ACCOMPANYING EXPERTISE
IN-DEPTH ANALYSIS

Requested by the TRAN committee

The Combined Transport Directive

Policy Department for Transport, Employment and Social Affairs
Directorate-General for Cohesion, Agriculture and Social Policies (CASP)
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EN

The Combined Transport Directive

Abstract

This study, provided by the Policy Department at the request of the TRAN Committee, serves as an evidence base to support policy discussions and contributes to a future revision of the Combined Transport Directive.

It identifies and analyses a subset of the network of **intermodal freight terminals** across the European Union, offering insights into their **location**, **served transport modes**, **physical area**, **handling capacity (in TEUs)**, **loading equipment**, and **additional services provided**. The report includes selected **case studies** that illustrate targeted actions aimed at improving the **efficiency and effectiveness** of terminal operations. Furthermore, it maps the **main connections between inland and port-based terminals** and key European seaports. A dedicated analysis is also presented on the **average distances travelled to and from intermodal terminals** in four selected EU Member States, providing context on logistical patterns and accessibility.

Together, these findings lay the groundwork for informed policy development with a view to incentivise the expansion of the EU's multimodal freight transport framework.

This document was requested by the European Parliament's Committee on Transport and Tourism.

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LIST OF ABBREVIATIONS

ARA	Amsterdam-Rotterdam-Antwerp
CEF	Connecting Europe Facility
CTA	Container Terminal Altenwerder
CTD	Combined Transport Directive
CTH	EUROKOMBI at EUROGATE Container Terminal Hamburg
CTT	Container Terminal Tollerort
ITU	Intermodal transport unit
KTH	Kombi-Transeuropa Terminal Hamburg
OCR	Optical Character Recognition
RMG	Rail Mounted Gantry cranes
RoLa	Rolling Highway
RTGs	Rubber Tyred Gantries
SO	Specific Objective
TEN-T	Trans-European Transport Network
TEU	Twenty-foot Equivalent Unit
TOS	Terminal Operating System

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1. EXECUTIVE SUMMARY

KEY FINDINGS

- Intermodal terminals across the EU show uneven distribution, with Germany dominating (25–30% of terminals). Rail access is widespread (87–93%), but barge, RoLa, and short-sea options remain limited, constraining modal diversity.
- Rail and road routes are significantly longer than straight-line distances, with rail showing higher median overhead (36.7%) than road (24.5%).
- Significant variation in total truck distances across countries is linked to both the number of routes and truck density per route.
- The distribution of regular rail–port services underscores the strategic role of Central Europe, with six of the ten most connected terminals located in this region.
- A performance-based definition of combined transport—focused on achieving at least 40% external cost savings over road-only alternatives—is more effective than mode- or distance-based criteria.

This report presents a comprehensive analysis of intermodal freight transport infrastructure, operations, and connectivity across the European Union, drawing on multiple data sources and thematic studies.

Distribution and characterisation of the intermodal terminals in EU

The findings highlight the structural diversity and uneven distribution of intermodal freight infrastructure across the European Union. Germany emerges as a central hub for intermodal transport, accounting for 25–30% of all terminals. Its dense network and high frequency of short-haul movements reflect a granular distribution of nodes and extensive intermodal coverage. **Rail infrastructure is widely available across the EU, present at 87–93% of terminals, while barge transport is accessible at 21–24%.** Other modes such as Rolling Highway (RoLa), short-sea shipping, and ferry services remain scarce.

Analysis of a sample of 11 strategic terminals

Strategic location and multimodal connectivity are key enablers of terminal performance. **Coastal access, central positioning along key corridors, and robust rail or inland waterway links contribute to strong intermodal networks**. Eleven economically significant terminals examined in this study have received targeted financial support, notably through the Connecting Europe Facility and EU co-financed projects such as Porthos, FEDeRATED, PASS4CORE-IT, and ERFLS, among others. These terminals have adopted a wide range of advanced logistics solutions, including digital services for smart operations, traffic optimisation, real-time container tracking, advanced Terminal Operating Systems, automated block storage, remote-controlled gantry cranes, integrated Optical Character Recognition (OCR) gate systems, fully automated gate access, and eco-friendly vehicles. Expansion and modernisation efforts include road access improvements, CO_2 capture and transport projects, expanded operational areas, increased storage and handling capacity, enhanced rail networks and tracks, new high-bay storage facilities, remote-controlled ship-to-shore cranes with onshore power integration, and, at CLIP terminal in Swarzedz, a horizontal loading system for semi-trailers onto rail wagons without cranes.

Connectivity

Connectivity analysis reveals that Busto Arsizio-Gallarate, Madrid Abroñigal, and Praha-Uhříněves are among the top inland terminals in terms of weekly rail service frequency to major maritime and inland ports. Busto Arsizio-Gallarate demonstrates diversified connectivity, linking to Amsterdam-Rotterdam-Antwerp ports as well as German and Italian ports. Praha-Uhříněves shows more regionalised patterns, primarily connected to northern German ports. Madrid's connectivity is largely confined within Spain, with most services directed to Valencia, reflecting the insular nature of the Spanish rail system and its non-standard track gauge. The distribution of regular rail-port services underscores the strategic role of Central Europe, with six of the ten most connected terminals located in this region.

Distances

Route distance analysis shows that the mean straight-line distance between origin-destination pairs is 602 km, with a median of 548 km. Road distances average 793 km (median 682 km), while rail distances average 797 km (median 749 km). The standard deviation of road distances is 591 km and for rail distances 525 km, indicating high variability in both cases. Both road and rail routes are significantly longer than straight-line distances, reflecting infrastructure and geographical constraints and routing inefficiencies. Rail routes are slightly longer than road routes on average, and the rail median overhead[1] (36.7%) exceeds the road median (24.5%), suggesting that rail paths may be less direct for typical trips. **Mean overheads for both modes are similar, around 32%**, indicating comparable detours for longer or more varied routes.

Seaport activity

In 2023, despite contraction in port freight, several key ports continued to play vital roles in sustaining Europe's maritime logistics. **Rotterdam remains the leading EU port, handling 11.9% of total throughput, followed by Antwerp-Bruges and Hamburg**, each with distinct specialisations in liquid bulk, container traffic, and Europe-Asia trade. Ports such as Gdańsk, Algeciras, Amsterdam, Le Havre, Rouen and Paris, Marseille, and Constanța contribute to regional connectivity and diversification.

Truck movement

Truck movement analysis reveals significant variation in total distances across Member States, influenced by the number of routes and truck density per route. Italy, with twice as many routes as Spain, records over three times the total road distance run, indicating high truck activity. Germany and Lithuania show the shortest average edge[2] lengths, with Germany's figures reflecting a highly connected network and Lithuania's values shaped by its smaller geography and limited intermodal infrastructure. Overall, **intermodal connectivity across the EU varies widely, shaped by geography, infrastructure, and modal integration**, with Spain's challenges highlighting the impact of systemic barriers on freight efficiency and network development.

Barriers and bottlenecks

Rail freight's share of the European transport market has stabilised at around 17%, well below the EU's 2030 goals, while inland waterways continue to lose ground. Infrastructure limits—such as restricted terminal capacity, short tracks, and port congestion—constrain modal shift. **Terminal inefficiencies, low service frequency, and lower reliability than road transport weaken intermodal**

[1] In this context, "overhead" refers to the additional distance travelled by a mode of transport compared to the straight-line (as the crow flies") distance between the same two points.

[2] Edge is a short traffic segment linking two nodes which are origin or destination of road freight.

competitiveness. High transshipment costs, delays, and complex contracting further disadvantage short- and medium-haul flows where road retains cost and flexibility benefits.

The Combined Transport Directive has not kept pace with market needs, and data gaps hinder policy decisions. External shocks, such as energy price spikes and geopolitical disruptions, have highlighted supply chain vulnerabilities and raised costs for rail traction and terminal handling.

Areas of policy recommendation (more detailed in the corresponding section)

1. **Clarify and modernise Combined Transport:** Adopt a performance-based definition focused on external cost savings and maintain a terminal public register.
2. **Expand infrastructure and electrify networks**: Develop urban-proximate terminals, invest in resilient cross-border infrastructure, resolve track gauge issues, and accelerate rail electrification with incentives for low-emission traction.
3. **Improve terminal operations**: Modernise equipment with EU funding, deploy integrated ICT systems for efficiency and security, and mandate service transparency to support informed modal choices.
4. **Enhance service quality and reliability**: Increase train frequency and 24/7 terminal access, implement real-time monitoring tools, and create a unified contracting framework for intermodal services.
5. **Address cost and competitiveness**: Offer financial incentives to offset transfer costs, support innovative load unit designs, and introduce road pricing to boost rail competitiveness.
6. **Strengthen national frameworks and monitoring**: Require Member States to set combined transport targets, implement harmonised EU-level data reporting, and establish regular reviews of the Directive.
7. **Boost resilience to external shocks**: Develop contingency plans for critical infrastructure and diversify routing options in transport contracts to mitigate disruption risks.
8. **Enable regulatory flexibility**: Introduce exemptions from driving bans for short road legs and ensure the Directive allows operational adaptability while upholding safety and environmental standards.

2. CONTEXT AND OBJECTIVES

The objective of the proposed study is to provide a comprehensive analysis of intermodal terminals across the European Union, with particular attention to their spatial distribution and functional role within the logistics chain. This is against the backdrop of the Combined Transport Directive (CTD), a piece of EU legislation which has not been updated in 12 years. The aim of the Combined Transport Directive (CTD) is to incentivise the transport of freight over long distances where rail or waterborne transport is used for a significant part of the journey.

The use of road transport in the context of combined transport should be limited to either the first or the last part of the journey moving freight from its origin to an intermodal terminal and from a terminal to its destination. Essentially, the Directive allows for the adoption of less strict conditions for the road transport legs of combined transport journeys than would be the case if road transport were used for the whole journey, while also allowing fiscal incentives to be used to encourage combined transport.

As such, the new proposal for a revised CTD aims to:

- reduce the externalities from the transport sector such as CO_2 emission;
- support modal shift from road to rail and waterborne;
- facilitate the uptake of intermodal/multimodal transport;
- promote digitalisation; and
- improve infrastructure and service performance of non-road transport.

A core element of the legislative debate is the definition of combined transport, particularly how it relates to the length of each transport leg. While the European Commission proposed a revised definition based on external costs, the Council has expressed a preference to return to a distance-based definition. In this context, the study aims to offer a fact-based approach that will help inform the Parliament's position and ensure the debate remains grounded in objective evidence.

This is where data collection and presentation become especially relevant: the study aims to deliver a comprehensive mapping of intermodal terminals, providing valuable insights through visual tools, statistical data, and detailed analysis of how these terminals operate - including the distances they serve and the range of services they provide.

Among other recent updates, the following call for a review of the CTD, is inserted into the following regulatory context:

- Formalised with a law in July 2021, the European Union committed to reducing its economy-wide greenhouse gas emissions by 55% by 2030 compared to 1990 levels, with the aim of achieving climate neutrality by 2050, as established in the European Climate Law[3,4].
- The European Green Deal, launched in December 2019, sets a target for a significant portion of the 75% of inland freight currently transported by road to be shifted onto rail and inland waterways[5].

[3] European Climate Law - European Commission.

[4] EU's Climate Law presents a new way to get to 2040 On 2nd July 2025 the European Commission proposed an amendment to the EU Climate Law, setting a 2040 EU climate target of 90% reduction in net GHG emissions, compared to 1990 levels, following the Commission Political Guidelines 2024-2029.

[5] 06 2025 | A European Green Deal | Strategy for sustainable and smart mobility.

- The Smart Sustainable Mobility Strategy (SSMS), adopted in 2021, calls for a comprehensive overhaul of the regulatory framework governing intermodal transport[6].
- The RePowerEU plan, launched in May 2022, emphasises the need to revise CTD in order to decrease EU's reliance on fossil fuels[7].
- The Zero Pollution Action Plan, announced in May 2021, aligns with the aim to increase the usage of cleaner transport modes and thereby decrease CO2 emissions[8].

Ultimately, the study is intended to support the CTD **rapporteur and Members of the European Parliament** on the TRAN Committee with a well-founded and clearly defined position on the Directive.

[6] eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0789.
[7] REPowerEU.
[8] EUR-Lex - 52021DC0400 - EN - EUR-Lex.

3. OUR APPROACH

The primary sources used for the analysis and mapping of intermodal terminals were the Agora map (445 data points extracted, launched in 2010, continuously updated) and the SGKV map (532 data points extracted, launched in 2022, continuously updated); both were employed in parallel to complement each other's blind spots and enhance the overall richness of the compiled information, despite a slight divergence in the categorisation schemes applied by each. To meet the completeness and reliability requirements for this study, the approach for data collection was further complemented by:

- The integration of data from the terminal website for the 11 terminals coinciding with the case studies developed later in this report.
- Targeted ad hoc searches of terminal websites during the data cleaning phase, where appropriate.
- We expanded upon the findings of the Impact Assessment for the Combined Transport Directive, which was also conducted by Ricardo.

Further detail on our approach, please refer to the Annex II.

4. FINDINGS

4.1. SO1. Mapping of intermodal terminals, specifying their transhipment capacities, current level of use during the most requested time slots, transport modes served (rail, inland waterways, sea, etc.), and sample services offered

KEY FINDINGS

- Germany accounts for 25–30% of terminals, confirming its role as a central hub for intermodal transport in Europe.
- Rail infrastructure is available at 87–93% of terminals[9]; barge transport is present in 21–24%, while other modes (RoLa, short-sea shipping, ferry) are rare.
- Most terminals range in size from 10,000 to 50,000 m², with handling capacities between 500 and 2,500 TEUs.
- Usable track lengths differ by dataset: Agora reports a mean of 1,906 m (median 1,200 m), while SGKV shows longer tracks with a mean of 2,497 m (median 1,600 m), indicating possible infrastructure improvements in the last few years, since SGKV is more recent.
- Equipment quantities vary: terminals with empty cranes average 2.75 units, whereas those with straddle carriers average nearly 34 units.

4.2. Characterisation of intermodal terminals

An intermodal terminal is a specialised facility designed to facilitate the seamless transfer and efficient management of intermodal transport units (ITUs), primarily involving cargo stored in containers, swap bodies, trailers, trucks, and semi-trailers. These terminals also handle specialised transport units such as train wagons. By enabling interactions among different modes of transport, including road, rail, inland waterways and maritime, intermodal terminals significantly streamline logistics and enhance the efficiency of cargo movement. This way, increasing the share of lower-carbon modes of transport is a key element in the implementation of a sustainable transportation policy (Karas, 2024): **by prioritising rail and maritime transport for the main leg of the journey, a significant reduction in greenhouse gas (GHG) emissions can be achieved compared to road-only transport**, contributing to the decarbonisation of logistics chains.

In many European countries, intermodal terminals often clearly separate the ownership of infrastructure and superstructure from their operational and managerial functions. This division allows terminals to specialise operational control, fostering improvements in efficiency independent of the varied legal, corporate, or financial arrangements among terminal owners, operators, railway companies, and intermodal operators. Intermodal terminals typically manage the following types of transport combinations:

[9] The two terminal datasets analysed in this study yield differing percentage estimates.

- Road-Rail transport: Integration of road vehicles with rail networks. This includes semi-trailers, flatbed wagons and full truckloads, facilitating smooth transfers between road and rail.
- Road-Maritime transport: Connection between road vehicles and maritime vessels. Containers, semi-trailers and trucks are transported by ship for part of their journey and continue their route by road afterward.
- Rail-Maritime transport: Direct coordination between rail and maritime transportation, where trains with intermodal units arrive directly at port loading docks. Cargo transfer is managed through specialized cranes.
- Road-Inland Waterway transport: Coordination between road vehicles and inland waterway vessels. Goods are first transported by truck to river ports, where they are transferred—often in containers or trailers—onto barges for the waterway leg of the journey and then returned to road transport for final delivery.
- Rail-Inland Waterway transport: Integration of rail freight with inland waterway systems. Intermodal units such as containers are transported by train to river terminals located along navigable inland waterways. There, cranes or other handling equipment transfer the cargo onto barges, enabling efficient long-distance transport via rivers or canals.

The Combined Transport Directive directly supports the use of intermodal transport, with **intermodal terminals as crucial nodes within the multimodal transport chain**, providing essential infrastructure and logistical services that enable uninterrupted cargo flows. Their importance extends far beyond mere transfer points, as they greatly influence the overall operational efficiency and capacity of transport networks. By optimising infrastructure and services, intermodal terminals play a key role in enhancing the reliability, speed and cost-effectiveness of global multimodal freight transport. Intermodal transport is considered one of the most effective strategies for improving the sustainability of freight movement.

Therefore, this analysis aims to **map and characterise European intermodal terminals, drawing on three main sources**, as described in 4.2.1. This analysis aims to provide insights into the current state of intermodal infrastructure by highlighting the most observed characteristics across terminals. Furthermore, a subset of strategically significant intermodal terminals was identified to serve as a reference point for the subsequent assessment of terminal connectivity and inter-terminal interactions.

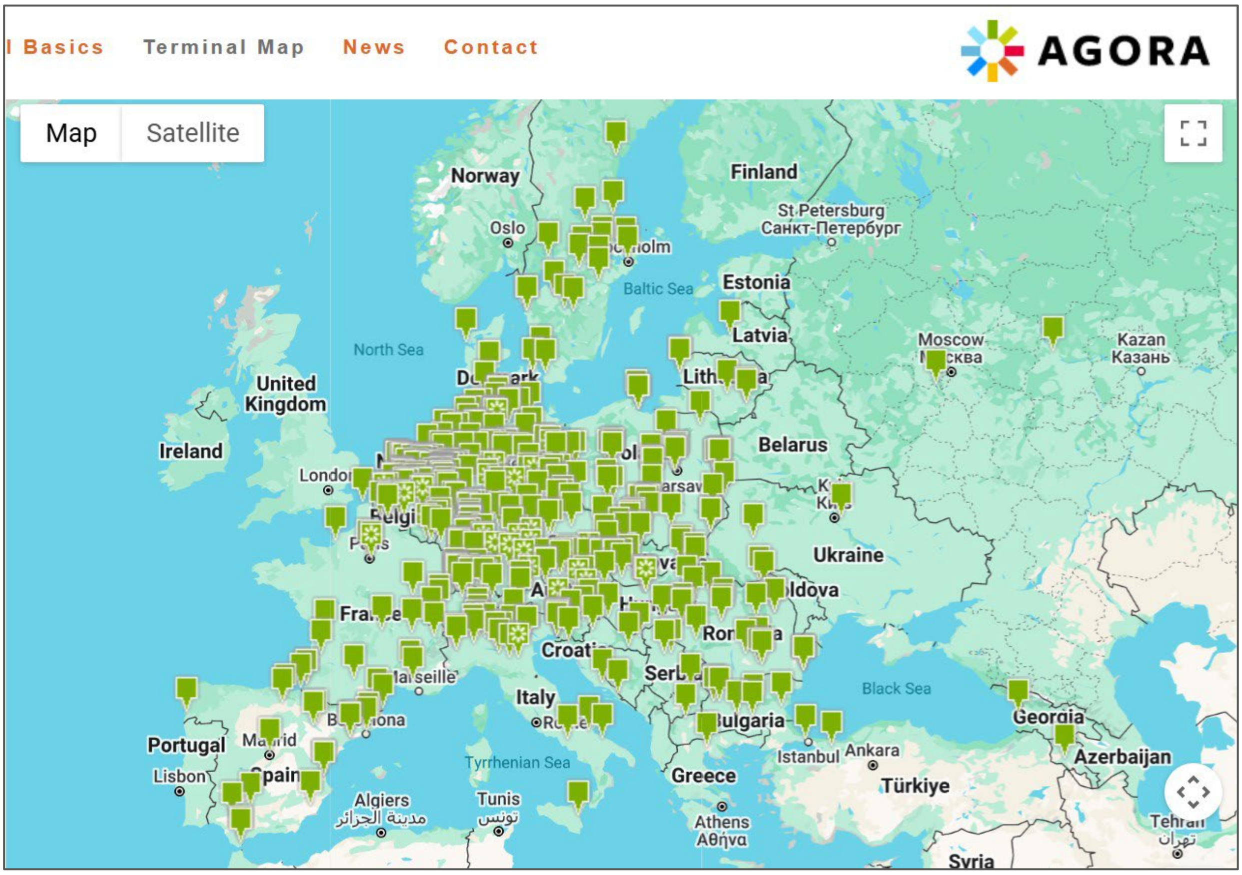
4.2.1. Sources for the analysis

The research conducted under this objective began with a systematic identification of data sources capable of providing comprehensive and consistent information on intermodal terminals. Key attributes of interest included terminal location, modes served, physical size, throughput capacity, connectivity, loading equipment, rail infrastructure, and available ancillary services.

To ensure analytical coherence, selected sources were required to present data in a standardised format across all terminals and maintain sufficient geographical coverage. At the same time, efforts were made to avoid scope creep by excluding facilities that, while used for storing goods, containers, or vehicles, do not actively support intermodal operations.

Building on Ricardo's prior work for the Supporting Study for the Evaluation and Impact Assessment of the Combined Transport Directive, and in collaboration with (European Commission, 2022), the team identified the following three data sources as having the highest potential to meet these criteria.

1. AGORA Intermodal Terminal Map



Accessible on https://intermodal-terminals.eu/terminalmap.php.

The interactive intermodal terminal database, which has been developed within the framework of the AGORA project and was launched by the ad-hoc working group on intermodal terminals in September 2010, offers a standardised access, presentation and information of intermodal terminals in Europe. **The dataset explicitly states its objective of continuous updating and expansion under the administration of KombiConsult.** In addition, the project supports and encourages collaborative contributions. The open structure of the platform, along with entries in selected data fields, provides evidence that terminal operators have actively added and updated information over time. However, there is no evidence that all entries are now up to date. When checking some terminal webpages that have undergone expansions or equipment acquisition, data may differ with that in the AGORA map, but this is also valid for the other data sources examined.

