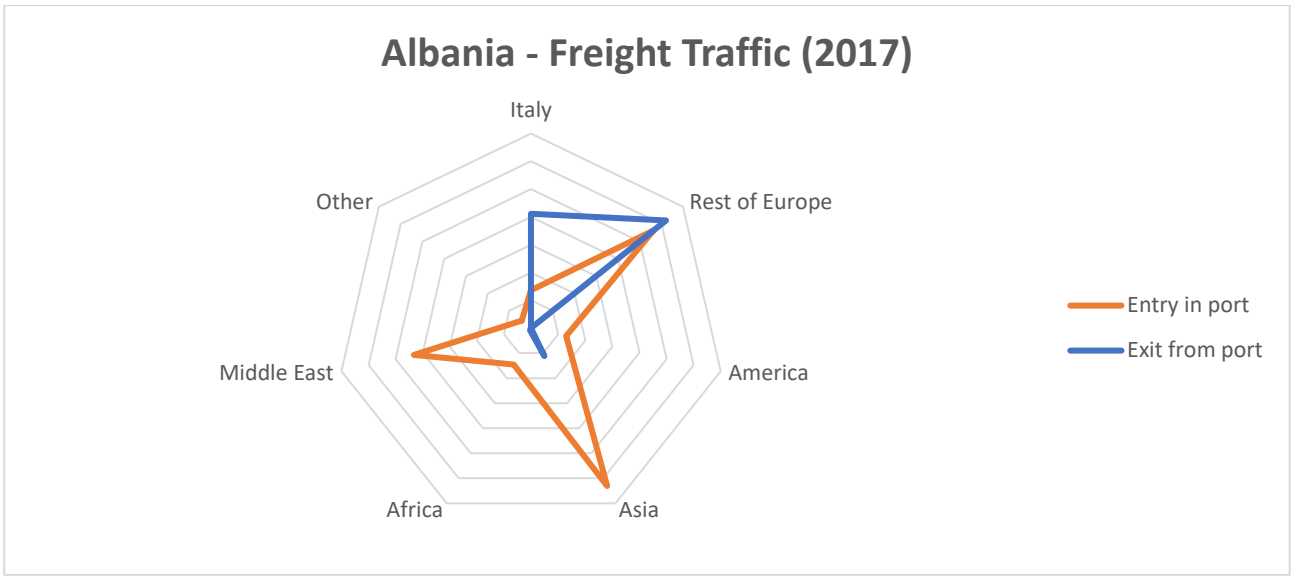

Figure 12 - Overall Albanian freight traffic by area