EUSAIR Transport MasterPlan

Volume 2

Maritime Transport

Contents

This Volume is part of the *Transport Masterplan of the Adriatic-Ionian Region*, elaborated by the *EUSAIR Facility Point* with the technical assistance of *PTSCLAS*, *TPS Pro* and *Systematica*, with the collaboration of *Tplan Consulting*, under the supervision of *Prof. Pierluigi Coppola* (Politecnico di Milano). Credits for reviewing and editing goes to *Dr. Francesco de Fabiis* (Politecnico di Milano).

The Masterplan includes the following volumes:

Volume 1 – Executive Summary

Volume 2 – Maritime Transport

Volume 3 – Inland Waterway Transport

Volume 4 – Road Transport

Volume 5 – Rail Transport and related Intermodality

Volume 6 – Air Transport

Volume 7 – Accessibility to urban nodes and tourist attractions

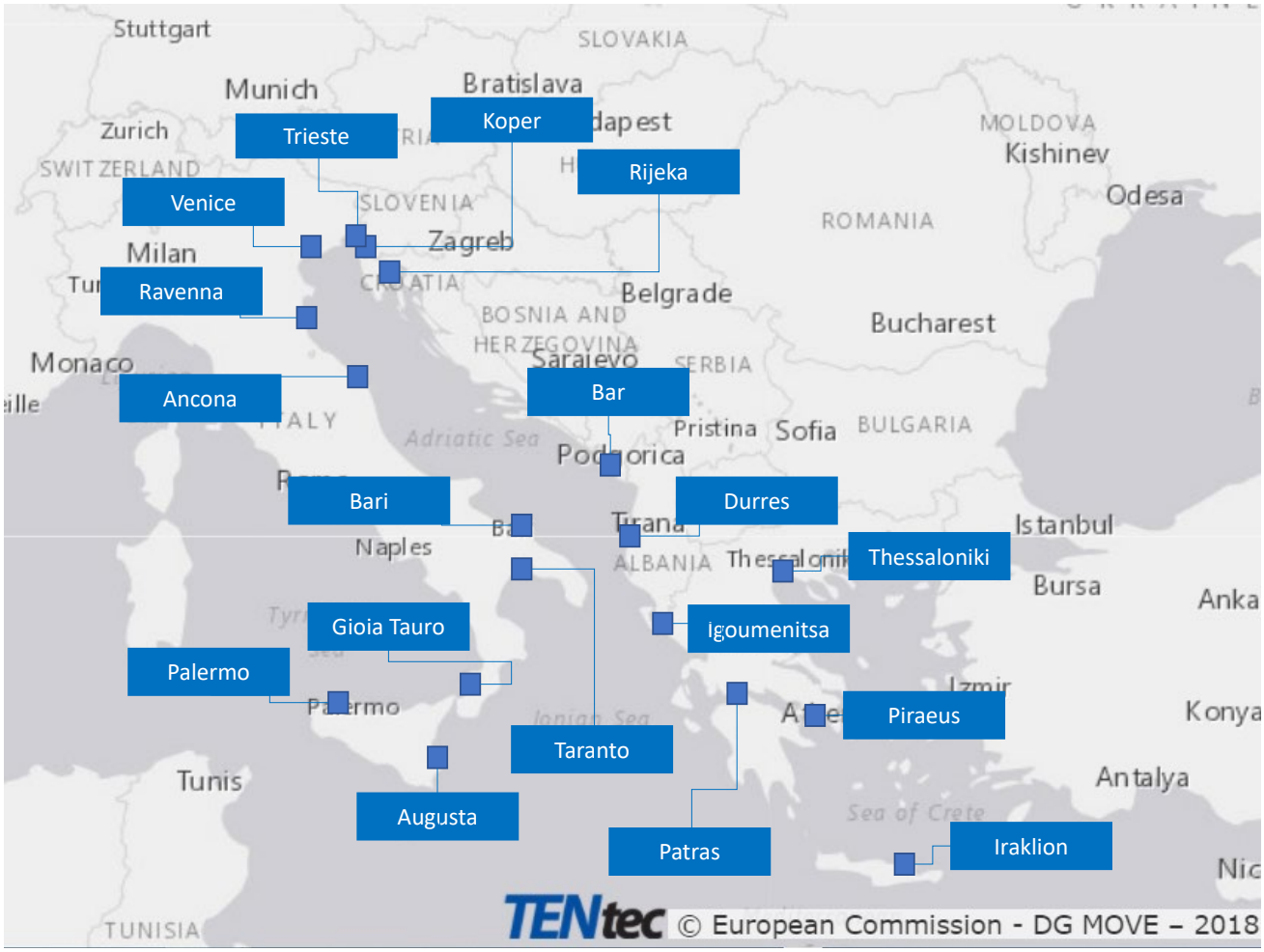
Introduction

The present document presents an analysis and description of the maritime transport sector in the Adriatic-Ionian region, with the objective to set out its main characteristics and key issues. After a general introduction, the analysis is presented by country and illustrates the features of main ports, their maritime connections and traffic, and the situations concerning strategic horizontal issues such as digitalization and the availability of alternative fuels. *NB: For Italy, whose geographic extent is far superior than other countries, the dedicated chapter has a different structure and presents information separately by each main port, with a final synthesis of main features and issues.*

The information and data have been collected via a desk research in online websites and public databases for the year 2019, as this represents the last meaningful year, before the COVID-19 crisis, for which data are extensively available across all territories. (If available, also figures from 2021, to witness the immediate evolution after the 2020 pandemic crisis, are shown).

The following map shows the maritime ports in the Adriatic-Ionian macro-area belongin to the Core TEN-T network.

Figure 1: Core maritime ports in the EUSAIR region



The map includes the "core" nodes representing the port clusters, as listed below:

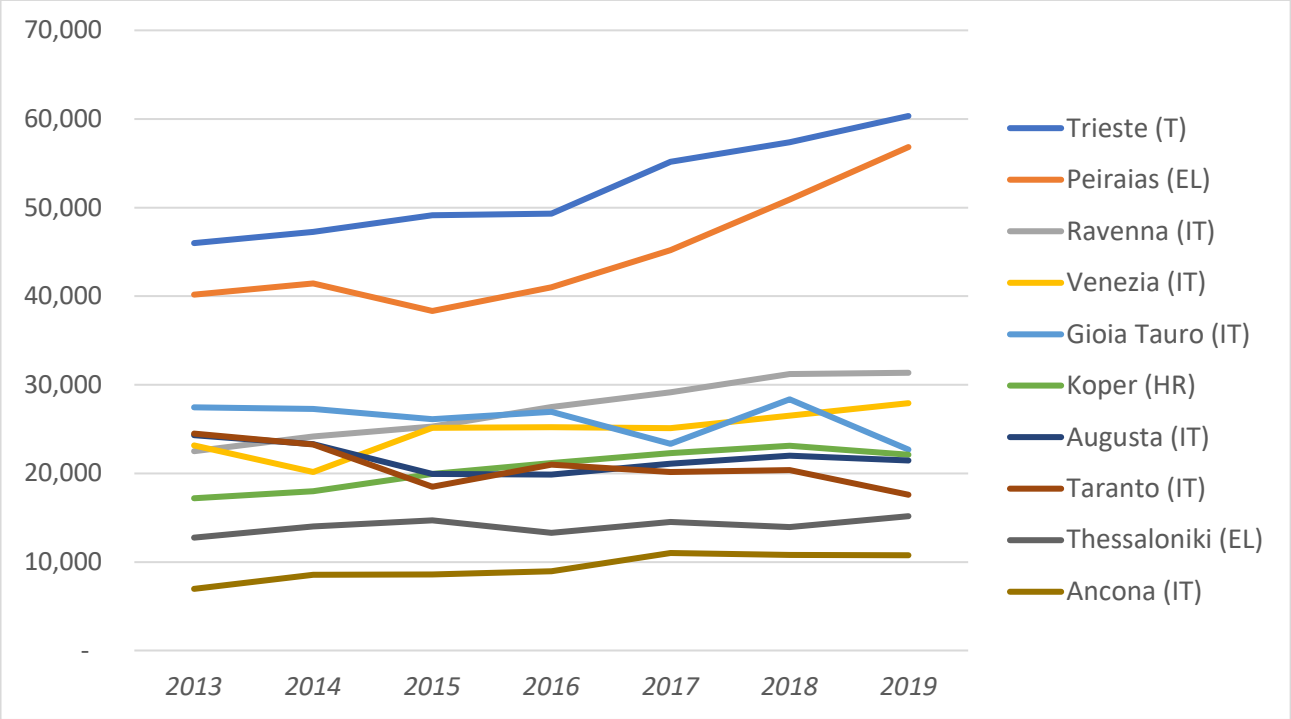
1. *Autorità di Sistema Portuale del Mar Adriatico Centrale:* including the ports of Ancona, Falconara, Pescara, Pesaro, San Benedetto del Tronto and Ortona;
2. *Autorità di Sistema Portuale del Mar Adriatico Centro-Settentrionale:* including the port of Ravenna;
3. *Autorità di Sistema Portuale del Mar Adriatico Orientale:* including the ports of Trieste and Monfalcone;
4. *Autorità di Sistema Portuale del Mar Adriatico Meridionale*: including the ports of Bari, Brindisi, Manfredonia, Barletta and Monopoli;
5. *Autorità di Sistema Portuale del Mar Adriatico Settentrionale*: including the ports of Venice and Chioggia;
6. *Autorità di Sistema Portuale del Mar Ionio:* including the port of Taranto;
7. *Autorità Portuale di Gioia Tauro e della Calabria*;
8. *Autorità di Sistema Portuale del Mare di Sicilia Occidentale:* including the ports of Palermo, Termini Imerese, Porto Empedocle and Trapani;

9. *Autorità di Sistema Portuale del Mare di Sicilia Orientale:* including the ports of Augusta and Catania;
10. *Port of Koper (Slovenia);*
11. *Port of Rijeka (Croatia);*
12. *Port of Bar (Montenegro);*
13. *Port of Durres (Albania);*
14. *Port of Patras (Greece);*
15. *Port of Igoumenitsa (Greece);*
16. *Port of Piraeus (Greece);*
17. *Port of Iraklion (Greece);*
18. *Port of Thessaloniki (Greece);*

As mentioned, these nodes, except for Bar and Durres that are not formally part of the EU Trans-European Transport Network (TEN-T), are established as core maritime nodes in the Trans-European Transport Network layer and, as such, they are crossed by one or more TEN-T Core Network Corridors: the Greek ports of Igoumenitsa, Piraeus, Patras and Thessaloniki lay on the Orient-East Med Core network corridor; the Italian ports of Ancona, Bari, Palermo and Augusta are positioned on the Scan-Med corridor, with Ancona laying on the Baltic-Adriatic corridor as well together with Ravenna, Trieste and Venice; the Slovenian port of Koper is on the Baltic-Adriatic corridor and on the Mediterranean corridor; the Croatian port of Rijeka, on the Mediterranean corridor.

Considering the 2019 traffic figures which show the evolution not yet impacted by COVID, the following chart shows the top 10 ports by traffic (in terms of gross weight of handled goods) and the evolution of their flows in the last seven years. The ports of Trieste and Piraeus clearly stand out in terms of relevance, mainly thanks to liquid bulks and containers respectively.

Figure 2: Top 10 ports in the EUSAIR region by freight traffic (gross weight of handled goods; 2013-2019)

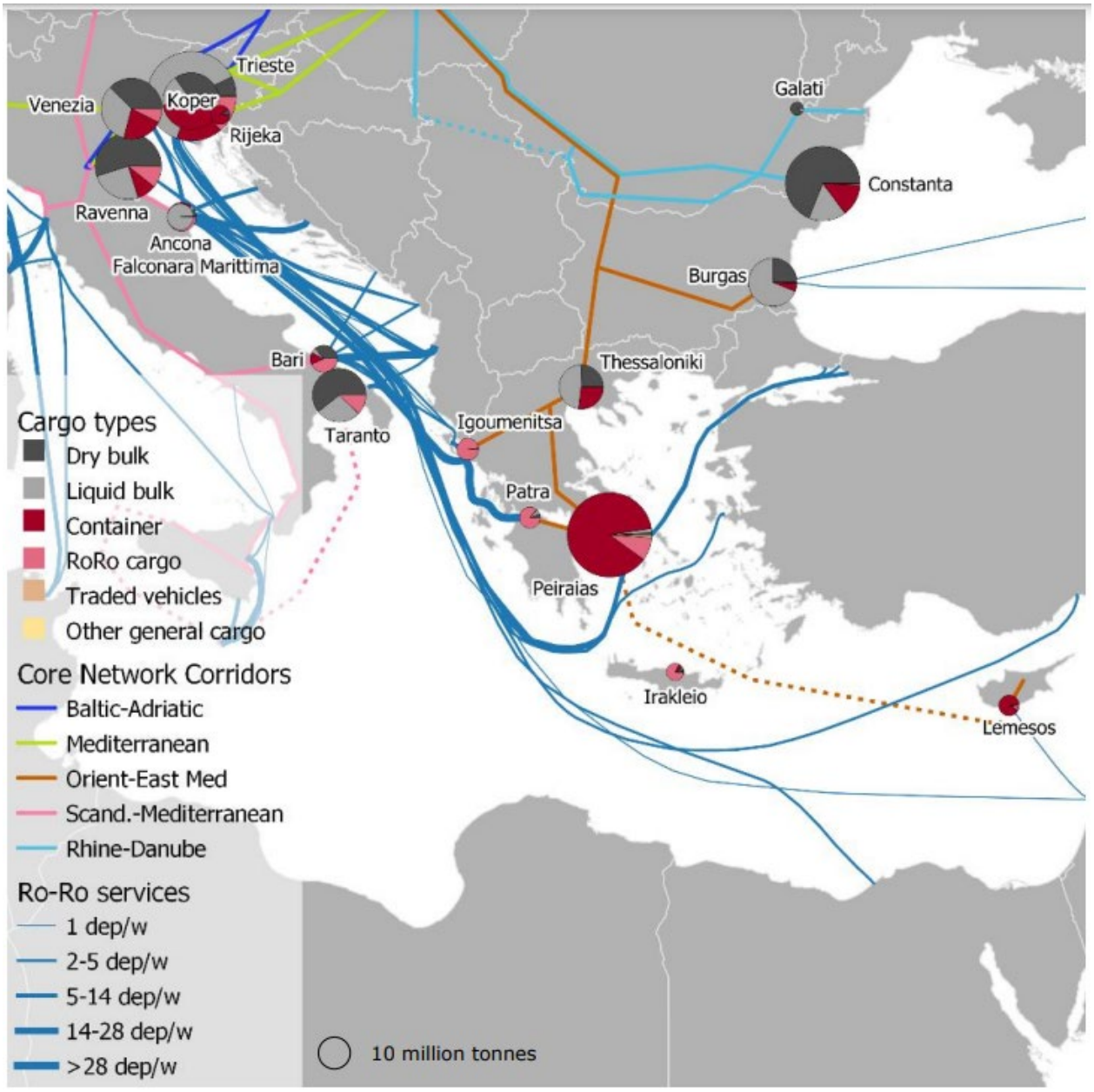


Source: PTSCLAS elaborations on Eurostat data

Overall, while the two above mentioned ports have been growing at an average annual rate of 4.6% (Trieste) and 5.9% (Piraeus), the average for rest of the ports of the region is a slower growth rate (1.6%), with notable exceptions in Ancona (7.5%) and Bari (10.5%).

The Motorways of the Sea play a remarkable role in the Adriatic-Ionian region. The provision of international Ro-Ro and Ro-Pax services is extensive, with high frequencies offered in many relations across the Adriatic and the Mediterranean, as shown in the map below.

Figure 3: Main international Ro-Ro connections and related frequency in the area (2019)



Source: EC, DG MOVE, Motorways of the Sea Detailed Implementation Plan of the European Coordinator, June 2020.
Note: ro-ro shipping routes exclude regular car carriers for traded vehicles (client contracts without free ro-ro capacity for external cargo); only ro-ro services (excluding car carriers) calling in one of the core ports of the Eastern Mediterranean or Black Sea are included.

1 Maritime transport characteristics in EUSAIR countries

1.1 Albania

1.1.1 Main ports

The characteristics of the Port of Durres are presented in the table below:

Port of Durres (Albania)	
	
Port area[1] (m^2)	293.142
Total port lenght[2] (ml)	1987
Terminals (total n.)	4
Freight terminals (n.)	3
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	11
Water depth (max)	11.5 m
Terminals with rail connections (n.)	1

The port of Durres is located in the south of the Adriatic Sea, south of the Albanian municipality of Durres, in the northern part of the bay of Durres, which is about 18 km long from north to south, with a coast of about 7 km to the east. West of the waterline it is more than 10m deep. The bay of Durres is well protected from rogue waves and provides shelter from east to north-west.

[1] Sum of the terminals area

[2] Sum of the quays lenght

Port terminals

Terminals

The table below shows the main characteristics of the four terminals.

Table 1 Terminals in the port of Durres

	Ferry terminal	Container terminal	General cargo west terminal	Bulk cargo east terminal
Number of quays	3	1	5	2
Quay length (ml)	500	265	800	422
Quay depth (mt)	8.5-10	8.6-10	7 – 8.2	6.5-11.5
Yard surface (m2)	800.000	60.062	92.680	135.000
Handling capacity (ton/year)	-	180.000	1.500.000	1.800.000
Handling capacity (pax/year)	1.5 million	-	-	-

Source: Autoriteti Portual Durres

Port access (rail and road connections)

Railway connection:

The port of Durres is connected by railway to the Albanian railway network; in particular the railway service for freight transportation and hauling cargo is provided h24 at the Bulk Cargo Eastern Terminal[3].

Road connection:

The port of Durres is connected, through the A1 (Durres – Morine) and the SH2 (Durres - Tirana), to all the main road axis that serves the country and that connects it to the following foreign countries:

- Montenegro, through the SH1 (Tirana – Han i Hotit)
- Kosovo, through the A1 (Durres-Morine)
- Macedonia, through SH3 (Tirana - Kapshticë) and SH6 (Skuraj - Maqellarë)
- Greece, through SH3 and SH4 (Durres – Kakavija)

1.1.2 Maritime connections overview

The ferry connections of the port of Durres are highlighted below, where it is possible the operator company is also indicated.

Table 2 Maritime connections in the port of Durres

Line	Operator
Durres - Bari (IT)	Adria Ferries; Nobel Maritime Inc.
Durres - Ancona (IT)	Adria Ferries

[3] https://www.durresport.al/index.php/en/port/

Durres - Trieste (IT)	-

Source: Autoriteti Portual Durres

A concerns container lines, the main ones are to/from Gioia Tauro through Mediterranean Shipping Company S.A., Taranto through the Evergreen Group, then Malta, Bar, Castellón de la Plana and Split.

1.1.3 Maritime traffic volumes (passengers and freight) and characteristics

Table 3 Traffic in the port of Durres (2019)

Category	Traffic
Annual cargo tonnage (2019)	4,072,541 tons
Annual container volume (2019)	145,762 TEU
Passenger traffic (2019)	878,867 pax

1.1.4 Digitalization

In early August 2021, the port of Durres successfully migrated its terminal operations from a manual system to a cloud-based infrastructure[4]. This transition enabled the terminal to introduce new functionalities gradually, beginning with the gate, followed by the yard, and finally, vessel operations. Within three months of implementing the system, all terminal operations had been converted, making it one of the pioneering sites to operate N4 SaaS (Software as a Service) in the cloud.

At the beginning of August 2021, the port of Durres completed the transition of its terminal operations from a previously manual system to a cloud-based infrastructure. Using the cloud infrastructure, the terminal is now able to roll out capabilities incrementally, starting with gate, moving to the yard, and then to vessel operations. After three months from the launch of the system, the cloud-based system was able to convert all of the terminal's operations and make it one of the first sites operating N4 SaaS in the cloud.

1.1.5 Alternative fuels

The Durres Port holds a prominent position as one of Albania's major energy-consuming entities. Until 2018, there was no discernible initiative towards transitioning to renewable and sustainable energy sources. However, the 2019 development plan marked a significant turning point as the Durres Port Authority expressed a keen interest in investing in the refurbishment of all buildings, prioritizing the use of energy-efficient materials. Furthermore, the authority is exploring the possibility of constructing solar panel sites within the port premises to facilitate a shift towards renewable energy sources and reduce energy consumption[5].

[4] https://itsupplychain.com/container-terminal-of-port-of-durres-transitions-to-modern-cloud-based-tos-with-navis-n4-saas-offering/

[5] https://supair.adrioninterreg.eu/wp-content/uploads/2020/01/SUPAIR_DT1-6-1_Action-Plan-for-a-Sustainable-and-Low-carbon-Port-of-Durres.pdf

1.1.6 Key issues

While the main port of Durres is endowed with multimodal access to/from the inland transport network (both road and rail), the overall Albanian port system shows a number of issues:

- A need to rehabilitate and modernise port infrastructure and services in order to increase the volume of cargo and the number of passengers;
- The lack of a Port Community System for the improvement of the electronic communication and interchange between port operators, port authorities, rail operators and other stakeholders involved in the transfer of goods;
- The still ongoing process to ratify and endorse IMO regulations and EC rules on maritime safety, security, environmental protection, and coastal management.

Table 4 Key issues in Albanian ports

	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Ports in Albania	Low priority issue	Minor lacks	Major lacks	Minor lacks	Minor lacks

1.2 Croatia

1.2.1 Main ports

The characteristics of the port of Rijeka are presented in the table below:

Port of Rijeka (Croatia)	
	
Port area (m^2)	1,500,000
Total port lenght[6] (ml)	7,100
Terminals (total n.)	8
Freight terminals (n.)	6
Passenger and Ro-Ro terminals (n.)	2
Quays (n.)	13
Water depth (max)	30 m
Terminals with rail connections (n.)	1

The Port of Rijeka is situated on the Kvarner Gulf, which is part of the northern Adriatic Sea. It is located on the TEN-T Mediterrean Corridor; the port is centered around the city of Rijeka and encompasses various terminals and structures. These facilities are spread across the city and its surrounding area, stretching from the Bay of Bakar, where the bulk cargo terminal is located, approximately 13 kilometers (8.1 miles) east of Rijeka, to Bršica in the western direction of Rijeka, where a general purpose terminal is present.

Freight terminals (6 + 1 Ro-Ro)

The port of Rijeka has seven main freight terminals: 1) General cargo terminal; 2) Container terminal; 3) Grain terminal; 4) Liquid cargo terminal; 5) Dry Bulk cargo terminal; 6) Ro-Ro Terminal; 7) General cargo terminal Barsica.

A network of Croatian highways connects the port with its background in the fastest and safest possible way. Rail corridors go through Zagreb and Ljubljana, and a modernization of rail Rijeka - Hungarian border is

[6] Sum of the quays lenght

underway, with the objective to double the line. Apart from roads and rails, petroleum pipelines are significant in connecting refineries in Croatia, Hungary, Austria, Serbia, the Czech Republic, and Slovakia. The international airport on Krk island is located in proximity of Rijeka port.

1.2.2 Connections overview

A number of domestic destinations are connected with the port of Rijeka by the operator Jadrolinja, namely Cres, Ilovik, Mali Lošinj, Martinšćica, Novalja, Rab, Silba,Susak, Unije, Veli Lošinj, Zadar.

1.2.3 Maritime traffic volumes (passengers and freight) and characteristics

The table below shows the most important indicators of traffic of the port of Rijeka in the 5-year period from 2016 to 2020. It can be seen there is an increase in tonnes of dry cargo, general cargo and container traffic

Table 5 Traffic evolution in the port of Rijeka

	2016	2017	2018	2019	2020	2021
Dry cargo tonnage	3,833,988	4,617,230	4,776,198	4,850,816	5,482,624	5,538,955
Liquid cargo tonnage	7,325,173	7,997,836	8,628,586	6,637,726	8,106,280	6,833,977
Bulk cargo tonnage	1,148,314	1,547,797	1,655,261	1,241,216	1,765,777	1,506,560
General cargo tonnage	2,363,753	2,707,628	2,769,316	3,245,738	3,341,731	3,613,934
Container volume (TEU)	214,348	249,975	260,375	305,049	344,091	356,068
Passenger traffic (Pax)	152,097	152,520	151,983	187,567	85,883	112,423
Cruisers (Pax)	23,818	23,238	23,101	53,898	4,402	9,996

Source: Port of Rijeka

1.2.4 Digitalisation

In 2019, the port of Rijeka signed an agreement for the construction of the Port Community System (PCS). PORT-Line, the system that will be implemented in Rijeka, is a web-based platform for the management and automation of port processes; will allow the sharing of information between all the actors of the Port Community, facilitating communications between the Port Authority, law enforcement, terminal operators, customs authorities and allowing the tracking and exchange of data and documents in real-time.

1.2.5 Alternative fuels

For the port of Rijeka, as part of the project for the NAPA ports (port of Trieste, port of Venice, port of Koper, port of Rijeka) the possibility of implementing an LNG depot in each port was assessed. The intermediary storage would be close to the Krk terminal (two different options have been analyzed) and linked by a pipeline to a centralized jetty for LNG bunkering. Road transport demand can be satisfied through separate road refueling stations. For 2030, a demand for LNG (including both the road and the maritime sector) is estimated of 11,258 tons of LNG, considering the needs of the whole of Croatia through the Krk refueling point.

1.2.6 Key issues

The main aspects where the effectiveness of the Croatian port system can be improved are reflected in the provisions of Croatia's Transport Development Strategy 2017-2030 and can be articulated as follows:

- An excessive sensitivity of the reliability of maritime transport in case of difficult weather conditions
- A low level of integration of ports into the local transport system (passenger/freight)
- An excessive environmental impact because of a generally old fleet

Table 6 Key issues in Croatian ports

	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Ports in Croatia	No priority	Major lacks	Major lacks	Minor lacks	Minor lacks

1.3 Greece

1.3.1 Main ports

According to Figure 1, Greece has the following core ports:

- Port of Patras;
- Port of Igoumenitsa;
- Port of Piraeus;
- Port of Thessaloniki;
- Port of Iraklion

In addition to the ports listed above, some minor ports are presented, among the ports of the main Greek islands:

- Chios port;
- Kos port;
- Lavrios port;
- Volos port.

The characteristics of the port of Patras are presented in the table below:

Port of Patras (Greece)	
	
Port area (m^2)	90932 + 6974
Total port lenght[7] (ml)	3000 + 922
Terminals (n.)	3
Freight terminals (n.)	1
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	n/a
Water depth (max)	10
Terminals with rail connections (n.)	-

Port terminals

The Port of Patras is divided in two main sections:

1) Northern Port
2) Southern Port

The Northern Port of Patras can afford cargo ships up to 25.000 register tons and passenger ferry ships up to 16.000 register tons and up to 330 meters length.

On July 11th 2011 the new South Port of Patras has become operable for the itineraries between Patras and Italy, which includes a Passenger Terminal, a North Gate Building and a South Gate Building.

The Ferry port of Rio is located north of the city of Patras and at a distance of 12 kilometres approximately. At Rio the Patras Port Authority only owns the wharfs and the electricity network.