Pros

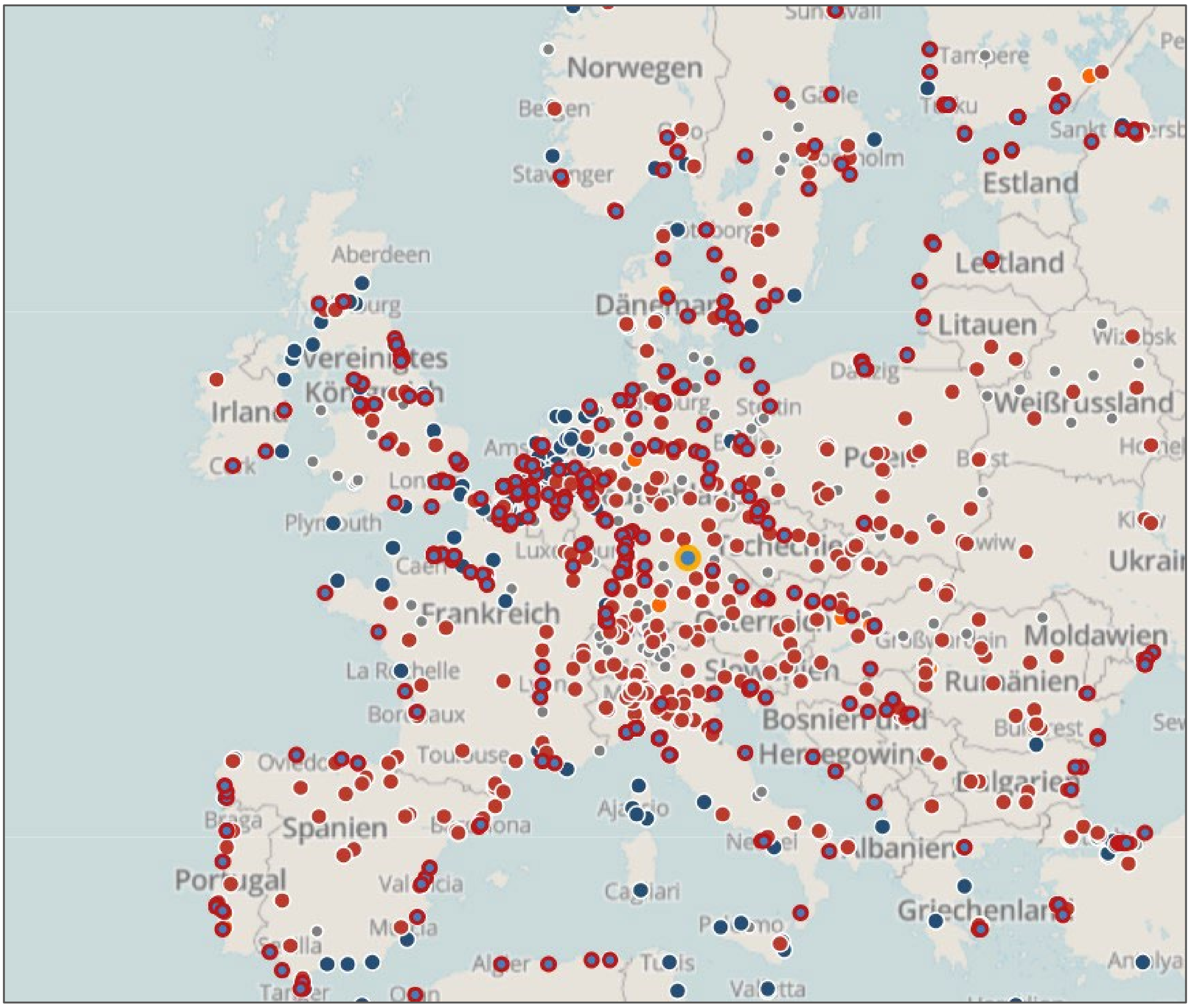
- In terms of the data offered for each terminal, it is the most comprehensive and systematically captured dataset. For example, whereas equipment data in other datasets is limited and dispersed across various device types, AGORA adopts a more focused and standardised approach. It concentrates specifically on gantry cranes and reach stackers, systematically reporting key metrics such as the number of units, handling capacity in tonnes per device, and the number of handlings per hour. This level of consistency is not observed in the other datasets reviewed.
- It covers all the area of our interest: modes served, physical size, throughput capacity, connectivity, loading equipment, rail infrastructure, and available ancillary services.
- Open layer promoting collaborative updates with indications that terminal operators have introduced new information, as previously mentioned.

- Very intuitive user interface for the extraction of data.

Cons

- The Project AGORA was launched 15 years ago. Although a collaborative and dynamic approach was sought, we already identified a number of cases where data on the terminal's website differ from the one in this dataset (although, this is not exclusive of this dataset).
- No data points were identified for EU Member States: Ireland, Finland, Estonia, and Portugal. In contrast, the SGKV maps does list 10 potential terminal locations in Portugal and five in Ireland, though these entries lack sufficient detail to be considered analytically robust.

2. SGKV Intermodal Map



Accessible on https://www.intermodal-map.com/.

Developed by **SGKV (Studiengesellschaft für den Kombinierten Verkehr)**, this map is one of the most comprehensive visualisations of **Combined Transport (CT) terminals** in Europe in terms of locations identified. It enables filtering by transport mode and facility type and offers information on combined transport connections, services, and equipment.

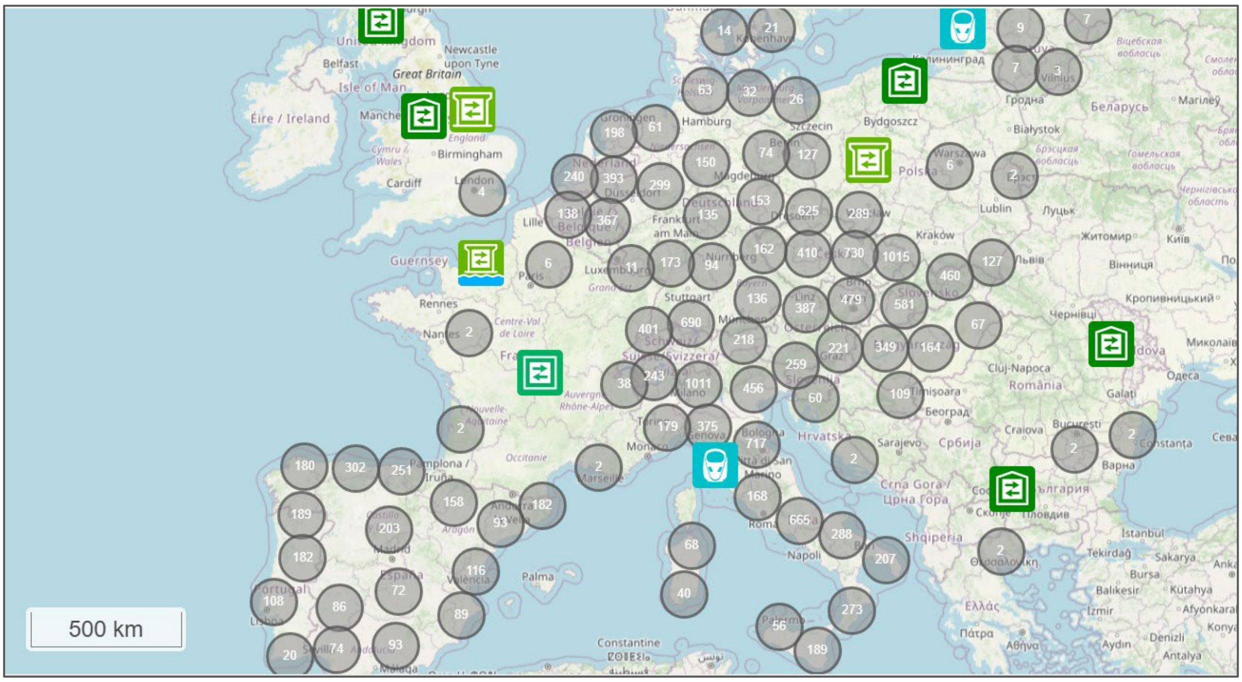
Pros

- It is the dataset focused on combined transport with the highest number of data points.
- It has information on transport / logistics operators at first / last leg services.

Cons

- As it has the highest number of data points, for most of the terminals the information is incomplete, fragmented or irregularly captured. For instance, the information on number of tracks and total length of usable tracks is missing for most of the terminals.
- The information is less standardised compared to the AGORA map. For key variables—such as loading equipment—the data lacks consistency and detail. Rather than presenting pre-defined attributes (e.g. number of units, handling capacity in tonnes, or operational efficiency metrics), the available information is limited, fragmented, and unevenly reported. This lack of uniformity complicates manual data extraction, processing, and subsequent analysis, representing a clear disadvantage relative to the AGORA map.

3. Rail Facilities Portal



Accessible on https://railfacilitiesportal.eu/topology/interactive-map?group=6198&layers=184.

The Rail Facilities Portal (RFP), launched by the European Commission in 2019 as the successor of the well-known "Railfreightlocations" portal, is a GIS-based digital platform that visually maps rail service infrastructure across Europe. It encompasses a wide range of facility types, including train stations, marshalling yards, intermodal terminals, and critical last-mile elements such as sidings. In addition to structural features, the portal also highlights available services at each location, such as refuelling stations, maintenance facilities, and customs operations. Designed to improve transparency and access in the rail logistics sector, the RFP helps ensure compliance with EU regulations—specifically Directive 2012/34/EU and Regulation 2017/2177. Today, the portal has been fully integrated into RailNetEurope's Infrastructure System (RIS), enhancing its usability and connectivity within the broader European rail network.

Pros

- The Rail Facilities Portal is supported by the European Union, reflecting its role in advancing strategic transport infrastructure under EU policy frameworks. It also fulfils essential regulatory functions by ensuring alignment with European legislation.

Cons

- It is more focus on rail than on intermodal. Facilities that enable the combination of road and barge does not receive any attention in this source.
- The portal covers a wide spectrum of facility types—ranging from major train stations and intermodal terminals to smaller service points such as marshalling yards, sidings, and refuelling stations, making the search less intuitive.
- The dataset exhibits similar completeness issues as the SGKV dataset and is further hindered by a non-intuitive structure, which significantly complicates data interpretation and extraction.

We provide a summary of our search for data source in the following table:

Dataset	Pros	Cons
AGORA	• Most comprehensive and systematically captured data per terminal • Consistent equipment data (e.g. gantry cranes, reach stackers) • Covers all relevant variables (modes, size, capacity, etc.) • Open, collaborative layer with updates from terminal operators • Intuitive user interface for data extraction	• Launched 15 years ago; some data may be outdated or inconsistent with terminal websites • No data points for Ireland, Finland, Estonia, and Portugal
SGKV	• Highest number of data points • Includes info on first/last leg logistics and transport operators	• Data often incomplete or fragmented • Missing key variables (e.g. facilities area, capacity in TEUs, most of times track length) • Poor standardisation complicates analysis
Rail Facilities Portal	• EU-supported and aligned with strategic and regulatory transport policy • Covers a broad range of facility types	• Focused primarily on rail-limited relevance for road-barge intermodal facilities • Includes many non-intermodal facilities • Non-intuitive structure; difficult data interpretation and extraction

Based on a comparative assessment of the relevance and usability of the available data sources, the AGORA map was selected as the primary foundation for the analytical exploration. This decision was informed by the map's relative completeness, consistency, and systematic presentation of key variables relevant to intermodal terminals.

However, recognising the potential for discrepancies due to outdated or inconsistent entries, we had recommended a cross-verification approach for the present deliverable. Specifically, **data points in AGORA were complemented with the SGKV dataset**. The data extracted from these maps correspond exclusively to terminals reporting information on either the number and length of tracks or on handling equipment. Terminals lacking data in both categories were excluded, as their contribution was deemed insignificant for the purposes of this analysis. In the case of the SGKV dataset, container depots and facilities labelled as "Other facilities", which did not demonstrate relevance to intermodal connectivity, were excluded to maintain consistency with the Agora dataset and to streamline the data extraction process. Only data points located within the borders of the EU27 were retained, although sometimes Swiss terminals or terminals from neighbouring countries can be mentioned, if relevant in the analysis. Given that our examination concluded the SGKV data to be more up to date than the Agora data, it is expected that some of the discrepancies between the two datasets may be attributable to infrastructure improvements over time. However, it is not possible to accurately assess the extent of this impact.

To enhance completeness and reliability, this approach for data collection was further complemented by:

- The integration of data from the terminal website for the 11 terminals coinciding with the case studies developed later in this report.
- Targeted ad hoc searches of terminal websites during the data cleaning phase, where appropriate.
- TEU capacity is reported for 243 of the 445 terminals identified in the AGORA dataset, with even lower coverage in other sources. For intermodal terminals located within seaports, we explored Eurostat as alternative source of TEU data, which could help supplement gaps in terminal-level reporting. However, Eurostat provides port activity data in TEUs, specifically covering the volume of containers handled at major EU ports. However, port storage capacity in TEUs is not included in Eurostat's publicly available datasets. The focus is on throughput and transport performance rather than infrastructure capacity.

It is acknowledged that, due to time and resource constraints, the final dataset may represent only a fraction of the total number of intermodal terminals across the EU; however, it is considered sufficiently robust to constitute a representative sample that captures common characteristics and prevailing trends. Nonetheless, expanding the dataset solely to increase coverage is not advisable if the additional data points lack substantive information for the analysis and merely serve as geographic placeholders.

The implicit conclusion from this data identification task is that the EU lacks a comprehensive, standardised and free to access mapping system for intermodal terminals in the Union.

4.2.2. Geographical distribution of intermodal terminals

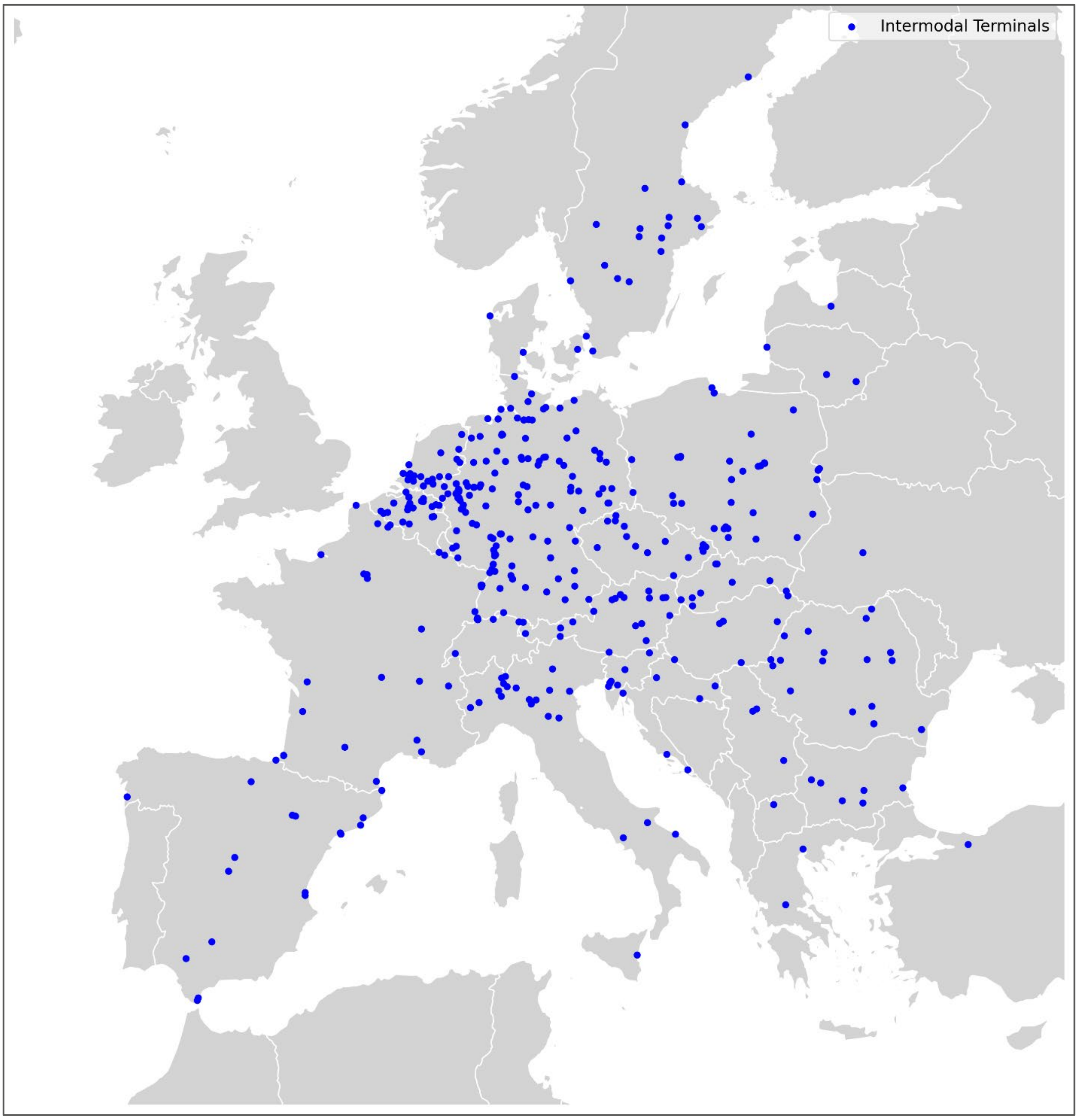
As seen in Figure 4-1, the Agora database includes 445 intermodal terminals, with a primary focus on those located within the European Union. The SGKV intermodal terminal dataset shows 532 data points. Between 25 and 30% of these terminals are situated in Germany, confirming its role as a central hub for intermodal transport in Europe.

This prominence is largely due to Germany's strategic geographic location and highly developed transport infrastructure. The country is integrated into Europe's largest inland waterway network—centred on the Rhine River—and own the most extensive rail infrastructure in Europe, ranking sixth globally by total railway length (as of 2021). Germany also hosts one of the continent's densest intermodal terminal networks, enabling high-frequency rail-road transfers, and serves as a key node within several TEN-T corridors, including the Rhine-Alpine and North Sea-Baltic routes.

These combined factors underpin Germany's strong capacity to develop and operate intermodal terminals at scale.

Figure 4-1: Geographical distribution of intermodal terminals in the EU-Agora and SGKV data

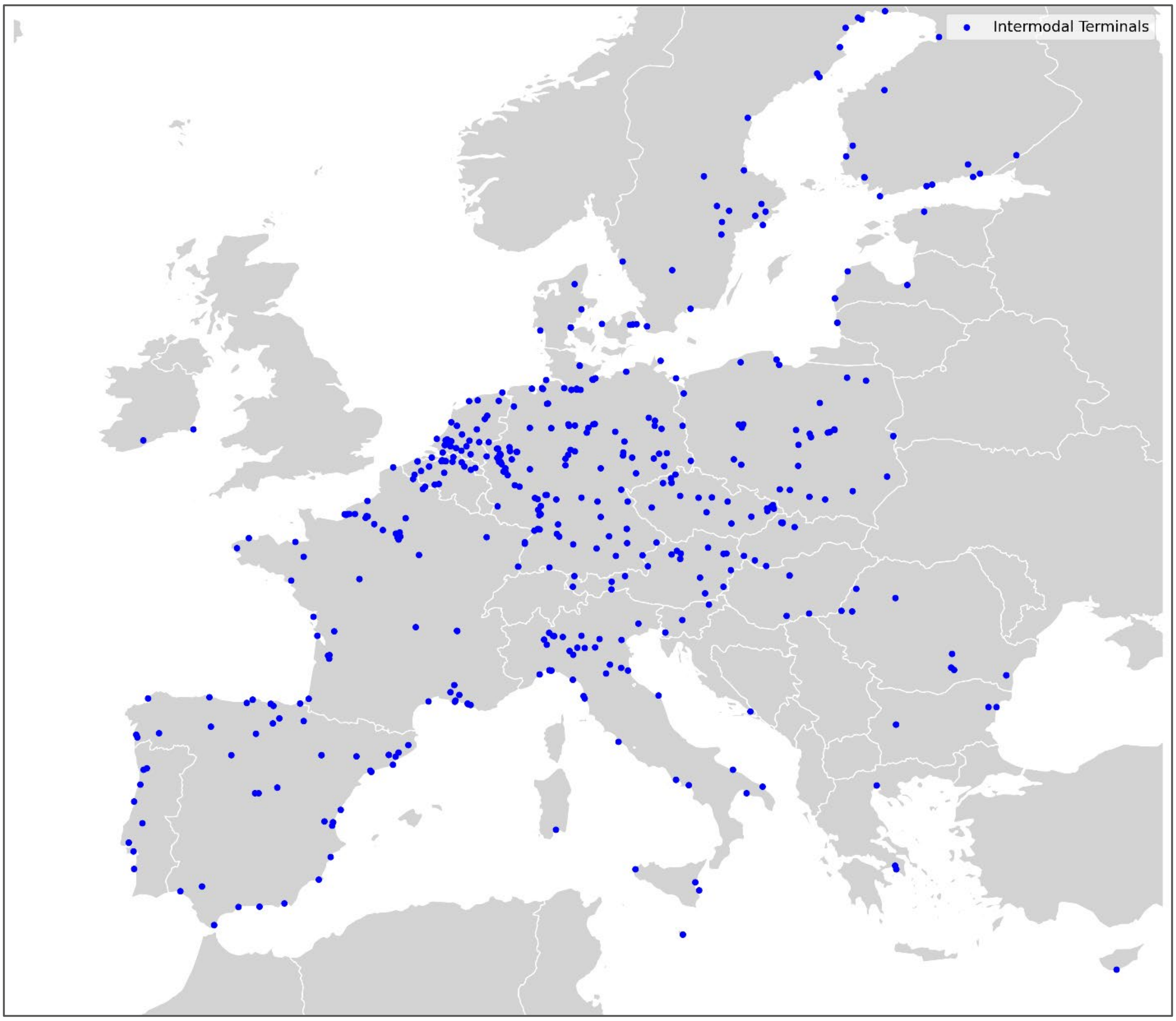
Agora data



Reading base: 445 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

SGKV data



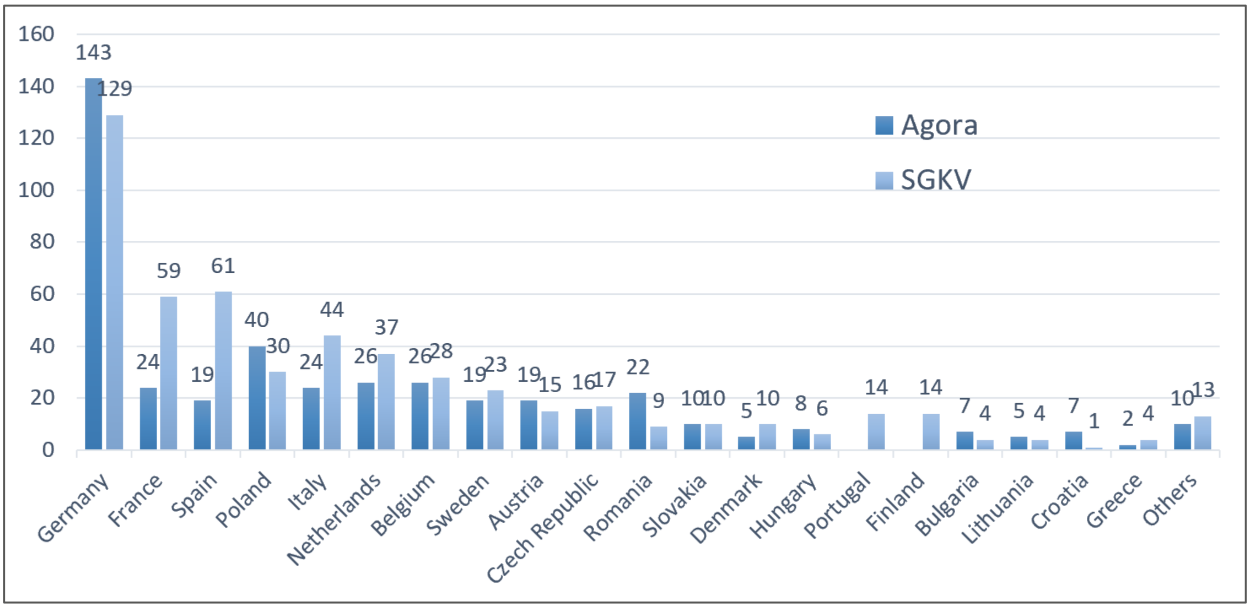
Reading base: 532 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from SGVK.

The second country with the most terminals in our search is France. France hosts a large number of intermodal terminals primarily due to its strategic geographic position in Western Europe. The country benefits from direct access to two major maritime gateways: the North Sea and the Atlantic Ocean. This dual access enables France to serve as a critical hub for maritime trade flows coming from Northern and Western Europe, facilitating efficient transfer of goods between sea and land transport modes.

Moreover, France's intermodal terminals are closely integrated with the broader European transport network through their connection to the Rhine River corridor. Although France does not lie directly on the main stretch of the Rhine, its terminals are linked either directly or via connecting inland waterways and rail networks to this key corridor. The Rhine River corridor represents one of Europe's most significant inland waterway systems, providing a vital artery for the movement of bulk and containerized cargo across multiple countries.

Figure 4-2: Number of identified intermodal terminals per country using Agora and SGKV data



Reading base: Intermodal terminals in the EU from Agora map (445 datapoints) and SGKV map (532 datapoints).
Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

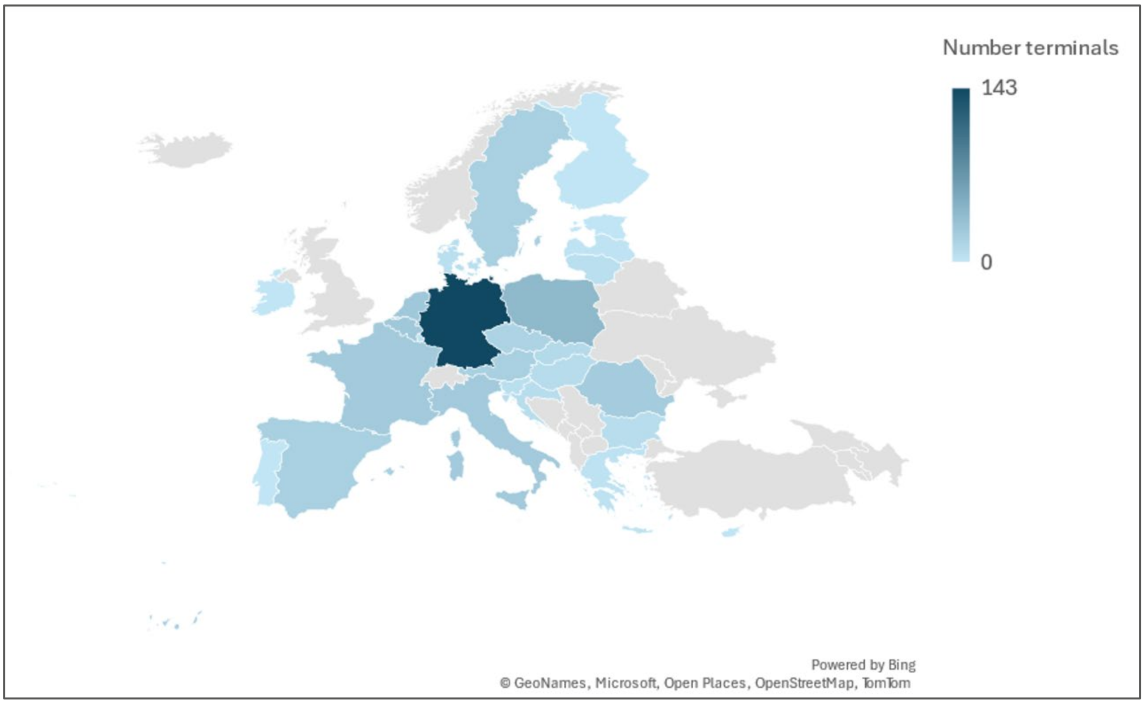
Continuing with the geographical analysis, Figure 4-2 highlights a second group of countries, each with between 25 and 50 terminals. This group includes a diverse mix of countries. This group includes Spain and Italy, both of which have coastlines on the Mediterranean Sea and the Atlantic Ocean (in the case of Spain). They also feature well-developed railway infrastructures, with each country operating over 16,000 km of rail lines. These networks are crucial for connecting port cities to inland logistics hubs and for supporting long-distance freight transport. The high concentration of intermodal terminals in Poland can be attributed to several interrelated factors, starting with Poland's strategic geographical location at the crossroads between Western Europe and key Eastern partners. The country shares borders with seven countries. Terminals like Małaszewicze are critical for Eurasian traffic, especially China-Europe rail via the Silk Road. As Germany, Poland also benefits from direct access to the Baltic Sea, with the seaports of Gdańsk and Gdynia playing a crucial role in both international and domestic intermodal traffic. These ports are integrated with extensive rail networks that connect inland terminals in cities such as Warsaw, Poznań, Łódź, and Kutno, ensuring efficient inland distribution of maritime cargo (Office of Rail Transport, 2022). Geographically, some of the countries in this second group (Belgium, the Netherlands) are positioned in Western Europe and benefit from direct access to both the North Sea and the Atlantic Ocean. In addition, they are all connected, either directly or indirectly in the case of France, to the Rhine River corridor, which supports intermodal transport through one of Europe's most important inland waterway systems.

A third group of countries is headed by Austria and the Czech Republic. Although they lack direct access to the sea, their central location makes them vital overland corridors between Western and Eastern Europe. Their relatively dense railway networks, considering their geographical size, enable efficient cargo flow across borders and enhance their importance in the European intermodal system.

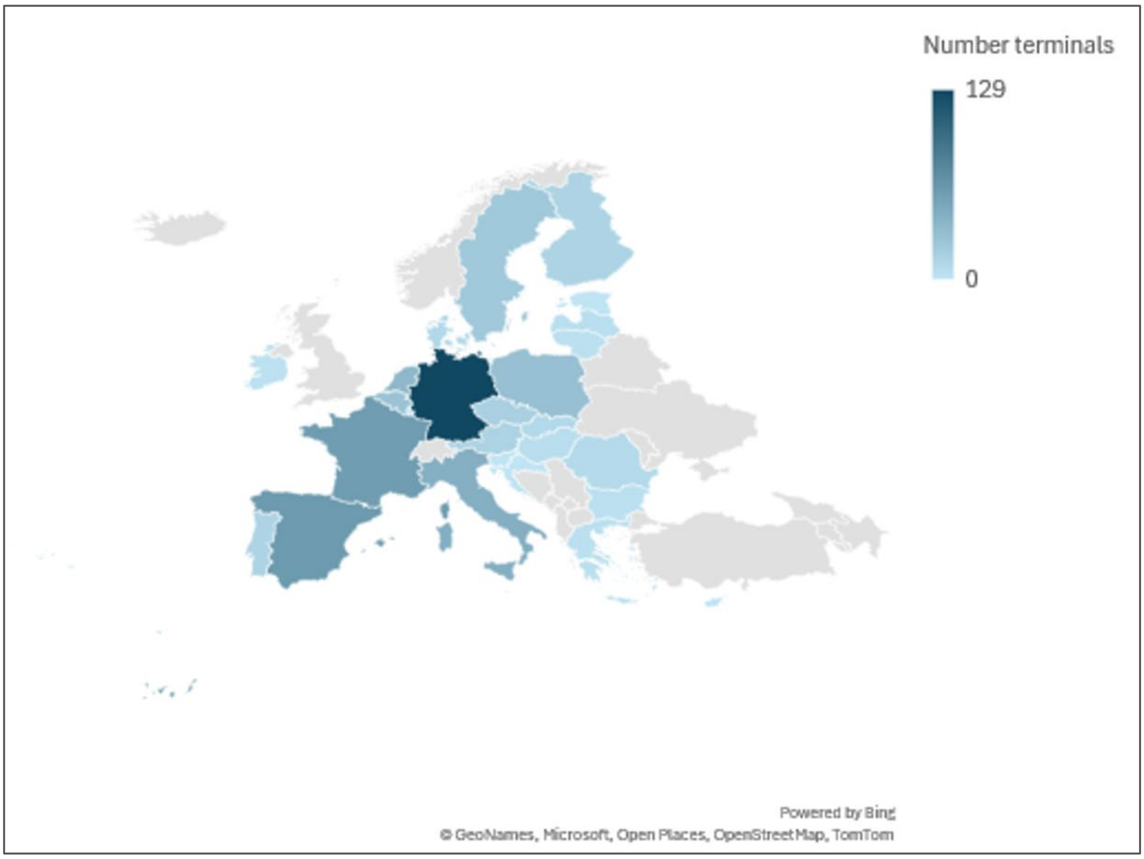
In summary, countries with strong intermodal terminal networks typically benefit from coastal access, central location along key corridors, or robust rail and inland waterway infrastructure. In contrast, countries with fewer terminals tend to be landlocked, peripheral, or constrained by limited transport systems, reinforcing the importance of geography and infrastructure in shaping terminal distribution.

Figure 4-3: Map of distribution of intermodal terminals across Europe – Agora and SGKV data

Agora data



SGKV data



Reading base: Intermodal terminals in the EU from Agora map (445 datapoints) and SGKV map (532 datapoints).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

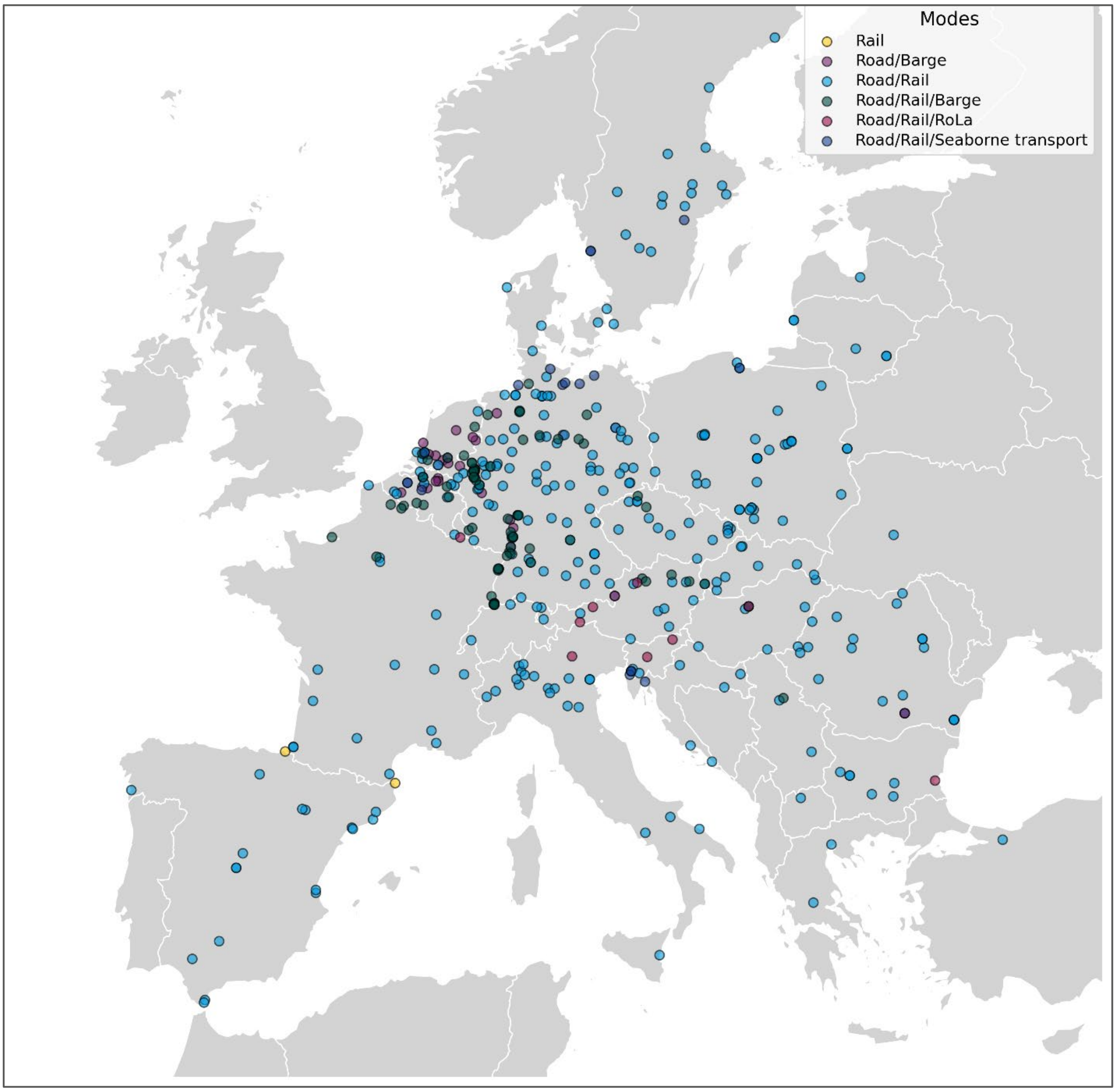
4.2.3. Modes served by intermodal terminals

According to the database used, there are six types of modes served by intermodal terminals. These are the following:

- Road: Terminals where trucks load or unload containers or semi-trailers.
- Rail: Uses trains to move large volumes of goods over long distances.
- Barge: Uses inland waterways (rivers and canals) for transporting containers on flat-bottomed boats.
- RoLa (Rolling Highway): A type of rail transport where entire trucks (with driver) are loaded onto special trains.
- Shortsea: Refers to sea transport of goods between nearby coastal ports, usually within the same continent.
- Ferry: Transports vehicles and containers across bodies of water (often for shorter distances) using ships that operate on fixed routes and schedules.

Figure 4-4: Modes served by intermodal terminals – Agora and SGKV data

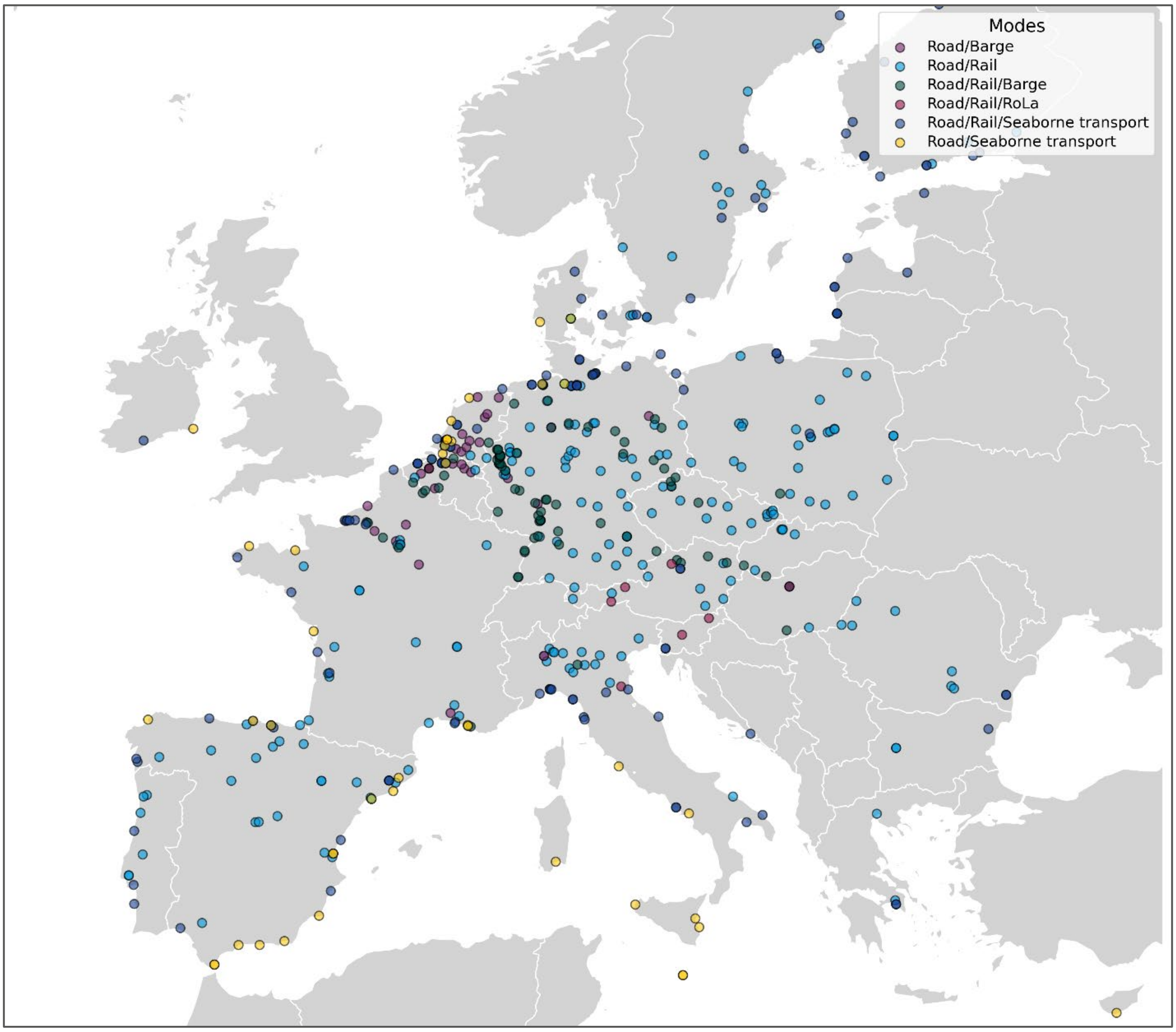
Agora data



Reading base: 445 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

SGKV data

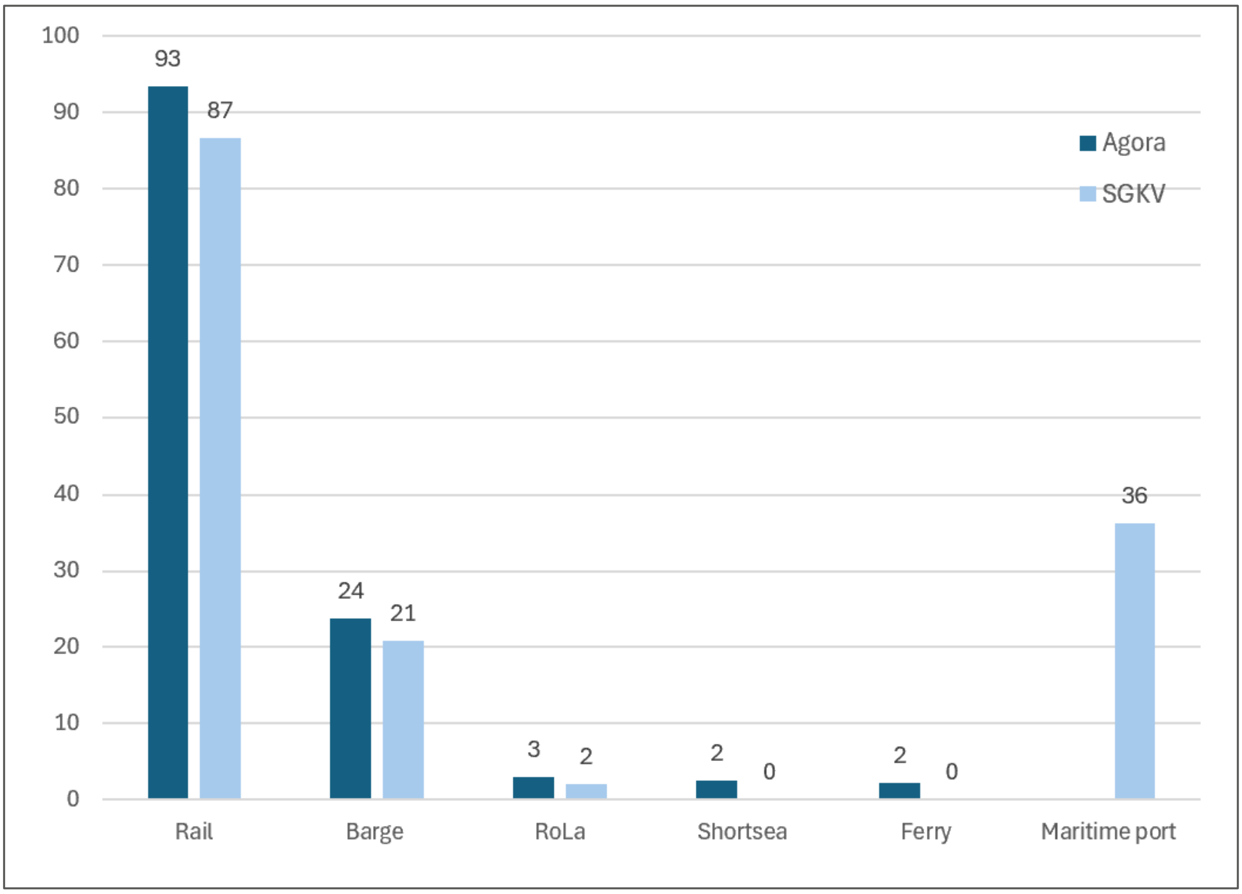


Reading base: 532 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from SGVK.

According to the Figure 4-5, which summarises the modes served at each intermodal terminal in the database, **rail infrastructure is available in 87- 93% of the total network.** Rail's versatility is a key factor in this prevalence, as it supports operations at both inland terminals and port facilities—unlike certain other modes, which are more geographically constrained. **Barge transport is the next most commonly available mode**, present in 21-24% of terminals. Its distribution is largely concentrated in countries with access to major navigable rivers, such as the Rhine and the Danube. Due to the necessary fluvial and canal systems, inland waterways (IWW) infrastructure is far less common than rail infrastructure in Europe, contributing to its overall smaller modal share. While only two EU Member States have no rail systems (Malta and Cyprus), ten have no IWW infrastructure in use (UIC Freight Department, 2023). **Other modes—namely Rolling Highway (RoLa), short-sea shipping, and ferry services—are available in only a small fraction of terminals**, each appearing in no more than 3% of the total. Their limited deployment reflects their dependence on specific geographical and infrastructural conditions.