Port access (rail and road connections)

Railway connection: The port of Patras does not have any railway connection yet.

[7] Sum of the quays lenght

Highway connection: The port of Patras is connected to one of the main road axis that serves the country, the A8 (Athens - Patras) that connects the port to the following foreign countries:

- Albania, through the A29 (Krystallopigi - Siatista)
- North Macedonia, through the A1 (Athens - Evzonoi)
- Bulgaria, through A25 (Promachonas – Lagkadas interchange A2)
- Turkey, through A2 (Igoumenitsa - Kipoi)

Port of Igoumenitsa (Greece)	
	
Port area (m²)	2,100,000 m²
Total port lenght[8] (ml)	1,197[9]
Terminals (n.)	2
Freight terminals (n.)	0
Passenger and Ro-Ro terminals (n.)	2
Quays (n.)	18
Water depth (max)	10.5 m
Terminals with rail connections (n.)	-

The port of Igoumenitsa has two main terminals which are both intended for passenger traffic. The ferry port is twice the size of the cruise port.

Table 7 Terminals in the port of Igoumenitsa

	Cruise port	Ferry port
Surface (m²)	3,041.46	6,326

[8] Sum of the quays lenght

[9] Medcruise.com

Quay lenght (mt)	420	775
Quay dept (mt)	10.5	10.5
Ramp (n.)	6	12

Source: Port of Igoumenitsa; Medcruise.com

Port access (rail and road connections)

Railway connection: The port of Igoumenitsa does not have a railway connection yet.

Highway connection: The port of Igoumenitsa is connected to one of the main road axis that serves the country, the A2 (Igoumenitsa - Kipoi) that connects the port to the following foreign countries:

- Albania, through the A29 (Krystallopigi - Siatista)
- North Macedonia, through the A1 (Athens - Evzonoi)
- Bulgaria, through A25 (Promachonas – Lagkadas interchange A2)
- Turkey, through A2 (Igoumenitsa - Kipoi)

Port of Piraeus (Greece)	
	
Port area (m²)	Container terminal 900.000 m^2 + cargo 180.000 m^2 + automobile 180.000 m^2 + cruise terminals n/a
Terminals (n.)	8
Freight terminals (n.)	3 container + 1 cargo + 3 automobile
Passenger and Ro-Ro terminals (n.)	4
Quays (n.)	22
Water depth (max)	18.5 m
Terminals with rail connections (n.)	1

Piraeus Port serves as Greece's primary port and stands as one of the Mediterranean's largest ports for both cargo and passenger transportation. It accommodates international ferries as well as those serving the countless Aegean islands. In July 2010, a section of the commercial port, situated a few kilometers away from the passenger port, came under the control of the Chinese company COSCO for a 35-year period. COSCO had

already established its presence in Greece prior to this agreement. Notably, Piraeus Port forms part of the new Silk Road, also known as the Belt and Road Initiative, facilitating connectivity between China and Europe.

Port terminals

Passenger terminals (4) - The port of Pireus has two main passenger ports: Cruise Port (with terminals A, B, C) and a Ferry Port. The following table provides details on the Cruise Port.

Table 8 Cruise terminal in the port of Piraeus

Cruise Port	
Surface (m^2)	2,100,000
Number of berths	9 - 11
Quay lenght (ml)	2,800
Quay depth (mt)	10
Terminal area (m^2)	45,000
Handling capacity (pax/day)	15,000[10]

Source: Port of Pireus

The surface of the cruise port is 2.100.000 square meters, and this surface allows to have 11 berths that can be used for the load and unload of the passengers. Regarding the passenger terminal, the capacity in pax/year is 20.000.

Freight terminals (4) - The port of Piraeus has five main freight terminals:

- Container Terminal (PPA S.A.[11]), with 2 quay depth of -18 m. an annual capacity of 1.1 M TEU and storage areas of 72,400 sqm; endowed with a railway connection.
- Container Terminal (PCT S.A.[12]), with quay depths down to -19.5 m and and an annual capacity of 6.2 M TEU; endowed with a rail connection.
- 2 Car Ro-Ro Terminals (G1 + G2), with a storage capacity of 9,000 units.
- General Cargo - Logistics Center.

The overall annual capacity in TEU for the containers terminal reflects the centrality of the port in the Mediterranean system.

Port access (rail and road connections)

Railway connection: The Piraeus Container Terminal is linked with the European Rail Network with its owned Rail Ramp and it is able to handle up to 10 trains per day, offering rail transportation services to Central Europe & Balkans[13].

Highway connection: The port of Piraeus is connected to one of the main road axis that serves the country, the A1 (Athens - Evzonoi) that connects the port to the following foreign countries:

- Albania, through the A29 (Krystallopigi - Siatista)

[10] T1 (12,000) + T3 (3,000); T2 n.a.

[11] Athens Stock Excange

[12] Cosco Shipping

[13] PCT.com

- North Macedonia, through the A1;
- Bulgaria, through A25 (Promachonas – Lagkadas interchange A2)
- Turkey, through A2 (Igoumenitsa - Kipoi)

Port of Iraklion (Greece)	
	
Port area (m²)	2.500 m^2 (passenger terminal)
Terminals (total n.)	3
Freight terminals (n.)	1
Passenger and Ro-Ro terminals (n.)	2
Quays (n.)	5
Water depth (max)	-14.2 m
Terminals with rail connections (n.)	-

The port of Iraklion, also known as Heraklion, can be found at the heart of the northern coastline of Crete. It serves as the primary and most extensive port on the island, accommodating significant volumes of commercial, passenger, and tourist traffic. Dedicated berthing facilities equipped with appropriate infrastructure have been designated for various types of vessels, including cruise ships, container vessels, conventional ships, bulk carriers, and those transporting dry or liquid cargo. Ample storage areas are readily available, serving both the container terminal and general cargo storage needs.

Because Crete is strategically positioned near the center of the Mediterranean Sea, serving as a vital crossroads for maritime routes connecting East to West and North to South, the port in question emerges as an ideal transit hub for vessels navigating the Mediterranean. It stands out as the primary destination for ships in transit, providing essential services such as supplies, crew changes, bunkering, and more, whether they are alongside the docks or anchored nearby.

Cargo terminal[14] **-** The Heraklion Port Authority possesses operational resources, equipment, and staff located on Piers III and IV. These facilities are capable of efficiently handling various types of cargo, including general or bulk cargo (utilizing pumps or piping) as well as containers. Additionally, the port provides open-

[14] Source: www.portheraklion.gr

air storage areas for containers and general cargo, alongside a covered warehouse designated for packaged loads. These packaged loads may consist of pallets, cartons, wooden items, parcels, bags, and similar items, offering protection from the elements.

Passenger terminal - All ships depart from the western part of the port and the I and II piers. The passenger terminal of the port occupies an area of 2.500. The Port of Heraklion reached rank #1 in 2020 among all Greek ports in terms of cruise passenger volume[15]. Despite the challenging circumstances posed by the pandemic, Heraklion managed to welcome 19,998 cruise passengers who arrived on 24 cruise ship visits. This figure represents approximately 30% of the total 64,356 cruise passengers recorded in Greek ports throughout 2020. It is important to note that Heraklion's 2020 cruise passenger numbers do not fully reflect the port's true potential, as they fell short by 287,000 passengers compared to the volume seen in 2019. However, this achievement underscores Heraklion's ability to retain a significant share of cruise passengers, outperforming other Greek ports despite the impact of the pandemic.

Port access (rail and road connections)

The location on an island makes the connection with the airport particularly relevant; the International Airport "Nikos Kazantzakís" is at 2 km distance, with the connection being through urban roads. At a similar distance, the connection to main East-West road axis of the Island is accessible.

[15] Source: www.medcruise.com

Port of Thessaloniki (Greece)	
	
Port area (m^2)	155 ha
Terminals (total n.)	3
Freight terminals (n.)	2
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	26
Water depth (max)	-12 m
Terminals with rail connections (n.)	1

The Port of Thessaloniki stands as one of the most relevant seaports situated in the Eastern Mediterranean. It serves as the pivotal entry point to the Balkans and South-East Europe, strategically positioned within Macedonia, Greece. This location places it in close proximity to critical Trans-European highway and railway networks, offering direct connectivity to nations in Southeastern Europe.

Freight terminals - In the Container Terminal, all containers undergo handling operations within a dedicated space situated on the western side of Pier 6. This Container Terminal spans an impressive 550 meters in length and 340 meters in width. It forms an integral part of the Free Zone and boasts connectivity to the national rail network. The terminal covers an expansive area of 254,000 square meters. Presently, it is configured to receive smaller and medium-sized vessels, specifically feeder vessels, accommodating those with a maximum draught of 12 meters and a total capacity of up to 550,000 TEU[16]. Regarding the general cargo terminal, the Port of Thessaloniki is the first Conventional Cargo Transit Port of Greece and one of the main ports in the eastern Mediterranean. It has fourteen (14) quays suitable for all types of bulk and break-bulk cargo, all of them connected to the national and international rail networks. The total length of quay walls is 4,200 meters.

Passenger terminal - The Port of Thessaloniki boasts one of the largest passenger terminals within the Aegean Sea region[17]. This Passenger Terminal aligns with the International Ship and Port Facility Security

[16] www.apice-project.eu/

[17] www.shipnext.com/

Code (ISPS Code) and is fully equipped with all essential facilities and conveniences to accommodate and serve passenger traffic, including cruise and coastal ships. In recent times, Thessaloniki has gained popularity as a cruise destination, primarily due to its close proximity to culturally significant destinations and its convenient location just a short distance from the city center. Additionally, for coastal shipping, there is a seasonal connection available between Thessaloniki and the Aegean islands.

Port of Chios (Greece)	
	
Port area (m^2)	n.a.
Terminals (total n.)	1
Freight terminals (n.)	1
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	3
Water depth (max)	-8 m
Terminals with rail connections (n.)	-

The port of Chios is located on Chios Island in the Aegean Sea. It is situated in the central - eastern part of the island. It is 3.5 miles from the peninsula of Eritrea in Cesme. The primary harbor of Chios plays a central role in handling all maritime transportation needs for both passengers and goods on the island, including those of smaller neighboring islands such as Oinousses and Psara. It functions as the essential link connecting this border region to mainland Greece while also serving as a vital gateway orienting towards the East. Despite being a smaller port than the main ones, the port of Chios is significant for the number of vessels that land in the port (with approx 104,500 ton of cargo, 3,830 vessels and 502,500 passengers handled annually)[18]. The traffic is in general for more than 50% relative to passengers, with a small percentage dedicated to cargo. The port has only one terminal (which acts as both cargo and passenger terminals) which is used for all large vessels depending on the type of cargo. The port accommodates 2 passenger/cargo ships of 20,000 tons each and 1 passenger ship of 700 tons at the same time. The maximum depth of the port is 8.20 meters. In the southern part, there is a marina.

[18] www.shipnext.com

The port is nested into the city's urban road network and is connected to the island's airport which is some 5 km far.

Port of Lavrio (Greece)	
	
Port area (m^2)	n.a.
Terminals (total n.)	2
Freight terminals (n.)	1
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	7
Water depth (max)	-12 m
Terminals with rail connections (n.)	-

The port of Lavrio (or Lavrion) is located on the southeast coast of Attica. It is the third-largest passenger port in Athens and serves about 180 thousand passengers annually, and ranks fifth (after Piraeus, Thessaloniki, Heraklion and Volos respectively) for container handling in the year 2020, with a total of around 11,000 TEUs handled. From 2016 to 2019 the port of Lavrio suffered a sharp decline in container traffic, losing about 84% of traffic. The port's main landside connection is towards Athens (some 60 km far) via the A6 highway.

Port of Volos (Greece)	
	
Port area (m^2)	n.a.
Terminals (total n.)	3
Freight terminals (n.)	2
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	14
Water depth (max)	-9.5 m
Terminals with rail connections (n.)	-

The Port of Volos is strategically positioned midway between the Port of Thessaloniki to the north and Athens to the south. This port plays a crucial role in servicing one of Greece's most industrialized cities, which is particularly known for its specialization in steel production and manufacturing. Notably, Volos is home to one of the world's largest cement factories. Additionally, Volos serves as a significant hub for research activities, hosting Greece's Center for Research and Technology Thessaly (CERETETH). This research center is engaged in innovative research endeavors aimed at developing new products and services tailored to the requirements of local, national, and European industrial and governmental institutions. As of October 2020, the average arrivals at the Port of Volos were distributed as follows: cargo accounted for 47.28%, passengers (ferries) for 13.04%, and the remaining 40% was associated with fishing and marina activities[19].

The port's is nested in the urban road network, with close access to the A1 highway towards Thessaloniki.

1.3.2 Maritime connections overview

All the Greek ports are highly connected with several lines with between Greek island and between other Adriatic countries (like Italy) and Greek ports. The most important ferry connections with Greek ports are presented in the tables below. For the port of Piraeus, the table is not presented as the list of connections is very long, with Piraeus being the most important maritime hub in Greece serving all relevant port

[19] www.worldportsource.com

destinations in the area. Similarly for Thessaloniki, that has a numerous list of ferry connections with the islands of the Northeast Aegean, the Cyclades, the Sporades and Izmir.

Table 9 Maritime connections to/from Greek ports

Port of Patras	
Line	**Operator**
Patras - Bari (IT)	Anek Lines;
Patras - Ancona (IT)	Minoan Lines; Anek Lines;
Patras – Venezia (IT)	Minoan Lines; Anek Lines
Patras – Brindisi (IT)	Grimaldi Lines

Source: Port of Patras

Port of Igoumenitsa - Lines
Igoumenitsa - Bari (IT)
Igoumenitsa - Ancona (IT)
Igoumenitsa – Venezia (IT)
Igoumenitsa – Brindisi (IT)

Source: Port of Igoumenitsa

Port of Iraklion - Lines
Iraklion – Athens (Piraeus)
Iraklion – Santorini (Thira)
Iraklion – Milos
Iraklion – Mykonos
Iraklion – Paros
Other destinations: Naxos, Tinos, Syros, Karpathos, Rhodes, Kasos, Sitia, Anafi, Chalki, Diafani, Ios.

Source: Port of Iraklion

Port of Lavrio – Lines
Lavrio – Kea (Greece)
Lavrio – Kynthos (Greece)
Lavrio - Lemnos (Greece)
Lavrio - Kavala (Greece)

Source: Port of Lavrio

Port of Chios	
Line	**Operator**
Chios – Piraeus (Greece)	Hellenic Seaways
Chios – Syros (Greece)	Hellenic Seaways
Chios – Mykonos (Greece)	Hellenic Seaways
Chios – Thessaloniki (Greece)	Hellenic Seaways
Chios – Mytilene (Greece)	Hellenic Seaways

Source: Port of Chios

Port of Volos - Lines
Volos – Alonissos (Greece)
Volos – Evia (Greece)
Volos – Skiathos (Greece)
Volos – Skopelos (Greece)

Source: Port of Volos

As it can be seen the lines cover all the main routes between Greece and other main point of the EUSAIR region.

1.3.3 Maritime traffic volumes (passengers and freight) and characteristics

In the tables below the main traffic flows are represented related to the last 5-year period. The key indicators used for each port are different, based on the characteristics of each port, in order to provide a more complete and useful scenario of sea-navigation flows.

Table 10 Traffic evolution in the port of Patras

	2016	2017	2018	2019	2020
Passengers	458.329	500.099	486.163	484.501	216.059
Trucks	118.827	117.038	116.902	118.532	108.186
Trailers	69.256	70.780	77.102	86.213	91.513
Buses	1.725	2.051	2.250	2.183	481
Vehicles	95.359	104.725	105.144	100.487	46.177

Source: Port of Patras

The Patras port has faced an important decrease in traffic due to the pandemic. The segment that suffered less is the truck segment, which faced just a slight decrease.

Table 11 Traffic evolution in the port of Igoumenitsa

Ferries	2016	2017	2018	2019	2020
Passengers	822.155	918.064	953.203	955.684	n.a.
Trucks	158.670	174.809	177.338	175.780	n.a.
Buses	1.845	2.274	2.546	2.428	n.a.
Cars	199.020	221.014	231.875	236.513	n.a.

Cruise	2016	2017	2018	2019	2020
Calls	7	8	14	5	n.a.
Passengers	7623	9092	12650	1053	n.a.

Source: Port of Igoumenitsa

The port of Igoumenitsa has significant traffics on ferries, it being the closes Greek port to other Adriatic countries.

No consistent set of data is available for the latest traffic evolution of the port of Piraeus. However, the number of container (TEUs) handled in the port can be presented.

Table 12 Traffic evolution in the port of Piraeus

	2016	2017	2018	2019	2020	2021
Container volume (TEU)	3.735.804	4.120.343	4.886.050	5.650.000	5.437.477	4.690.000

Source: Port of Piraeus Not.

The relevant growth of container traffic at Piraeus is evident, until the COVID crisis started a slight decline.

In the table below it is possible to see the most relevant traffic of the years 2020-2021 for the Port of Thessaloniki. It can be seen that the recent trend is that of an increase in all traffic categories, except for a slight decrease in liquid bulk traffic.

Table 13 Traffic in the port of Thessaloniki

Years	2020	2021
General cargo (ton)	5.948.911	6.179.402
Liquid bulk (ton)	7.837.899	7.484.823
Dry bulk (ton)	3.304.453	3.752.582
Containers (tons)	460.724	470.645
Total tonnes	**17.091.263**	**17.416.807**

Source: ESPO

For the ports in the islands such as Iraklion, Chios and Volos, traffic figures, where available, have been presented above, in the ports' descriptions.

1.3.4 Digitalization

The digitalization level in Greek ports is, in general, limited. In the ports of Piraeus and Thessaloniki, some relevant initiatives are worth mentioning.

The **Piraeus Port** Authority is committed to enhancing the strategic significance of its port in the international vehicle trade. To achieve this goal, the authority has made the decision to invest in comprehensive digitization and optimization efforts. In a bid to sustain the growth it has experienced in recent years and further solidify its strategic position, the Piraeus Port Authority is rolling out an intelligent IT system. This system is designed to provide end-to-end transparency for all supply chain processes, enabling the tracking of vehicle flows passing through the port. Moreover, the algorithms embedded within this system have the capability to optimize operational procedures within the port in real-time, offering advanced planning solutions. Consequently, this system provides the Port Authority with the advantage of enhancing the quality of its services and the adaptability to devise new business processes. The implementation of this system empowers the Piraeus Port Authority to more efficiently utilize its existing resources and continuously refine its operations. Additionally, it enhances the Port Authority's capacity to manage its car terminal effectively[20].

The Port of Thessaloniki has achieved a significant milestone by becoming the first Greek port to embrace blockchain technology[21], incorporating a platform (TradeLens) that aligns with the port's overarching vision of evolving into a smart port. This entails harnessing smart technologies to digitize systems, thereby offering innovative and top-tier services characterized by streamlined procedures. Ultimately, this transformation aims to generate value not only for the port itself but also for the broader port community. The platform is designed to facilitate efficient, transparent, and secure information exchange, fostering enhanced collaboration and trust throughout the global supply chain. The implementation of this platform empowers the port to make substantial enhancements in asset and yard management by leveraging data from partners. Simultaneously, it contributes to cost reduction by eliminating the need for individual connections to each shipping line and the broader port community.

[20] www.inform-software.com

[21] www.porttechnology.org

1.3.5 Alternative fuels

The availability of alternative fuels in Greek ports is, in general, limited. However, an important set of initiatives is ongoing related to the diffusion of LNG in Greek ports. Greece seeks to become a regional marine bunkering and distribution hub for LNG in the Eastern Mediterranean, in line with the EU co-funded "Poseidon Med II" project. This project (initiated in June 2015 and worth 53.3-million-euro) offers a roadmap for the extensive adoption of LNG as ship fuel in Greece, Italy, and Cyprus with the participation of six ports: Venice in Italy, Piraeus, Patra, Iraklio, and Igoumenitsa in Greece, and Limassol in Cyprus. The port of Piraeus, Greece's largest port and a landmark Sino-Greek cooperation in the country, stands to benefit greatly from the introduction of LNG bunkering, as its proximity to the Revythoussa hub means the ship-to-ship transfer is possible even without the need to build storage facilities. Another relevant initiative is the BlueHUBS project, ongoing since 2019, at the ports of Heraklion and Piraeus (together with the port of Limassol in Cyprus), which includes:

- The construction of two LNG Bunkering Vessels serving the purposes of bunkering the LNG fuelled vessels and the small-scale mobile LCNG stations of the respective ports.

- The supply of the Mobile LCNG Stations serving the purposes of refuelling the CNG fuelled port heavy duty vehicles and buses.

- The supply of one small fleet of LNG tanker trucks with bunkering equipment.

Other initiatives in the field of alternative fuels are those related to onshore power supply (cold ironing), especially with the INTERREG-funded projects ELEMED and EALING. ELEMED had the aim to implement a pilot action at the Greek port of Kyllini to pave the way for cold ironing across the Eastern Mediterranean and will offer onshore power supply and electric propulsion alternatives for ships servicing the Zakynthos and Kefalonia routes. EALING is a study proposing a common EU harmonised and interoperable framework – from a technical, legal and regulatory point of view - for the transition to electrification.

In the port of Igoumenitsa, the ALFION project, completed in 2022, and co-funded by CEF, carried out the final studies and engineering designs to implement onshore power supply technology at the port.

1.3.6 Key issues

The Greek maritime transport system is central to the national transport system and economy. The high traffic levels and the generally adequate infrastructure endowment do not however exclude some persisting issues, such as:

- Limited application of Port Community System / Single Windows
- Poor rail connections to/from major ports such as Patras and Igoumenitsa
- Inadequate connectivity among islands (domestic issue)
- Congestion during peak hours and peak periods in ferry and cruise ports
- In touristic ports, general lack of basic land-side facilities for passengers and vehicles, such as terminal buildings, pedestrian paths, parking areas, road access

Table 14 Key issues in Greek ports

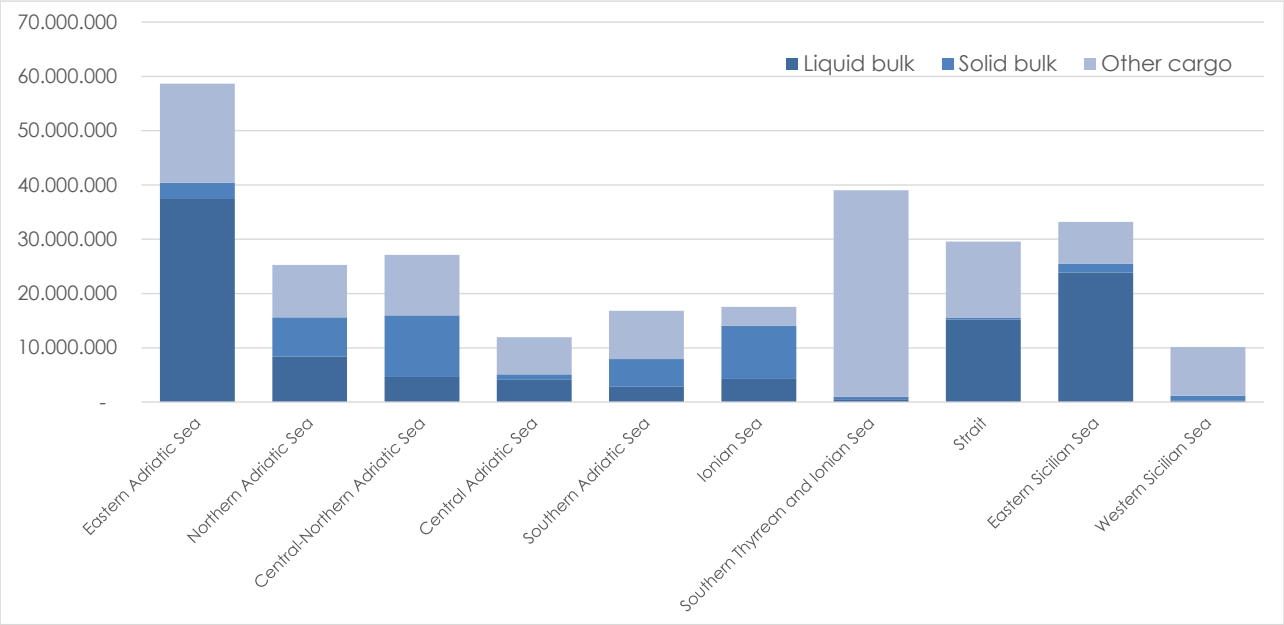
	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Ports in Greece	Low priority issue	Minor lacks	Minor lacks	Major lacks	Major lacks

1.4 Italy

1.4.1 Overview of traffic figures of Italian port systems in the EUSAIR region

Due the geographic coverage and relevance of Italian ports, this chapter has a different structure than those addressing the port systems of other countries, as it collects the main informations per each port in dedicated paragraphs. Firstly, the following charts show the most recent traffic figures (2021, source ESPO), presented per Port System (referring to the aggregate of ports managed by the same Authority) e per type of data (on tonnes, on TEUs, on Ro-Ro calls and on passengers). Historical data showing traffic evolution will be presented in the individual paragraphs dedicated to the main ports.

Figure 4: Traffic in tonnes in Italian EUSAIR port systems by type of cargo, 2021 (elaborations on ESPO data)



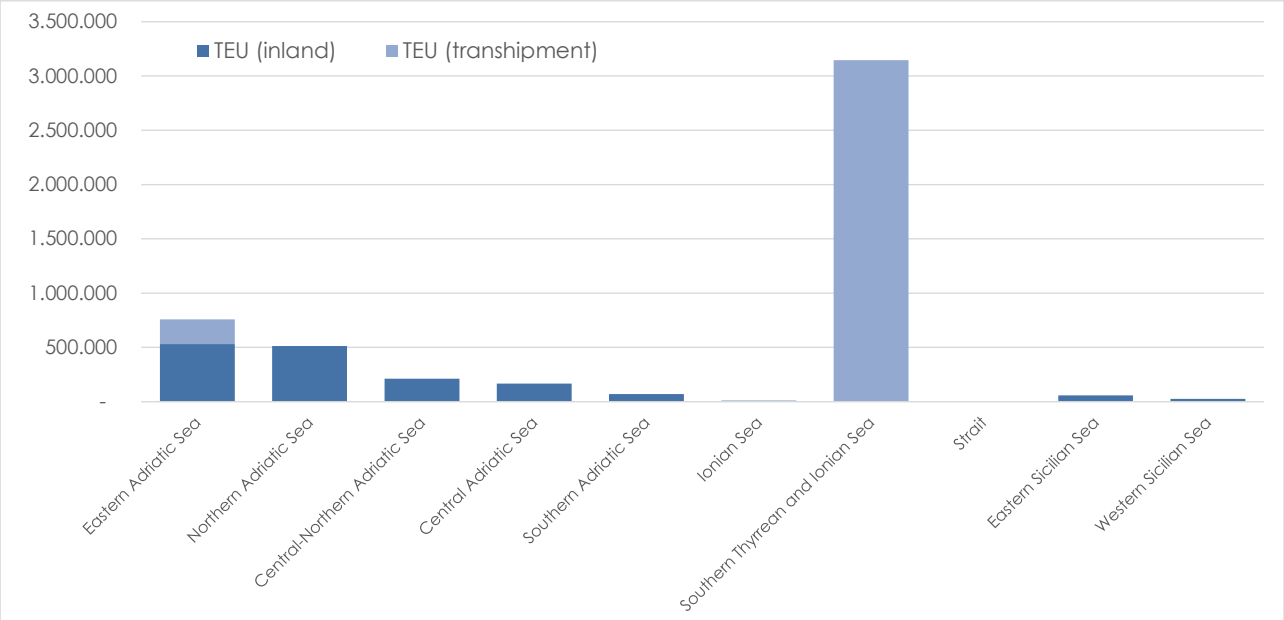
The highest volume of traffic is recorded in the port system of the Eastern Adriatic Sea, with the **Port of Trieste** being the main port (55.4M tonnes of the 58.6M total considering also the port of Monfalcone). The main traffic involves **liquid bulk (oil)**, which in Trieste equals **37.4 M tonnes**.