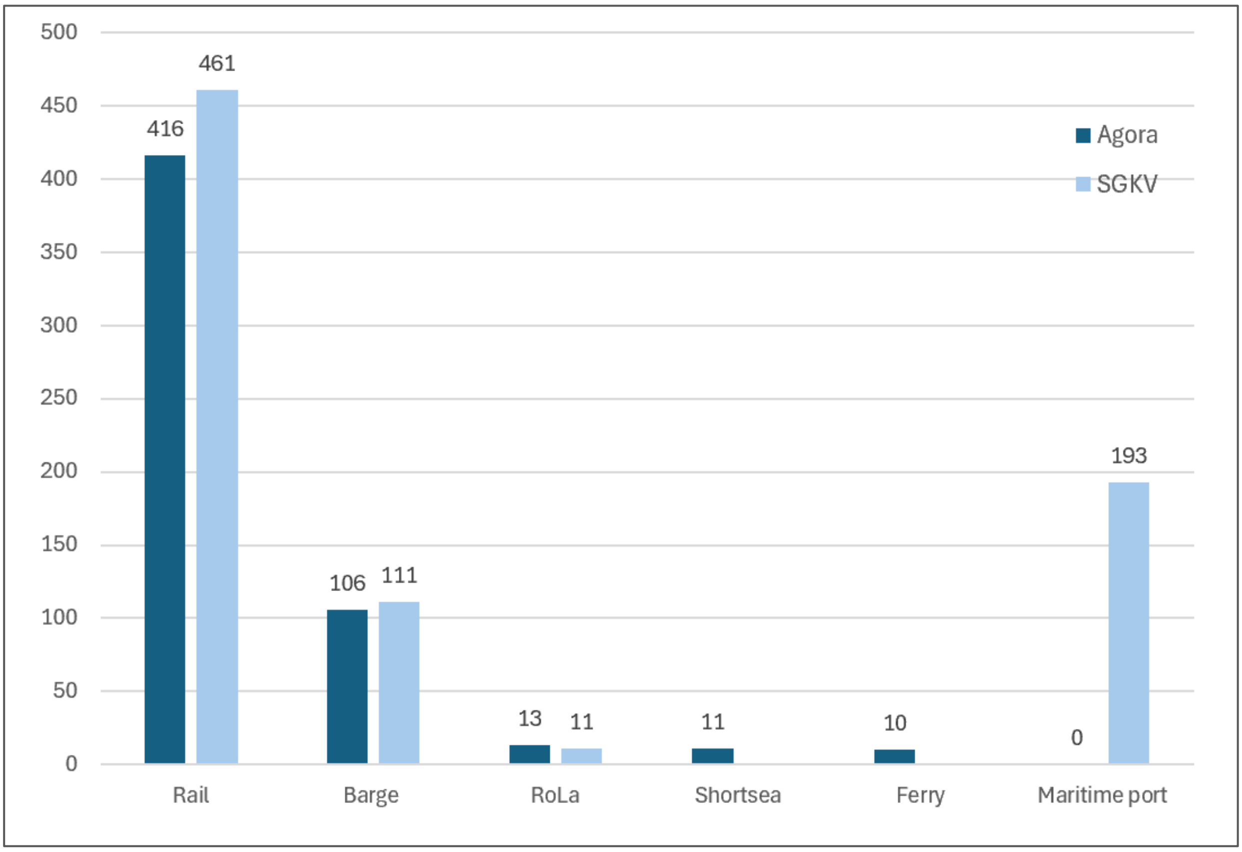
Figure 4-5: Percentage of terminals serving each mode (%)[10]



Reading base: Intermodal terminals in the EU from Agora map (445 datapoints) and SGKV map (532 datapoints).
Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

[10] While the Agora map identifies terminals that offer ferry and shortsea services for freight purposes, the SGKV map identifies Trimodal or Road / Waterway terminals which were later split, by analysis into Barge terminals and Maritime ports. That is why the categorisation offered by Agora does not coincide with the one offered by SGKV.

Figure 4-6: Number of intermodal terminals with each transport mode

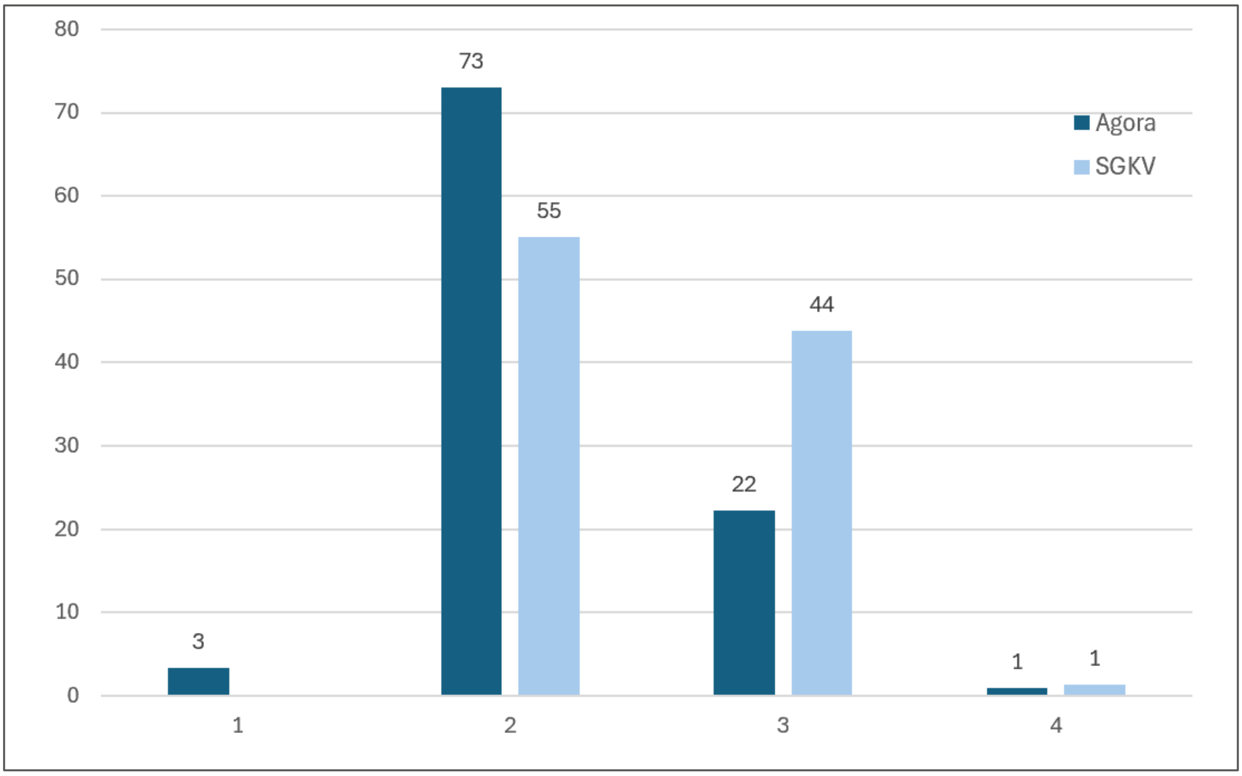


Reading base: Intermodal terminals in the EU from Agora map (445 datapoints) and SGKV map (532 datapoints).
Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

In terms of how many modes each terminal typically serves, Figure 4-7 shows the distribution of terminals by the number of modes they accommodate. The figures reveal a notable discrepancy between the Agora and SGKV datasets. In the SGKV map, terminals serving three modes account for 44% of the total, compared with only 22% in the Agora map. This difference appears to stem from variations in categorisation: SGKV includes maritime transport as a mode in all relevant cases where there is connection to the sea, whereas Agora records it only when shortsea shipping or ferry logistics are explicitly offered by the terminal. Among terminals classified as serving three modes, the most common combination is road, rail, and barge, underlining the predominance of these three transport modes.

Figure 4-7: Percentage of terminals according to number of modes present (%)

In the Figure 4-7, the data show that most terminals accommodate two or three transport modes. By contrast, terminals offering four or more modes are comparatively rare, as illustrated in the figure below.



Reading base: Intermodal terminals in the EU from Agora map (445 datapoints) and SGKV map (532 datapoints).
Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

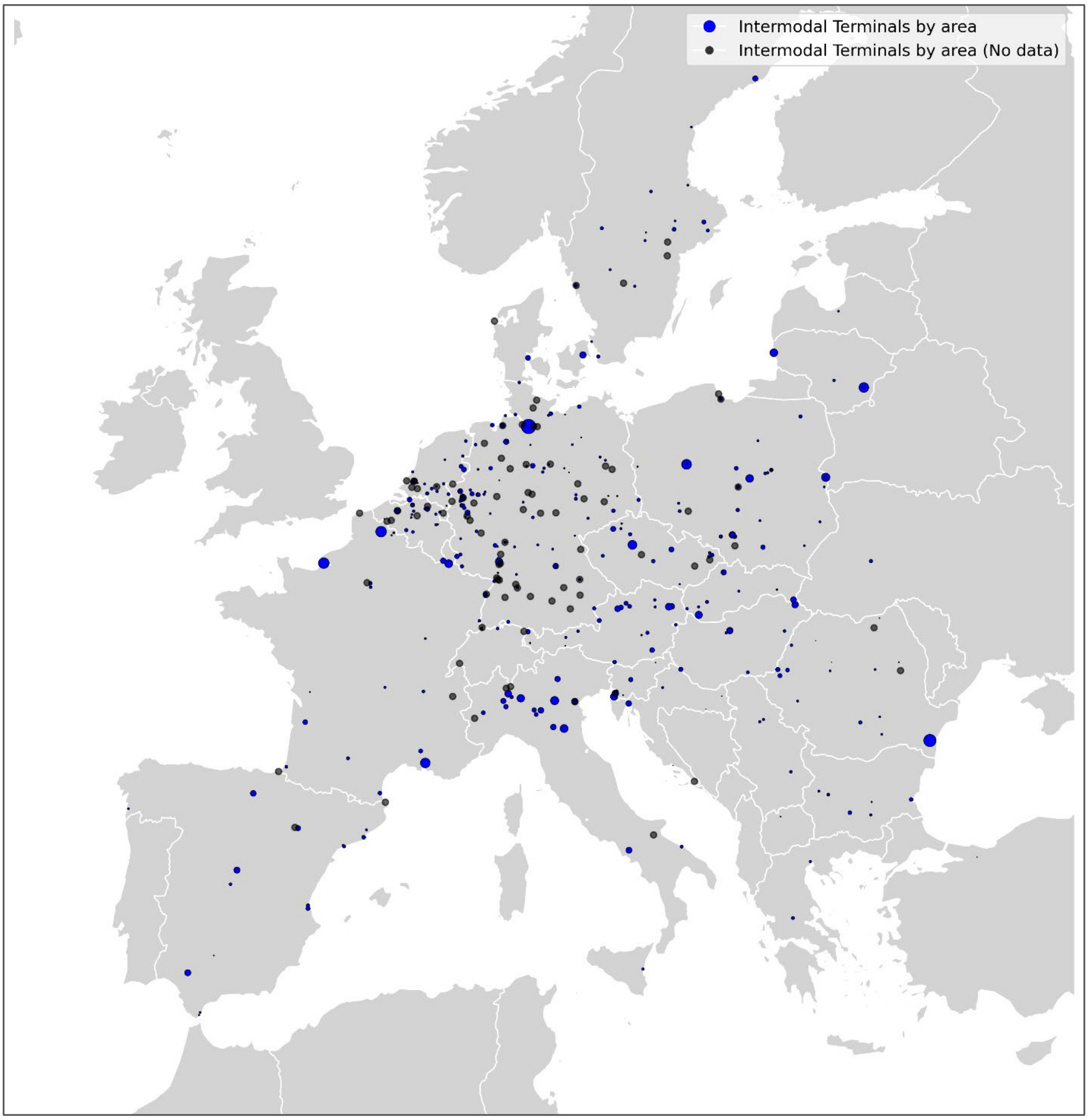
4.2.4. Size and capacity of intermodal nodes

Terminal size is defined by the total terminal area, measured in square meters. The dataset of Agora includes terminals ranging from 750m² to 1,106,146m², reflecting a wide variety of sizes. The dataset extracted from SGKV map does not contain information on surface of the terminals. The information found in Agora was complemented with data from the webpages of the most relevant intermodal terminals. To facilitate the analysis, terminals are grouped into the following size categories:

- Less than 10,000m²
- Between 10,000 and 50,000m²
- Between 50,000 and 150,000m²
- Between 150,000 and 300,000m²
- More than 300,000m²

For some terminals, information on their total area was not available in the consulted data sources.

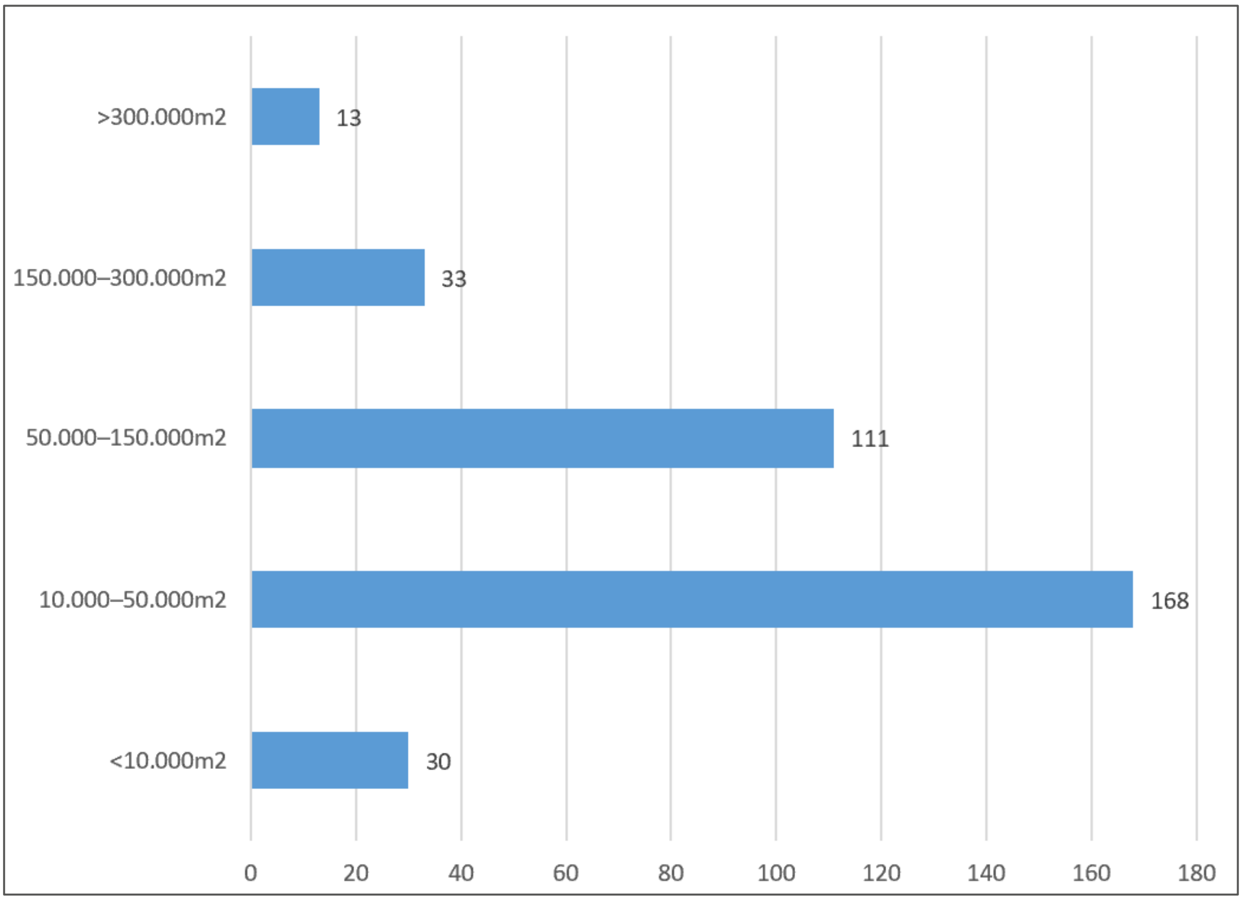
Figure 4-8: Map of size of intermodal terminals (only Agora data)



Reading base: 445 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

Figure 4-9: Number of terminals by area range



Reading base: 340 intermodal terminals in the EU reporting data on area.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

The Figure 4-9 shows the number of terminals in each range[11]. It indicates that the most common terminal size ranges are between 10,000 and 50,000 m² and between 50,000 and 150,000 m². **This suggests that medium-sized terminals are the most prevalent.** In contrast, terminals smaller than 10,000 m² are less common. Similarly, terminals larger than 150,000 m² are also less numerous, as they require significantly more equipment to be operated.

The average terminal area across the dataset is 68,916 m², while the median stands at 35,000 m², highlighting a skewed distribution with a few significantly larger facilities.

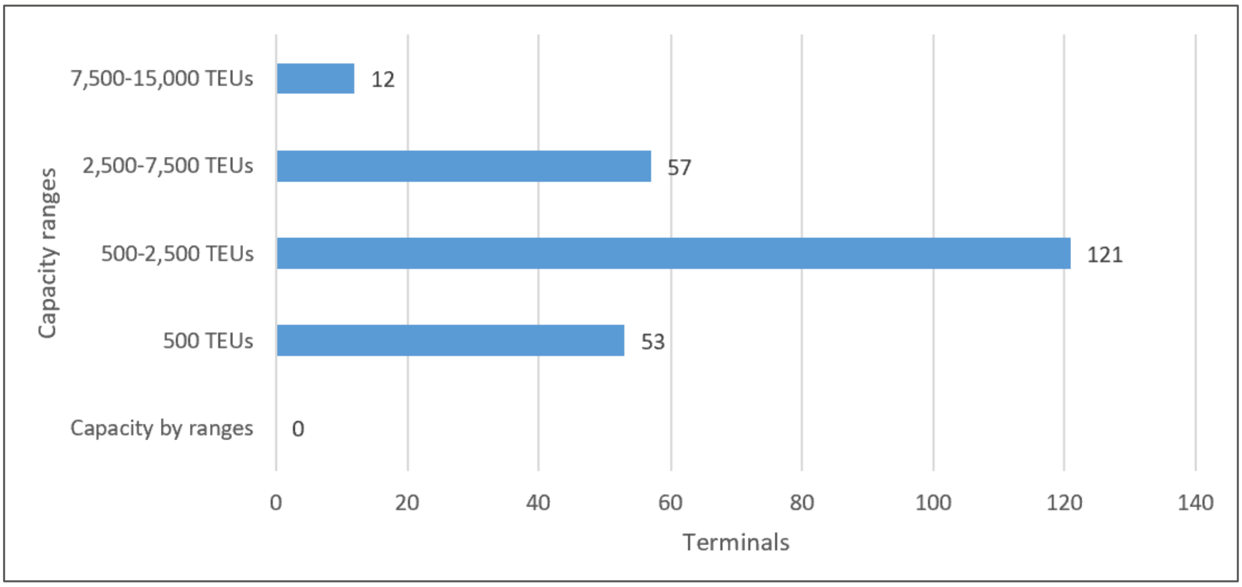
Terminal capacity is defined by the number of TEUs that can be accommodated in interim storage. It should be noted that capacity data in TEUs is available for 243 out of the 445 terminals in the dataset from Agora, while the SGKV map does not report this variable**.** In the case of Agora, while the data available represents a substantial portion of the dataset, the partial coverage may introduce some limitations to the completeness of the analysis. The information found in Agora was complemented with data from the webpages of the most relevant intermodal terminals. Within the sampled terminals, **capacity varies significantly—from as few as 40 TEUs to as many as 1,000,000 TEUs**. This highlights the considerable heterogeneity in terminal sizes across the network. Again, in order to analyse the capacities of the terminals, ranges were made, obtaining the following:

- Less than 500 TEUs

[11] There are 91 terminals for which there was no data, or the data was zero. These have not been included in the analysis.

- Between 500 and 2,500 TEUs
- Between 2,500 and 7,500 TEUs
- Between 7,500 and 15,000 TEUs
- More than 15,000 TEUs

Figure 4-10: Number of terminals by capacity range



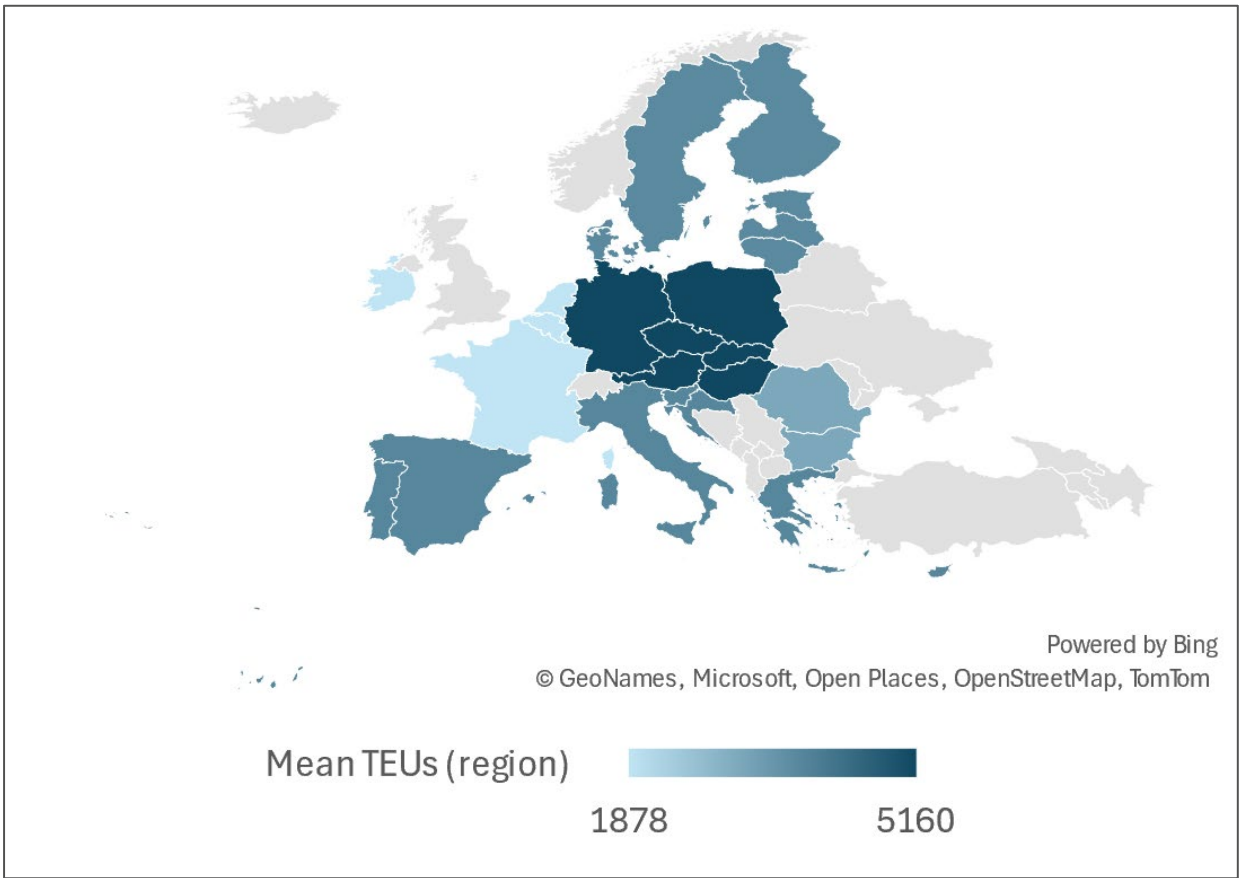
Reading base: 243 intermodal terminals in the EU reporting capacity in TEUs.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

The Figure 4-11 illustrates the distribution of terminals by TEU capacity range, showing that the most **common capacity lies between 500 and 2,500 TEUs**. Unlike terminal size—which is more frequently in the medium range—capacity is concentrated in the lower tiers. Most terminals fall into the small-to-medium category, with a balanced number in the <500 TEU and 2,500–7,500 TEU ranges. Terminals with higher capacities are significantly less common, indicating that intermodal facilities generally operate with modest handling volumes. This also suggests that capacity is less scalable than physical size. Regarding the distribution of TEU capacity across the various regions of Europe, an analysis was conducted to determine the average TEU capacity per region.

For the following analysis of capacity in TEUs by region within Europe, two outliers were removed from the averages: Constanta South Terminal (Romania), with a capacity of 1,000,000 TEUs, and Rijeka Brajdica (Croatia), with a capacity of 600,000 TEUs. This yields the following map of TEU capacity by region:

Figure 4-11: Map of TEU capacity by region (only Agora data)



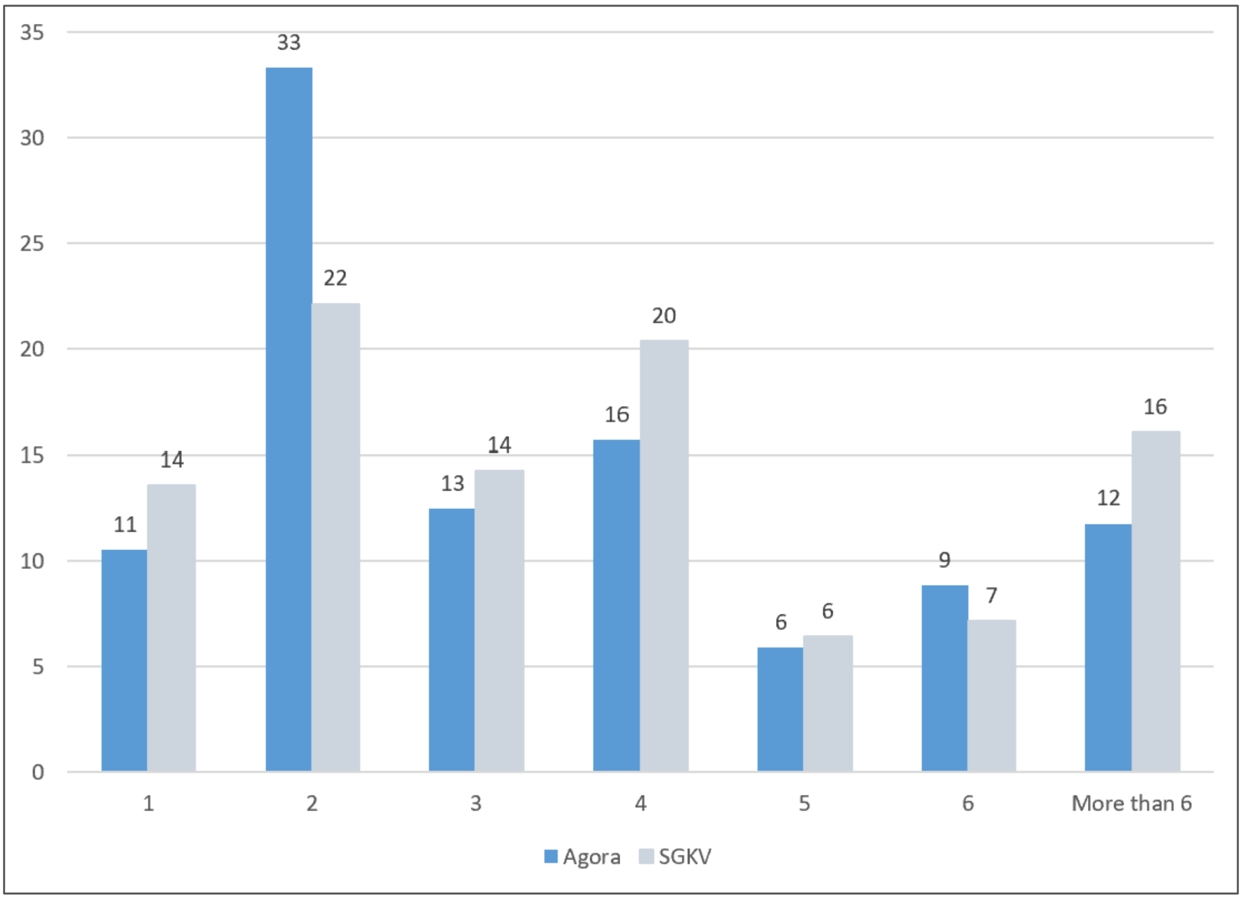
Reading base: 445 intermodal terminals in the EU.
Source: Own elaboration based on data extracted from Agora Intermodal Map.

4.2.5. Infrastructure for rail operation

Rail is the third most-used freight transport mode in Europe, accounting for 11.9% of total freight in 2020, following road transport, which holds a 53.8% share. The development of combined transport has played a key role in supporting rail operations. According to the International Union of Railways, combined transport grew by 42% between 2010 and 2022—more than double the growth of conventional road freight (19%) over the same period (UIC Freight Department, 2023).

In the current terminal sample, **87-93% of facilities support rail services**. Within these terminals, rail infrastructure typically comprises a multi-track system that enables efficient loading and unloading, staging, and direct connection to mainline networks. These tracks are essential to the operational integration of rail within terminal activities. Figure 4-12 shows the number of tracks within the sample of terminals.

Figure 4-12: Percentage of terminals according to number of tracks (%)



Reading base: Intermodal terminals in the EU reporting number of tracks, from Agora map (408 datapoints) and SGKV map (280 datapoints).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

The Figure 4-12 shows that most intermodal terminals have typically between one and six tracks. This is likely due to space constraints within terminal areas. **The most common configuration is two tracks, even for smaller terminals** with lower traffic volumes having at least two tracks helps prevent congestion and facilitates smoother operations. A slight discrepancy between the Agora and SGKV datasets suggests that some terminals may have added rail tracks over time, as the SGKV dataset is more recent and reflects updated information.

The mean number of tracks of terminals according to the Agora data is 3.8, and their median is 3 tracks. In the SGKV data, the mean number of tracks is 4 and the median is 3.5, confirming the concept that a more updated dataset shows and increase over time of number of tracks in the network.

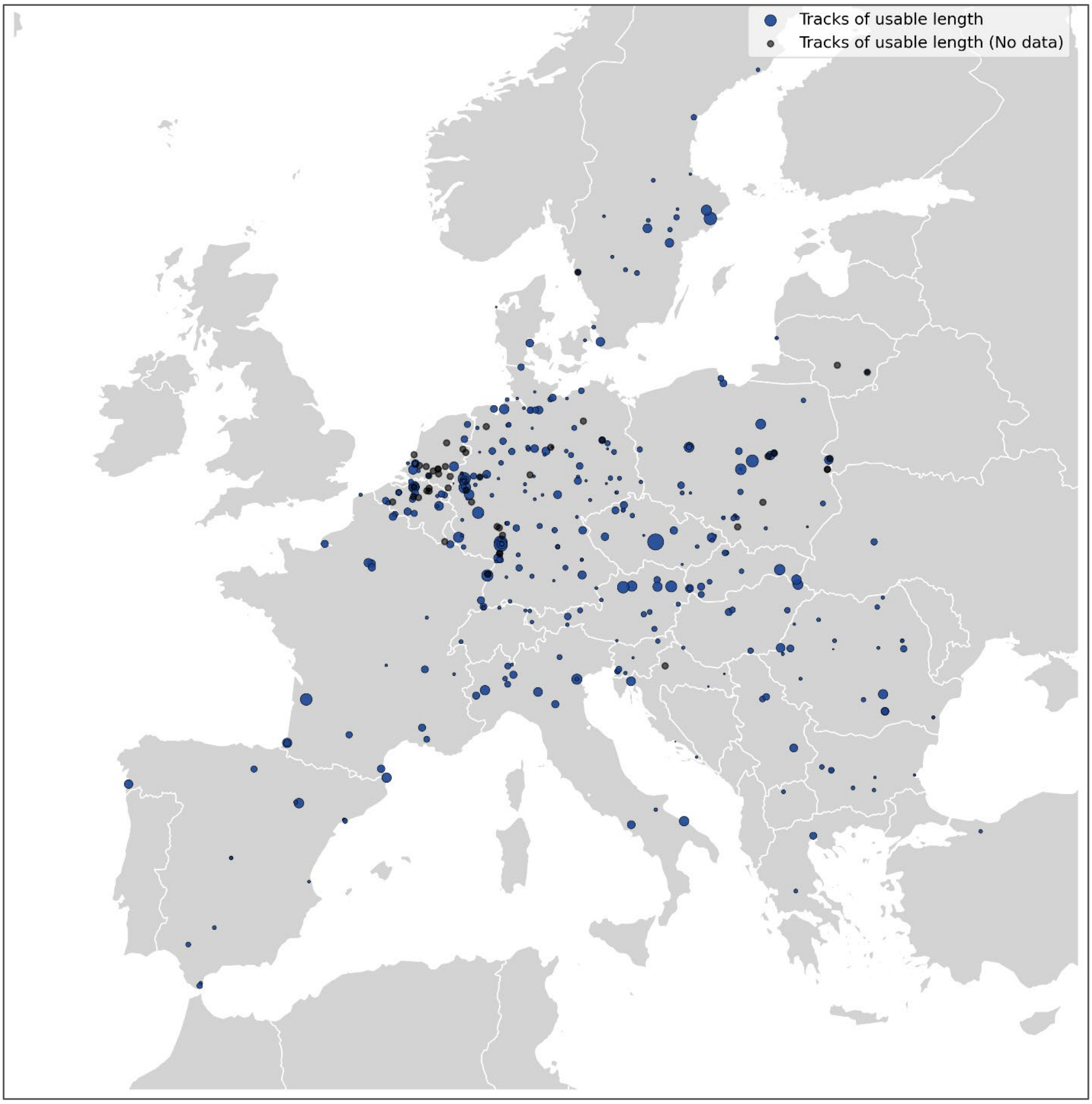
In addition to the number of tracks, another key metric for rail operations is the length of usable track. This measure, expressed in meters, indicates the length of rail infrastructure available for operational use. While closely correlated with the number of tracks, a separate analysis was conducted by categorising terminals according to ranges of usable track length as follows:

- Less than 500m
- Between 500 and 1,000m
- Between 1,000 and 3,000m
- Between 3,000 and 7,000m
- More than 7,000m

The spatial distribution of terminals is illustrated as follows. In the accompanying map, terminal facilities are represented by dots, with the size of each dot corresponding to the relative length of available rail tracks—larger dots indicate terminals with longer track infrastructure.

Figure 4-13: Track of usable length (based on length of the tracks) – Agora and SGKV data

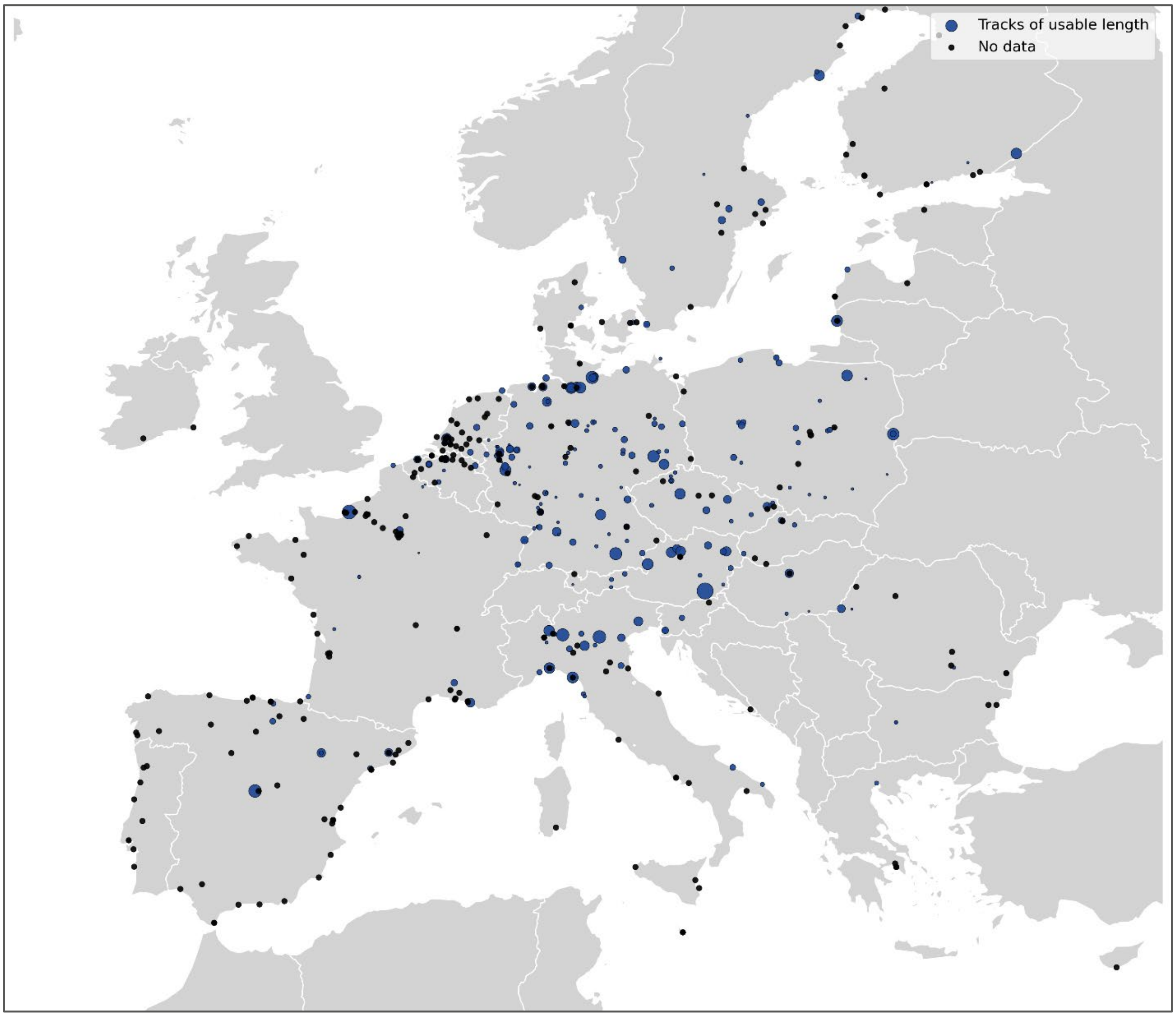
Agora data



Reading base: 445 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

SGKV data

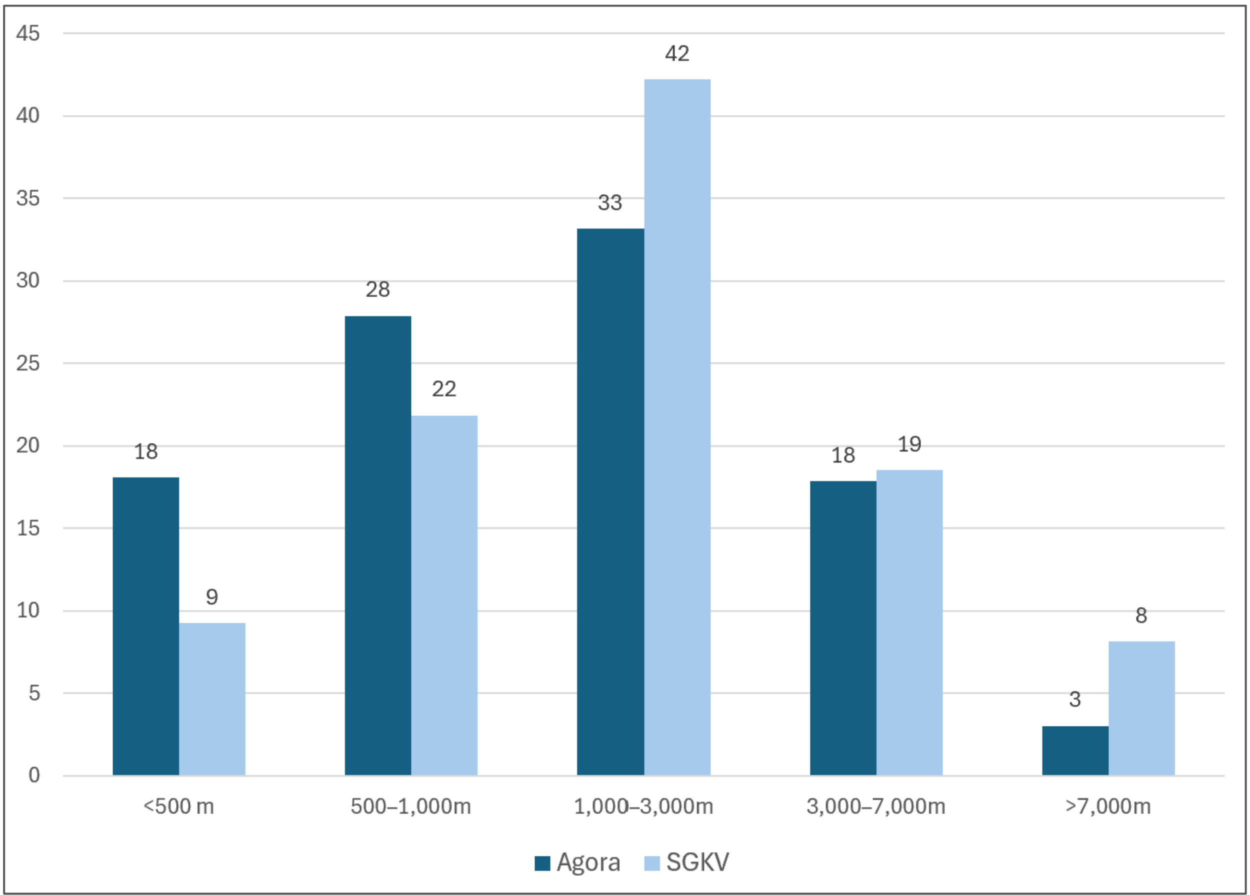


Reading base: 532 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from SGVK.

We observe in the map the high concentration of terminals with longer tracks in Central Europe, mainly concentrated in the proximity of ARA and Hamburg and Bremerhaven ports and in Northern Italy.

Figure 4-14: Percentage of terminals by range of length of tracks (%)



Reading base: Intermodal terminals in the EU reporting length of tracks, from Agora map (398 datapoints) and SGKV map (270 datapoints).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

The Figure 4-14 shows that the majority of terminals have between 1,000 and 3,000 meters of usable track length, followed by the 500-to-1,000-meter range. In the Agora dataset, the mean length of usable tracks is 1,906m, and their median is 1,200m. In the SGKV dataset the mean length of usable tracks is 2,497m with a median of 1,600m. The higher SGKV values, which suggest longer infrastructure, may indicate that the more recent dataset reflects greater improvements in terminal facilities. The two mid-length categories together represent over half of all terminals, suggesting that most facilities maintain sufficient track length to accommodate one or two full-length European freight trains without excessive space use. Only twelve terminals exceed 7,000 meters of track, most of which also rank among those with the highest number of tracks, reflecting the close relationship between these dimensions.

4.2.6. Equipment for loading and unloading

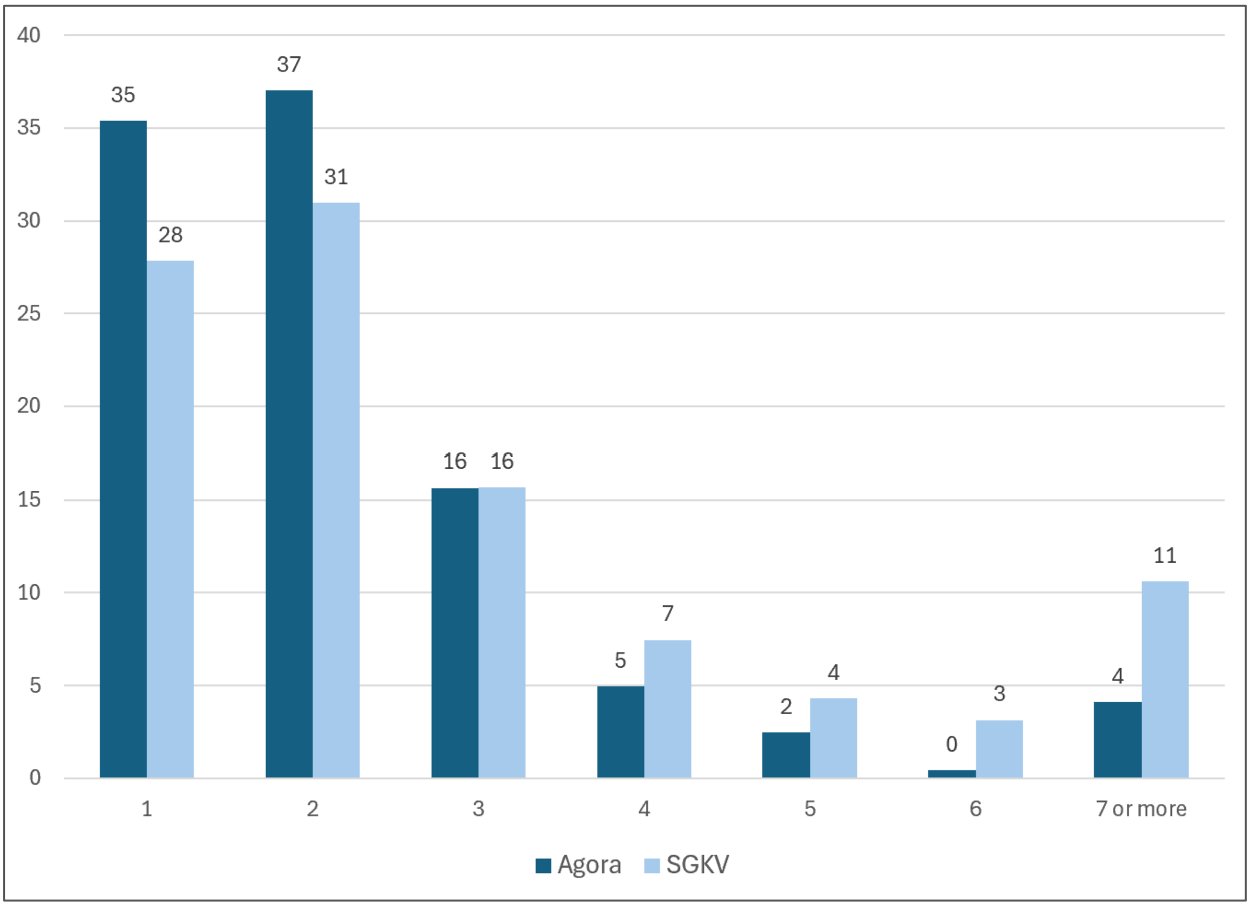
A variety of equipment can be used to perform intermodal operations at a terminal. The choice of equipment is related to several factors in terms of capital investment, volume, stacking density, and productivity (Rodrigue, 2024). In terms of equipment, our dataset includes two types: gantry cranes and reach stackers.