The second biggest port system in terms of tonnes is the system of Southern Thyrrenian and Ionian Sea with the **Port of Gioia Tauro** representing a major **transhipment hub** (38 M tonnes). The Eastern Sicilian Sea port system also stands out mainly because of a specific segment, that is the 23.8 M tonnes in **liquid bulk** of the **port of Augusta**.

A more balanced traffic mix characterises the Adriatic ports:

- The Central-Northern Adriatic Sea port system, represented by the **Port of Ravenna**, totals 27.1 M tonnes;
- The Northern Adriatic Sea port system reaches 25.2 M tonnes, mainly thanks to the **Port of Venice** (24.2 M tonnes);
- The Southern Adriatic Sea port system reaches 16.8 M tonnes, mainly in the Ports of Brindisi (7.6 M) and Bari (7.3 M);
- The Central Adriatic Sea port system totals 11.9 M tonnes, mainly thanks to the **Port of Ancona** (10.8 M tonnes).

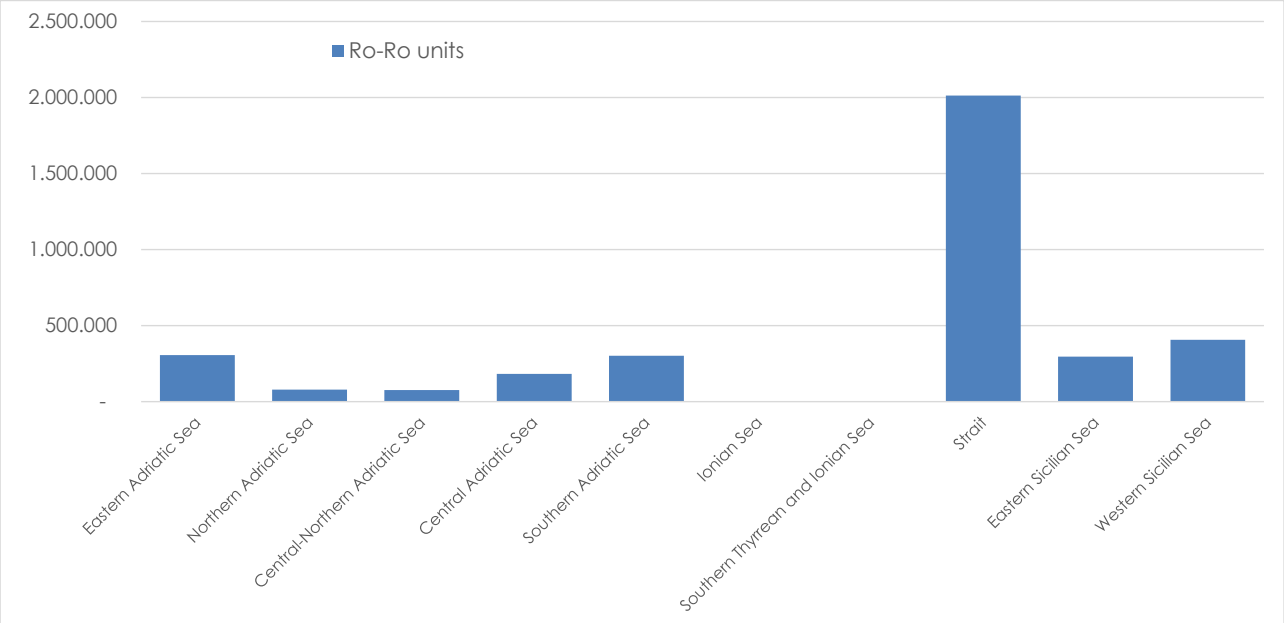
Figure 5: Container traffic in Italian EUSAIR port systems by container origin/destination, 2021 (elaborations on ESPO data)



As shown in the above chart, **container traffic** figures are clearly dominated by the data of the **Port of Gioia Tauro** transhipment hub which accounts for more than 3 M TEUs, all of which are in transit to/from other ports. As for the other ports, the systems in the northern-eastern Adriatic stand out, with the **Port of Trieste (758 thousand TEUs**, mostly to/from inland, but with a relevant share of transhipment, equal to 30%) bringing the total TEUs of the Eastern Adriatic Sea port system to the second spot among Italian EUSAIR port systems; the Northern Adriatic Sea port system, overall, has a similar container traffic, with the Port of Venice accounting for 513 thousand TEUs by itself (no transhipment). Other Adriatic port systems follow in the container traffic ranking (with the Port of Ravenna accounting for 213 thousand TEUs and the Port of Ancona

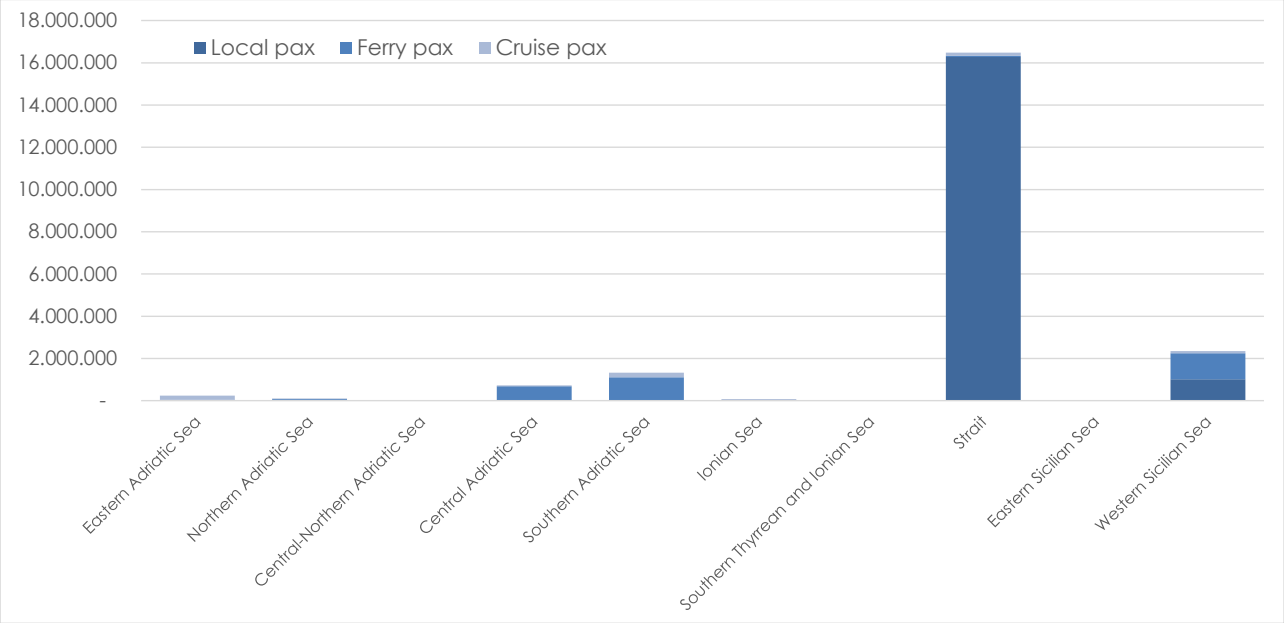
for 167 thousand TEUs), whereas lower values are registered in the ports of the southern regions (Port of Bari: 70 thousand TEUs; Port of Catania: 54 thousand TEUs; Port of Palermo: 14 thousand TEUs; Port of Taranto: 11 thousand TEUs; Port of Trapani: 11 thousand TEUs).

Figure 6: Ro-Ro traffic in Italian EUSAIR port systems, 2021 (elaborations on ESPO data)



The highest traffic of Ro-Ro ships among Italian EUSAIR ports is by far across the Messina Straits, represented by the local ferry flows linking Sicily and continental Italy. Such ports account for 2 M units in 2021, most of which in the **port of Messina (1.0 M units**) which is on the Sicilian side, whereas on the Calabrian territory the traffic is split between the two ports of **Villa San Giovanni** (856 thousand units) and **Reggio Calabria** (100 thousand units). Other relevant Ro-Ro traffic are present in the **port of Palermo** (320 thousand units; part of the Western Sicilian Sea port system), in the **port of Trieste** (305 thousand units; part of the Eastern Adriatic Sea port system) and in the **port of Catania** (295 thousand units; part of the Eastern Sicilian Sea port system).

Figure 7: Passenger traffic in Italian EUSAIR port systems by type of traffic, 2021 (elaborations on ESPO data)



For **passenger traffic** as well, the flows recorded by the Port System Authority of the Straits are by far the most intense. Most of it is represented by the ferry across the straits itself between Messina on the Sicilian side and Villa S. Giovanni and Reggio Calabria on the Calabria one.

The following paragraphs will present the main features of each of the main ports (generally, one per each Port System) in terms of its function within the maritime and intermodal transport system, infrastructural characteristics, multimodality and traffic evolution. Finally a chapter comparing the key issues of the Italian EUSAIR ports (1.4.12) will be presented.

1.4.2 Main ports – Port of Trieste

Port of Trieste (Italy)	
	
Port area mqs	2.3 mln
Quay length	12 km
Docks n.	58
Commercial traffic docks	15
Cruise traffic docks	2
Total number of terminals	17
Water depth (max)	18 m

The port of Trieste is managed by the Port System Authority of Eastern Adriatic Sea together with the port of Monfalcone. It is the first port for freight traffic and for rail forwarding in Italy and the main oil port in the Mediterranean. It is located at the intersection of two TEN-T Corridors (Baltic-Adriatic and Mediterranean) and its role is growing in terms of the relevance as transportation hub for maritime and inland trade flows within the Central and Eastern Europe macro-area and within the broader framework of intercontinental flows between Far East and Europe.

The port has been characterised by a very positive evolution in recent years, taking advantage of the availability of high depths (down to 18 m), suitable for the draughts of modern ships (i.e. 25,000 TEU) and exploiting the opportunities coming from trends in the industry and in the economy such as:

- the increasing weight attributed by operators to the opportunities offered by the railway and multimodality, both for economic and environmental reasons;
- the growing development of manufacture economy in central-eastern Europe, with the gradual shift of the economic centre of gravity of Europe from the North-West to the South / East;

- the growth of European trade along the maritime routes of the Middle and Far East (via Suez), with the development of international maritime services (eg Far East, Turkey, etc.) operated with large ships.

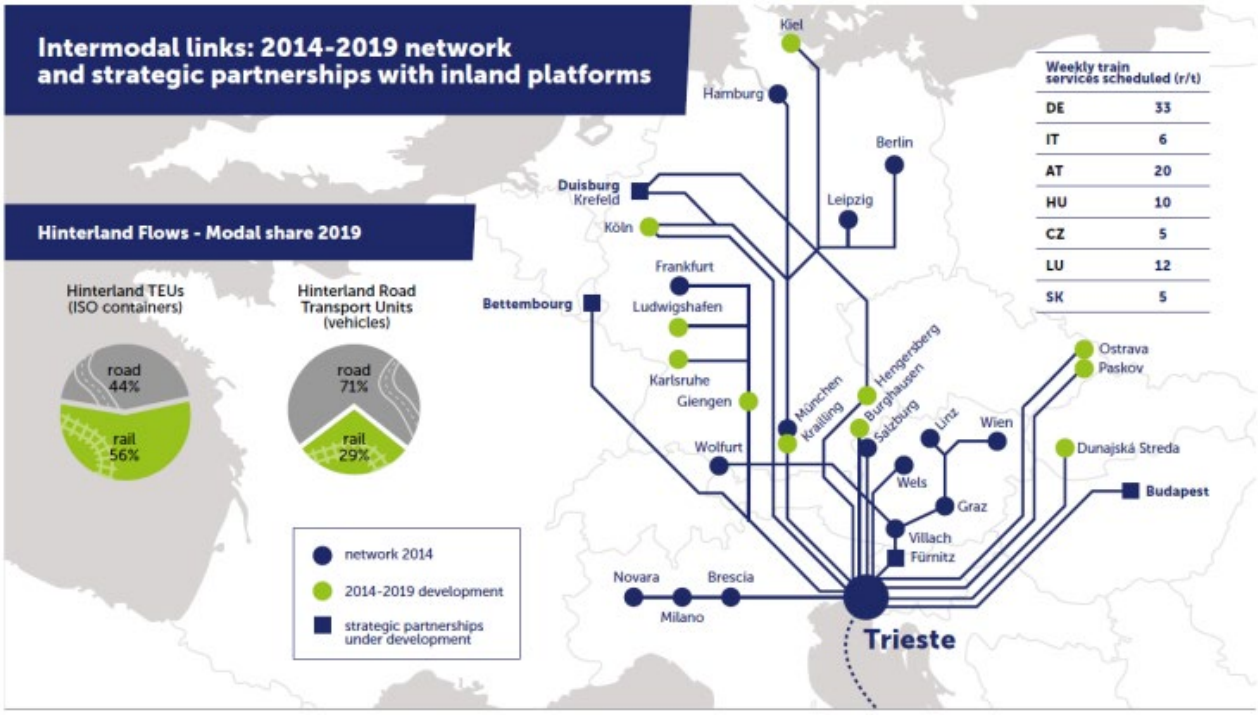
The total throughput of the Port of Trieste in 2021 equals 61.9 million tonnes[22], of which 53.7 M in import and 8.3 M in export. Most of this weight is represented by crude oil in import (42.3 M tonnes).

Table 15 Traffic in the port of Trieste, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	41.286.761	42.756.341	43.750.555	43.234.735	43.349.423	37.564.687	37.426.452	-1,6%
Solid bulk (tons)	1.607.232	1.971.001	1.639.595	1.665.508	1.717.294	540.827	3.024.273	11,1%
Other goods (tons)	14.238.885	14.516.913	16.557.304	17.776.259	16.930.728	16.043.253	18.190.365	4,2%
Container (TEU)	501.222	486.462	616.153	725.426	789.594	776.022	757.255	7,1%
Ro-Ro (units)	293.722	290.089	302.516	299.343	227.805	243.528	305.804	0,7%
Pax (units)	103.131	199.372	139.594	111.539	204.736	10.516	134.823	4,6%

As shown in the table above, in the last seven years, despite the 2020 difficulties due to COVID, there has been a remarkable growth rate in most traffic categories, especially solid bulk (+11% per year) and containers (+7% per year), going along the growing importance of Trieste in terms of rail traffic. The **railway share** of traffic in the port of Trieste reached 56% in the container sector and 23% in the Ro-Ro sector (transport of trucks and road units by ship) in 2019; these indicators are already well above the targets set by the EU for the European system for 2030 (30%) and 2050 (50%).

Figure 8: The Trieste port as an intermodal gateway to central and northern Europe (source: AdSP Mare Adriatico Orientale)



[22] ESPO Statistics.

The **passenger maritime connections** to/from the port of Trieste, as of summer 2022, include: Durres (Albania); Mali Lošinj, Poreč, Rovinj (Croatia), Igoumenitsa, Patras and Corfu (Greece), Piran (Slovenia) and Ancona (Italy).

In terms of prospective strategies, the Port of Trieste has been acting along the following main guidelines:

1) **Energy and green transition** – Relevant initiatives in the field include the projects to provide the port with facilities for the shore-side supply of electric power (for Ro-Ro ships as well as for cruise ships, container ships and the logistics platform; plans for cold ironing involve the port of Monfalcone as well); the environmental and productive recovery of spaces and resources (eg reclamation, circular economy), not only for the benefit of logistics, but also for the advanced and innovative industry, which is seen as a priority synergistic element of growing importance; the renewal of energy systems of port buildings (LED lighting); the installation of a 8 MW photovoltaic plant that covers almost 25% of the port's energy requirements. As regards the provision of LNG (Liquid Natural Gas) for ships, to date, no infrastructure is available; plans to build an LNG depot were carried out as part of the Railway Terminal and LNG Facility - RTALF project.
2) **Digitalisation –** The digitalized management of data and documents as well as the IT systems for automated control of traffic are increasingly central to the efficiency strategies of the sector. The Port Community System (PCS) called Sinfomar was developed starting from 2014 as a technological platform with which the Port System Authority is equipped to connect the main players that make up the Port Community and with the aim of optimizing the management of administrative procedures, tax and customs related to port logistics. Future evolutions of the PCS will include: evolution of the Sinfomar PCS modules relating to landing, boarding and anchoring fees to automate and digitize payments at the same time as they are fulfilled, in coordination with the Customs and Monopolies Agency; integration of freight villages and ports of the port System Authority with related coordination of intermodal services and coordinated traffic management; evolution of the Port Community System with a view to Multimodal Corridor Management with related developments also of a cross-border and international nature; evolution and diffusion of logistic-customs "smart road" at regional level, track & trace and fluidification of controls; use of the block chain for the exchange of information relating to payments of bills of lading and their bank release; development of interfacing procedures with the Maritime Single Window.
3) **Cooperation within the industrial and logistic network of the territory** - The attractiveness of the Port System is closely linked to "advanced manufacturing" components in the related area (in harmony with the growing opportunities, particularly evident in a post-pandemic world, offered by the so-called "reshoring"). In this respect, as the Three-Year Operative Plan puts it: "The operations aimed at productive reuse (e.g. for the benefit of advanced industry) of underused areas and spaces, often to be reclaimed, located in the port region, will be relevant in the projects developed by the System Authority, regardless of the circumstance that the use is logistic or more purely industrial. The strategy of the System is therefore to focus on the coupling between logistics and advanced industry and on the circular economy, lines of development that can also be favoured by the numerous opportunities for partnerships, already started or to be activated, with the institutions of innovation and research. Finally, the system of subsidiaries and investee companies, active in the system of the so-called "regional logistics platform" which includes port nodes, railway logistic

connection lines, as well as logistics platforms (freight village) is and it will be a further essential factor of integration.

4) **Development of competitive infrastructure -** From the infrastructure point of view, the recent development of the Port of Trieste has been focused mainly on the improvement of the Logistics Platform (completing the works for the new terminal of the Logistics Platform itself), on the design phase of the upgrade of piers (namely Molo VI and Molo VII) and on priority rail projects with the completion of interventions for strengthening of PFN (Punto Franco Nuovo) connections, the restoration of the section Servola-Aquilinia railway and other improvements to the railway adduction infrastructure.

The Port of Monfalcone

The port of Monfalcone is located some 30 km North-West of the Port of Trieste. Its traffics are mainly of a commercial/industrial nature. The main traffic category is represent by **solid bulk** (whose volumes exceed the Trieste ones with 2.4 million tonnes in 2021). Also in the port of Monfalcone, as in that of Trieste, the attention to the opportunities offered by the **railway** is very high; in fact they are strategic, as, in the process of integrating Monfalcone into the Port System, various components of the railway system are defined as priorities.

1.4.3 Main ports – Port of Venice

Port of Venezia (Italy)	
	
Port area mqs	20.450.000 m2
Total port lenght	n.a.
Quay lenght	30 km
Docks n.	163
Commercial traffic docks	n.a.
Cruise traffic docks	11
Total number of terminals	27
Terminals with /or rail connections	135 km
Water depth at terminals	11.5 m

The port of Venice is managed by the Northern Adriatic Sea Port System Authority together with the port of Chioggia; it is the eighth port by volume of commercial traffic in Italy and one of the most important ones in the Mediterranean Sea as regards the cruise sector.

The Port System of the Northern Adriatic Sea, consisting of the ports of Venice and Chioggia, is strategically located at the summit of the Adriatic Sea at the intersection of two European transport corridors, Mediterranean and Baltic-Adriatic, and is the terminal of the Mediterranean Sea Motorways Eastern that connect central Europe to Africa and the Middle East and terminal of the river rod that crosses the Po Valley allowing for fluvial-maritime intermodality and balanced transport of goods by barge. The port of Venice allows the arrival of ships with a maximum draft of 11.5 meters the limitations are given by the access channels. Continuous maintenance of the lagoon seabed, port accesses and access channels to Marghera is required.

The Port of Venice has a specific multipurpose vocation; the port works and interacts with various supply chains (agri-food, steel, chemical, energy), as well as commercial and tourist ones, not only in Veneto but

also in Northern Italy. Sectors with positive growth potential are the agri-food, steel, cement and building materials sectors.

The Port of Venice spans a total area of over 2,045 hectares, equivalent to 5% of the entire city of Venice and 11% of the urbanized municipal territory. Within its boundaries, there are over 30 kilometers of quays, housing 163 berths organized across 27 terminals, divided into commercial, industrial, and passenger terminals. The port consists of two main areas: the Porto Marghera area, where logistic, commercial, and industrial activities take place, and the Venice area, primarily developed in the Marittima area and minor berths, where passenger activities for cruise ships, hydrofoils, and yachts occur. **Porto Marghera** covers more than 1,447 hectares of industrial, commercial, and tertiary operational areas, with over 662 hectares of canals, basins, road surfaces, and railways. It has 12 kilometers of active quays accessible by vessels with a draft of up to 11.5 meters. Within the Porto Marghera area, there is a dense network of service infrastructure, including road connections (40 kilometers), railway tracks (over 135 kilometers), and optical fiber (7 kilometers). The "Venice" area, dedicated to passengers, spans an area of over 26 hectares, including 4.73 hectares of covered areas and 12.37 hectares of water surfaces in the Marittima basin.

Table 16 Traffic in the port of Venice, 2015-2021 (elaborations on ESPO data)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*CAGR 2015-2021*
Liquid bulk (tons)	8.953.918	9.031.737	8.787.511	9.362.986	9.017.717	8.575.492	8.415.159	-1,0%
Solid bulk (tons)	7.332.689	7.118.110	6.845.549	7.380.731	6.253.688	4.937.674	6.439.556	-2,1%
Other goods (tons)	8.817.611	9.093.971	9.501.564	9.751.561	9.716.505	8.904.056	9.350.160	1,0%
Container (TEU)	560.301	605.875	611.383	632.250	593.070	529.064	513.814	-1,4%
Ro-Ro (units)	62.487	72.050	67.328	81.539	79.211	73.609	79.685	4,1%
Pax (units)	1.755.485	1.777.398	1.649.064	1.787.848	1.814.485	52.674	104.240	-37,5%

The 2020 decline in traffic due to COVID has lowered the average growth rate of the last seven years; however, the best performances are recorded in the solid bulk and packaged goods sector, sectors useful for supplying the hinterland manufacturing industry; on the other hand the passenger sector has been heavily affected by the regulatory limitations imposed at the local level. At the intercontinental level, traffic is mainly directed towards the Far East, touching the ports of Singapore, Hong Kong and Shanghai. There are also connections with the Red Sea (in particular with the Saudi port of Jeddah) and North Africa (Algiers, Alexandria, Damietta, Tripoli, Port Said). As far as short sea shipping is concerned, the infra-Mediterranean connections with Greece and Turkey are particularly developed.

Landside access to the port is provided by both road and rail. The Port of Venice is directly connected to the national and European road network (Baltic-Adriatic and Mediterranean corridors). The Port System Authority is working to improve the road access to commercial and passenger terminals, relieving the city streets from heavy traffic and making them safer. As for rail, The Port of Venice is equipped with over 45 kilometers of internal railway network, its own freight yard, and connects to the rest of Europe through internationally significant railway corridors. The Port System Authority aims to strengthen the railway network in support of intermodality and sustainable transportation. Currently the main mode used is the road one. The railway share, which currently stands at 8.5%, will increase thanks to the infrastructural implementations in progress, favoring the extension of the reference markets. 8.5% of the traffic leaving the port via pipeline is used to supply the Ferrara and Ravenna plants and the Mantua.

The **passenger maritime connections** to/from the port of Venice, as of summer 2022, include: Igoumenitsa, Patras and Corfu (Greece) and Ancona (Italy).

According to its Three-Year Operational Plan, the **strategic vision** of the port system is that of a port system integrated into the environment in which it is inserted, regulated, innovative, digital, green, connected to the energy / transport / logistics networks of Europe and the territory, active in the goods sectors and passengers at an international level, in support of the entire regional and macro-regional economic system, capable of catching the opportunities offered by the growth of rail traffic, at the service of maritime connections and logistics in the North-East, developing quality employment adapted to the needs of its production context in dialogue with the territory. As part of the funding of the "Complementary Fund" for ports of the National Recovery and Resilience Plan, the **electrification** of the docks is planned between the years 2022-2026 for the following docks: Marittima; Santa Marta; San Basilio; Riva VII Martyrs; Terminal Ro-Ro of Fusina in Marghera; New Passenger Terminal – North Channel in Marghera**.** The construction of a **LNG Small Scale depot** of the company Venice LNG SPA is expected by 2023.

In terms of **digitalization**, a relative initiative is ongoing for the digitization of dustoms procedures at the Port of Venice. This project, which involves the digitalization of import cargo inspections, brings about a significant acceleration of outbound traffic flows through electronic information exchange and the tracking of vehicles and goods within the port. The successful implementation in the Venetian port has yielded results that set a national standard of excellence. Thanks to the development of interoperability services between terminals, the Port System Authority, and the Customs and Monopolies Agency, and the use of advanced vehicle tracking devices, both administrations have been able to provide services to the port community that streamline vehicle transit.

Relevant factors affecting the evolution of the Port of Venice are the following**:**

- Legislative provisions at the national level - D.L. 45/2021 and the D.L. 103/2021 – that sanctioned the need to rethink the long-term future of the entire Venetian port system.
    1. Ideas Contest. The Decree Law 1 April 2021 n. 45, converted into law no. 75, provided for the creation of a competition of ideas for the construction and management of docking points outside the protected waters of the Venice lagoon that can be used by passenger ships of gross tonnage over 40,000 tons and by container ships for transoceanic transport.
    2. Large ships decree. The Law Decree 20 July 2021 n. 103, converted into law no. 125, containing urgent measures for the protection of waterways of cultural interest and for the safeguard of Venice, as well as defining the duties of the Extraordinary Commissioner, establishes that by 31.12.2021 the updating of the Morphological and Environmental Plan of the Lagoon is approved which, with the “new Mud Protocol” is a fundamental element for excavation activities.
- The reorganization and shortening of supply chains, that will open new markets compatible with the development of traffic in the ports of Venice and Chioggia and with the enhancement of the logistics function.
- The dynamics of orders for container ships, which are no longer oriented only to mega carriers, but also to medium-sized ships that still require depths of more than -12m; this is connected with the ongoing trend of regionalisation of supply markets;

- The evolution of the railway share, that in Venice has been growing in recent years; an exponential increase in international and national rail traffic is expected as a result of the extensive investment program financed by the resources made available by the European Commission.
- The implementation of the road and rail last mile system is the essential condition for efficiently responding to both the extraordinary growth in railway demand and the need to separate urban traffic from port traffic while maintaining the role of the Venetian port system as a Core Port. in the TEN-T network. This accessibility implementation must also include the upgrading of port railway terminals by introducing the intermodal function at the service of maritime and land-to-land traffic.