- Gantry crane: A fixed piece of intermodal equipment, the overhead crane consists of a horizontal beam (gantry) supported by legs that may be fixed, rail-mounted, or rubber-tired with limited manoeuvrability. It enables vertical, horizontal, and lateral load movement, typically operating over road/rail or ship/shore interfaces. While predominantly used at port terminals, their use is increasing in inland intermodal rail terminals.

- Reach stacker: Flexible piece of equipment performing intermodal operations for rail and trucks used to stack, load or unload containers from trailers or rail wagons. It operates with a hydraulic arm and spreader and can stack containers several levels high. They are often used in inland intermodal rail terminals.

In the Agora database, both types of equipment are classified according to lifting capacity (in tonnes) and handling performance (number of moves per hour). The SGKV dataset only shows data on the number of gantry cranes and reach stackers, but not on their lifting capacity. Most terminals are equipped with only one type of crane or reach stacker, see Figure 4-15 and Figure 4-16 respectively, but a few operate with two types. In terms of the total number of machines per terminal, this varies depending on the terminal. The distribution of equipment per terminal is similar for both types of machinery.

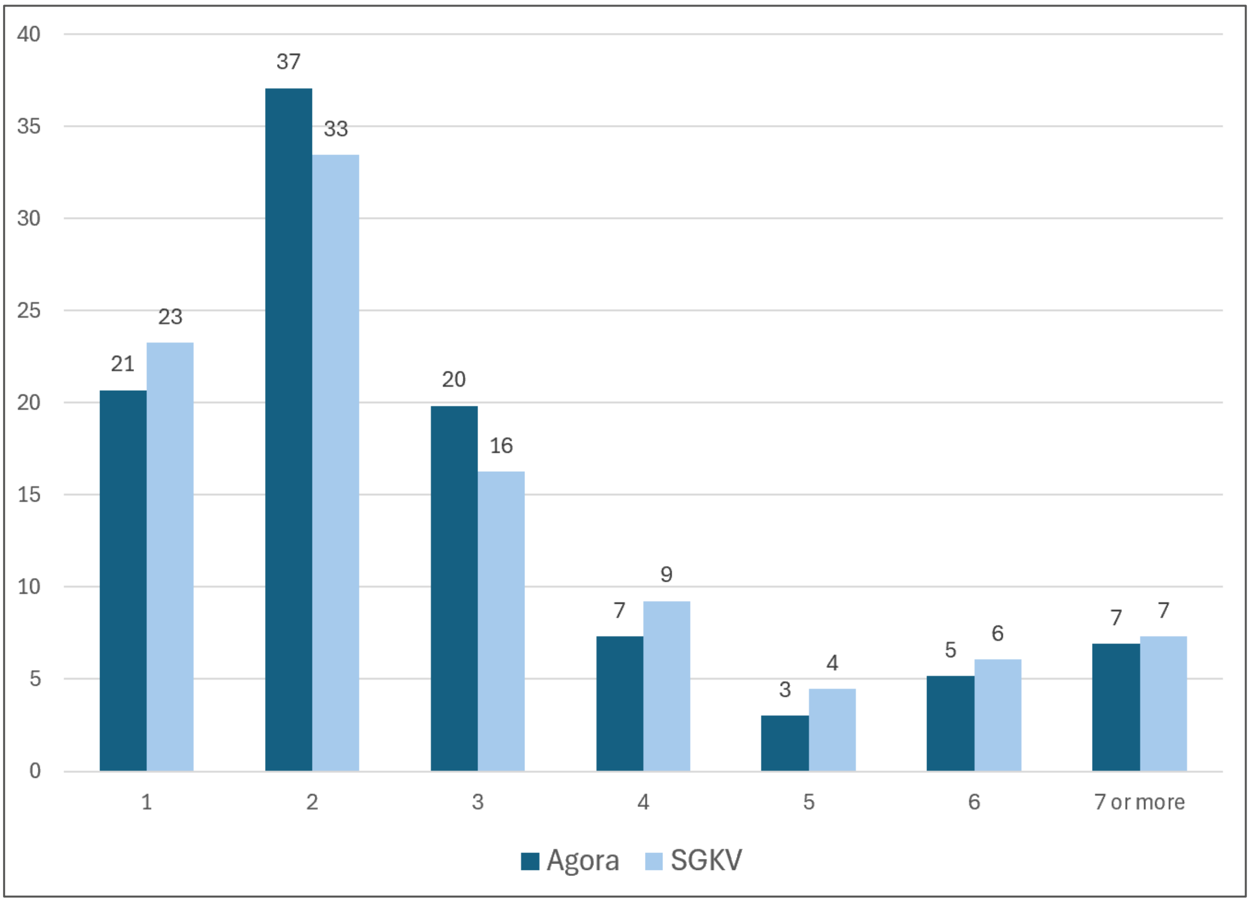
Figure 4-15: Percentage of terminals according to number of gantry cranes (%)



Reading base: Intermodal terminals in the EU reporting number of gantry cranes, from Agora map (243 datapoints) and SGKV map (255 datapoints).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

Figure 4-16: Percentage of terminals according to number of reach stackers (%)



Reading base: Intermodal terminals in the EU reporting number of reachstackers, from Agora map (232 datapoints) and SGKV map (314 datapoints).

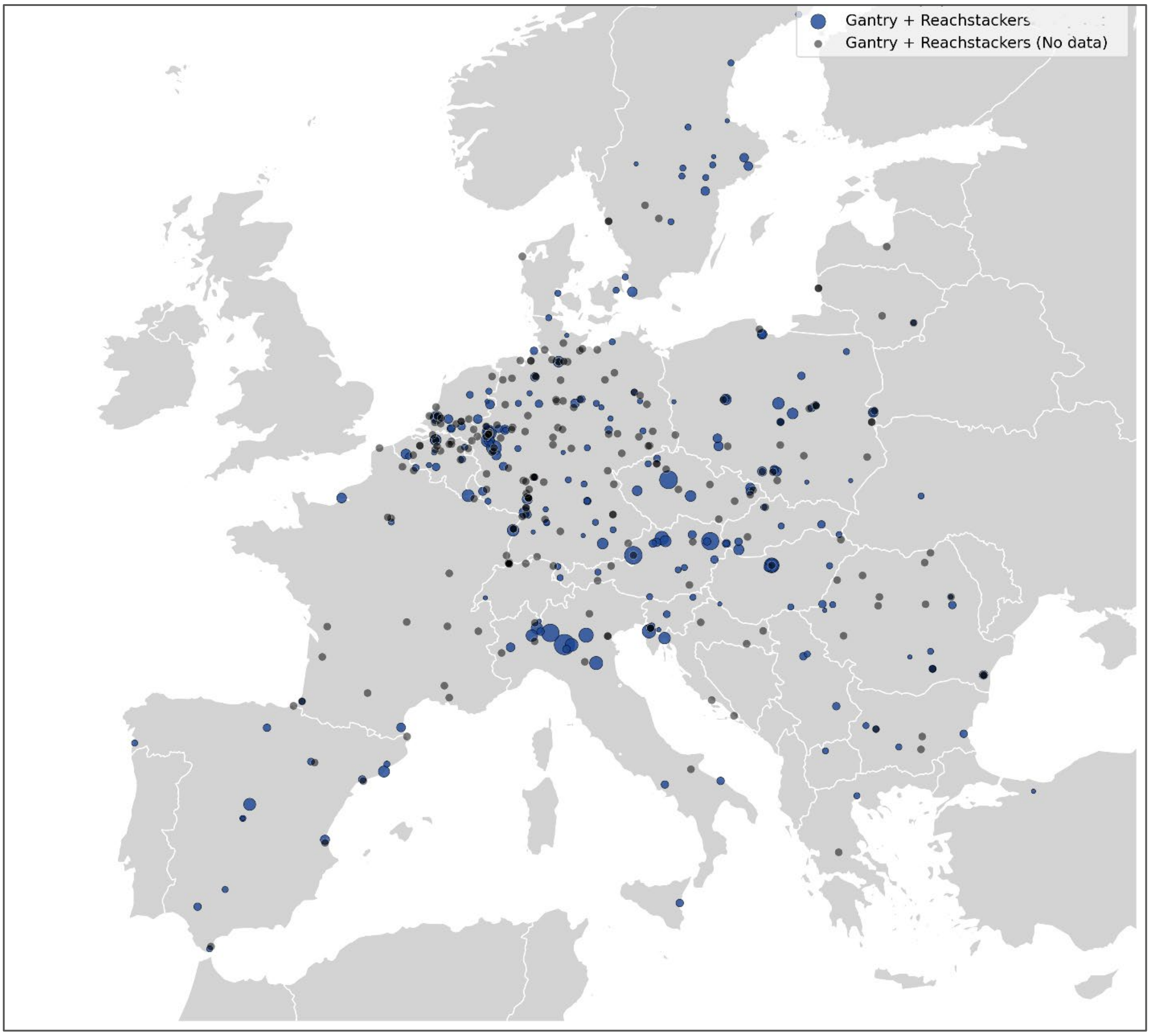
Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

The data indicate that most terminals operate with one to three of these devices. Beyond four units, the count falls off sharply. The optimal equipment size depends on the volume of cargo each terminal handles.

We mapped the distribution of equipment (gantry cranes + reach stackers) in the Agora dataset, flagging the limitation than less than 240 terminals out of 445 in the sample report data for this variable. Accordingly, the dataset records the following equipment figures for the terminals, showing larger points where more equipment is found:

Figure 4-17: Distribution and total number of loading equipment across EU – based on Agora and SGKV data (considering only gantry cranes and reachstackers)

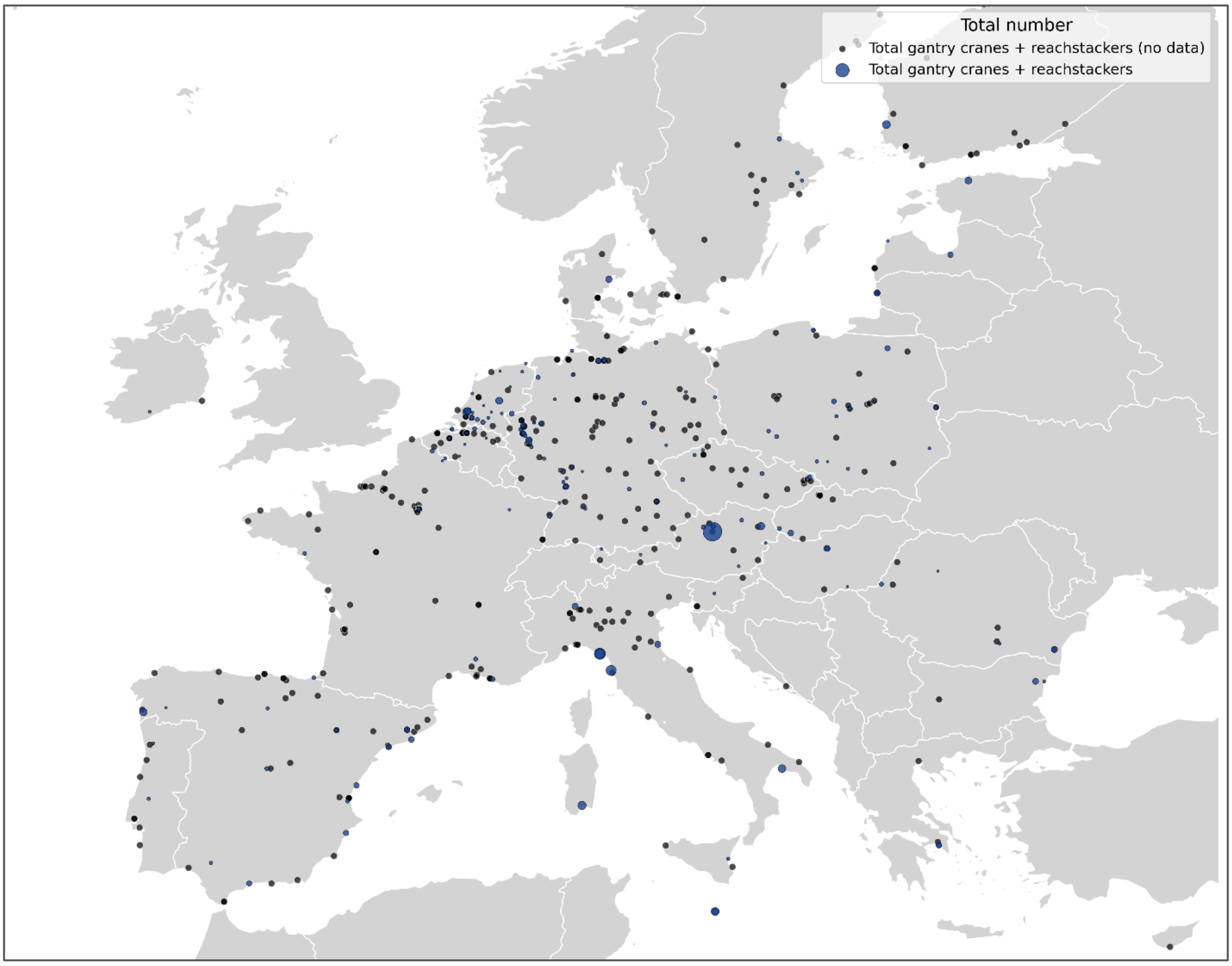
Agora data



Reading base: 445 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

SGKV data



Reading base: 532 intermodal terminals in the EU.

Source: Own elaboration based on data extracted from SGVK.

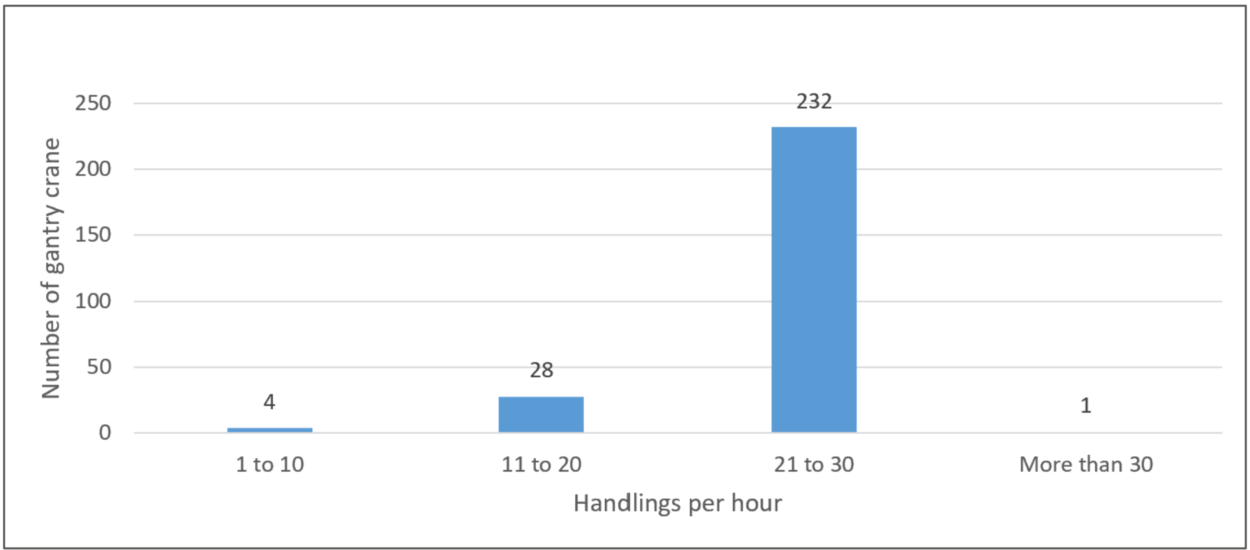
Table 4-1: Mean of weight handled and handlings per hour of gantry cranes and reach stackers

Gantry cranes	Mean of weight handled (in tonnes)	**32.11**
	Mean of handlings per hour	**28.08**
Reach stackers	Mean of weight handled (in tonnes)	**39.11**
	Mean of handlings per hour	**16.31**

The Agora data show that actual gantry cranes in our sample **lift an average of approximately 32.11 tonnes and can perform around 28 handlings per hour**. In contrast, **reach stackers in our sample lift about 39 tonnes each on average, but they typically achieve only around 16 handlings per hour**. In Figure 4-18 and Figure 4-19, the distribution of handlings per hour for both gantry cranes and reach stackers is displayed. While the average lifting capacity of gantry cranes and reach stackers differs by only about seven tonnes, the main distinction lies in operational performance: gantry cranes can perform nearly twice as many handlings per hour. This helps explain observed equipment patterns across terminals.

Although overall distribution is similar, a clear difference appears among terminals with only one piece of equipment—reach stackers are nearly twice as common as gantry cranes. This may reflect the higher handling efficiency of gantry cranes, allowing smaller terminals to operate with just one, whereas reach stackers often require multiple units to meet even modest throughput demands.

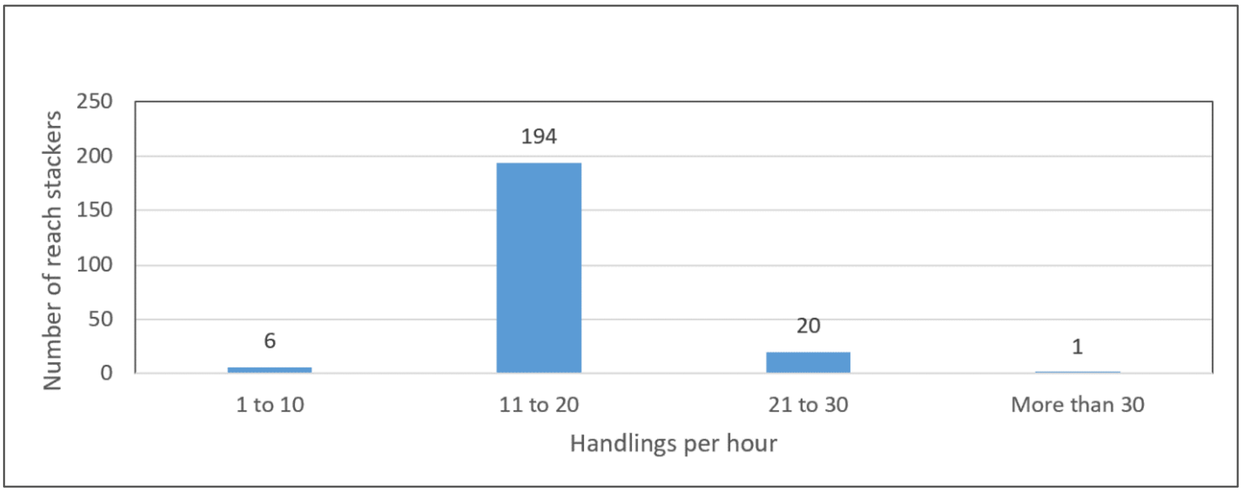
Figure 4-18: Distribution of handlings per hour gantry cranes (only Agora data)



Reading base: 265 intermodal terminals in the EU with data on gantry cranes handlings per hour.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

Figure 4-19: Distribution of handlings per hour reach stackers (only Agora data)

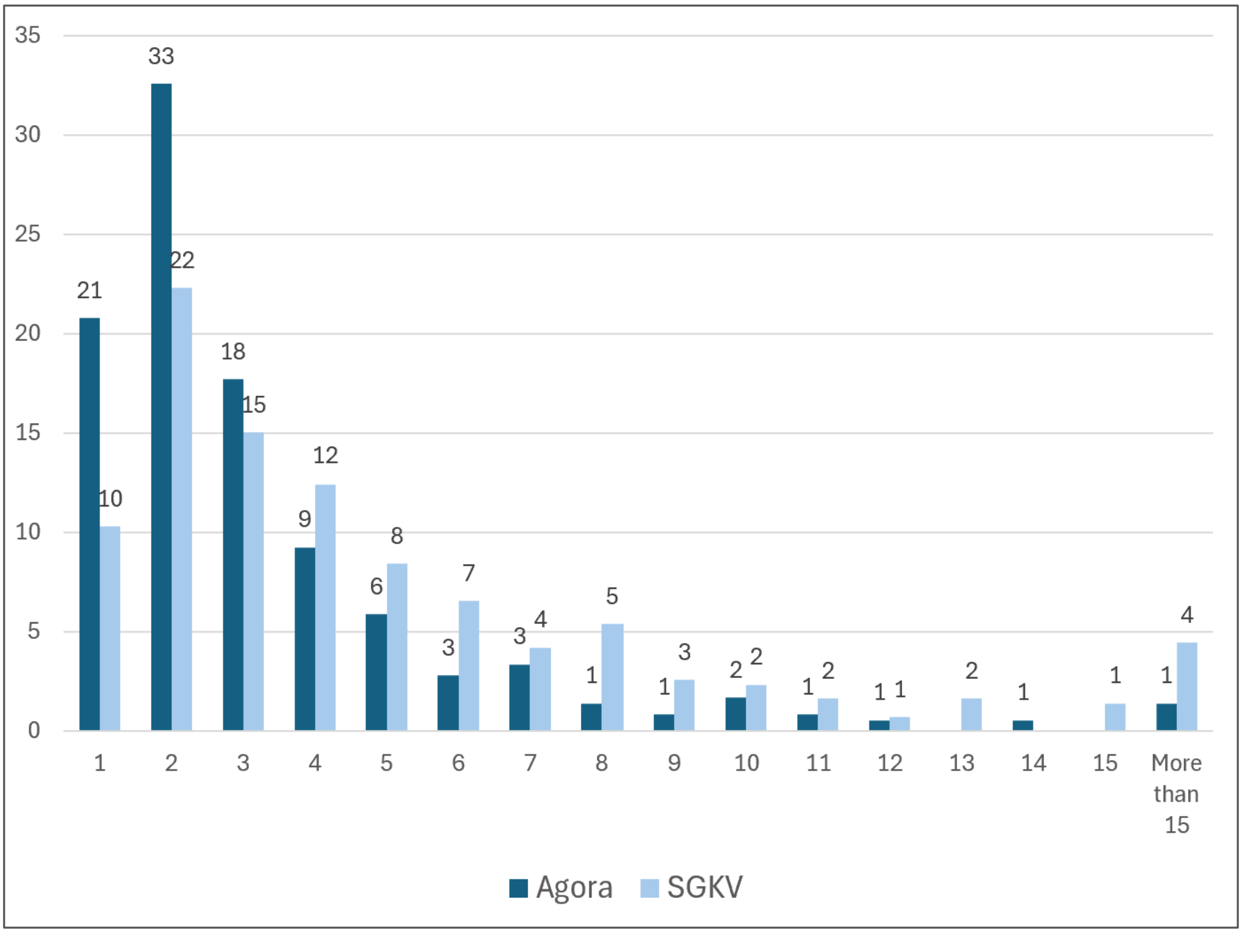


Reading base: 221 intermodal terminals in the EU with data on reach stackers handling capacity.

Source: Own elaboration based on data extracted from Agora Intermodal Map.

At the opposite end of the spectrum, some terminals are equipped with a significantly higher amount of equipment. The Figure 4-20 displays the distribution of total equipment units per terminal.

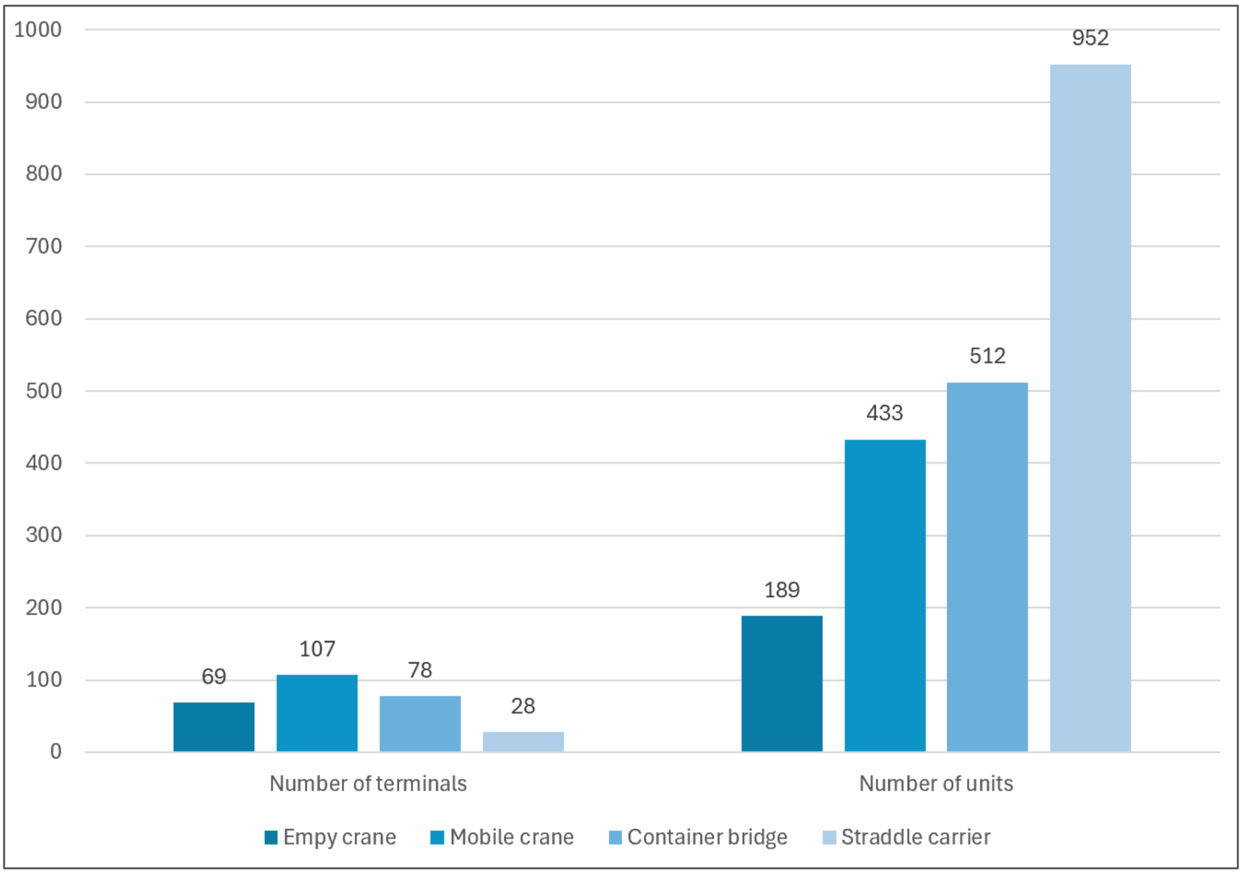
Figure 4-20: Percentage of terminals according to number of total equipment



Reading base: Intermodal terminals in the EU reporting number of equipment, from Agora map (356 datapoints) and SGKV map (426 data points).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

Figure 4-21: Additional equipment reported by SGKV map

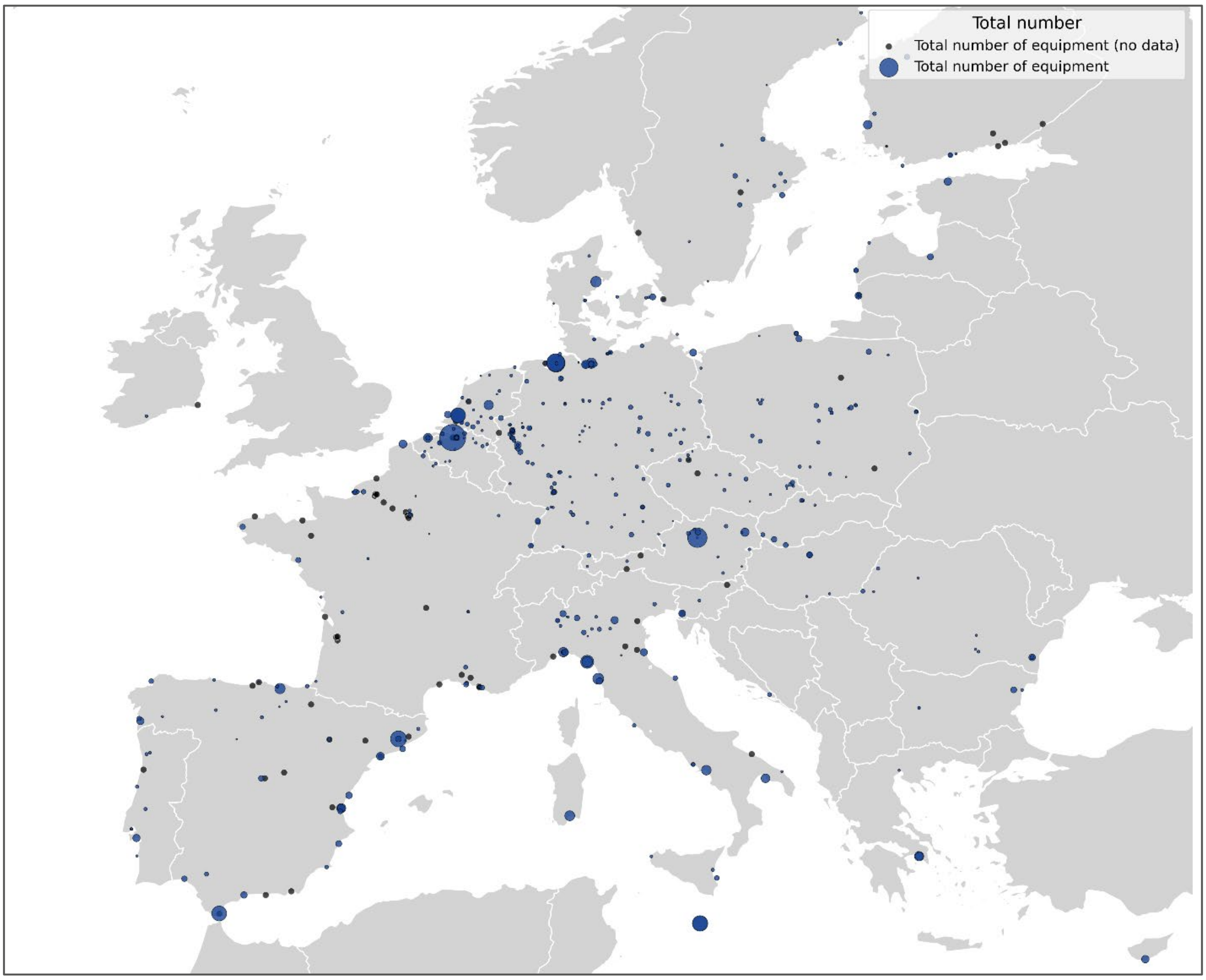


Reading base: 460 intermodal terminals in the EU reporting data on any type of equipment.

Source: Own elaboration based on data extracted from SGKV Intermodal Map.

In addition to the gantry cranes and reach stackers reported by Agora, the SGKV map records further types of equipment used in the operation of intermodal terminals. Based on our sample, the number of units per terminal varies by equipment type. Empty cranes appear in the lowest quantities, with an average of 2.75 units per terminal equipped with them, whereas straddle carriers are present in the highest quantities, averaging almost 34 units per terminal.

4.2.7. Distribution of total number of equipment (gantry cranes + reach stackers + other equipment) (only SGKV)



Reading base: 535 intermodal terminals in the EU.
Source: Own elaboration based on data extracted from SGVK.

4.2.8. Most common services offered by intermodal terminals

Terminal operators can choose to offer a range of additional services. These services enhance the attractiveness of using the terminal and, more importantly, encourage the use of intermodal transport over conventional road transport. The Table 4-2 presents the most common services offered, along with a description of each and a brief explanation of their role in facilitating and promoting intermodal transport.

Table 4-2: Main services offered by terminals

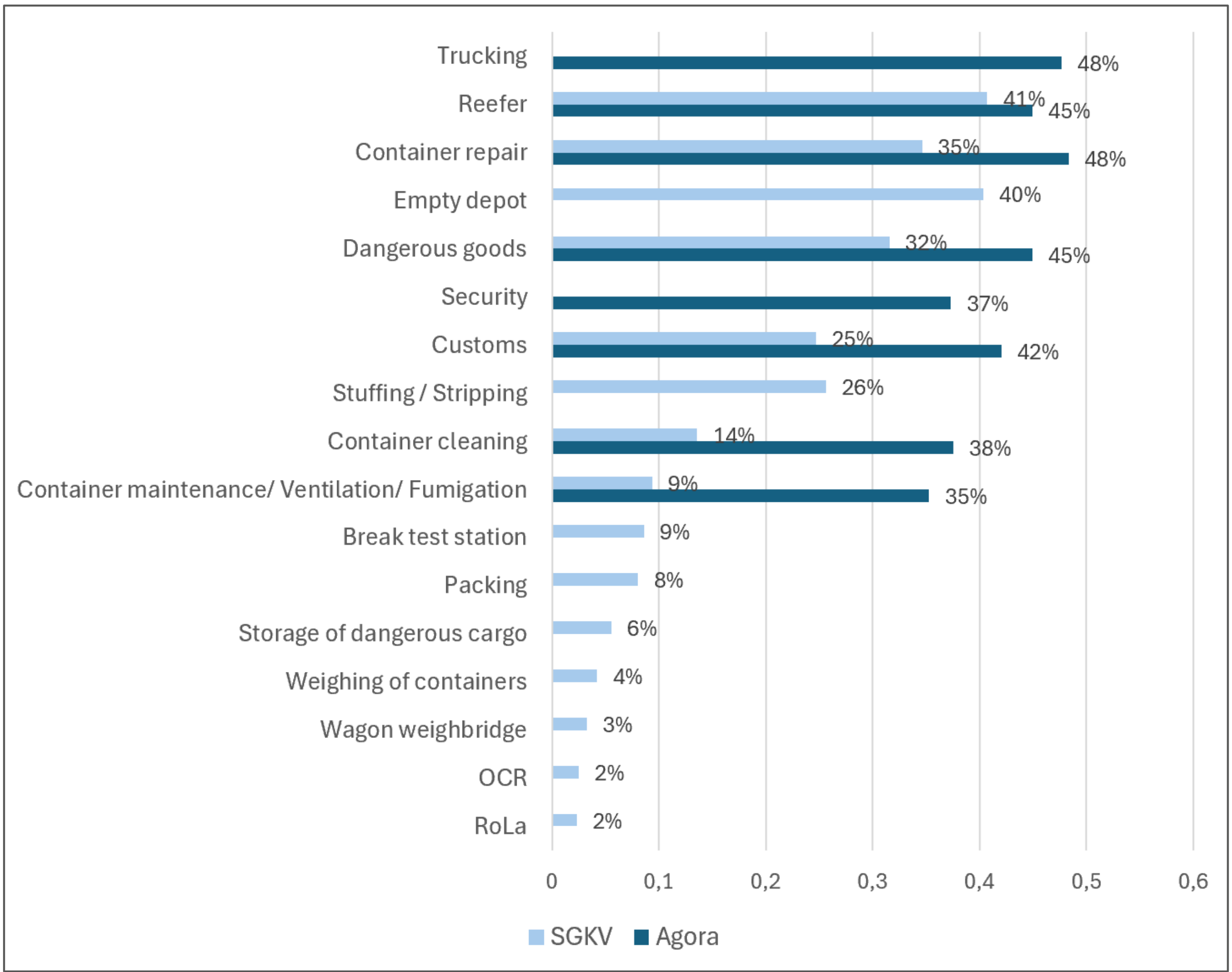
Service	Description	Importance on intermodal transport
Security	Safe handling and storage of cargo, protecting goods from theft, vandalism and unauthorised access	Increases reliability and trustworthiness, essential for combined transport operations involving multiple transfers and longer dwell times
Customs	Handling documentation, inspections and clearances required for goods entering or exiting a country	Ensures smoother transitions at intermodal terminals, significantly reducing delays and operational bottlenecks
Container maintenance	Routine checks, servicing and preventive maintenance of containers to ensure their suitability for transport	Minimises disruptions, ensuring the seamless transfer of goods across different modes of transport
Container repair	Addresses structural and functional damages, enabling containers to return to service promptly	Ensure a high availability rate of containers, crucial in combined transport chains, where turnaround speed is critical
Container cleaning	Cleaning services remove residues and contaminants from containers, preparing them for subsequent cargo	Especially critical when transporting sensitive goods such as food, pharmaceuticals or chemicals
Dangerous goods	Specialized equipment, training and safety protocols necessary for transporting hazardous materials	Ensures compliance with international regulations and reduces risks
Reefer	Temperature-controlled storage and handling facilities for refrigerated cargo	Vital for transporting perishable goods across intermodal chains, ensuring product quality and extending market reach
Trucking	Last-mile delivery and pickup operations, offering flexibility and accessibility to intermodal terminals	Ensures seamless integration between rail, maritime, and road segments, facilitating rapid transfers and reducing overall transport time
Stuffing and stripping	The process of loading / unloading cargo into an empty shipping container	Enables cargo to transition between bulk, palletised, or break-bulk form and standardised containerised form, facilitating seamless integration into rail and maritime transport networks.

Terminal services serve multiple roles, with two primary functions. First, they reduce waiting times, crucial for maintaining speed and efficiency in freight transport. Since intermodal transport involves transshipment and can be less flexible than direct road transport, **terminals help minimise delays and ensure smooth modal transfers through services like customs clearance and trucking support**.

Second, terminals ensure proper handling and preservation of goods during transfers, preventing damage and maintaining safety standards. Services such as container cleaning and dangerous goods handling support this function.

The Figure 4-22 shows what percentage of terminals in the database offer these services:

Figure 4-22: Percentage of terminals offering most common services



Reading base: Intermodal terminals in the EU reporting number of equipment, from Agora map (445 datapoints) and SGKV map (532 datapoints).

Source: Own elaboration based on data extracted from Agora Intermodal Map and SGKV Intermodal Map.

The most frequently reported service among the terminals in the database is **trucking (only reported in the Agora dataset but not in SGKV dataset), container repair and reefer.** Given that these are standard services within the sector, their relatively low representation may be due to incomplete reporting, as not all terminals appear to disclose the full range of services they provide. Additionally, some terminals included in the dataset are small-scale operations with limited capabilities, which may explain the absence of a broader service offering. Other services that are present in more than 40% of the terminal in average are empty depot and dangerous goods.

4.2.9. Data on the current level of utilisation during peak demand periods (for three selected ports)

This section outlines an analysis of utilisation levels at three intermodal terminals, identifying peak-demand periods. The purpose of this is to understand the operational efficiency of each intermodal terminal, capacity constraints and the potential for network-wide improvements. Based on the availability and comparability of accessible data, the following three terminals were chosen:

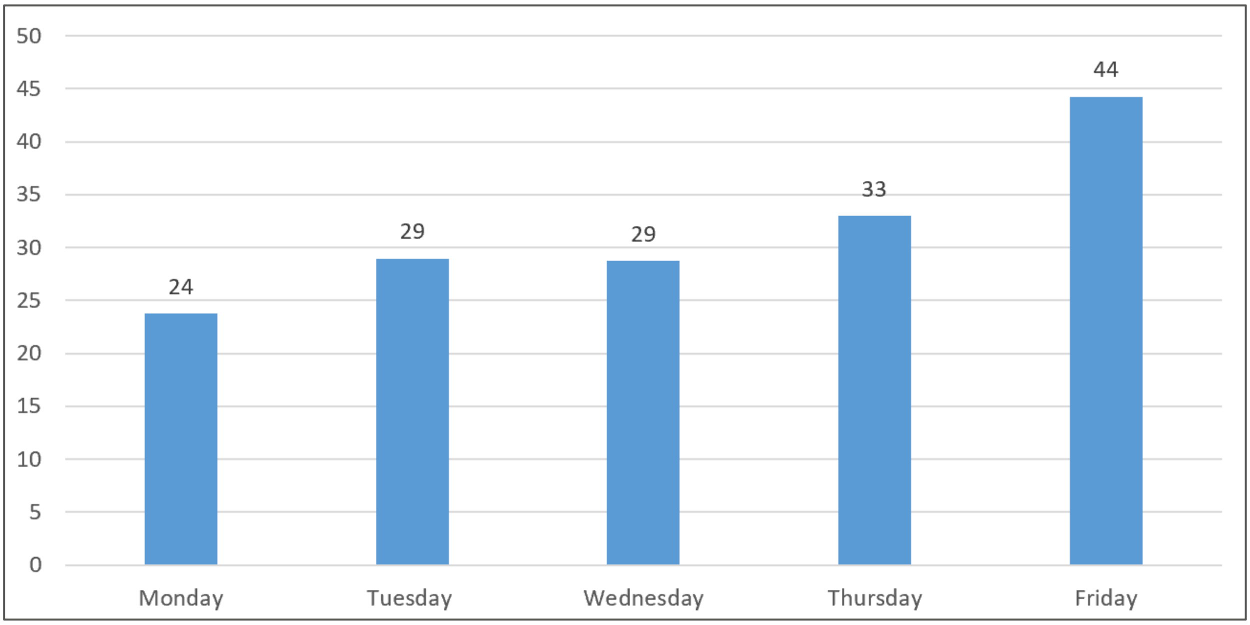
a. Intermodal terminal 1: Port of Barcelona El Morrot

El Morrot terminal is situated within the Port of Barcelona in Catalonia, Spain. It serves maritime, rail and road transport and offers sidings and gantry cranes.

Operational times within the terminals and access waiting times for the El Morrot container terminals APM Terminals, BEST and Bergé Logistics were analysed using hourly averages over the days 16th to 20th June 2025. The following graphs were produced based on information from (Port BCN, 2025), to illustrate how these performance metrics evolved throughout that week.

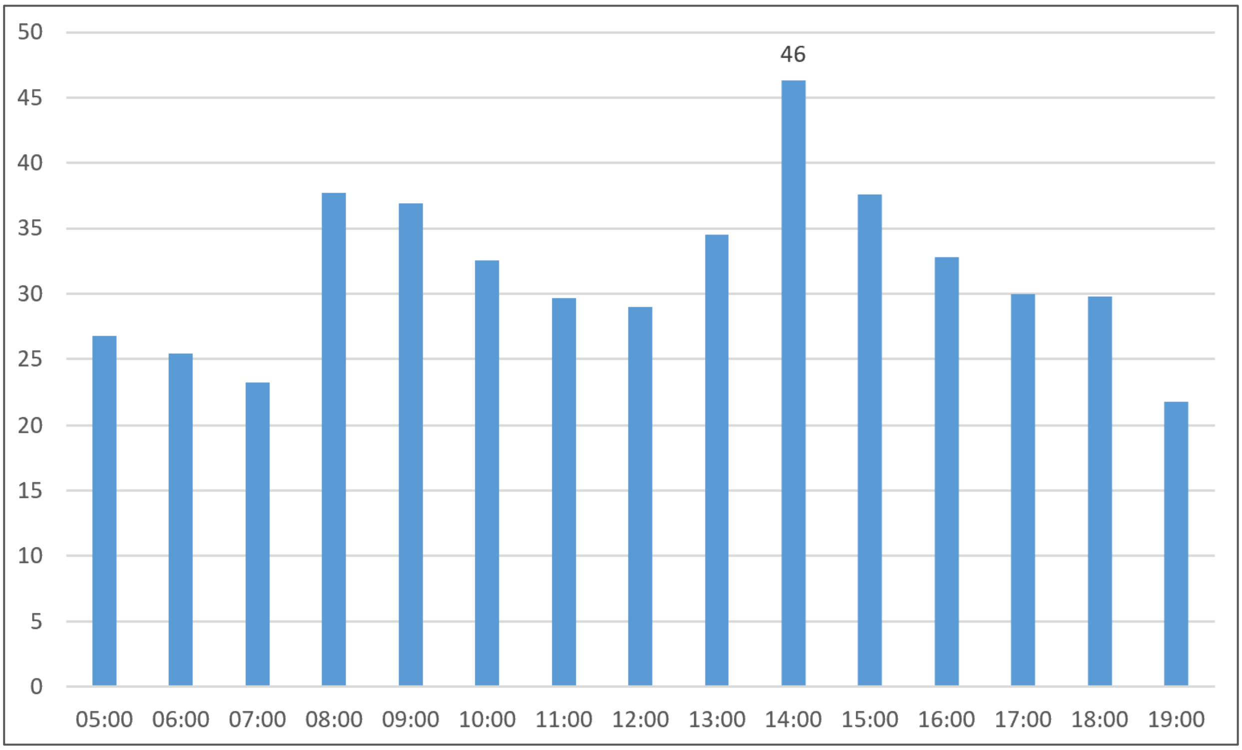
Regarding the average time spent inside the terminal, daily averages are shown in Figure 4-23, revealing a **gradual increase throughout the week, with Friday showing the highest peak in truck operation time**. When looking at hourly operation times, the averages remain stable throughout the day, with the **highest peak observed at 14:00**, where the **average operation time reaches 46 minutes**. For the remaining hours, the average time is around 30 minutes.