A focus

1.4.4 Main ports – Port of Ravenna

Port of Ravenna (Italy)	
	
Port area mqs	20,8 km2
Total port lenght	14 km
Quay lenght	8 km
Docks n.	17
Water depth at terminals	10.5 m

The port of Ravenna is the only commercial port in Emilia-Romagna and one of the main ports of the Adriatic for freight traffic. In terms of tonnage, the main sector for the Port of Ravenna is metallurgical products (6,4 M tonnes before the impact of pandemic – 2019), followed by agro-food products (5.5 M tonnes in 2019). While the COVID decline in terms passenger figures has yet to be made up for, the recovery after the pandemic brought the Port of Ravenna to record historical peaks of goods handled, with over 27 million tons in 2021. Furthermore, in the same year, the Ravenna Port Hub Project was launched.

Figure 9: Traffic in the port of Ravenna, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	4.227.860	4.339.528	4.547.703	4.623.994	4.643.362	4.154.282	4.650.727	1,6%
Solid bulk (tons)	10.091.865	10.734.033	11.413.706	11.301.203	11.167.726	9.433.803	11.307.208	1,9%
Other goods (tons)	10.419.264	10.889.203	10.552.161	10.759.144	10.445.160	8.819.396	11.142.116	1,1%
Container (TEU)	244.813	234.511	223.369	216.320	218.138	194.868	212.926	-2,3%
Ro-Ro (units)	70.109	79.036	69.727	69.347	66.853	63.373	75.781	1,3%
Pax (units)	43.152	48.002	51.584	19.320	17.536	408	1.946	-40,3%

The **passenger maritime connections** to/from the port of Ravenna, as of summer 2022, include Igoumenitsa and Patras (Greece).

The "Ravenna Port Hub" project is intended to place the port of Ravenna in a new competitive dimension. The planned works consist in:

- the deepening of the seabed at 13.5 meters with the dredging of over 4.700.000 cubic meters of material.
- in the construction of a new quay, approximately 1.000 meters long, for the new container terminal which will be built on the right side of the Candiano Canal in the Trattaroli Peninsula, and which will be connected to the railway line.
- in the structural adaptation to the anti-seismic legislation and the new backdrops of existing quays.
- in the construction of new urbanized and equipped logistic platforms in the port area for about 200 hectares using part of the material resulting from dredging suitably treated.

In a second phase, the excavation of the seabed will be completed to a depth of 14.5 meters.

The pillars of the strategic vision for the evolution of the Port of Ravenna include:

- **Innovation and digitalisation** (including the expansion of the Port Community System, as well as hardware and software solutions aimed at improving physical security, through the installation of technological elements on operational vehicles, and organizational security, and personnel training, increasing competencies for managing identified technological/informational processes and tool)
- The **green transition** (including the ongoing planning of cold ironing system at the cruise terminal, and the recent realisation of the LNG depot, that sets Ravenna as one of the leaders in this stream of innovation: the depot has a storage capacity of 20 thousand m3 with a yearly capacity of over 1 million m3 and the possibility to fuel up to 12,000 trucks and 48 ferries per year)
- The development of **multimodality and integrated logistics** (that includes the interventions that fall within the "Ravenna Port Hub" project, as well as major investments on the railway and road system for the last mile connections that include the realisation of a new rail freight terminal in "Sinistra Candiano")
- **Urban regeneration** and cohesion with the territory.

Landside connections to the road and railway network are already efficient and make the port easily accessible from major Italian and European markets.

1.4.5 Main ports – Port of Ancona

Port of Ancona (Italy)	
	
Port area mqs	1,4M
Quay lenght	333 meters (construction works in progress to obtain a 600 meters quay)
Terminals with rail connections	n.a.
Water depth at terminals (max)	14 m

The Central Adriatic Port Authority is the public entity that manages one of the main ports of the Adriatic north-coast: the port of Ancona (with the API refinery of Falconara). Besides that, it manages also the ports of Pescara, Pesaro, Ortona and San Benedetto del Tronto.

The main **port of Ancona**, is located in the centre of the Adriatic Sea. The port area is over 1.4 million m2, divided into passenger and ferry terminals, container terminals, and plants for solid bulk. The port has a strategic function in the Adriatic-Ionian Macro Region, as a terminal for international ferry lines to Greece, Croatia, and Albania. In particular, the Ancona-Igoumenitsa-Patras route has over the years become the main route between Greece and central Europe. Ancona is in fact the leader in Ro / Pax traffic between Greece and central-western Europe. Before the pandemic, more than one million passengers on ferries and cruise ships passed through the port of Ancona, bound for the shores of the eastern Adriatic (Croatia, Albania, Greece) and the Aegean. The **passenger maritime connections** to/from the port of Ancona, as of summer 2022, include Durres (Albania), Split, Stari Grad/Hvar and Zara (Croatia), Igoumenitsa, Patras and Corfu (Greece) as weel as Trieste and Venice (Italy).

Table 17 Traffic in the port of Ancona, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	4.724.195	5.025.241	4.643.313	4.607.454	4.434.506	3.445.604	3.698.201	-4,0%
Solid bulk (tons)	501.653	438.166	581.810	305.619	386.948	252.206	290.322	-8,7%
Other goods (tons)	3.371.662	3.477.096	5.812.977	5.906.014	5.945.728	5.153.710	6.832.103	12,5%
Container (TEU)	178.476	185.846	168.372	159.061	176.193	158.677	167.338	-1,1%
Ro-Ro (units)	136.581	141.744	148.660	147.650	143.874	63.327	183.251	5,0%
Pax (units)	1.010.144	1.005.079	1.090.639	1.151.266	1.189.441	376.989	724.661	-5,4%

As regards container traffic, major investments are underway to increase the depth of the port basin to -14 meters and extend the existing quay by 333 meters to 600 meters. Container traffic has developed in recent years, exceeding 150,000 TEUs of traffic per year and attracting all the main global carriers of container transport. Also in this sector, the port of Ancona reveals its vocation as a "Gateway to the East" at the service of the market basin of central Italy, as in the ferry and bulk cargo traffic of the port. Equally significant is the oil traffic generated by the API refinery in Falconara Marittima. The **port of Falconara**, in fact, with the API refinery, moves over 5 million tons of liquid bulks, mainly crude oil and refined petroleum products. The port has three types of moorings: a wharf (1,385 meters long with 5 to 8 meters draughts); a marine platform (equipped also for loading and unloading of crude oil with high viscosity and for refined oils); a mooring platform (16 km from the coast, 30 meters draught). In order to maintain the competitiveness of the port and the companies operating there, the Port System Authority of the Central Adriatic Sea is implementing the works plan envisaged by the current Port Regulatory Plan: two hundred and twenty thousand square meters of new yards with a 900 meter quay, depths of 14 meters, for container ships; a breakwater of seven hundred and seventy-six meters under construction.

The main terminals of the port of Ancona are connected to the **railway** and projects are underway for the extension of the track system; the port does not however have regular connections, but spot services.

The main **landside connections** are via the road network, via the state road SS16 that connects it to the A14 highway.

In terms of **green transition initiatives** (electrification), the Italian PNRR has already approved the works for the electrification of the docks through the project "Cold ironing system for ferry ships moored in the historic port of Ancona". The electrification of quay 17 of the port of Ancona is being carried out, intended for small and medium-sized boats; cold ironing columns are available for tug boats. The Fincantieri quay is adequate to allow electricity supply. As concerns alternative fuels availability (LNG), to date, no infrastructure is available. The feasibility design for a 9,000 m3 LNG storage facility (SUSPORT project) was carried out, but not feasible due to lack of space.

In terms of **digitalisation**, a Port Community System that communicates with customs and PMIS is available. The Port Community System solution, known as LISy (Logistic Information System), is an internet platform of the "single window" type, where procedures, data, and information are hosted on a secure central server, allowing use by authorized users through a standard web browser and in accordance with security policies; the system is capable interface and communicate with the existing computer systems used by operators, providing further flexibility to users.

The Port of Ortona

Among the other ports managed by the Central Adriatic Port System Authority, the port of Ortona stands out in terms of **commercial traffic** with 1.1 million tonnes in 2021. It is the main multifunctional commercial seaport of Abruzzo

region. It is located in a key position compared to industrial and productive areas of Central Italy specialized in the handling of the bulk, general cargo and project cargo. The port has spaces and infrastructures suitable for cargo, Ro-Ro and passenger traffic.

1.4.6 Main ports – Port of Bari

Port of Bari (Italy)	
	
Port area	285 ha
Quay lenght	3500 m
Terminals with rail connections	n.a.
Water depth at terminals (max)	12 m

The Port System Authority of the Southern Adriatic Sea includes the ports of Bari, Brindisi, Manfredonia, Barletta, and Monopoli following the Legislative Decree 4 August 2016, n. 169 “Reorganization, rationalization and simplification of the regulations concerning the Authorities”.

The **Port of Bari** is a port serving the southeastern region of Italy. The port of Bari is traditionally considered Europe's door to the Balkan Peninsula and the Middle East and is a multipurpose port able to meet all operational requirements. Cruise ship companies operating at the port include some of the most important companies worldwide (e.g., Costa Crociere, MSC, Royal Caribbean International).

Table 18 Traffic in the port of Bari, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	0	0	0	0	1.146	0	0	n.d.
Solid bulk (tons)	2.134.379	2.044.714	1.739.865	1.456.186	1.965.124	2.118.676	1.877.708	-2,1%
Other goods (tons)	2.935.845	3.564.988	3.922.062	4.032.899	4.133.575	3.542.822	5.426.720	10,8%
Container (TEU)	60.009	71.593	68.695	68.262	82.627	36.448	70.254	2,7%
Ro-Ro (units)	0	132.102	149.596	158.013	165.945	160.004	176.850	6,0%
Pax (units)	1.491.786	1.521.588	1.620.528	1.753.075	1.871.774	404.300	1.007.442	-6,3%

The main traffic category is the general cargo (5.4 million tons in 2021, and a yearly growth rate of almost +11% in the last seven years). Ro-ro traffic has grown remarkable as well, whereas passengers traffic has yet to recover the pre-pandemic figures. The **passenger maritime connections** to/from the port of Bari, as of summer 2022, include Durres, Sarandë and Vlora (Albania), Dubrovnik (Croatia), Igoumenitsa, Patras, Corfu, Sami/Cephalonia and Zakynthos (Greece), and Bar (Montenegro).

The current configuration of the Port of Bari is the result of a series of interventions that have occurred over time as new needs arose or particular trends emerged in the maritime transport sector. The port area extends for about 285 hectares with a total development of operational docks of about 3,800 ml, affected by different and heterogeneous types of traffic in transit, which provide for the exchange of both goods (conventional, black and white bulk, containers, Ro -Ro and cars and steel products), and passengers (cruises and ferries), increased in recent years before the pandemic, thanks also to the Cruise Terminal and the general increase in the services offered to ferry traffic. No railway system is available in the port.

The **landside access** is provided within the network of urban roads and state roads that eventually connect the port area, within 12 km, to the A14 highway.

In terms of **green transition**: to date, no cold ironing infrastructure is available. Plans have been realised for cold ironing for Ro-Ro, Ro-pax and cruise ships. As for LNG, no infrastructure is available; feasibility studies for LNG are still at an early stage.

In terms of **digitalisation**: In 2020, the activities for the activation of the application cooperation services between PCS GAIA and the AIDA customs information system were completed within the “PROG0101” project. Within this project, the main interventions involve the digitization of boarding/disembarking procedures, entry/exit from port nodes, tracking of goods within the port area, as well as the computerization of port fee payments at the Port of Bari.

1.4.7 Main ports – Port of Taranto

Port of Taranto (Italy)	
	
Port area mqs	3,2M
Water depth at terminals (max)	25 m
Total port length (ml)	9.995 ml

The **port of Taranto** is the final node of the railway / road terminal of the Scandinavian-Mediterranean corridor (Helsinki / Malta) and a maritime hub that connects the corridor to Valletta. Located in a strategic position to the main routes between East and West, the port of Taranto is a node serving commercial traffic between Europe and the rest of the world and for national and Euro-Mediterranean short-haul traffic. The port is located on the northern coast of the gulf of the same name. Its infrastructures are distributed along the north-western sector of the Great Sea (Mercantile Port and Industrial Port) and immediately outside it towards the west.

The port of Taranto includes a container terminal (with a prospective depth of -16.5 m and a capacity of 2 / 2.5 million TEUs); an iron and steel terminal, linked to the steel plant of the former ILVA, today Acciaierie d'Italia; an oil terminal, linked to an important refinery owned by ENI Refining & Marketing; a cement terminal: the area under concession and the related plants are currently being remodelled.

Table 19 Traffic in the port of Taranto, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	6.038.432	5.534.334	4.589.968	3.779.132	4.344.056	4.278.384	4.256.063	-5,7%
Solid bulk (tons)	11.715.233	13.736.471	11.347.052	11.702.407	9.170.869	8.290.602	9.771.650	-3,0%
Other goods (tons)	4.811.578	5.398.043	5.711.268	4.951.896	4.610.246	3.208.996	3.501.470	-5,2%
Container (TEU)	0	375	0	0	0	5.512	11.841	n.d.
Ro-Ro (units)	0	1.592	101	0	0	0	0	n.d.
Pax (units)	358	0	8.546	658	9.205	0	80.309	146,5%

As shown in the table above, the most relevant traffic type for the port of Taranto is the bulk traffic, thanks to the presence of the steel plant as highlighted in the description of the port; in fact, the growth and declines in this type of traffic are strongly linked to the evolution of the business of said steel plant.

The infrastructural planning of the Ionian Sea Port Authority System aims to make the intermodal development of the port a stable objective. The Port of Taranto is located outside the city center and access to major communication routes is immediate thanks to the direct connection with the motorway network. From a railway point of view, the port is connected to the Bari-Bologna Adriatic backbone. Starting from 2022, the reactivation of the **railway connections** with the national network is expected, with the collaboration of Mercitalia Rail. It will therefore be possible for containerized goods to reach the central hub of the Bologna freight port and destinations in Northern Italy and Central Europe from the port of Taranto in about 34 hours.

The Port Authority is the implementing body of the “Distripark” project – recently renamed “Eco-industrial Park” - which provides for the promotion, activation and completion of technical-administrative procedures and the works for the construction of a logistics platform in retroport area, as well as the interventions connected to the creation of an intermodal transport network capable of facilitating the development of logistics, in an area of n. 75 hectares.

As part of the PNRR, interventions are planned for the construction of **cold ironing** plants at the public docks, at the Multi-sectoral Pier and at the Petroli Pier. Among, the priority objectives of the port the **digital transition** is envisaged, with the establishment of the Administrative Single Window is envisaged as well as of the implementation of the Port Community System, integrated with the security systems, to reduce port management times and make the logistics chain more efficient, at the same time promoting the telematic dialogue between the various actors of the port community.

1.4.8 Main ports – Port of Gioia Tauro

Port of Gioia Tauro (Italy)	
	
Port area mqs	4.4 mln
Quay lenght	5.1 km
Commercial traffic docks	2 (1 container + 1 RO-RO)
Total number of terminals	2
Water depth at terminals (max)	18 m

The port of Gioia Tauro stands out among the Southern Italian ports, and in the whole Mediterranean Sea, as a major transhipment hub for container traffic. The port benefits from the natural depth of its waters (up to 18 meters) and offers a 3.4 kilometer long quay. The facilities include 22 dock cranes capable of reaching up to 23 rows of containers. The port district has a total area of 4.400.000 square meters; it is located in a median position along the coast of the Gulf of Gioia Tauro. The entrance to the canal has a width of 300m and widens into an evolution basin with a diameter of 750m. The canal extends northwards for over 3 kilometers, with a width ranging from 200 to 250 meters. In terms of depths, at present, with the completion of the interventions envisaged in the 2007-2013 and 2014-2020 programming, the port infrastructure has been strengthened: in this regard, the eastern quay, with depths between -18/17 meters, is able to accommodate at the same time 4 large container ships (so-called mother ships).

Table 20 Traffic in the port of Gioia Tauro, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	0	870.000	935	918.924	88.328	749.348	515.000	n.d.
Solid bulk (tons)	0	0	0	0	0	0	0	n.d.
Other goods (tons)	0	0	0	0	0	0	0	n.d.
Container (TEU)	2.546.805	2.797.070	2.448.569	2.328.218	2.522.876	3.193.364	3.146.533	3,6%
Ro-Ro (units)	n.d.	70	92	152	101	47	42	n.d.
Pax (units)	0	0	0	0	0	0	0	n.d.

In 2020, in contrast to the other main European ports, thanks to the purchase of the Medcenter Container Terminal ("MCT"), the port of Gioia Tauro saw an increase in volumes reaching 3,193,000 TEU and placing itself from the thirteenth place in 2019, in the ranking of the main European ports, in ninth place. In 2020 the Port of Gioia Tauro activated the first railway connection that leaves from the port, in such a way as to be able to connect port operations (especially containers) with the hinterland. The railway gateway extends inside the customs area in the area already intended for freight transport which occupies an area of 325 thousand square meters in which there are six strips of tracks of 3825 meters of which 2761 in the container terminal area and 1064 in the intermodal terminal. Numbers that are in line with the major European railway hubs. In fact, the programming effort in terms of last mile rail connections over the years has allowed to achieve, with the "New intermodal terminal of Gioia Tauro", the railway accessibility of the Core port, as well as competitive, effective and efficient conditions for the terrestrial forwarding of containers, also by rail.

Within the strategic vision for the development of the Port, **digitalization** is a priority. Interventions both in the implementation and in the planning phase include the digitalization of logistics and ICT. In particular, with the completion of the works and software envisaged in the "Creation of an integrated platform of services aimed at offering users and operators of the port of Gioia Tauro a wide range of information services with high added value", the 'goal of making the logistics chain more efficient also thanks to the dialogue with the Unico Customs Office being implemented at national level and interoperability with the National Logistics Platform.

Energy and environmental efficiency is also a priority: coherent and synergistic projects aimed at significantly increasing the environmental sustainability of the port have been identified, and issues relating to efficiency, energy consumption and technological innovation in order to reduce polluting emissions have been developed. Initiatives envisaged by the Three-Year Operating Plan 2021-2023 include:

1) Development of LNG mixing and refuelling facilities under Directive 2014/94/EU of the European Parliament on the deployment of alternative fuels infrastructure.

2) Extraordinary maintenance of technological systems and energy efficiency.

1.4.9 Main ports – Port of Messina

Port of Messina (Italy)	
	
Port area mqs	820,000
Quay lenght	1.7 km
Total number of terminals	4
Water depth at terminals (max)	13 m

The **port of Messina** is the main port managed by the Port System Authority of the Straits, which manages four ports in two regions across the Straits of Messina, namely: the ports of Villa San Giovanni and Reggio Calabria in Calabria, and the ports of Messina and Milazzo in Sicily. The primary port functions in Messina consist mainly in the ferry of passengers and goods on heavy wheeled vehicles in the Strait of Messina, in cruising, in lo / lo handling, in the Motorways of the sea (Messina-Salerno line). There are also shipbuilding realities of national importance, which exploit the two existing and active dry docks. The port also has a multipurpose commercial terminal (Nuremberg pier) capable of satisfying ro / ro and lo / lo traffic. South of the historic port, in Tremestieri, there is another terminal dedicated to the connection with the mainland for heavy traffic and the construction of a new port is underway, also dedicated to ro / ro activities and the Motorways of the Sea.

The lack of dedicated infrastructures, both port-side and in the hinterland, has prevented the port from fully grasping the opportunities that have arisen in recent years with the development of motorways of the sea, for which the geographical position of Messina is privileged compared to other Sicilian ports given the shorter distances of the sea routes with the ports of central and northern Italy and the good internal motorway connections on the Messina-Catania and Messina-Palermo lines. Furthermore, from the infrastructural point of view there is a low resilience, especially in the Tremestieri terminal, where adverse wind condition easily

hinder operations and force the traffic of freight vehicles to be moved to the main historic port, with relevant implications in terms of landside traffic crossing the central areas of the city. In fact, the port is nested in the city centre's urban road network and the substantial ferry traffic uses urban roads to cross the city and reach the A18 and A20 highway.

Similarly, increases in car traffic due to summer journeys or during special holidays expose the capacity issues, bringing the areas closest to the ports of the cities of Messina, Villa San Giovanni and Milazzo to act as large car parks for moving vehicles with waiting times for ferries that can easily reach three / four hours with a navigation time that does not exceed twenty minutes.

The port has a **rail connection**, that is used by ferries of the Ferrovie dello Stato (national railways) group in order to allow train services to cross the Straits.

Table 21 Traffic in the port of Messina and Milazzo, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	17.168.452	16.578.453	20.055.484	18.314.248	17.856.829	14.880.732	15.206.560	-2,0%
Solid bulk (tons)	187.012	294.475	374.377	323.918	138.850	162.732	220.212	2,8%
Other goods (tons)	0	0	0	0	0	0	0	n.d.
Container (TEU)	0	0	0	0	0	0	0	n.d.
Ro-Ro (units)	0	807.452	807.452	217.537	995.571	866.203	1.055.403	5,5%
Pax (units)	7.909.616	8.114.504	10.959.555	11.500.074	12.487.727	7.264.665	8.771.794	1,7%

Due to the nature of available ESPO statistics, the table shows aggregated figures for the two main ports of the system: Messina and Milazzo. The liquid bulk traffic figures are linked to the Milazzo traffic generated by the oil refinery (see box below). The passenger figures (which include mostly the straits ferries but also the ferries to Aeolian islands to/from Milazzo) have a strong growth trend, which is already recovering after the 2020 slowdown due to the pandemic. The increase of Ro-Ro units is also to be underlined.

The main strategic efforts of the Port focus on **infrastructural advancements** in order to overcome the critical issues relating to the peaks of ferry traffic, and also to exploit the opportunities deriving from the possible growth of Motorways of the Sea connections, as well as specific segments of the cruise market.

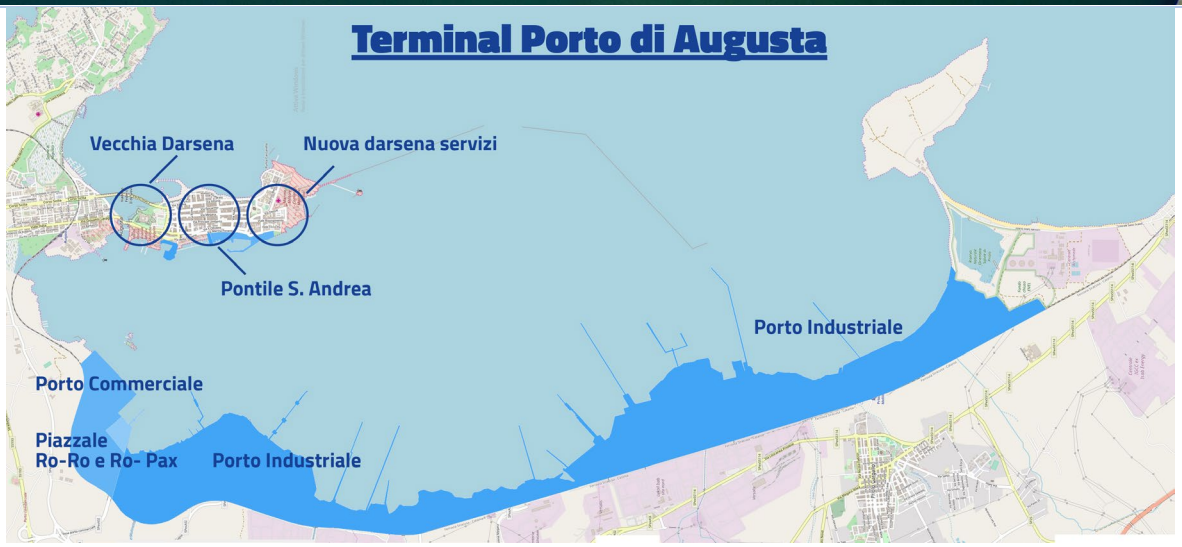
The Three-Year Operating Plan of the Authority also mentions as relevant initiatives relating to **Digitalisation** and **Sustainability**. Digitalization entails planning and implementation of a Maritime Single Window and of a Port Community System; in terms of sustainability improvement, initiatives include the planning of Cold ironing (especially for ferries), of LNG facilities and the optimisation of energy consumption.

The Port of Milazzo

Among the other ports managed by the Port System Authority of the Straits, the port of Milazzo stands out in terms of typical type of traffic in that it is located on the Northern Sicilian coast, in the Thyrrenian Sea, and does not involve the ferry traffic across the Straits. The primary port functions currently develop in two main areas: in the historic port there is the connection of passengers and goods with the Aeolian Islands and Naples, the movement of goods and, in particular, of steel products; outside the water basin of the port, instead, there is a **crude oil refining terminal** of primary importance with three docking piers for large tankers with a potential for docking equal to four simultaneous units. This accounts for the **relevant traffic of liquid bulk** which brings the aggregate port system figures to more than 15 million tonnes in 2021.

1.4.10 Main ports – Ports of Catania and Augusta

Ports of Catania and Augusta (Italy)



Port area (m^2)	470.000 (Catania); 860.000 (Augusta)
Quays (n.)	26 (Catania); 43 (Augusta)
Quays length (m)	4200 (Catania): 1160 (Augusta)
Water depth (max)	-8 m (Catania); -18 m (Augusta)

Terminals with rail connections (n.)	-; -

The **port of Catania** and the **port of Augusta** are managed by the Port System Authority of the Eastern Sicilian Sea.

The port of Catania is located at the centre the Eastern coast of Sicily. The port is endowed with deep seabeds and its activities are varied: operations involve the commercial, cruise, shipbuilding, industrial and fishing sectors.

Table 22 Traffic in the port of Catania, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	8.995	12.880	26.232.138	5.047	0	0	0	-100,0%
Solid bulk (tons)	229.245	342.275	1.162.039	423.732	373.988	342.724	373.203	8,5%
Other goods (tons)	7.319.539	7.528.507	0	8.188.627	8.079.360	7.982.143	7.690.924	-0,6%
Container (TEU)	49.595	49.198	0	59.764	63.179	62.177	58.471	2,8%
Ro-Ro (units)	n.d.	281.090	0	316.657	296.990	306.077	295.956	1,0%
Pax (units)	223.137	243.746	0	223.139	313.138	61.618	20.391	-32,9%

In terms of traffic figures, the main category is “other goods” that has shown a solid growth until the pandemic, and even during 2020 has had a relatively low decline. The port is characterised by the proximity to the railway station, the metropolitan railway, the airport, the Interporto and the agri-food center and a good connection to the road and railway network around the territory. In 2017 relevant works in the port area (New Darsena project) forced most traffic operations to move to Augusta. In terms of **passenger maritime connections**, as of summer 2022 they include Naples and Salerno (Italy) and La Valletta (Malta). The **landside access** to the port is provided within the urban road network of Catania, with the main entrances of the port area being very close to the city centre and some 10 km away from the major roadways.

The **port of Augusta**, located in the province of Syracuse in Eastern Sicily, is included in the TEN-T “CORE "NETWORK as a Strategic Port of the European Union for its central position along the routes of international traffic. The port complex includes an oil and commercial area, a military base and a city-port with two docks. The port is divided into two parts: the external harbor and the internal harbor. From the sea, it is accessed through two entrances located along the overall 6.5 km long breakwater that protects it. Depths at the quays are appropriate for the specific type of traffic, reaching -18 m.

Table 23 Traffic in the port of Augusta, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	25.388.943	24.875.605	28.936.703	23.123.040	20.465.954	22.987.553	23.872.133	-1,0%
Solid bulk (tons)	953.665	816.212	5.031.904	1.069.828	956.659	1.042.452	1.243.769	4,5%
Other goods (tons)	0	0	7.653	0	0	0	0	n.d.
Container (TEU)	0	0	463.940	0	0	0	0	n.d.
Ro-Ro (units)	0	0	523.653	0	296.990	0	0	n.d.
Pax (units)	0	0	6.210.339	0	0	0	0	n.d.

The port of Augusta handles a total of up to 33 million tons of goods each year, consisting mainly of liquid bulk (almost 24 million tons in 2021) – in fact, the main activity of the port is represented by the maritime

transport of petroleum refining products. The remaining freight traffic, with an average annual handling of about 1.5 million tons, is mainly represented by solid bulk registered as fertilizers, cement, iron, timber, marble, basalt and coal. As mentioned, in 2017 the port hosted operations also in other traffic categories, moved from the port of Catania due to works ongoing in that port.

In terms of **last mile connections**, as the commercial port of Augusta is positioned outside the urban area, a greater level of road accessibility is present; the rail connection is instead currently missing, even though the connection project between the commercial port and the Core railway line it is at an advanced level of planning.

The Port System Authority of the Eastern Sicilian Sea has among its goals the development of new investments in **digitalization** and the **green transition**. In 2021, agreements with the Ministry of Infrastructure and Sustainable Mobility (Mims) were signed for the "Infrastructure and Network Digitalization Axis", allocating 5.2 million euros for the implementation of the "Smart Port Digital Ecosystem," which will automate all cargo loading and unloading operations in the ports of Augusta and Catania; additionally, 1.2 million euros were allocated to the "Green Ports Axis" for the installation of photovoltaic systems on shading canopies to generate electricity from renewable sources in parking areas near the ports of Augusta and Catania.

1.4.11 Main ports – Port of Palermo

Port of Palermo (Italy)	
	
Port area mqs	75.650 mqs

Water depth at terminals (max)	14 m

The Port System Authority of the Western Sicilian Sea manages four main ports: Palermo, Porto Empedocle, Termini Imerese and Trapani. The **port of Palermo** is one of the most relevant ports in southern Italy. The port is located within the city centre of Palermo, which, in addition to its role as an economic - commercial centre, is a historic city with a rich cultural heritage and rich tourism that represents an important industry not only for the city but also for its port. The main terminals of the port of Palermo are a container terminal (that accounts for some 14,000 TEU in 2021); a multipurpose terminal (that offers transport solutions for all goods that do not travel in containers: general cargo - cellulose and wood, fruit and other food products; rolling stock - trucks, new cars, operating machines, railway vehicles; or special loads – project cargo, exceptional loads in terms of weight and size); a ferry terminal; a bulk terminal (both for solid and liquid); a relevant shipbuilding terminal (the yards allow repairs of the hulls as well as maintenance interventions of the engine systems).

Container and cargo terminal

According to the Port Master Plan this area is dedicated to load and unload Ro-Ro, general cargo and containers. Among its main functions the Master Plan considers the use of the internal yards as parking areas for the trucks and vehicles waiting to embark. It is composed by four piers: Piave, S. Lucia, Quattroventi, Puntone, and Ro-Ro and Ro-pax traffics are using the following berths of the port of Palermo: Quattro Venti, Puntone, S. Lucia North, S. Lucia North, Piave North, Piave South. It is important to highlight that this part of the port as at the heart of important investments for the renewal of the basic infrastructures (quay wall, pavements and yards, maritime stations, consolidation of the wall, access infrastructures, renovation of the spaces).

Cruise and passenger terminal

This area is located on the Southern section of the port and is mainly dedicated to cruise traffic, using the Vittorio Veneto and Sammuzzo Piers, allowing the contemporary mooring of three cruise vessels. The Masterplan envisages one maritime station at the Vittorio Veneto Pier (currently under restoration) and one cruise terminal to be built on the Sammuzzo Pier. Within the Sammuzzo Pier a pilot tower will be located. Moreover, the cruise terminal and the maritime station will be used also for other purposes, such as events, temporary exhibitions, and touristic services.

Shipyards

This area is located on the Norther section of the port and is dedicated to host industrial activities connected with the shipyards. Two main areas are identified: one dedicated to major ships and one dedicated to minor ships. The first one, named D1 within the port Master Plan, includes the main breakwater of the port, as well as three dry docks. It is dedicated to repair and maintain the ships, as well as the dry berthing, the towage, the realization of major maintenance works. The second area includes various berths on the breakwater and one dry dock and two floating dry docks, and it is dedicated to host, repair and maintain minor ships such as fish boats and touristic ones. The main operator of the dry dock is Fincantieri. The dry dock allows operations (maintenance and revamping) of ships of up to 160,000 dwt.

Table 24 Traffic in the port of Palermo, 2015-2021 (elaborations on ESPO data)

	2015	2016	2017	2018	2019	2020	2021	CAGR 2015-2021
Liquid bulk (tons)	855.287	496.029	352.166	378.735	427.081	252.006	248.983	-18,6%
Solid bulk (tons)	211.277	112.845	46.316	35.954	14.746	274.945	102.508	-11,4%
Other goods (tons)	5.820.198	5.878.044	5.911.092	5.774.402	5.347.682	6.765.350	7.286.457	3,8%
Container (TEU)	12.896	12.160	13.310	15.962	14.124	13.294	14.107	1,5%
Ro-Ro (units)	235.157	273.533	266.952	257.712	221.134	246.387	320.503	5,3%
Pax (units)	1.804.140	1.911.973	1.815.613	1.986.941	1.954.601	946.340	1.279.659	-5,6%

The maritime traffic of the port of Palermo is mainly characterized by Ro-Ro cargo flows (Motorways of the Sea) with connections with other Mediterranean regions, including the TEN-T network and North Africa Countries such as Tunisia, Algeria and Morocco. This mode of transport is very suitable for the integration of long haul services (more than 700 km) with short road connections and during the last decade a strong and complex network of Ro-Ro Short Sea Shipping (SSS) services has rapidly grown within the Mediterranean Sea. **Motorways of the Sea** services regularly connect the port of Palermo with Genova, Civitavecchia, Napoli, Cagliari, Livorno, Salerno, various minor islands - in particular Ustica and the Eolie – and also with Barcelona, Valencia, Marseille, Tunisi, Algeri and Morocco.

Considering the transport modal split of hinterland traffic, it is worth to underline that Palermo is **not connected by rail**, therefore 100% of hinterland connections are based on road transport.

The main problems addressed by the Three-Year Operational Plan in Palermo are:

- Lack of **functional organization of the spaces** within the port and overlapping of different transport flows on the same terminals, access infrastructures and storage areas.

- Need of **improvement of the functional characteristics of the port** in terms of efficiency of the logistics operations, spaces and infrastructures for the movement of goods and passengers whose characteristics are not suitable to host modern ships. Dredging works, reinforcement of the piers and basic infrastructures, demolition or requalification of existing structures and equipment of the port are necessary interventions to resolve such problems.

- Need of **new interface areas between the port and the city** with a new organization of the access infrastructures and the recovery of great historical and cultural value areas.

- **Sustainable and "green ports" innovation** according to a balanced relationship between the sustainable development of port activities in order to reduce the impact produced on the surrounding urban environment. Also **digitalization and innovation** of the port management tools to ensure the respect of the highest international standards in safety and control of the port activities. In this respect, the "Smart Port" project, launched in 2021, includes the implementation of integrated energy efficiency interventions in the port facilities of Palermo, Termini Imerese, Trapani, and Porto Empedocle, as well as the introduction of innovative smart technologies and Internet of Things (IoT) solutions. These practices will also improve the energy efficiency of the port. Furthermore, to provide information and guide visitor traffic, the development of a digital wayfinding and digital signage platform is planned. This platform will be accessible through an app, available for iOS and Android systems, and interactive touch-screen totems positioned along the route from the port to the city. It will offer tourists suggested itineraries and information about organized events in the area.

The Port of Termini Imerese
Termini Imerese is a node of the intermodal maritime and logistic system of the Western Sicily together with Trapani, Porto Empedocle and Palermo. This infrastructure plays a fundamental role in the Motorways of the Sea (MoS) system thanks to the huge commercial spaces and the possible future development. Termini Imerese is mainly specialized in the bulk cargo, but it is also used for some minor Ro-Ro pax traffic (53.000 passengers recorded for 2020). Considering its proximity with Palermo (30 km of distance), the Port System Authority decided to relocate in this port the bulk traffic handled in Palermo, releasing spaces in the main port of the Island and creating new development opportunities and capabilities for Termini Imerese. Its main purpose is to fix two weaknesses: (i) low protection of the breakwater, which is not complete; (ii) as a result, the presence of sandy depots that does not allow a safe docking of the RO-RO ships due to a low seabed (5mt of depth for the Veniero Pier).

1.4.11.1 Recap of main features and key issues of the Italian EUSAIR ports

After having analysed the characteristics of Italian ports, the following table aims at comparing them against some of the main dimensions that are relevant for the present study and for the strategic evolution of the port, namely: the depth of seabed at the quays and necessity of capital dredging; availability of infrastructure for the energy transition and electrification of operations; availability alternative fuel refuelling systems for maritime transport; implementation of advanced digital applications for the management of physical and informative flows (Port Community System and Maritime Single Window); availability of railway infrastructure and rail connections with the hinterland. The table shows information colored in **green**, if the dimension does not represent a critical issue for the port; in **yellow**, if the criticality is being dealt with in the planning of the port; in **red**, if it represents a critical issue.

Table 25 Main characteristics and issues in Italian EUSAIR ports

	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Port of Trieste	The port has natural seabed with a maximum depth of 18 meters.	To date, no cold ironing infrastructure is available. The design phase for powering cruise ships at the Bersaglieri pier, container ships at pier VII, Ro-Ro ships in Riva Traiana have been completed.	To date, no infrastructure is available. The plans to build an LNG depot were carried out as part of the Railway Terminal and LNG Facility – RTALF project.	Available PCS "Sinfomar" that communicates with customs and PMIS.	The port is strongly integrated with the railway, most of the docks are connected, works are being carried out for the enhancement financed under CEF The port has numerous weekly connections with Germany, Austria, Hungary, Czech Republic, Slovakia, Luxembourg.
Port of Venice	The port allows the arrival of ships with a maximum draft of 11.5 meters the	As part of the funding of the "Complementary Fund" for ports of	To date, no infrastructure is available. The construction of the	LogIS, Logistics Information System available.	The port and terminals of Marghera are

	limitations are given by the access channels. Continuous maintenance of the lagoon seabed, port accesses and access channels to Marghera is required.	the National Recovery and Resilience Plan, the electrification of the docks is planned between the years 2022-2026 for the following docks: Marittima; Santa Marta; San Basilio; Riva VII Martyrs; Terminal Ro-Ro of Fusina in Marghera; New Passenger Terminal – North Channel in Marghera.	Small Scale depot of the company Venice LNG SPA is expected by 2023.		strongly integrated with the railway.
Port of Ravenna	Depth ranging from 4.27 m to 10.5 m. Need for dredging of the canal port up to -14.50 m envisaged in the Port Regulatory Plan and funded within the "Ravenna Port Hub" project.	Unavailable. The electrification of the docks dedicated to cruise traffic is being planned and will be financed with PNRR resources.	In October 2021, the first small scale LNG in the Adriatic came into operation, which has a storage capacity of 20,000 cubic meters of LNG and a potential annual handling of over 1 million cubic meters of liquid gas.	Available PCS-Ravenna (dialogues with customs and PIMIS).	The port and terminals are strongly integrated with the railway The port has numerous weekly connections to the main terminals of central-northern Italy.
Port of Ancona	Quay 26 needs capital dredging to host container ships; bringin depth from 10.9 m to -14 m.	Cold ironing is available for tugboats and at the Fincantieri quay. Works for the electrification of the docks have been approved by PNRR.	To date, no infrastructure is available. A study showed negative results for the feasibility of a LNG depot due to lack of space.	Available LISy – Port Community System that communicates with customs and PMIS.	The main terminals of the port of Ancona are connected to the railway; the port does not have regular connections but spot services.
Port of Bari	Currently no intervention for increasing the depth of seabed at quays is planned.	To date, no infrastructure is available. Plans have been realised for cold ironing for Ro-Ro, Ro-pax and cruise ships.	No infrastructure available. Feasibility studies for LNG are at an early stage.	In 2020, the activities for the activation of the application cooperation services between PCS GAIA and the AIDA customs information system were completed within the "PROG0101" project.	No railway infrastructure available.
Port of Taranto	Currently no intervention for increasing the depth of seabed at quays is planned.	As part of the PNRR, interventions are planned for the construction of cold ironing plants at the public docks, at the Multi-sectoral Pier and at the Petroli Pier.	No infrastructure available. Feasibility studies for LNG are at an early stage.	The Administrative Single Window is envisaged as well as of a Port Community System, integrated with the security systems.	Railway connections are to be reactivated in 2022.

Port of Gioia Tauro	Depths recently increased to -18 m.	No infrastructure available nor planned.	Development of LNG mixing and refuelling facilities is planned.	Digital applications are limited. Upgrades in the field of port security and an extension of the PCS is planned.	Railway connections are available.
Port of Messina	No criticalities as for the depths of the main terminals.	No infrastructure available. Planning of cold ironing systems is at an early stage.	No infrastructure available. Planning of LNG facilities is at an early stage.	PCS not available. Low degree of digital applications. Digital transition plans at early stages.	Railway connection at the Ferrovie dello Stato terminal for their ferries carrying trains.
Port of Catania	No criticalities as for the depths of the main terminals.	No infrastructure available nor planned.	No infrastructure available nor planned.	Low degree of digitalisation.	No railway connections available.
Port of Augusta	No criticalities as for the depths of the main terminals.	No infrastructure available nor planned.	No infrastructure available nor planned.	Low degree of digitalisation.	Railway connections are missing, but a project for a rail link between the commercial port and the Core railway line is at an advanced level of planning.
Port of Palermo	Depths are appropriate for the hosted operations.	The design phase of Cold Ironing facilities has been started in 2021.	There are no facilities and no interventions are planned in the short term.	No PCS is available. A “Smart Port” project is ongoing to increase the efficiency, the management and the and security of the port activities.	No railway connections available.

Key issues identified are quite varied according to individual ports; however, in general, the table shows that the main areas of improvement for Italian EUSAIR ports regard the **endowment of facilities for the green transition** (cold ironing systems and LNG facilities), which are however the objective of projects within the Italian PNRR (Recovery and Resilience Facility), that will be presented in detail in chapter 2; and the **low degree of digitalisation**, especially for ports in the Southern regions.

1.5 Montenegro

1.5.1 Main ports

The Port of Bar has two different operators, "Port of Bar" H.Co. and "Port of Adria". In the "Port of Bar" H.Co. major percentage of shares are owned by the Government of Montenegro (54,05%) and in the "Port of Adria", major shareholder is Turkish company "Global Ports Holding", owning 62% of shares.

The characteristics of the Port of Bar are presented in the table below:

Port of Bar (Montenegro)	
	
Port area (m^2)	n/a
Total port length[23] (ml)	1619
Terminals (n.)	4
Freight terminals (n.)	3
Passenger and Ro-Ro terminals (n.)	1
Quays (n.)	4
Water depth (max)	14 m
Terminals with rail connections (n.)	2

The Port of Bar is strategically situated at the gateway of the Adriatic Sea, positioned 976 nautical miles (nm) away from the Suez Canal and 1190 nm from Gibraltar. This advantageous location grants the port notable competitive benefits compared to ports in the Northern Adriatic region. It reduces transit times and offers cost savings in maritime transportation. The port is seamlessly connected with the Belgrade-Bar railway and the road traffic network, making it an essential component of the intermodal transport chain; however the railway line is old and needs capacity upgrades.

Landside access

The area of the Port of Bar and Adria is integrated with the Belgrade-Bar railway and the road traffic network. The port is connected to the trunk road M-24, connecting Herceg-Novi, Bar, and Ulcinj. Additionally, the port is a starting point for the Bar-Belgrade railway line.

[23] Sum of the quays and berth lenght

Port terminals

Passenger terminal (1) - The Port of Bar features a dedicated terminal equipped with modern facilities to cater to passenger services. It comprises five berths specifically designed to accommodate passenger ships and ferryboats. Adjacent to the terminal, there is a designated area for road vehicles engaged in Ro-Ro (Roll-on/Roll-off) traffic through the terminal. The handling operations take place at an operational quay, approximately 400 meters in length, with a water depth ranging from 4 to 5.9 meters[24].

Freight terminals (2 + 1 Ro-Ro) - The port of Bar has three main freight terminals: 1) Dry bulk cargo terminal, specialized for all types of ores, concentrates, as well as other types of bulk cargo; it has an open storage area of 27,000 m^2 and a grain silo with a capacity of 30,000 t; 2) Liquid cargo terminal, the most "remote" terminal in the port of Bar and the water depth in front of the quay wall is 12 m; 3) Ro-Ro terminal with an open area where to stock the road vehicles. The terminal is located on the Pier 3 and the operational quay is 270m long with a water depth of 10 m.

Port of Adria (Montenegro)	
	
Port area (m^2)	518.790 m2
Total port lenght[25] (ml)	1440
Terminals (n.)	4
Freight terminals (n.)	3
Passenger terminals (n.)	1
Terminals with rail connections (n.)	3
Water depth (max)	12 m

Port terminals

Passenger terminal (1). The cruise terminal has the possibility to accept cruises over 300 m.

Freight terminals (3). The port of Adria has three main freight terminals:

[24] https://newbrain.adrioninterreg.eu/wp-content/uploads/2021/04/PORT-OF-BAR_Action-plan_NEWBRAIN_signed.pdf

[25] Sum of the quays lenght

- General cargo terminal; located on Piers 1 and 2, it has a 12.300 m^2 surface and is served by an operational quay that is 1010 m long with average depth of sea up to 11.5 m; it is qualified and equipped for acceptance and dispatch of all types of general cargo (final or semi-final products), and is endowed with railway lines in both piers, storing facilities and 15 portal cranes; the estimated annual capacity is 2,139,800 t/y.
- Container terminal; it occupies a surface of 80,000 m^2 and is served by an operational quay that is 330 m long (with two berths for container vessels) with average depth of sea up to 12 m; endowed with a railway line, its estimated annual capacity is 50,000 TEU/y.
- Timber terminal; it occupies a surface of 58,000 m^2 and it has the following functions: acceptance and despatch of transportation vehicles, loading, unloading and transhipment, storing sawn wood, wood products, sorting and forming units for despatch, drying of woods and other; also endowed with railway connections; its estimated annual capacity is 100,000 m^3/y.

1.5.2 Maritime connections overview

No data available.

1.5.3 Maritime traffic volumes (passengers and freight)

Table 26 Traffic volumes in Montenegro ports

Port of Bar	
Annual Dry bulk tonnage (2017)	1.349.761,95
Annual Liquid cargo tonnage (2017)	267.606,64
Annual Ro-Ro tonnage (2017)	83.168,74
Port of Adria	
Annual cargo tonnage (2019)	213.2017,00
Annual container volume (2019)	49,282 TEU

The Port of Bar is the largest port in Montenegro, where not only merchant ships dock but also many passenger ships and ferries that connect it with other Adriatic ports, especially those in Italy. However, the ports currently operates far below its capacity of 5 million tons of goods annually. The Port of Adria experienced significant business activities and achieved positive results in the year 2018. During the first three months of that year, the total cargo throughput reached 152,747 tons, demonstrating a substantial increase of 54% compared to the same period in the previous year. Furthermore, container throughput, measured in TEU units, saw a 7% increase, while general cargo traffic recorded a remarkable surge of 162% compared to the first quarter of 2017. When compared to the same period prior to privatization in 2013, the first quarter of the current year witnessed a 65% growth in container throughput and a 35% increase in general cargo traffic. This upward trend in traffic growth continued throughout the entirety of 2019, showcasing the port's consistent efforts in pursuing and achieving continuous growth[26].

[26] Source: https://www.portofadria.me/single-post/2018/04/19/port-of-adria-records-constant-cargo-traffic-increase

1.5.4 Digitalization

The port system authorities in Montenegro acknowledge the significance of digitization in optimizing port operations. Specifically, the Port of Bar and Adria have recognized the importance of digitalization and have initiated the first phase of a Port Community System (PCS) in 2014 with the support of the European Union through cross-border cooperation (CBC) and transnational initiatives. The primary objective of implementing digitalization in these ports is to facilitate efficient and secure exchange of operational documentation among all stakeholders within the port community. This digitalization effort aims to reduce service costs, enhance transparency of services for both public authorities and service users, and align operations according to their respective roles within the port community[27].

1.5.5 Alternative fuels

In 2019 the port system authorities of Montenegro launched an Action Plan for the sustainability of port operations, identifying the structure and characteristics that an ideal Green Port should have. For the elaboration of the Green Port Action Plan, it is of particular importance to consider that the energy infrastructure of the port is based on one system for the entire port. Because of this, it is currently not possible to split the energy consumption between the Port of Bar and Port of Adria. In addition, the Port of Bar is currently not able to allocate energy consumption to specific energy consumer groups of the port (e.g., warehouse, administration buildings, or cranes). Usually, this is the responsibility of the local electricity network operator. The deployment strategy used by the ports after the evaluation of the Action Plan focuses on these main points: emission reduction goals, energy management system (EMS), obtaining green energy and solar photovoltaics.

1.5.6 Key issues

The key issue for the development of the port of Bar and Adria relates not to its infrastructure but to the inadequate road and rail network supporting the flows of goods to/from the port itself; in fact the port operates below its capacity. Another key issue is represented by the need to improve the sustainability of port operations and optimise energy consumption.

Table 27 Key issues in Montenegrin ports

	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Ports in Montenegro	Low priority issue	Major lacks	Major lacks	Minor lacks	Major lacks

[27] https://isten.adrioninterreg.eu/wp-content/uploads/2020/04/DT1.1.8_Bar.pdf

1.6 Slovenia

1.6.1 Main ports – Port of Koper

The characteristics of the port of Koper are presented in the table below:

Port of Koper (Slovenia)	
	
Port area (m^2)	2,800,000[28]
Total port lenght[29] (ml)	3,300[30]
Terminals (n.)	12
Freight terminals (n.)	10
Passenger and Ro-Ro terminals (n.)	2
Quays (n.)	n/a
Terminals with rail connection (n.)	2
Water depth (max)	18 m

The Port of Koper holds a unique position as the sole port in Slovenia. It operates as a versatile facility and has experienced significant growth in traffic throughout the 2010s, surpassing 20 million tonnes in 2015. Notably, the port's main focus lies on container traffic, with nearly 1 million containers handled in 2021, and new vehicle shipments, reaching a peak of over 750,000 in 2018. This positions the Port of Koper as the largest container terminal in the Adriatic region and one of the major car terminals in the Mediterranean. Due to high utilization of existing port capacities, there are ambitious ongoing investment plans, estimated at up to 300 million EUR, to further enhance and expand operations. Moreover, the Port of Koper serves as a transit port, with over 70% of its traffic directed towards non-domestic hinterland markets, while less than 30% caters to the Slovenian market[31]. As a result, the port plays a broader role and holds significance within the European context, contributing to regional connectivity and trade.

[28] Thailand's Office of Industrial Affairs, Royal Thai Embassy in Vienna

[29] Sum of the quays lenght

[30] https://www.portsofnapa.com/port-of-koper

[31] https://www.espo.be/news/port-of-the-month-port-of-koper-slovenia

The Port of Koper is the only port in Slovenia. The port is a multipurpose one and its traffics have been growing fast in the '10s, overpassing the total of 20 million tonnes in 2015, and with the main focus on containers (almost 1 million in 2021) and new vehicles (more than 750,000 at the 2018 peak), making the Port of Koper the biggest container terminal in the Adriatic and one of the biggest car terminals in the Mediterranean. Since the existing port capacities are very well utilized, there are ambitious ongoing investment plans estimated at an amount up to 300 million EUR. The port is also a transit port, serving more than 70% to non-domestic hinterland markets and less than 30% to the Slovenian market. The port therefore has a wider European role and value.

Theport's strategic objectives for 2025 include[32]:

- Increasing the capacity and throughput of the port by 2025 to await the renewed twin track line ready, thus increasing the advantages and opportunities of this logistical route, while pursuing the goal of having at least 60 percent of transhipped quantities from the port of Koper transported by rail until the twin track line is renovated, after which the share is increased to 70 percent.

- Using new technologies, the Port will carry out a digital transformation of key processes. This will achieve connectivity between all internal and external stakeholders in the logistics chain and increase the level of cost efficiency.

- Achieving the highest standards of sustainable development under the EU ECO Management and Audit Scheme (EMAS) and continue to reduce the Company's carbon footprint through energy efficiency improvement measures.

- Considering the location of the port, a strategic agreement on coexistence and development will be reached with the Municipality of Koper and the Municipality of Ankaran. The port being of strategic national importance, a consensus on development will also be achieved with the country.

Port terminals

Passenger terminals (1) - The port of Koper has one main passenger terminal, whose quay has a depth of -10 m and a length of 420 m.

Freight terminals (10 + 1 Ro-Ro) - The port of Koper has eleven main freight terminals, whose characteristics of the terminals are shown in the table below.

Table 28 Terminals in the port of Koper

	General cargo terminal	Dry bulk	Liquid cargo	Container	Car and RO-RO terminal	Iron terminal
Surface (m2)	183,000	n.a.	-	270.000 m2	n.a.	n.a.
Quay lenght (m)	840	525	-	694.5	n.a.	630
Quay dept (m)	7-10	6 – 12.8 m	12.5	14.5	12.5	17.2
Berths (n.)	6	3	5	5	5	3
Storing area (m2)	183.000	120,000	203.000	-	895,000	-
Storing capacity (units)	-	-	-	19,130 + 9,547	45,000	800,000

[32] Source: Luka Koper's Strategic Plan

Railway tracks	-	-	-	5x700 m; 2x270 m; 2x300 m	15 (total lenght: 7.1 Km)	-

	Alumina terminal	Silo terminal	Reefer terminal	Timber terminal	Livestock terminal
Surface (m2)	n.a.	n.a.	n.a.	-	-
Quay lenght (m)	250	500	450	-	-
Quay dept (m)	14	13.5	8 – 11	-	4 – 8
Berths (n.)	1	n.a.	3	-	1+1
Storing area (m2)	-	-	27.800	155,500	
Storing capacity (units)	20.000	115.00	-	-	1,300
Railway tracks	-	-	-	-	

Source: Port of Koper

During 2020, the Port of Koper initiated a development project aimed at expanding its container handling capabilities and enhancing overall capacity. The first phase of this project successfully increased the capacity to its current level of 1.3 million TEU (Twenty-Foot Equivalent Units) per year. The port has plans for a second phase that will further elevate the capacity to 1.5 million TEU annually. These investments not only contribute to the annual capacity growth but also improve the daily yard capacity, bolstering the efficiency and effectiveness of container operations at the port[33].

In 2020, the Port of Koper has launched a development project designed to extend its container handling operations and increase capacity, whose first phase brought the capacity to the current 1.3 million TEU and whose second phase will bring it to 1.5 million TEU per year. In addition to the annual capacity increase, daily yard capacity will also benefit from these investments.

Port access (rail and road connections)

Railway connection: the port of Koper is connected by railway to the Slovenian railway network; in particular the railway service for freight transportation is provided to the following destinations.

Table 29 Railway connections to/from the port of Koper

Country	Route	Frequency
AT	Koper – Graz (Cargo Center Graz)	up to 10x weekly
	Koper – Villach – antenna to Vienna, Linz, Salzburg, Wolfurt (RCO/Adria Kombi)	up to 6x weekly
	Vienna – Koper (Adria Kombi/RCO dedicated)	2x weekly
	Koper – Enns – Salzburg – Koper with antenna to Wolfurt (SETG)	2x weekly

[33] https://www.porttechnology.org/news/port-of-koper-begins-expansion-of-container-terminal/

	Ybbs, Krems – Koper (Metrans) – export trains (Metrans)	2x weekly
	Linz – Koper (export trains) (Metrans – export)	4x weekly
	Koper – Dunajska Streda – Koper – roundtrip trains with antennas to Krems (Metrans)	7x weekly
	Koper – Enns – Koper (SETG)	3x weekly
	Koper – Salzuburg – Koper (SETG)	2x weekly
	Koper – Wolfurt – Koper (SETG)	1x weekly
HU	Koper – Budapest (Adria Kombi/RCO dedicated)	9x weekly
	Koper – Budapest – Koper roundtrip trains (Metrans)	14x weekly
	Koper – Budimpešta (EP dedicated)	2x weekly
SK	Koper – Žilina (Adria Kombi / RCO dedicated)	up to 6x weekly
	Koper – Žilina (Metrans dedicated)	3x weekly
	Koper – Bratislava – Terminal RCO (Adria Kombi / RCO)	4x weekly
	Koper – Dunajska Streda – Koper roundtrip trains with antennas to Kosice, TIPP Žilina (Metrans)	14x weekly
	Koper – Bratislava – Spap Terminal roundtrip dedicated (PKP Cargo International)	1x weekly
CZ	Koper – Č. Trebova with antennas to Prague/Ostrava/Plzen (Metrans) – via Dunajska Streda (Metrans)	5x weekly
	Koper – Ostrava (PKP – Terminal Paskov) dedicated (PKP)	1x weekly
	Koper – Mělník – Maersk dedicated (PKP)	1 weekly
	Koper – Ostrava Terminal Senov (Metrans dedicated)	2x weekly
	Koper – Nošovice (Adria Kombi / RCO)	4x weekly
	Koper – Dunajska Streda – Koper roundtrip trains with antennas to Česka Trebova (Metrans)	7x weekly
	Brno – Koper (Adria Kombi/RCO dedicated)	2x weekly
DE	Koper – München (Adria Kombi)	3x weekly
	Koper – München CDM (SETG)	1x weekly
PO	Koper – Wroclaw(Siechnice) – Ostrava – Koper (Baltic Rail)	2x weekly
	Koper – Wroclaw (Terminal Siechnice) – Katowice (Terminal Wlosienica) (Baltic Rail)	2x weekly
	Koper – via Ostrava (CZ Terminal Senov) – South Poland roundtrip trains (Metrans)	7x weekly
HR	Koper – Ljubljana – Zagreb (Adria Kombi)	5x weekly
RS	Koper – Ljubljana – Beograd (Adria Kombi)	3x weekly
SL	Koper – Ljubljana – Celje – Maribor (Adria Kombi)	2x daily
RO	Ploiesti – Budapest – Koper (Adria Kombi/RCO Hungary)	1x weekly

Source: Port of Koper

In the case of rail connections, key problems arise in particular due to the lack of infrastructure mainly because of the need of the second track on the Koper-Divača line, which is the port's main communication artery and where 60% of the goods transported by rail[34] are passing.

Highway connection. The port of Koper is connected to the main road axis that serves the country, the A1 (Šentilj - Koper) that connects the port to the following foreign countries:

- Italy, through the A3 (Gabrk - Fernetti)
- Austria, through the A1 (Šentilj - Koper) and A2 (Predor Karavanke – Obrežje)
- Croatia, through A2 (Predor Karavanke – Obrežje) and A4 (Slivnica - Gruškovje)
- Hungary, through A5 (Dragučova - Pince)

In the last period a big part of the Slovenian motorway has been completed, which definitely contributes to the accessibility to the port.

1.6.1 Maritime connections overview

The port of Koper has several cargo connections towards the Far East (with direct weekly routes to Singapore, Hong Kong, Shanghai and other relevant ports) and short sea connections to several Mediterranean ports, including the following weekly lines: Ravenna, Venice, Monfalcone, Koper, Piraeus, Ashdod, Haifa, Alexandria, Izmir, Gemlik, Lattakia, Tartous, Limassol[35].

1.6.2 Maritime traffic volumes (passengers and freight) and characteristics

The table below shows the most relevant traffics of the port of Koper:

Table 30 Traffic evolution in the port of Koper

	2016	2017	2018	2019	2020	2021
Dry Bulk cargo ('000s tons)	7,470	7,918	7,991	6,619	4,987	5,566
Liquid Bulk cargo ('000s tons)	3,593	3,877	3,855	4,307	3,323	3,331
General cargo ('000s tons)	1,534	1,378	1,526	1,280	946	1,126
Container volume (TEU)	844,776	911,528	988,501	959,354	945,051	997,574
Cars (units)	749,006	741,253	754,409	705,993	617,157	656,500
Passenger traffic[36] (Pax)	78,923	72,175	101,415	115,581	-	4,450

Source: Port of Koper

As it can be seen from the table above, the container traffic has increased in the 5-year period considered, on the opposite all the other freight traffic faced a significant decrease in the same period. Passenger traffic has increased from 2016 to 2019, showing a positive constant trend in the period considered. A relevant

[34] Integrated and Sustainable Transport in Efficient Network - ISTEN. DT1.1.5 - Local context analysis for Koper. October 2018

[35] Source: Luka Koper website.

[36] Including cruisers

rebound after the COVID19-related decline of 2020 has been recorded already in 2021 for all cargo segments, whereas cruise flows have started again after the total cancellation of activities in 2020.
Containers and cars play a significant role in the company's Strategic Business Plan until 2025, being identified as strategic cargoes. Currently, these cargo types constitute 46% of the overall maritime throughput[37]. Both containers and cars are considered commodities with elevated added value and relatively lower environmental impact compared to other cargoes. This highlights the company's focus on handling goods that bring greater value while being mindful of their environmental footprint.
Containers and cars, which are also identified as strategic cargoes in the company's Strategic Business Plan until 2025, now account for 46% of the total maritime throughput. In both cases, these are commodities with higher added value and less environmental impact.

1.6.1 Digitalization

The port of Koper's efforts towards digitalization in recent years have generated the implementation of a number of solutions[38]: in accordance with the Decision of the Customs Administration of the Republic of Slovenia from 2007, the system "TinO", a combination of TOS (terminal operation system) and Port Management system which supports ordering the services, planning of work, invoicing, storage, etc, is the official system for keeping records of cargo within the Port of Koper area. A Vehicle Booking System (VBS) is in place in the form of an online platform of Luka Koper for making truck appointments, checking cargo status and scheduling plans, recording truck entries in the port, reviewing the validity of annual permits for entry into the port, and editing data for organisations booking truck appointments in the Port of Koper. Also, an e-container system is in place, that allows the client to check the status of containers at the Luka Koper's Container Terminal.

1.6.2 Alternative fuels

The port system authority of the port of Koper is concentrating on the study of different forms of alternative fuels to be included within the port structure: specifically, we are talking about cold ironing and wood biomass. Port of Koper already provides shore-side electricity supply (cold ironing) for the berthed Slovenian Army vessels and tug boats. In this way on board the Army vessels and tug boats, the auxiliary power units don't use diesel fuel and would not generate emissions such as pollution and noise. The solution implemented in the port of Koper came out from the experience of the Port of Hamburg with the Siemens solution-SIHARBOUR (passenger terminal Altona), which was only the conceptual basis to start the activities in the port of Koper.

Regarding the investment in infrastructure that will enable ships in the port to connect to the electricity grid, a conceptual design study has determined the approximate value of the investment at EUR 58 million, which has been included in the 2021-2025 Port Development Programme.

[37] Source: https://container-news.com/port-koper-decade-growth/

[38] Source: port of Koper website

In the Port's plans, the installation of solar PV plants with the capacity of approximately 4 MWp is foreseen by 2030. Luka Koper prioritizes the comprehensive management of noise emissions and light pollution, ensuring that these impacts are effectively addressed. The port has implemented a system to mitigate these issues. Additionally, Luka Koper places great emphasis on marine protection, waste management, and energy efficiency. The port has established measures and protocols to safeguard marine ecosystems, efficiently manage waste, and optimize energy consumption to minimize its environmental footprint[39]. Luka Koper also fully manages the impacts of noise emissions and light pollution and has a system in place for marine protection, waste management and energy efficiency.

1.6.3 Key issues

The primary obstacle affecting the efficiency of operations at the port of Koper is the presence of **a single gate for vehicles** entering or exiting the port. Compounding the problem is the gate's **proximity to the city center**, resulting in traffic congestion, particularly during peak hours. To address these challenges and minimize delays and waiting times, it is imperative to establish a new entrance and create a direct connection between the port and the A1 highway[40].

This issue is related to the **need to speed up internal procedures** to smoothen the flows of vehicles to/from the port.

The current **low degree of digitalisation** poses a strategic risk of not achieving the goals of digital transformation in key processes in accordance with the strategic goals of the company; training activities are planned in 2022 to build the employees' digital competencies.

The main strategic risk arising from the external environment remains the uncertainty with regard to the timeline of completion of the **Divača-Koper second railway line**, and the obsolete, insufficient capacity of the existing track, which might threaten the further growth of throughput also before the construction of the second track.

Table 31 Key issues in Slovenian ports

	Adequate water depth	Availability of infrastructure for the energy transition and electrification of operations	Availability alternative fuel refuelling systems	Implementation of advanced digital applications	Availability of railway infrastructure and rail connections with the hinterland
Slovenia	Low priority issue	Major lacks	Major lacks	Minor lacks	Minor lacks

[39] https://www.gov.si/en/news/2021-02-23-port-of-koper-as-a-green-point-of-entry-into-the-heart-of-europe/

[40] Source: https://isten.adrioninterreg.eu/wp-content/uploads/2020/04/DT1.1.5_Koper.pdf

1.7 Overall remarks and main issues

The ports of the basin handled roughly 300 million tonnes in 2018 – less than the port of Rotterdam alone. There are nine ports with an annual maritime traffic of more than ten million tonnes, the largest ones being Trieste and Piraeus. Almost half of the basin's traffic is handled in the Northern Adriatic ports. With regard to cargo types, the region stands out with a comparatively high share of dry bulk and ro-ro traffic, with Trieste and Piraeus being the major players and another eleven ports handling ro-ro traffic in the basin.

A comprehensive comparison of the key issues across all countries is not useful since the issues are varied and depend on the specific functions and roles of port clusters. However, some general issues that are widespread through the macro-region's ports can be underlined as follows.

Table 32 Common issues in EUSAIR ports

Development of port infrastructures and capacity	Within the maritime sector of the Adriatic-Ionian region, in order to allow and strengthen a continued growth of flows, needs to **develop port infrastructures** have emerged. The need of additional terminal capacity for short sea shipping is particularly important.
Low degree of digitalisation	There is a need to **optimise port interfaces and procedures**. This is a common gap in ports all over the EU and the way towards the European Maritime Single Window and the EU-wide acceptance of Electronic Transport Documents is still long. As the 2020 MoS Detailed Implementation Plan recalls: by 2018, only two Member States had put in place regulations and pilot projects to accept Electronic Transport Documents and the EU-wide use was close to zero, while more than half of the 21 member states for which data was available had similar regulations in place for air transport where the use was already widespread (around 40%). Maritime Transport ought to catch up here because the direct competitor of short sea shipping – road transport – has a much lower administrative burden.
Missing links in last mile connections between ports and the network	Insufficient landside connections also affect the capacity of the transport system. Such connections need to be enhanced in order to ensure appropriate capacity and service level in comparison to their needs and assure that the development of the transport system has an impact on the socio-economic growth of regions. The Greek ports in particular – even those situated on the mainland –currently do not have sufficient demand for rail hinterland services, though they could potentially serve the Western Balkan countries.
Low degree of green transition advancements	A limited diffusion of **alternative fuels** availability is also apparent. There are installations in the Central-Northern Adriatic (Ravenna LNG depot) and plans for installations in most Italian EUSAIR ports and in Grece. On-shore power supplies (cold ironing) facilities are also lacking, suffering from problems represented by high investment costs for ports in cold ironing infrastructures, the low number of vessels geared with technical equipment

	for using the, and the price drawbacks for shore-side electricity; in fact, these are essential obstacles for the diffusion of cold-ironing systems in most port systems in the EU.

2 Planned projects in the macro-region

In this chapter, the projects in the maritime sector and for the improvement of the landside accessibility of ports are presented by country, and are grouped by main themes that the Masterplan means to focus on for the maritime sector, namely:

- ➔ Investments for improving the ports' operation, capacity and/or intermodal accessibility
- ➔ Projects aimed at improving the degree of digitalization
- ➔ Projects for the green transition (decarbonization initiatives and development of alternative fuels availability)

2.1 Albania

Albania is part of the Transport Community, an international organisation in the field of mobility and transport, consisting of the entire EU and the six Western Balkans regional partners. With them, Albania developed an Action Plan with the purpose of providing a list of short-medium term activities aiming at addressing critical issues in waterborne transport. The Government of Albania in 2016 adopted the Sectorial Strategy of Transport and a national Action Plan. The main goal of the Strategy is to have an efficient transport system, integrated in the region and in the EU network. The overall objective of the plan is to develop Albania's national transport system, and in addition, to significantly improve its sustainability, interconnectivity, interoperability and integration with the international and European wider transport system and region. The SST is implemented under the leadership of the Ministry of Infrastructure and Energy with other institutions and with the technical support provided by many international development partners. The strategy identifies 43 priority Policies for the 5-year period which include soft measures and investments divided in 144 tasks. In the maritime sector there are 47 tasks and 13 priority actions that can be summarized in 3 main strategic objectives:

1. Improvement of technical capacities of maritime administration and the institutions involved;
2. The development of maritime legislation to achieve EU standards;
3. Development of port infrastructure.

The Ministry does periodical monitoring reports of the Strategy, its aims is to measure the progress achieved so far in the implementation of the action plan of the strategy and to identify the challenges and the issues that need to be reviewed.

The Durres Port Authority also follow strategy based on the European and SEETO (Southeast Europe Transport Observatory) regional transport policies as part of the strategy of intermodal transport.

2.1.1 Infrastructure investment projects

Table 33 Infrastructure projects in Albanian ports

Port	Project description	Impact	Cost	Timeline
Durres	**Rehabilitation of Quays 1 and 2 on the Western Terminal** The project will consist in the extension of the two quays in order to increase the capacity for single calls	Increase port capacity	62,4M €	n.a.
Durres	**Infrastructural intervention/improvements on canal depth** The action consists in the implementation of the Durres Hub Project, aimed at resolving the bottleneck consisting in limited maritime infrastructure, and guaranteeing port competitiveness. It includes dredging works (to reach -10,5 meters) and new mobile cranes.	Increase port capacity Increase navigability	n.a.	2020-2025
Durres	**Improve and Rehabilitation infrastructure in the port** This action refers to the modernization of the existing Durres-Tirana railway line to rehabilitate the existing railway line from the future location of the Tirana Public Transport Terminal (PTT) to Durrës port for a length of 34.7km	Increase port accessibility Permit intermodal traffic	90,45M €	2020-2025

2.1.2 Decarbonization and development of alternative fuels projects

Table 34 Decarbonisation projects in Albanian ports

Port	Project description	Impact	Cost	Timeline
Durres	**Sustainability goals in the Durres Port Action Plan** In the SUPAIR project, an Action Plan leading to sustainability goals was defined for the Durres port, including the following actions: A. Revitalization of Green Spaces; B. Recycling Plan for a Sustainable Port; C. Mobility Plan for Durres Port Staff; D. Clean Energy Investment (renewable)	Increase sustainability of port operations	n.a.	n.a.

2.1.3 Digitalization projects

Table 35 Digitalization projects in Albanian ports

Port	Project description	Impact	Cost	Timeline

Durres	**Rehabilitation of Quays 1 and 2 on the Western Terminal** The project will consist in the extension of the two quays in order to increase the capacity for single calls	Increase port capacity	62,4M €	n.a.
Port	Project description	Impact	Cost	Timeline
All Ports	Establish and implement of the Albanian Vessel Traffic Monitoring and Information System (VTMIS)	Increase safety and vessels services	n.a.	2019-ongoing

2.2 Croatia

Croatia, after a long period of work completed in 2014, adopted the "Transport Development Strategy of the Republic of Croatia" for the period from 2014 to 2030. Nowadays there is the second phase of the strategy for the period 2017-2030. This document aims to assess and define the future measures in the transport sector related to international and international transport in all transport segments. The strategy includes 9 different "General Objectives" concerning passenger and freight transport, the development of intermodality and the reduction of the climate impact of the transport sector. It also contains more "specific objectives" about the development of single logistic center or transport mode. About the maritime transport the Strategy includes:

- The development of the competitiveness of port of Rijeka;
- The reduction of the environmental impact of maritime transport through the development of the fleet and environmental protection;
- The improvement of the modal split of freight transport across the Adriatic sea in favour of the maritime transport;
- The improvement of the level of economic efficiency of the maritime transport system;
- The improvement of the safety of the maritime transport system;
- The development of the integration of the ports into the local transport system.

2.2.1 Infrastructure investment projects

Table 36 Infrastructure projects in Croatian ports

Port	Project description	Impact	Cost	Timeline
Rijeka	**Upgrade of the Rijeka port infrastructure – Basin Rijeka** The project encompasses a range of activities aimed at refurbishing the infrastructure at various piers, including those in Prague, Budapest, Vienna, Visin, Orlando, and De Franceschi. These efforts involve the restoration of a total pavement area spanning 109,420 square meters, complete with associated installations. Additionally, the project entails the renovation of 12,161 meters of railway and 1,652 meters of crane tracks. As part of this initiative, sections of railway and	Increase rail accessibility of the port	33,66 M€	2017-2023

	crane tracks that are currently unused will also undergo reconstruction, ensuring alignment with European infrastructural technical standards. Importantly, it's worth noting that a substantial 85% of the project's funding comes from the European Union, supported by the Connecting Europe Facility (CEF) funds.			
Rijeka	**Upgrade of the Rijeka Port infrastructure – AGCT Dredging** The objective of the project is to eliminate the bottleneck at the Adriatic Gate container terminal. The project involves several activities, with one of them being the dredging of the seabed along the coastal wall of the southern berth's waterfront. This dredging operation will cover a distance of 100 meters and is intended to create a uniform sea depth throughout the entire operational Kostrena pier, which spans 428 meters at the Jadranska vrata container terminal. The goal is to achieve a consistent sea depth of 14.88 meters along this stretch.	Improve nautical accessibility	17,39M €	2018-2022

2.2.2 Decarbonization and development of alternative fuel projects

Table 37 Digitalization projects in Croatian ports

Port	Project description	Impact	Cost	Timeline
Rijeka	**SUSPORT – SUStainable PORTs** The primary goal of SUSPORT was to enhance the environmental sustainability and energy efficiency of the participating Adriatic ports. This objective was pursued through the implementation of concrete pilot projects in various areas, including noise reduction, improved air quality, and the reduction of CO2 emissions. SUSPORT stands out as the sole strategic initiative in the realm of maritime freight transport that has received approval from the program. It involves the active participation of all the Italian Port System Authorities located along the Adriatic coast, except for Trieste (including Venice, Ravenna, Ancona, and Bari, as well as Porto Nogaro). Additionally, it collaborates with major Croatian ports (Rijeka, Zadar, Split, Ploče, Dubrovnik) and enjoys the support of research and promotion agencies in both Italy and Croatia.	Improve institutional capacity and know-how on sustainability	7,14M €	2020-2022

2.2.3 Digitalization projects

Table 38 Green transition projects in Croatian ports

Port	Project description	Impact	Cost	Timeline
Rijeka	**Port Community Information System** The project includes design activities and construction of a unique standardized port information system that is compatible with the CIMIS system (Croatian Integrated Maritime Information System). The project is 85% co-financed by the EU through the CEF funds.	Improve the efficiency of data sharing	1,66 M€	2017-2022
Rijeka	**INTESA – Improving the efficiency and safety of maritime transport in the Adriatic** The project includes the adoption of real-time IT systems and navigation assistance, with the aim of improving maritime transport efficiency, navigation safety and harmonizing procedures in the Adriatic. The project activities encompass several key aspects, including: enhancing the efficiency of port procedures for unloading cargo from ships, whether by train or truck: improving the processes involved in ships entering and departing from the port; ensuring that safety and security requirements are maintained and protected when port activities are increased during unfavorable weather conditions developing and implementing an integrated Information and Communication Technology (ICT) tool designed for managing and transmitting crucial maritime safety information to all vessels operating in the Adriatic Sea. These initiatives collectively aim to enhance the overall efficiency, safety, and security of maritime operations in the region. It is part of the Interreg Cro-Ita 2014/2020 and 85% co-financed by the EU. The project is completed in July 2022.	Improve maritime transport efficiency	2,90 M€	2019-2022

2.3 Greece

For the transport sector in 2014 the Government of Greece developed a National Transportation Plan which covers all transport modes want provide the basis for sustainable transport infrastructure, competitivty and service development in Greece over the medium/long-term horizon (2027/2037). It will also determine the main actions that may receive financial support from International Financing Institutions and donors, especially EU and EIB. This plan is accompanied by other strategic plans and actions, two of them are the National Port Policy 2013-2018 and the National Logistic Strategy 2017.

This National Port Policy is redicted and revisited every 5 years by the Ministry of Shipping and Island Policy. Its objectives are the business development of the ports as well as their specialization based on business

criteria. Some of the most important objectives in the maritime sector are the rationalisation of maritime and port network, the implementation of ITS technologies, the improvement of accessibility to minor islands, the upgrading and development of port infrastructures in main ports and improve land connection between ports and the hinterland. The Plan also determinates the main actions that may receive financial support from international financing institution, especially EU (with ESIF) and EIB.

2.3.1 Infrastructure investment projects

Table 39 Infrastructure projects in Greek ports

Port	Project description	Impact	Cost	Timeline
Corfu	**Two new terminals** The project includes two different port terminals; a passenger one and a tourist one. The passenger terminal will have berth for 3 o 4 ferries while the marina will have 85 berths for private tourist boat or a small cruise ship. The project includes the reconstruction of a 600 m. long windward jetty and of a 160 m. long leeward jetty; dredging works; New buildings for passengers.	Increase the passenger capacity	4,5M €	2022-
Thessaloniki	**Construction of road connection** between Port of Thessaloniki and Egnatia Odos Motorway	Improve the last mile connection	87,7M €	2006-2023
Thessaloniki	**Container Terminal Expansion**. The project focuses on enlarging Quay No. 26 within the Container Terminal located at Pier No. 6. Its primary objective is to create deeper berths to accommodate the expected cargo capacities. This expansion effort encompasses the construction of pavements and drainage systems for the newly developed Terminal yards and the pre-existing areas of the Container Terminal. Additionally, the project involves the installation of electromechanical systems and the construction of new buildings to support the expanded operations..	Increase port capacity and nautical accessibility	130,0M €	2021-2023
Thessaloniki	**Rail and Road Connections inside port.** It consists of a reconstruction of the existing network and construction of new rail and road network inside the port area. It includes includes: ▪ Construction of new line for the rail connection of the container terminal with the port's west gate. ▪ Construction of new line for the rail connection of the bulk cargo	Increasing the accessibility of the port and rail and road last mile connections.	6,5M €	2019-ongoing

	terminal at the east part of Pier 6 (Quay n.24) with the port's west gate. ▪ Construction of infrastructure for manoeuvring and train deposition/composition. ▪ Reconstruction and upgrade of existing rail connection of piers with Gate 11. ▪ Reconstruction and upgrade of existing quay rail and road connections.			
Thessaloniki	**Construction of Dry Bulk Terminal**. The project involves the expansion of Quay No. 24, which comprises the eastern section of Pier 6. Its primary objective is to create deeper berths to accommodate the anticipated volumes of dry bulk cargo. Additionally, the project aims to enhance the quality of infrastructure by constructing new buildings in the area.	Increase port capacity and nautical accessibility	8,0M €	n.a.
Thessaloniki	**Unification and extension of Piers 4 and 5 into a larger one** The project consists in the unification of these two piers with an expanded storage capacity and increase pier head depth	Increase port capacity	36,0M €	
Thessaloniki	**Passenger Terminal –** The project is part of the Port's development plan and aims to realise a 2nd passenger terminal in a renovated builsing in pier 2.	Improve structural capabilities	5,0M €	2019-ongoing
Igoumenitsa	**Phases B and C of Port Development plan**. The whole project is promoted by General Secretariat of Public Works and foresees two different steps. The project will provide the port with infrastructure that enables the achievement of its strategic goals with an additional passenger terminal, including the construction of two new quays, two new dock and a 2nd passenger terminal.	Increase port capacity and improve passenger infrastructures	109,44M €	2008-2023
Heraklion	**Construction of new port facilities**. The project foresees: the expansion of Pier 6, new quay wall with longer operational depth, new Ro-Ro ramp	Improve port capacity	35,4M €	n.a.
Heraklion	**Cruise terminal expansion.** The project aims at developing a wider and more modern terminal featuring all necessary facilities for a smooth embarkation/debarkation of the passenger	Increase port capacity for accomodationg	3,0M €	n.a.

		increasing demand		
Heraklion	**Strengthening of windward jetty.** The project which aims to prepare studies for upgrading the port infrastructure of Heraklion Port, specifically the upgrade and extension of the existing windward breakwater, which was lastly modified during the 1960's and has a total length of 2,390 m. Moreover, HUPPINES includes studies for the installation of a wave energy generation system at the port of Heraklion, emphasizing the importance of renewable energy in the port's development	Ensure the safety of port operations and improving port sustainability	7,0M €	n.a.

2.3.2 Decarbonization and development of alternative fuel projects

Table 40 Green transition projects in Greek ports

Port	Project description	Impact	Cost	Timeline
Lemesos, Piraeus, Heraklion	**BlueHUBS: LNG and CNG Supply Chains** The project includes: • The construction of two LNG Bunkering Vessels serving the purposes of bunkering the LNG fuelled vessels and the small-scale mobile LCNG stations of the respective ports. • The supply of the Mobile LCNG Stations serving the purposes of refuelling the CNG fuelled port heavy duty vehicles and buses. • The supply of one small fleet of LNG tanker trucks with bunkering equipment.	Establish supply chains for the distribution of alternative energy sources Minimize environmental impact	65,96M €	2019-ongoing
Igoumenitsa	**ALFION - Alternative Fuel Implementation** The project's primary objective is to conduct the required final studies and engineering designs to implement onshore power supply technology at the port. It also includes the integration of renewable energy sources into the port's power system and the establishment of a central power management system to regulate the port's energy network. The project's scope is to transform Igoumenitsa port into a pivotal energy hub within the Adriatic-Ionian Sea region. This transformation will be achieved by offering sustainable solutions that align with the	Permit use of alternative fuels Minimize environmental impact	1,08M €	2020-2022 (completed)

	demands of marine and vehicular traffic at the port, addressing three core objectives: 1. Enhancing Port Infrastructure and Power Management: Upgrading the port's infrastructure and optimizing its power management systems. 2. Developing Renewable Energy Sources Within the Port Area: Establishing renewable energy sources within the port's vicinity. 3. Providing Environmentally Friendly Electric Energy to Berthed Ships: Delivering green electric energy to ships while they are docked at the port..			

2.3.3 Digitalization projects

Table 41 Digitalization projects in Greek ports

Port	Project description	Impact	Cost	Timeline
All ports	**Extension, upgrade, and modernisation of the national VTMIS**. The objective of the project, besides the upgrade and modernization of the existing national VTMIS system, is its expansion to cover specific areas. The project will improve the operative area of the VTMIS system to ensure the safety and protection of the human life at sea, the protection of the environment and to provide a better quality of search & rescue services and better services to vessels	Increase of safety and vessels services	30,0M €	2021-2027
All ports	**National Integrated Port Community System** The project foresees the creation of a platform as a complete information system for the electronic submission of data by users and other stakeholders of the country's ports, accessible through the Single Digital Portal of Public Administration. The Platform will remain entirely state-owned, be unique to all ports in the country, and maintained and operated under the responsibility of the General Secretariat of Ports of the Ministry under its exclusive supervision. It simplifies the relationship between users and other port stakeholders with the port administration.	Improve the data accessibility and the transparency of port activities	12,0M €	2021-2027

2.1 Italy

Italy adopted a strategic plan in 2015 to revitalise the port and logistics sector. This is the “Piano Strategico Nazionale della Portualità e della Logistica” (National Strategic Plan for Ports and Logistics), which aims to

improve the competitiveness of the sector and facilitate traffic growth as well as promote intermodality in freight traffic.

The plan includes ten objectives and ten actions concerning, like: governance, simplification of procedures, competitiveness, accessibility, integration, infrastructure enhancement, innovation, sustainability, resource certainty and national coordination. This new strategic plan goes beyond the governance of individual ports. it establishes 'port system authorities' that bring together two or more ports to be regional gateways and have the right size to compete in global markets. Each Port System Authority has its own three-year plan. In that plan the Authority includes all strategic interventions and activities that aims to improve its infrastructures and to increase attractiveness and competitiveness.

2.1.1 Infrastructure investment projects

There are many investment projects related to the expansion or renewal of port infrastructures in Italy. The following tables are divided by Port Authority.

Table 42 Infrastructure projects in Italian EUSAIR ports (Trieste)

Port	Project description	Impact	Cost	Timeline
Trieste	**Second phase of the construction of a new quay called "Logistic Platform".** This new quay will be directly connected to the belt-road and the off-port rail network, with a wharf of about 600 m in length and a depth of -14 m. The first phase is completed in 2021. The logistic platform allows ro-ro ships to dock	Increase port capacity	206,5M €	2022-2025
Trieste	**Realization of a new Ro-Ro terminal in Noghere (PNRR Fund)** This project aims to create a new working draught of no less than 12 meters for berthing RO-RO vessels and a total surface of 430.000 sqm (in two phases).	Increase the number of available docks Increase port capacity	153,0M €	2022-2026
Trieste	**Upgrade of the port railway system**. The project is partially financed by EU funds (CEF/TEN-T). TriesteRailPort aims, in particular, to improve the hinterland accessibility and multimodal connections of the Port of Trieste by upgrading the railway infrastructure of the port's marshalling yard connecting Piers 5 and 6 (Ro-Ro Transport) and 7 (containers) to Campo Marzio Station and renovating the railway branch lines connecting the FreeEste and ex Aquila refinery areas to the Aquilinia station. The action, running from 2019 to 2023, concerns both physical and soft infrastructure and will result in: – an increased capacity of the port's marshalling yard up to 18,000 trains; – longer trains up to 750m; – faster shunting operations;	Respond to the increasing freight train traffic	45,5 M €	2018-2023

	– full IT interoperability with the port railway stakeholders.			
Trieste-Monfalcone	**Railway works inside and outside the port area of Trieste** (promoted by RFI). The project, split in two phases (the first one is already concluded), consists of an upgrading of Trieste Campo Marzio station and of the railway line "Linea di cintura" to Campo Marzio/Trieste Aquilinia; It represents an implementation of intermodal integration and, in conclusion, an upgrading of Trieste Servola e Trieste Aquilinia stations that will improve the railway traffic. The Aquilinia and Servola yards, opened between the Thirties and the Sixties of the last century to allow the industrial development of the Julian area, will improve their functions at the service of the Port. The project also includes the activation of the 750 meter freight module, will continue to be, with the current growth estimates, the first Italian freight terminal for number of trains (*source: Adriaports.com*)	Improve of intermodal traffic and last mile connection in the port	112,0M €	2026
Trieste	**Enlargement of the container terminal at quay 7.** The project aims to increase the potential handling and storage up to a maximum of 1,200,000 TEU. Partially covered from PNRR fund (100,5 million euro).	Increase port capacity	187,0M €	2020-2023

Table 43 Infrastructure projects in Italian EUSAIR ports (Venice)

Port	Project description	Impact	Cost	Timeline
Venice	**Channelling the Green Deal for Venice**. partially financed by EU funds (CEF/TEN-T). The aim is to increase the nautical accessibility and to provide a safer and more efficient maritime access to the port of Venice respecting the environment.	Increase nautical accessibility	1,7M €	2020-2023
Venice	**Upgrading of last mile connections to Malcontenta node**. The project consists of implementing the node of Malcontenta, doubling a part of railway network inside port area. It will solve the existing interferences between rail and road system (PNRR).	Improve railway road in port	46,0M €	2022-2026
Venice	**Upgrading road and rail infrastructure inside the Port area.** The intervention enhances the railway and road axis of Via Elettricità by doubling the current railway track and adapting the road platform for improved functionality as well as other railway works.	Improve last mile connection with a safety increase.	12,0M €	2022-2026

Venice	**New rolling stock vehicle maintenance and repair depot in the Marghera Scalo Station** The project will increase the service offered, such as wagon checking, inspection and maintenance.	Improve port services	3,5M €	2024-2026
Venice	**Venice Onshore-Offshore Port System** The project foresees the construction a new container terminal in Porto Marghera (Montesyndial Area). The Project aims to ensure levels of service performance similar to the conventional terminals of last generation, in terms of maximisation of the speed of loading/unloading of ocean vessels. (Cofinanced by PNRR)	Improve the port infrastructure capacity.	184,46M €	2022-2024
Venice	**Embanking of West Industrial Canal.** The intervention foresees the embanking of the West Industrial Channel. It will be realized an intervention of about 2 km on the east bank and an intervention on west and north banks. The project will remove some operational constraints.	Increase port navigability	12,0M €	2020-2023
Venice	**Upgrade of rail links between the South Industrial Area of Marghera and Marghera Scalo Station**. The investment includes the realization of a movable railway bridge and the related links to existing railway network. The railway bridge will provide a new connection between the southwest backbone of the Port of Venice and the Venice Marghera station, allowing for a reduction in interference between the road and railway networks and shorter overall railway maneuvers. The intervention is partially financed by EU funds (CEF/TEN-T).5	Improve last mile rail connection	8,0M €	2018-2024
Venice	**Last mile connection project**: multimodal direct link with a double track railroad between Via Elettricità and Petrolchimico. It will Improves multimodal connection between two important port areas. with a contribution of EU funds (CEF).	Increase of railroad capacity Improve last mile rail connection	23,0M €	2021-2024
Venice	**Enhancement of accessibility infrastructures of port of Venice**. It consists of designing new accessibility and infrastructure following the functional changing ongoing in the historical part of port of Venice (area Marittima and Santa Marta) and in the commercial part of Port of Venice (Isola Commerciale).	Improve of port accessibility Requalification of the Venice waterfront	8,0M €	2020-2024
Venice	**Installation of safety devices** for the railway operation in the Venice Marghera Scalo area, with a contribution of EU funds (ESIF).	Improvement of rail safety in the port area	15,0M €	2021-2023

Venice	**Environmental embanking restoration works**, focused on depositing site B and on the north bank of Industrial South Canal (PNRR fund)	Increase navigability	27,5M €	2021-2026
Venice	**New Cruise Terminal** located in the first industrial zone of Porto Marghera	Improvement of the quality of service offered to cruise passengers.	63,0M €	2020-2023
Venice	**Embanking of Malamocco - Marghera Canal.** The intervention consists in an adaptation of the canal allowing cruise ships transit due to the reallocation of cruise traffic. It restores and preserves the canal morphology and stop the sediment displacement (Partially financed by EU funds CEF/TEN-T).	It guarantees the navigability of the canal	56,5,0M €	2022-2024
Venice	**Reshaping of Molo Sali wharf** in order enlarge the turning basin 1; reshaping of Isola dei Petroli's bank in order to enlarge the turning basin 1 and 2; reshaping the turning basin 3.	Improvement the navigation safety Increase the port productivity	31,0M €	2021-2024
Venice	**Upgrading of the railway link to the Port of Venice**. The project is promoted by RFI S.p.A. It includes the upgrading of the station of Venice Marghera Scalo with the construction of new tracks for running trains with length of 750 m.	Improve the freight train capacity Increase the rail traffic	597M €	2022- 2030

Table 44 Infrastructure projects in Italian EUSAIR ports (Ravenna)

Port	Project description	Impact	Cost	Timeline
Ravenna	**Ravenna Port Hub.** The project concerns: dredging activities in several parts of the canal harbour (up to -12.50 m in the inner parts and up to -13,50 m in the approaching canal); operational quays upgrading; realization of a new quay serving a specific container terminal; re-use of dredged material as first step of the construction of areas for logistics activities.	Increase of port capacity and improvement of multimodal system	157,37M €	2020-2024
Ravenna	**Ravenna Port Hub - 2nd phase** The project foresees: dredging works in several parts of the canal harbour (up to -14.50 m in the inner parts and up to -15.00 m in the approaching canal) and the development of a multimodal platform dedicate to the agroofood logistic chain (PNRR fund).	Increase of port capacity and improvement of multimodal system	119,0M €	2021-2027

Ravenna	**Ro-Ro terminal upgrading.** The project consists of an upgrading of the existing Ro-Ro and Ro-Pax terminals (Largo Trattaroli) through the construction of marine jetties and the completion of the parking area.	Increase the Ro-Ro terminal capacity	30,0M €	2021-2024
Ravenna	**Extension of the rail tracks** on the right side of the Candiano Canal	Increase the rail accessibility	3,5M €	2017-2026
Ravenna	**Last Mile railway upgrading** The project includes the enhancement of the Sinistro Candiano Station with adding 7 other tracks, one with 750 meters module. The second intervention is the construction of the new Destro Candiano Station adding 3 other tracks. The project includes also the electrification of the tracks.	Improve the railway operation and and traffic Resolve bottleneck Increase the freight train capacity		2017-2026
Ravenna	**Construction of a dredged material treatment plant.** The project foresees the construction of a dredged material treatment plant with an annual capacity of at least 400.000 m3	Permit the treatment of dredged material allowing their reuse.	85,0M €	2027
Ravenna	**Renovation work of the Marcegaglia quay –** The project includes works for the renovation of the Marcegaglia quay, located. left of the Candiano canal, with a length of 355 m; the project allows for the adjustment of this canal section in terms of summit level of the edge beam (+2.5 meters above sea level) and in terms of operational depths (-13 meters).	Increase port capacity	12,57M €	Ending in 2024
Ravenna	**Structural adjustment of the quays** Structural adaptation to meet anti-seismic regulations and the new depths of over 2,500 meters for existing docks	Increase safety and port capacity	60,0M €	n.a.
Ravenna	**New Maritime Station** The project aims to equips the port of a new maritime station. The project involves the construction of a maritime passenger boarding and disembarking station, centered around a two-story building of approximately 5,000 square meters.	Improve the attractivity to cruise companies	25,68M €	2022-2024

Table 45 Infrastructure projects in Italian EUSAIR ports (Ancona)

Port	Project description	Impact	Cost	Timeline

Ancona	**Dredging activities** The project includes some dredging works to reach the draft of -14 meters for “banchina 26” pier and other. completing breakwaters and adapting the Northern wharf to protect the new line of quays.	Improve the nautical accessibility	20,0M €	2015-2025
Ancona	**Includes works for the building of the new line of quays;** adaptation of the former industrial areas to port logistics; a new Ro-Pax terminal and new road access to the port and to the embarking quays; new Ro-Pax mooring.	Improvement and increasing the port facilities for freight traffic and Ro-Pax.	73,4M €	2015-2027
Ancona	**New rail-road terminal in the Scalo Marotti area**; extension and electrification of the shunting track to the port terminal; an extension of the terminal tracks to 600 metres.	Development of intermodal transport	12,0M €	2014-2022
Ancona	**New passenger terminal** The project aims at a new terminal for a modern, up-to-date facility, designed to meet the present and future developments of the market and international maritime traffic that characterizes it, with the necessary infrastructure to be increasingly competitive. The new terminal is planned at Molo Clementino and will be a joint initiative with MSC	Improve the quality of service	22,0M €	2016-2025
Ancona	**New road connection with SS 16** The project involves the construction of a road connection between the port of Ancona and the SS 16 "Adriatica," with a junction at the roundabout near the Torrette district.The design solution includes a route approximately 3.3 km long, with 1,120 meters in a tunnel and 285 meters on a viaduct. The road section falls under category C1 "secondary rural" according to DM 05711/2001, featuring one lane per direction and an overall width of 10.50 meters.	Improve last mile connection	99,62M €	2017-2024

Table 46 Infrastructure projects in Italian EUSAIR ports (Bari and Brindisi)

Porto	Project description	Impact	Cost	Timeline
Brindisi	**Dredging works** The intervention plans dredging activities on several docks, allowing dephts between -12 meters and -16 meters	Increase navigability	100M €	
Bari	**Road connection with A14 highway** The project aims to connect the port of Bari to the highway (PNRR)	Increase road accessibility Reduce road congestion	263M €	

Bari	**New Cruise Terminal** Construction of a new cruise terminal on the quay 10 with new extraschengen gates and a total area of 3.000 square feet	Increase quality of service for cruise passengers	10M €	
Bari	**Extension of the outer 5° breakwater arm and of the 3° and 4° arm of the new breakwater** The project aims to respond to the increasing space demand of containerized cargo	Increase port capacity	30,0M €	

Port	Project description	Impact	Cost	Timeline
Taranto	**Upgrade of railway connections** The project is divided in two lots: the upgrading of railway equipment and new tracks for new logistics platform connection with the national railway line	Improve railroad accessibility	37,5M €	2020-2023
Taranto	**Railway infrastructures** Construction of the railway infrastructure and road accessibility in the "Eco industrial Park" (PNRR). The area under consideration in this study is located in the municipality of Taranto, in the northwest part, bordering the municipality of Statte. It is strategically positioned, being bordered to the north by State Road 7, connecting the municipality of Taranto to the municipality of Massafra, and to the west by SP 38, linking the ECOPARK area to the Bari-Taranto motorway and the port of Taranto. Another strategic element for the development of the Ecopark in the hinterland area is the presence of the railway line and the Bellavista station.	Improve rail and road accessibility of the port	50M €	n.a.
Taranto	**Dredging operations at the container terminal** Interventions for dredging up 2,3 M m^3 of sediments in the container terminal and for realizing the first part of the sediment tank functional to the extension of Pier 5. The intervention envisages the dredging of the dock until a -16,50 meters depth on a berth length of 1.200 m, the dredging of the evolution circle and the dredging of the entrance of the Multipurpose Pier and the realization of the connected	Increase navigability	83,0M €	2017-2022

	containment tank, in which the sediments dredged up will be placed.			
Taranto	New breakwater for the protection of the outer port of Taranto – Ponente and Levante sections. (PNRR)	Increase port safety	35,76M €	n.a.
Taranto	**Rainwater collection system**, A new rainwater collection system aims to provide the Port areas with a system of collection of rainwater that will avoid the rainwater to drain to the sea, thus improving the quality of water,	Improve sustainability	18,05M €	2019-2024
Taranto	**Development of "ex Yard Belleli" site.** Integrated project for permanent safety implementation and industrial reconversion, economic and productive development of the "ex Yard Belleli" site.	Increase port safety	45,5M €	n.a.
Taranto	**Structural adjustment of the south quays of San Cataldo Pier** Reconstruction and reengineering of the San Cataldo Pier, aimed at expanding and improving production capacity, particularly in terms of container transshipment activities at the port terminal.	Increase the port capacity	25,5M €	n.a.
Taranto	**Construction of intermodal logistc hub** The project consists in the construction of a 75 hectars logistic platform in the retro port area	Permit intermodal traffic Increase the logistic capacity	219,14M €	

Table 47 Infrastructure projects in Italian EUSAIR ports (Gioia Tauro)

Port	Project description	Impact	Cost	Timeline
Gioia Tauro	**Upgrading the capacity of docks** The project includes works on: - Dry dock – industrial plant - Resection of western docks sections - Structural adjustment works for the increase of the load-bearing capacity of the quay pavement in stretch C - Integration of bollards along the eastern quay at the end to increase safety when docking ships latest generation containers	Increase port capacity	64M €	2021-ongoing
Gioia Tauro	**Upgrading the capacity of port areas** The project includes works on: - Restoration of the state of the places along the areas of coastal deposit	Increase port capacity	5,0 M€	2021-ongoing

	- Urbanization intervention of the citadel of inspections			
Gioia Tauro	**Upgrading the intermodal system in the port** The project includes works on: - Internal road network - Maintenance of lighting system and green areas	Upgrade of intermodal and logistics endowment	6,8 M €	2021-ongoing
Gioia Tauro	**Strengthening and update of port security systems -** construction of anti-intrusion system	Increase port security	6,9 M€	2021-ongoing

Table 48 Infrastructure projects in Italian EUSAIR ports (Messina)

Port	Project description	Impact	Cost	Timeline
Messina	**New logistic platform in S. Filippo Tremestieri area** Implementation of an intermodal platform equipped with access roads directly connected to the Tremestieri highway junction, a parking area for heavy-duty vehicles and cars (30,000 square meters), and the expansion of the existing port system with new infrastructure, including five new berths for ferry ships or four for roll-on/roll-off (Ro-Ro) ships. The project includes coastal replenishment to the north, both in open and protected areas (using dredged sediments from the port area), and the naturalization with regimentation of the three upstream torrents as mitigation measures.	Improve the logistic capacity	81,5M €	n.a.
Messina-Tremestieri	**Upgrading of port infrastructures** The project aims to construct the third ramp in Tremestieri, reorganize the moorings and the maritime station in Messina, and improve the port of Villa San Giovanni. This includes the creation of a unified area of quays for ships – to be renovated – below, and covered walkways on the upper level for connection between the Caronti ferry disembarkation and that of high-speed ships. (PNRR funds)	Increase port capacity	37,0M €	n.a.
Villa S. Giovanni	**New maritime station** The project aims to create a new maritime station in order to improve users accessibility. The new passenger terminal will consist of a building that	Increase quality	2,0M €	n.a.

	houses public services (ticket offices, restrooms, bar, shops, and technical rooms) and facilities for operators, institutions, and the Port Authority. Public-facing areas will have views of the Strait, while the front office and ticketing services will be located on the interior side.			

Table 49 Infrastructure projects in Italian EUSAIR ports (Catania and Augusta)

Porto	Project description	Impact	Cost	Timeline
Catania	**Breakwater upgrading** The project includes the consolidation and reloading of the breakwater mantle. The project is financed by the PNRR fund.	Increase port safety	70,0M €	Planned to end in 2026
Catania	**Road connection with logistic platform** The connecting road is entirely elevated for a length of about 2 km. This road serves as the link between the Intermodal Hub and the Logistics Hub, providing a dedicated route that ensures integrated operation between the hubs. In this way, both functionally and in terms of internal and external accessibility, the road combines the concepts of unity, integration, and functionality that underlie the ideas of an interport/logistics platform.	Improve port accessiblity	2,0M €	Planned to end in 2026
Catania	**Consolidation and adaptation of docks** The project includes several projects to improve safety, rectify docks and in the old port in order to enhance cruise traffic.	Increase port capacity	22,0M €	n.a.
Catania	**New Maritime Station** The project aims to create a new cruise terminal with sustainable principles and materials.	Increase quality of service for cruise passengers	22,0M €	2022-2024
Augusta	**Railway connection and city bypass** The project aims to create a new railway connection to the port bypassing the city of Augusta (PNRR fund)	Permitt intermodal traffic	135M €	Planned to end in 2026
Augusta	**Breakwater upgrading** The project includes restoration and static reinforcement works for the outer breakwater of the Port of Augusta. The intervention focuses on the original section of the structure built in the 1930s to restore the full efficiency of the port structure and ensure the safety of navigation within the harbor. The works involve the reconstruction of the protective covering of the	Increase port safety	53,83M €	n.a.

	outer breakwater using artificial boulders, with prior reconstruction of the core using natural rocks.			
Augusta	**Upgrading of commercial quay** The project aims to upgrade the quay to permitt docking of new type of cargo ships. The project includes also new gantry cranes and a new terminal container.	Increase port capacity	34,52M €	n.a.

Table 50 Infrastructure projects in Italian EUSAIR ports (Palermo and Termini Imerese)

Porto	Project description	Impact	Cost	Timeline
Palermo	**New Ro-Ro Terminal on Piave Quay and new access infrastructures** This intervention aims at optimizing all port volumes by means of the demolition and rebuilding of a 84,000 cubic meters single functional building.	Increase port capacity Improve quality of service	77,0M €	n.a.
Palermo	**Linking road to the core nodes** It is a complex intervention of last mile connection to/from Port of Palermo, based on a great road and highway infrastructure, that also includes a tunnel, represents the concrete implementation of Port System of the Western Sicilian Sea, to be considered as Core TEN-T network node. It links the port of Palermo and the Termini Imerese interport to the main Sicilian traffic routes, the Palermo – Catania and Trapani Mazara Motorways included in the Core TEN-T Network.	Increase port accessibility Reduce freight transit in Palermo city center	1.290M €	n.a.
Palermo	**Reinforcement of quays** Reinforcement of Vittorio Veneto and S. Lucia piers and quay Piave (PNRR fund). The project's goal is to adapt to the trend of increase of ships' sizes.	Improve capacity	45,0M €	n.a.
Palermo	**Functional restoration and adaptation of ex Tirrenia building** This intervention aims to allocate some port functions and some commercial functions increasing the quality of port services.	Use of existing buildings	19,3M €	n.a.
Termini Imerese	**Completion of the outer breakwater** The project is divided in two interventions. These include the extension of the actual outer breakwater and the construction of a new pier.	Increase port safety	48,19M €	n.a.
Termini Imerese	**Dredging works** The project aims to repristinate the functionality of the port of Termini Imerese digging to a depth of 10 meters in the commercial port area.	Increase navigability	35,0M €	n.a.

2.1.2 Decarbonization and development of alternative fuel projects

Table 51 Green transition projects in the Italian EUSAIR ports (Trieste)

Port	Project description	Impact	Cost	Timeline
Trieste	**Cold Ironing** The project incluedes several interventions in Trieste and Monfalcone Ports to provide onshore power supply to quays. (PNRR fund)	Reduce air pollution in port	31,0M €	2026
Trieste	**Railway Terminal and LNG facility** The project aims to study and design LNG facilities in the new port area (CEF/TEN-T). The project encompasses various essential components, including the final design of the shunting station, an environmental impact assessment for both the station and the new container terminal on Pier 8. Additionally, it involves studies and designs for the integration of Information Technology (IT) port community resources with rail operations. Furthermore, the project will delve into the study and design of the liquefied natural gas (LNG) storage and bunkering facility, catering to both maritime and road sectors. This holistic approach aims to address the infrastructure and operational aspects while considering environmental impacts and fostering the integration of technologies for improved efficiency and sustainability.	Preparatory to alternative fuels	6,39M €	2021-2024

Table 52 Green transition projects in the Italian EUSAIR ports (Venice)

Port	Project description	Impact	Cost	Timeline
Venice	**Cold ironing** The project includes several electrification interventions in Marghera and Venice ports. (PNRR fund)	Reduce air pollution in port	92,8M €	2022-2026
Venice	**LNG supply facilities in the Port of Marghera** The project aims to design and create the first LNG depot in Venice area. It will be the first port in the Adriatic Sea that completes the logistic chain and bunkering of LGN vessels.	Permitt use of alternative fuels	140M €	2022-2024
Venice	**Venice green hydrogen Valley** Pilot project in small scale that aims to create a green hydrogen site with production and distribution capacity	Permitt use of sustainable fuels	26,5M €	2022-2025

Venice	**GAINN4SEA - GAINN for South Europe maritime LNG roll-out.** The Action encompasses the implementation of two new LNG-multi-modal facilities for the transport sector in the maritime Core ports of Venice and Livorno. This will be done via the development of adequate infrastructure in the two ports that are expected to become the gateways of the Italian LNG network. Livorno LNG multi-modal facility is expected to have a storage capacity of about 9.000 m3, while Venice about 32.000 m3. Both multi-modal facilities are planned to be duly equipped for the reception of LNG from bunkering ships.	Reduce air pollution Permitt use of alternative fuels	77,73M €	2018-2023
Venice	**Green Port project** The project aims to efficiency energy consumption with a new illumination system and electric service vehicle. (PNRR fund)	Reduce energy consumption	26,5M €	2022-2025

Table 53 Green transition projects in the Italian EUSAIR ports (Ravenna)

Port	Project description	Impact	Cost	Timeline
Ravenna	**Cold ironing** Electrification of "Port Corsini" quay at the Cruise terminal (PNRR fund). The project involves the construction of a nearly 8 km pipeline to supply power to cruise ships moored at the maritime station undergoing renovation.	Reduce the air pollution in port	35,0M €	Planned to end in 2026
Ravenna	**Photovoltaic system and Green Hydrogen implant (GREEN PORTS)** The project foresees the construction of a photovoltaic system with 19,7MWp of power and the installation of electrolyzers	Permitt use of sustainable energy	21,46M €	2021-2024

Table 54 Green transition projects in the Italian EUSAIR ports (Ancona)

Port	Project description	Impact	Cost	Timeline
Ancona	**Cold ironing** Elettrification of quay in historical port of Ancona. (PNRR fund). Ferry, passenger, or small service ships moored at docking and commercial piers will be connected to the electrical grid.	Reduce the air pollution in port	7,00M €	Planned to end in 2026

Table 55 Green transition projects in the Italian EUSAIR ports (Bari)

Port	Project description	Impact	Cost	Timeline

Bari	**LNG and Cold Ironing** The project is aimed at improving the sustainability of port operations and includes planning and implementation of LNG bunkering facilities and Onshore Power Supply (cold ironing).	Allow to use more alternative fuels	the total cost is unknown.	2014-2030

Table 56 Green transition projects in the Italian EUSAIR ports (Taranto)

Port	Project description	Impact	Cost	Timeline
Taranto	**Realization of cold ironing implant** The project includes a cold ironing implant for "public quay", "molo settoriale" quay and "pontile petroli" quay (PNRR fund)	Reduce the air pollution in port	58,0M €	Planned to end in 2026

Table 57 Green transition projects in the Italian EUSAIR ports (Messina)

Port	Project description	Impact	Cost	Timeline
Messina	**"Stretto Green"** The project aims to implement LNG bunkering facilities onshores and it includes the quay electrification (PNRR fund). As concerns cold ironing, the studies carried out so far have hypothesized that for the three ports to be electrified, there is a total power requirement of approximately 45 MVA. For the Port of Messina, electrification of all the docks in the historic port is planned, and cruise ships will also be powered; the total power will be around 22 MVA, and there has already been consideration of the possibility of increasing this power. In the Port of Reggio Calabria, the Levante Docks and the Molo Eolie will be electrified, with an available power of approximately 19 MVA, also to be allocated to cruise ships. For the Port of Milazzo, characterized by smaller and more diverse vessels, electrification will cover almost all the docks but with lower total powers, around 4.4 MVA.	Reduce air pollution in port Permit use of alternative fuels	50,0M €	Planned to end in 2026

Table 58 Green transition projects in the Italian EUSAIR ports (Catania and Augusta)

Port	Project description	Impact	Cost	Timeline
Catania	**Cold ironing** Project for the electrification of docks in the port of Catania funded through the complementary fund to the PNRR (National Recovery and	Reduce air pollution and emissions in port	56,5M €	2024-2026

	Resilience Plan). Electrification of docks for cruise ships, Ro-Ro, and Ro-Pax. Power requirement: 47 MW.			
Augusta	**Cold ironing** Project for the electrification of docks in the port of Augusta funded through the complementary fund to the PNRR (National Recovery and Resilience Plan). Electrification of docks in the commercial port for container ships, ro-ro, and cargo. Power requirement: 35.7 MW.	Reduce air pollution and emissions in port	32,6M €	2024-2026

Table 59 Green transition projects in the Italian EUSAIR ports (Palermo and Termini Imerese)

Port	Project description	Impact	Cost	Timeline
Palermo	**Upgrade of the lighting system and of port energy efficiency** (PNRR fund). The project includes the refurbishment of existing facilities in the area of the port and involves adapting to current regulations on energy efficiency and reducing climate-changing emissions. This includes the establishment of a new public lighting system with state-of-the-art devices, consisting of 144 LED lamps, enabling significant energy savings. The project incorporates intelligent technological solutions in line with the Smart City paradigm, such as smart Wi-Fi-enabled poles, video surveillance, and IoT systems for environmental monitoring.	Reduce energy consumption	32,0M €	n.a.
Termini Imerese	**Upgrade of the lighting system and of port energy efficiency** (PNRR fund). The project includes the establishment of a new public lighting system with state-of-the-art LED lamps enabling significant energy savings.	Reduce energy consumption	6,0M €	n.a.

2.1.3 Digitalization projects

Table 60 Digitalization projects in the Italian EUSAIR ports

Port	Project description	Impact	Cost	Timeline
Venice Chioggia	**Information system to real time monitor maritime traffic and forecast the maritime traffic levels in the last maritime mile**	Increase port safety	1,5M €	2022-2022

	The goal is to optimize arrivals and departures in the Port and therefore the system will be integrated with international standards such as AIS, VTS and the National Single Windows. Monitoring tools and supporting decision system will work closely to foster the port performance. The system will be integrated with meteo sensors and weather forecast models. Then, there will be an upgrade of the simulation centre to validate management and infrastructural choices for the navigation in port channels. Partially financed by EU funds (CEF/TEN-T).			
Venice Chioggia	**Railway telematic systems** The project includes interventions for shunting operations (SIMA) and its integration with PCS and information systems of other subject involved in developing rail services. It will provide all the necessary interfaces for the data interchange with the information systems of the port operators who take part in the processes. The aim is to manage all the rail shunting operations provided by the railway operator on the railway network of the Port. The project also includes the implementation of a monitoring system and video surveillance for the automatic identification of containers and rail wagons; development of interfaces with the existing computer-based systems of the clients, railway undertakings and the infrastructure manager. Partially financed by EU funds (CEF/TEN-T).	Increase rail operation safety	1,0M €	2015-2022 (completed)
Venice Chioggia	**Set up ICT infrastructure** to design a data management system and a linked geographic information system (GIS) for gathering, managing, and analysing data. With a contribution of EU funds (ESIF).		1,5M €	2022-2024
Ravenna	**ICT services for the port community**: interoperability of PCS with the National Maritime Single Window; the National Logistics Platform and the Customs ICT platform. It consists in the implementation of advanced PCS-based ICT services for port operators and public agencies. The main objective is to improve the PCS for a better coordination of the port processes using a wide range of interoperability features. The new services will be developed for the processes related to safety and security, logistics, reporting formalities, customs clearance, gate automation,	Increase port productivity and efficiency	3,0M €	2015-2022 (completed)

	ITS, etc. The most important goal in terms of interoperability is to implement the full interoperability with the National maritime single window, the customs agency single window and the National Logistics platform. It is financed by Italian government, Port Authority of Ravenna, EU fund (CEF/TEN-T) and other private investors.			
Palermo	**Logistics System Management of the Port System Authority of the Western Sicilian Sea** In response to the need to create efficient and safe nodes, the project is based on the implementation of the hardware infrastructure of the PCS (Port Community System), a platform connecting multiple systems operated by a variety of actors within the port community for the optimal functioning of the port system. The project is complementary to the implementation of a telematic platform for the monitoring and management of all port activities, including access control to port gates (Entry/Exit) of passengers and heavy vehicles.	Increase port productivity and efficiency	5,0M €	2022 (completed)
Taranto	**Port Community System** The project includes several interventions to reduce handling time and to improve the logistic chain through the digital dialogue between the different port stakeholders with the digital platform "Taranto Digital Port"	Increase transparency and simplify user's activities	n.a.	2021-2022 (completed)
Catania, Augusta	**Smart Port** The project includes the implementation of the Port Community System, use of advanced analytics and 5G connection in ports. It is financed by Italian Ministry of Infrastructures and transports.	Increase port productivity and efficiency	5,22M €	n.a.

2.2 Montenegro

Montenegro adopted the "Transport Development Strategy 2019-2035" which determinates infrastructural, organizational and operative development targets of the transport system. The strategy is elaborated in harmony with the EU context and the TEN-T guidelines and with public policy priorities and target, cooperation between relevant authorities and financial and material resources. In addition, the document has been drafted in accordance with the Development Directions of Montenegro which recognizes sustainable and inclusive growth priorities defining key measures and projects. The Transport Development Strategy identifies 19 policy areas with define priorities, suggested investments and development measures. This document is complementary with objectives recognized by the Montenegro Sustainable Development Strategy for the field of transport. Both plans aim to develop the Montenegrin transport system, make

investments in new transport capacities, promote sustainable way of transport with multimodal transport system and intermodal integration focusing on security, competition of the national transport sector, connection to the TEN-T network, quality of transport services and minimization of negative impact of infrastructures development on the environment. The strategy wants to improve the accessibility, performance of operations and quality of services of road, rail, maritime and air transport. This includes the application of ITS technologies in the road, rail and maritime transport sector, in particular it aims to completing activities on realization of the system for management and supervision of maritime traffic (VTMIS). One strategic goal is the EU integration, achieved through the implementation of the proposed measures which are in line with the acquis, regulations / directives and EU requirements.

2.2.1 Infrastructure investment projects

The Transport Development Strategy identifies the improvement of connectivity of the Port of Bar as a specific objective. This includes two different measures: a better valorisation of certain port services and the valorisation of the Port of Bar as a new cruising destination.

Table 61 Infrastructure projects in Montenegrin ports

Port	Project description	Impact	Cost	Timeline
Bar	**Extension of the coast at the passenger terminal and dredging activities**. The project involves extending the actual coastline at the passenger terminal for 432,85 m in length and a 30 m in width, along with dredging activities. The project will enable the acceptance of medium and large passenger ships, as well as cruise ships. So, the existing limitations associated with low water depth along the operational coast would be eliminated, bringing the maximum water depth to -14 meters.	Increase port capacity Improve nautical accessibility	12,5M €	n.a.
Bar	**Extension of the Quay at Volujica Terminal** The project aims to extend the quay of Volujica by 166 meters including civil works and all other infrastructures and railway tracks.	Increase intermodal capabilities	5,0M €	n.a.
Bar	**Reconstruction and extension of the dry bulk cargo pier**. Development of the Dry bulk cargo terminal – extension of the operational quay for additional 400 m; extension of the open storing area; building silos for bulk cement; improvement of the cargo handling technologies at the Terminal (modernization of existing equipment, purchasing new equipment, etc.)	Increase port capacity	5,0M €	n.a.
Bar	**Restoration of the railways network inside the harbour.** This project will allow better connection between the port and the hinterland, as the current capacity of the rail line is not sufficient for the potential demand.	Improve rail accessibility of the port and last mile connections	1,5M €	n.a.

2.2.2 Digitalization projects

Table 62 Infrastructure in Montenegrin ports

Port	Project description	Impact	Cost	Timeline
All Ports	**Vessel traffic monitoring, information and managing system Phase II** The project is now under preparation, with the pre-feasibility study and conceptual design completed. This phase will include the installation of the missing sensors at location and the installation of new equipment in Kotor Bay and Lake Skadar. The project also includes the implementation of a Maritime Single Window.	Increase maritime safery	4,2M €	

2.1 Slovenia

The Government of Slovenia approved the Transport Development Strategy of the Republic of Slovenia in 2015, outlining a 15-year plan. Subsequently, in 2016, they adopted the "National Programme for the Development of Transport of the Republic of Slovenia." Aligned with EU policies, the strategy takes a comprehensive approach to the transport system, fostering synergies in achieving transport-related objectives. The National Programme seeks to provide more detailed insights into activities, implementation methods, and timelines for the measures outlined in the strategy. Additionally, a crucial objective is to establish a foundation for accessing EU funds more seamlessly. Specific objectives for maritime transport can be resumed with:

1. Improvement of the navigation safety
2. Increase port capacities of transhipment
3. Improve hinterland connections, especially via railway;
4. Development of motorways of the sea and short distance maritime transport;
5. Provide alternative fuel infrastructures;
6. Development of inland waterways.

The document defines 108 strategic measures not only referred to infrastructures but also to the organisation, management, and safety, 14 of them interest waterborne transport.

Following the Strategy Slovenia drafted the National Maritime Development Programme which form the basis for implementing measures of the maritime transport strategy especially in the field of maritime transport safety and maritime commerce.

The modernisation of ports is one of the conditions for more qualitative and efficient integration of Slovenia in the European transport network and ensures a facilitated flow of goods, services and passengers. The growth of cargo transit transport and natural barriers (e.g. the Alps, the Pyrenees) favour accelerating the

development of maritime transport and relieving the growing road transport. The modernisation of the rail connection can also improve the functioning of the port and increase the capacities of the port of Koper.

2.1.1 Infrastructure investment projects

Table 63 Infrastructure projects in Slovenian ports

Port	Project description	Impact	Cost	Timeline
Koper	**New passenger terminal** In response to the increasing traffic, the port is undertaking plans to construct a new passenger terminal building, expected to be completed by the end of 2025. The envisioned facility is designed to be ecological, green, and energy-neutral.	Increasing capacity and the quality of service for cruise passengers	2,0M €	2015-ongoing
Koper	**Arrangement of landside areas**	Increase level of service	22,0M €	2015-2030
Koper	**Dredging works** The works of dreding have the aim to increase the depth of the port so that ships with draught up to 13.5m can call at the port.	Increasing capacity enabling larger ship to dock	10,0M €	2015-2023
Koper	**Deepening of the navigational channel in Basin 2 outside the concession area** The investment included deepening of the navigable channel of basin 1 at the cargo port of Koper to the depth of -15 meters. In the framework of the project, a cassette was built in the Ankaran Bonifika area, in which about 150,000 m3 of marine mud was deposited as a result of the deepening of the channel.	Increase nautical accessibility	15,0M €	2021-2027
Koper	**Extension of the northern side of Pier 1**	Increase the port capacity	60,0M €	2021-2027
Koper	**Construction of new berthing facilities in Basin 1, 2 and 3**	Increase the port capacity	110,0M €	2021-2035
Koper	**Extension of Pier 2**	Increase the port capacity	100,0M €	2020-2035
Koper	**Construction of Pier 3**	Increase the port capacity	50,0M €	2020-2040
Koper	**Construction of additional rail infrastructure within the port**	Improve intermodal traffic and last mile connection	25,0M €	2021-2030
Koper	**Connection of the port to the motorway** Implemented through the extension of the Bertoška artery and the realization of the Srmina access	Improve port accessibility	23,11M €	2016-2023

2.1.2 Decarbonization and development of alternative fuel projects

Table 64 Green transition projects in Slovenian ports

Port	Project description	Impact	Cost	Timeline
Koper	**EALING - European flagship Action for Cold Ironing in ports** The Action, being the first phase of the Global project "European flagship action for cold ironing in ports" (EALING), is a study proposing a common EU harmonised and interoperable framework – from a technical, legal and regulatory point of view – for the transition to electrification for at least 16 of the EU maritime ports involved in the EALING consortium, facilitating the implementation phase of OPS infrastructures and equipment.	Reduce air pollution in port	6,96M €	2020-2023
Koper	**On-shore-power-supply grid inside the port**	Reduce energy consumption	69,0M €	2017-2033

3 Conclusions and policy recommendations for the maritime sector

In this chapter a recap of the findings of the previous chapters is proposed, in order to highlight the main issues of the sector in the macro-region, and its outlook; furthermore, a set of policy recommendations is proposed for the development of the sector.

3.1 Key issues

Some general issues, widespread through the macro-region's maritime transport system, can be summarized as follows.

Table 65 Common issues in EUSAIR maritime transport system

Insufficient port infrastructures and capacity	Within the maritime sector of the Adriatic-Ionian region, the current level of development of port infrastructures seems inappropriate to allow and strengthen a continued growth of flows, needs to **develop port infrastructures**. The need of additional terminal capacity for short sea shipping is particularly important.
Low degree of digitalisation	The current efficiency of **port interfaces and procedures** is generally low. This is a common gap in ports all over the EU and the way towards the European Maritime Single Window and the EU-wide acceptance of Electronic Transport Documents is still long. As the 2020 Motorways of the Sea Detailed Implementation Plan recalls: by 2018, only two Member States had put in place regulations and pilot projects to accept Electronic Transport Documents and the EU-wide use was close to zero, while more than half of the 21 member states for which data was available had similar regulations in place for air transport where the use was already widespread (around 40%). Maritime Transport ought to catch up here because the direct competitor of short sea shipping – road transport – has a much lower administrative burden.
Missing links in last mile connections between ports and the network	**Insufficient landside connections** also affect the capacity of the transport system. Such connections need to be enhanced in order to ensure appropriate capacity and service level in comparison to their needs and assure that the development of the transport system has an impact on the socio-economic growth of regions. The Greek ports in particular – even those situated on the mainland –currently do not have sufficient demand for rail hinterland services, though they could potentially serve the Western Balkan countries.
Low degree of green transition advancements	A limited diffusion of **alternative fuels** availability is also apparent. There are installations in the Central-Northern Adriatic (Ravenna Liquid Natural Gas depot) and plans for installations in most Italian EUSAIR ports and in Grece. On-shore power supplies (cold ironing) facilities are also lacking, suffering from problems represented by high investment costs for ports in cold ironing infrastructures, the low number of vessels geared with technical equipment for using the, and the price drawbacks for shore-side electricity; in fact, these are essential obstacles for the diffusion of cold-ironing systems in most port systems in the EU.

3.2 Outlook

The present paragraph recaps the main interventions which are in the pipeline of relevant authorities for the development of the sector, grouping them up in terms of three major strategic objectives for the transport system at the European level, namely:

- Safety, security and resilience
- Sustainability
- Connectivity and traffic development

3.2.1 Main projects and policies for Safety, security and resilience

To increase the resilience and the nautical accessibility some Italian ports have planned dredging activities in the short-medium term, like port of Ancona with a 20 million € project or Brindisi and Brindisi with an expense of 130 million € including dredging works and the extension of the breakwater arm that will increase the protected space for containerized cargo. Taranto has also planned dredging works to increase navigability for the container terminal, a new rainwater collection system and a new breakwater for the protection of the outer port areas with an expenditure of about 120 € partially from the PNRR (Piano Nazionale di Ripresa e Resilienza – the Italian Recovery and Resilience Plan). Finally, also Sicilian ports of Catania, Augusta and Palermo are developing breakwater upgrade works, including the consolidation and reloading of the breakwater mantle, these projects are partially financed by the PNRR funds and are worth in total more than 170 million €. The slovenian port of Koper is also planning until 2027 different dredging activities with a total worth of 25 million € with the aim to increase the navigability of the channel.

In the region there are a lot of investments about safety and security, following the EU regulation. All states apart the Slovenia have developed projects to digitalize port activities and to improve security and security of commercial operations. The most frequent activity in this topic is the implementation of a Vessel Traffic Monitoring and Information System in most important port of each State, which ensures the safety and proper management of maritime traffic, supports search and rescue activities and monitors and protects the natural environment. One of them is the Albanian plan to establish and implement the (VTMIS) which is one of the priorities of Albanian Governments. Albanian National transport strategy also includes the objective of introduce and implement the Long-Range Identification and Tracking System (LRIT) which is already established and already operable. Greece and Montenegro are also implementing and extending their national VTMIS to all commercial ports and they are investing respectively 30 million € between 2021 and 2027 and 4,2 million €.

3.1.3 Main projects for Sustainability improvement

European policies are directed towards the development of eco-sustainable infrastructures in order to reduce GHG emissions and the environmental impact of the transport sector. Following these requirements, there are several investments that can lead to the transition to a zero-emission sector are the provision of infrastructure aimed at this goal and energy efficiency strategies. In fact, there are several projects of various kind concerning port infrastructures, on one side, with the improvement of energetic efficiency of port

facilities, like terminals or offices building and on the other side the transport activities with the development of cold ironing facilities or LNG/CNG depots for vessels bunkering or for duty commercial vehicles.

Several port authorities in the region are aiming to improve their energy efficiency and to reduce energy consumption, by upgrading light towers in port area with energy-efficient LED lamps or by developing photovoltaic systems to generate electricity from renewable energy sources, these activities could be resumed with the greening port theme which is fundamental for reducing energy consumption by port authorities. An example is the ALFION project[41] in the Greek port of Igoumenitsa that aims to provide the final studies for the development of renewable energy sources to power port facilities or the port of Koper in Slovenia with a massive project about an onshore power supply grid worth 69 million of €. In Italy several ports are developing green port projects, like Venice Green Port which consist in a new illumination system and the implementation of electric service vehicles worth more than 26 million € from the PNRR fund and foresees completion by 2026 or Palermo's port authority which is upgrading the lighting system and bettering the energy efficiency in Palermo and Termini Imerese ports with 38 million € from the PNRR fund.

Italy is pursuing a national policy of developing sustainable energy solutions for ports. Using PNRR funds, several Italian port authorities are planning to invest in cold ironing facilities in order to supply electricity to commercial and passenger ships docked in ports. Ports like Trieste, Venice, Ravenna, Ancona, Taranto, Messina, Catania and Augusta together are investing a total of about 600 million € in cold ironing facilities with the aim of complete the project in 2026 using PNRR funds and foresees completion by 2026. The Slovenian port of Koper also has a cold ironing development project worth 6,96 million euro financed by the Connecting Europe Facility fund and with the timeframe of 2020-2023.

For the transition to a low-impact sector there is not only the development of cold ironing solution but also the development and implementation of alternative fuels such as the construction of LNG/CNG storage facilities for naval use or for duty commercial vehicles. A lot of projects are active or planned in this field between Greek and Italian ports with different functional features and purpose. Greece for example is carrying out a project in some of the most important national ports (Lemesos, Piraeus and Heraklion) worth 66 million euro called Bluehubs which includes LNG bunkering vessels facilities and small LNG/CNG stations for refuel port duty vehicles and buses. Like Greece also Italy is also turning to LNG in many of its ports. The ports of Trieste, and Venice, Ravenna, Bari, Messina have developed or are developing LNG depot for vessel bunkering.

Furthermore, two Italian ports are developing hydrogen implant projects for the purpose of produce green sustainable hydrogen, these are port of Venice that is developing a pilot hydrogen project with the scope to create a green hydrogen site with production and distribution capacity which is worth about 26,5 million € from the PNRR fund and the Ravenna Green Port project that foresees the construction of a wide photovoltaic system and the installation of electrolyzers to generate green hydrogen.

The Croatian port of Rijeka has been investing 7 million € between 2020 and 2022 to strengthen the institutional capacity and cross-border governance of ports in the Programme Area in this area, improving the know-how on environmental sustainability and energy efficiency of maritime transport.

[41] https://www.alfion.gr

3.1.4 Main projects for Connectivity and traffic development

Within this macro theme, it is worth highlighting that all National Transport Strategies indicate as a priority the improvement of asset port capacity against future traffic growth and market trends and the develop of strategic action plan for port growth and modernization. The development of commercial and passenger traffic is of vital importance for the economic sustainability of ports and also for the economy of the territories in which they exist. For this reason, the various port authorities in the macro-region have planned multiple infrastructural interventions up to 2030 that can increase the attractiveness to new traffic, such as:

- The building of new terminals for containerized cargo, like the Thessaloniki Container terminal and the new dry bulk terminal that are worth about 140 million €.
- The realization or improvement of new Ro-Ro terminal to increase the attractivity to ferry traffic, like for Trieste or Ravenna.
- The upgrading of quays or piers to accommodate larger ships or modern cruise terminals to increase the quality of service offered to passengers, this is the case of various ports with a high level of passenger traffic such as Messina, Bari, or Greek ports of Corfù, Thessaloniki, Heraklion or Lefkimmi.

These investments concerning the maritime side and the vessels activities are often combined with investments to improve hinterland connections. This type of intervention concerns:

- the improvement of the port-city interface and waterfront when the port falls within a fully urbanised context, as is the case for example in Venice, Palermo or Trapani.
- The improvement the road network and connection with the nearest existing or planned logistical poles.
- The improvement or new development of the direct railway connection, that represent one of the most important investments for Venice with more than 600 million € of investment and Trieste with 160 million € of investment that aims to improve the intermodal traffic and the last mile connection in the ports.

In general, the ports of the Adriatic-Ionian macro region are planning interventions to improve their commercial competitiveness through the improvement of internal connections, both road and, when present, rail, all the most important ports for the different countries have planned projects for the infrastructural adaptation of their piers and cargo terminals, directing economic resources where they have a competitive advantage.

The development of a port's competitiveness and efficiency is also achieved through investments in process digitisation. An example is represented by the implementation of the Port Community Systems by several ports in Italy, Croatia and Greece. This is an open electronic platform which enables intelligent and secure information exchange between public and private stakeholders to improve the competitivity of the seaport communities. A Port Community System optimizes, manages, and automates logistics-efficient processes connecting transport and logistics chains. Several Italian ports are planning interventions to implement this system, like port of Ravenna with an investment of 3 million euros which it will allow the interoperability of the PCS with National Maritime Single Window and the ICT platform. Also Palermo and Taranto during 2022 are investing into this technology with more than 5 million € in total. Greece plans to complete the PCS project in 2027 with a total cost of 12 million € and the Croatian port of Rijeka is investing on the Port community system with 1.66 million € in 2022 using EU funds.

3.3 Development guidelines

Taking into account the above-mentioned objectives and the status of EUSAIR maritime transport system, the development guidelines shown in the table below are recommended, grouped into the three strategic policy areas.

In general, the relevance of the maritime sector in the overall transport system of the EUSAIR macro-region stems from the geographical features of the area, which is marked by the presence of the sea; maritime transport is therefore a key element to ensure accessibility to the region for both passenger (especially for tourism) and freight transport; ferry services are also key to provide accessibility to remote islands.

As a consequence, a remarkable place among the main priorities that need to be further addressed in the maritime transport system is held by those concerning **connectivity and traffic development**, and in particular the actual endowment and effectiveness of infrastructures enabling the provision of competitive services; the upgrade of **safety conditions** in many ports is a priority that can be addressed in parallel with the afore-mentioned need. It is also worth mentioning that a Flagship action called "Adriatic-Ionian Green/Smart Port Hubs Concept" is being developed within the EUSAIR framework, in line with the goals and objectives of the European Green Deal, as a means to facilitate the implementation of initiatives aimed at improving **digitalisation and sustainability** in the ports of the macro-region.

SAFETY, SECURITY AND RESILIENCE	ENVIRONMENTAL AND SOCIAL SUSTAINABILITY	CONNECTIVITY AND TRAFFIC DEVELOPMENT
• Increase the resilience of maritime port infrastructure to extreme weather events • Exploit existing digital solutions for monitoring the status of infrastructure • Expand the use of existing and potential digital solutions for security within ports	• Boost the uptake of alternative fuels and low carbon vessels in ports • Develop cold ironing solutions • Monitor GHG, pollutant emissions and water quality in ports • Greening ports (green spaces, energy efficiency, circular economy)	• Improve port infrastructures for specific traffic types, such as containerised traffic and ferry operations • Improve the integration of ports with land transport modes • Expand the use of Port Community Systems • Implement solutions for overcoming paper-based procedures and long waiting times of border crossing procedures

List of figures

List of tables