Figure 4-23: Average time of operation per day (minutes)



Source: Own creation based on data from PortBcn (2025) (PortBcn - Acces a Terminals).

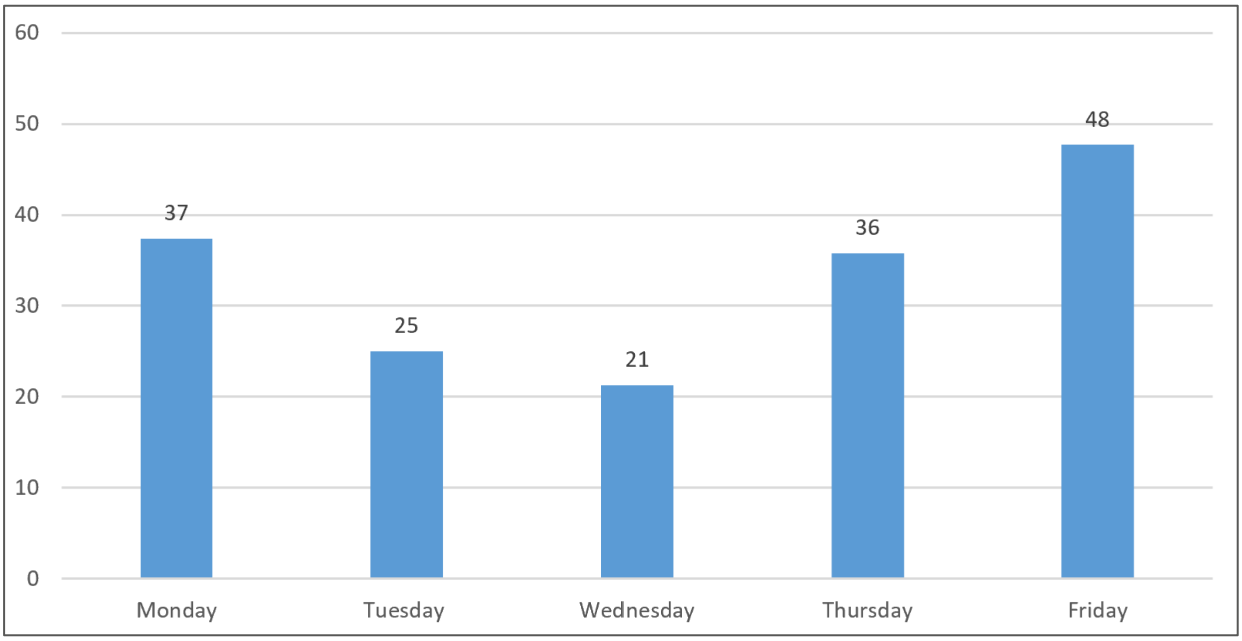
Figure 4-24: Average time of operations per hours (minutes)



Source: Own creation based on data from PortBcn (2025) (PortBcn - Acces a Terminals).

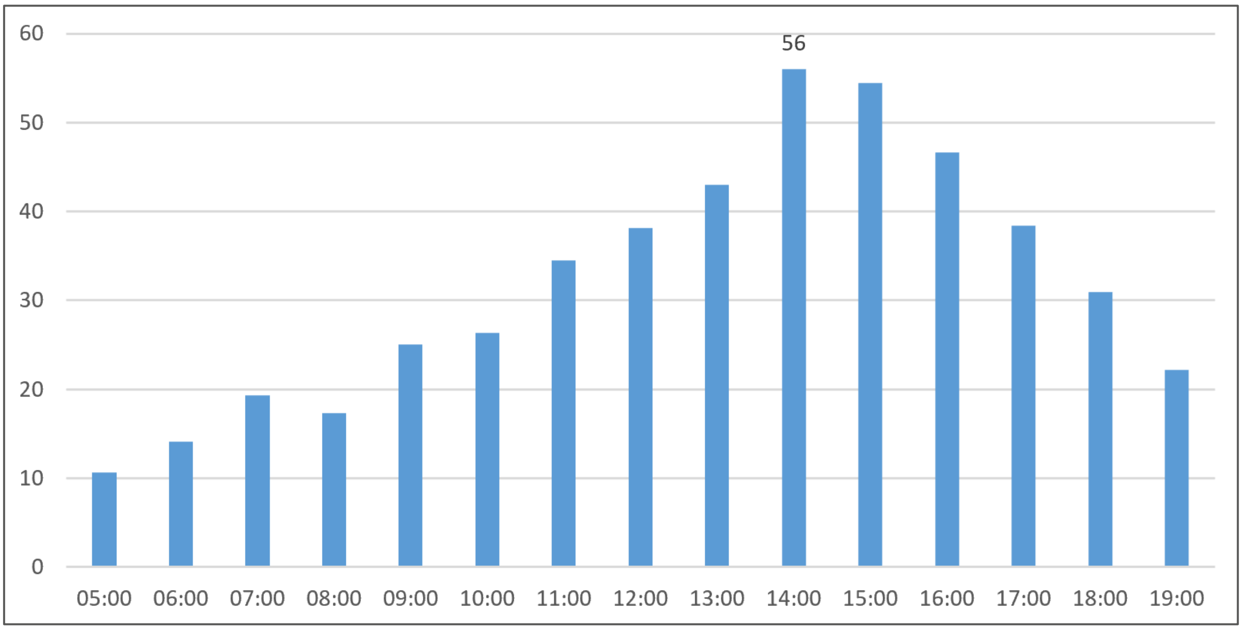
Regarding **access waiting times, the pattern appears to follow a U-shape throughout the week**. Wednesday shows the lowest average waiting time, while Friday and Monday record the highest, in that order. The fact that Friday has the highest average waiting time aligns with the findings in Figure 4-23 which also shows Friday as the day with the longest average operation time, suggesting greater overall congestion in the terminals on that day. Looking at the hourly distribution of waiting times in Figure 4-24, congestion seems to build up gradually throughout the day, peaking at 2:00 PM, which mirrors the trend seen in operation times. This pattern indicates that truck arrivals accumulate as the day progresses, and then begin to decrease in the afternoon, as the terminals start to decongest.

Figure 4-25: Average waiting time for access per day



Source: Own creation based on data from PortBcn (2025) (PortBcn - Acces a Terminals).

Figure 4-26: Average waiting time for access per hours



Source: Own creation based on data from PortBcn (2025) (PortBcn - Acces a Terminals).

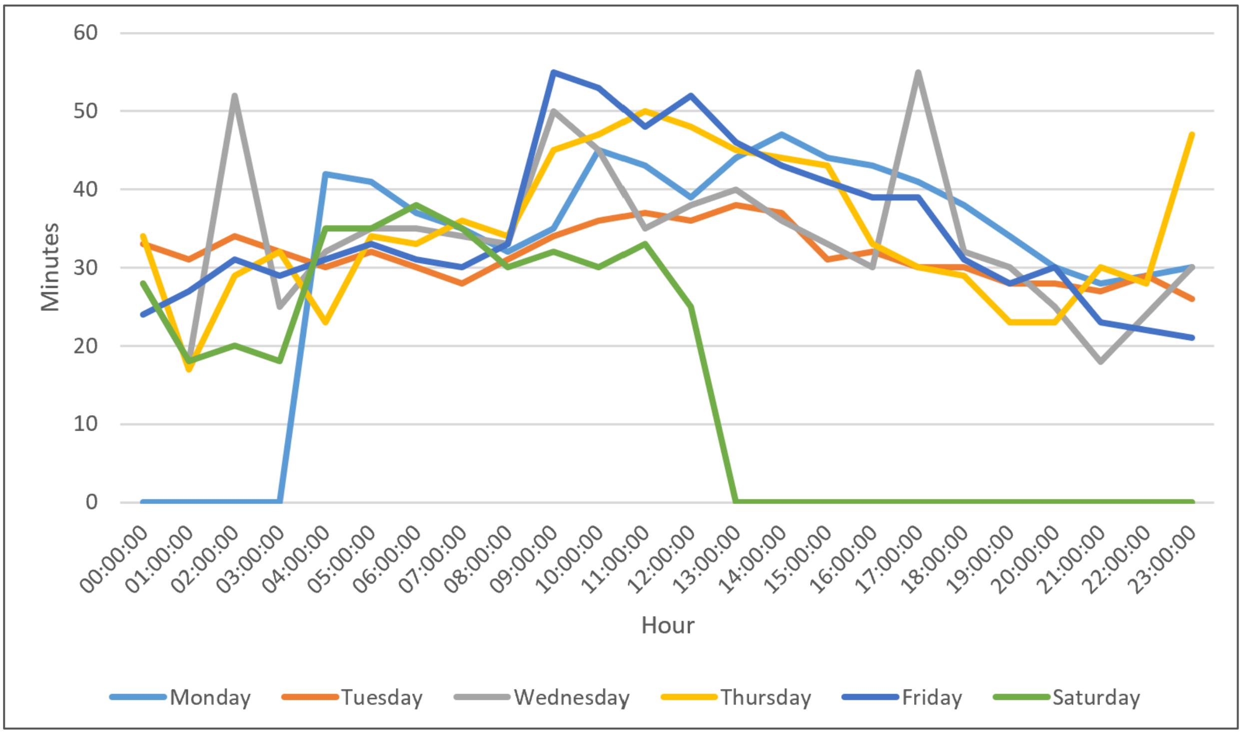
The charts highlight two main insights about truck movements at the terminal. First, handling times remain relatively consistent, as all trucks follow similar procedures and the terminal limits the number of vehicles inside, preventing processing delays. Second, **queuing times at the gate are more variable**, influenced by truck arrival patterns and the gate's limited throughput. Unlike internal operations, no cap is enforced on trucks waiting to enter, leading to greater volatility in access times. This makes access time a more sensitive indicator of terminal congestion.

b. Intermodal terminal 2: Ludwigshafen KTL

Ludwigshafen KTL is situated on the left bank of the River Rhine in Ludwigshafen, Germany. The terminal handles both rail and inland waterway traffic and features extensive sidings, modern gantry cranes and direct connections to the national rail network.

Hourly average round-trip times for May 2025 were analysed using data from the terminal's official website to support daily delivery and pick-up planning (KTL Kombi-Terminal Ludwigshafen, 2025). Based on this data, we produced three charts. The first shows hourly averages by weekday, revealing several zero values on Mondays and Saturdays, likely indicating terminal closure during those hours.

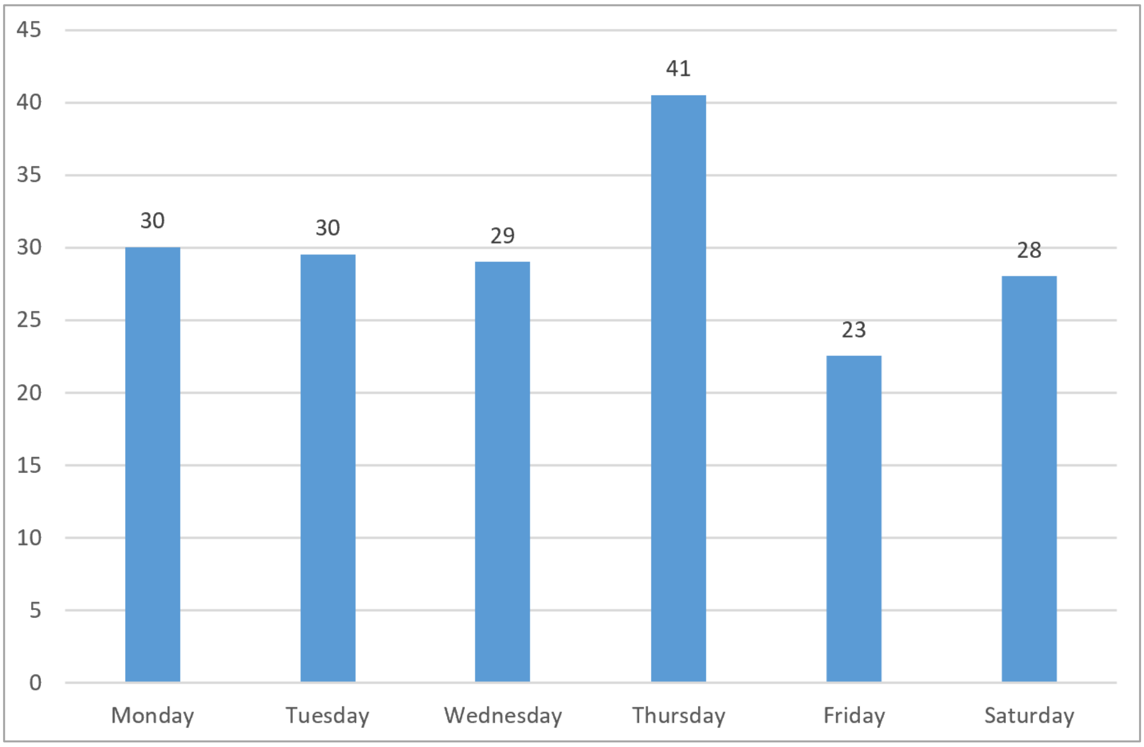
Figure 4-27: Peak hours of Ludwigshafen KTL



Source: Own elaboration based on data from (KTL Kombi-Terminal Ludwigshafen, 2025).

Based on Figure 4-27, two additional figures were created. The Figure 4-28 represents the average round trip time in minutes for delivery and pick-up operations, a process that includes check-in, loading and unloading, and check-out. The data shows a stable pattern throughout the week, with most days averaging around 30 minutes. There is a peak on Thursday, where the average rises to 41 minutes, followed by the lowest average on Friday, with 23 minutes. However, this variation is not particularly large when compared to the daily average operation times at El Morrot, which also showed an average of approximately 32 minutes, with a maximum of 44 minutes. Thus, both terminals display comparable levels of consistency in round trip durations.

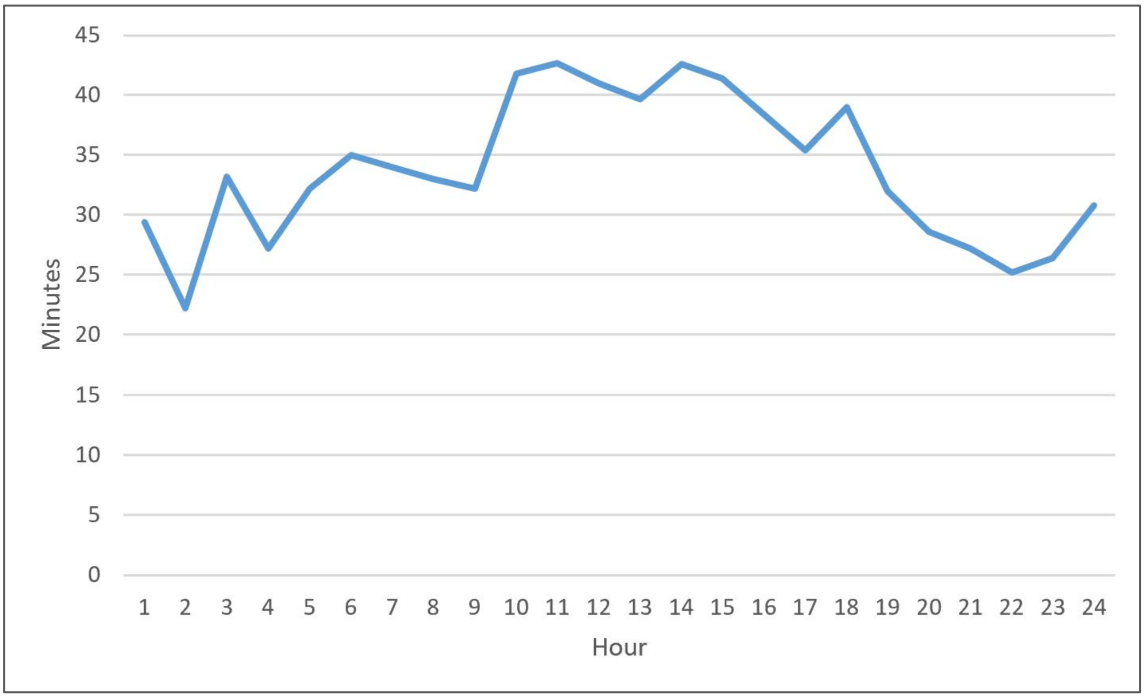
Figure 4-28: Average time of roundtrip per day (minutes)



Source: Own elaboration based on data from (KTL Kombi-Terminal Ludwigshafen, 2025).

Regarding the average time in Figure 4-29, the distribution is similar to that of the operation times at El Morrot, with a **slight accumulation between 10:00 AM and 2:00 PM**, but without significant variability or change throughout the day:

Figure 4-29: Average time of round trip per hours (minutes)



Source: Own creation based on data from (KTL Kombi-Terminal Ludwigshafen, 2025).

Overall, this terminal does not show clear signs of specific times of day with higher congestion. This is likely explained by the conclusion drawn from the El Morrot case, whereby the data that most clearly reflect congestion are the access waiting times, which is not accessible for the Ludwigshafen terminal. Additionally, this terminal operates a contactless delivery and pick-up process, which significantly speeds up operations and helps prevent congestion. This system likely contributes to the smoother and more uniform flow of trucks throughout the day, making it harder to identify peak congestion periods based solely on round trip times.

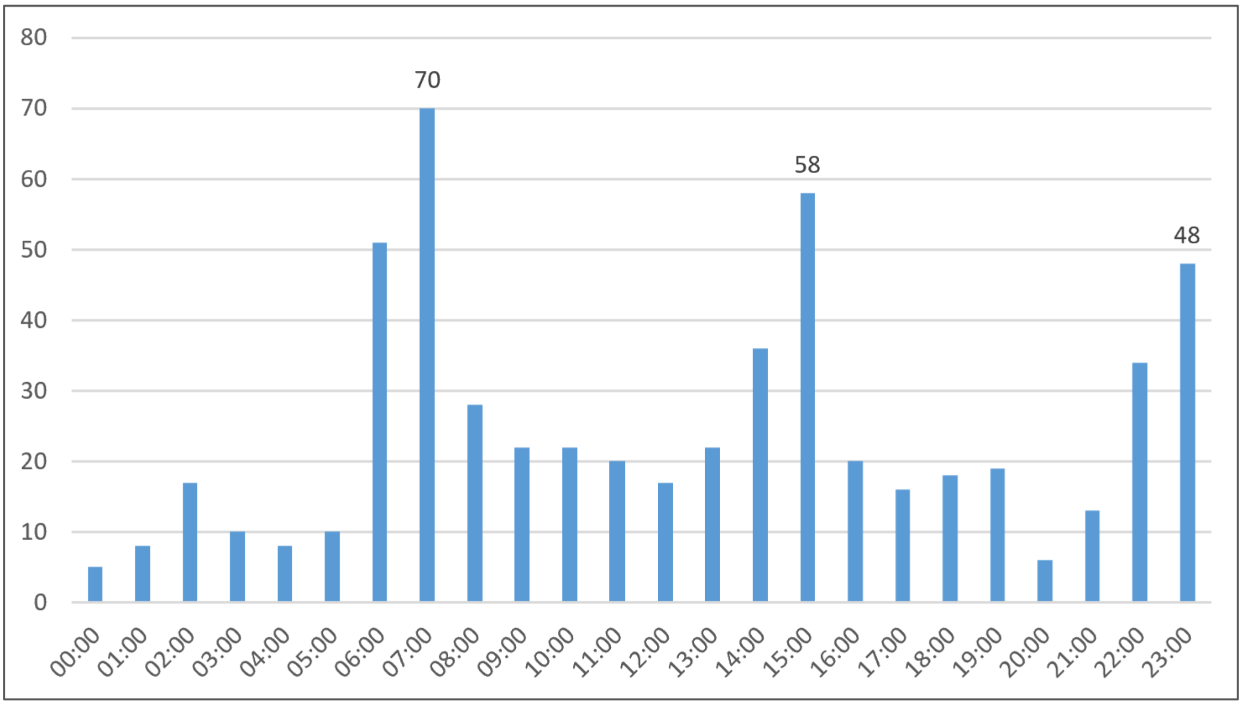
c. Intermodal terminal 3: Port of Hamburg

The Port of Hamburg is situated on the River Elbe in Hamburg, Germany. It handles freight from maritime, rail and road transport and features extensive quay facilities alongside an onsite rail network.

Information of the vessels arrival, departure, discharge and loading times from 28th of May to 24th June 2025 were analysed using the Port of Hamburg's sailing list database on the HHLA website (HHLA, 2025). Based on this, two charts have been created to illustrate how vessel traffic evolves over time.

The Figure 4-30 reveals three **pronounced traffic spikes at 07:00, 15:00, and 23:00**. At their highest, these spikes double, and in the case of 07:00 nearly triple, the overall hourly average, indicating potential periods of intense congestion for the port. The peaks correspond to morning, afternoon, and late-night windows, showing that significant vessel activity is spread across the entire day. Notably, the magnitude of each spike diminishes as the day progresses, from about 70 arrivals at 07:00, to roughly 58 at 15:00, and 48 at 23:00. This pattern suggests that while the port experiences heavy traffic in all three time slots, it may be actively distributing high-demand periods throughout the day to balance terminal capacity and mitigate bottlenecks.

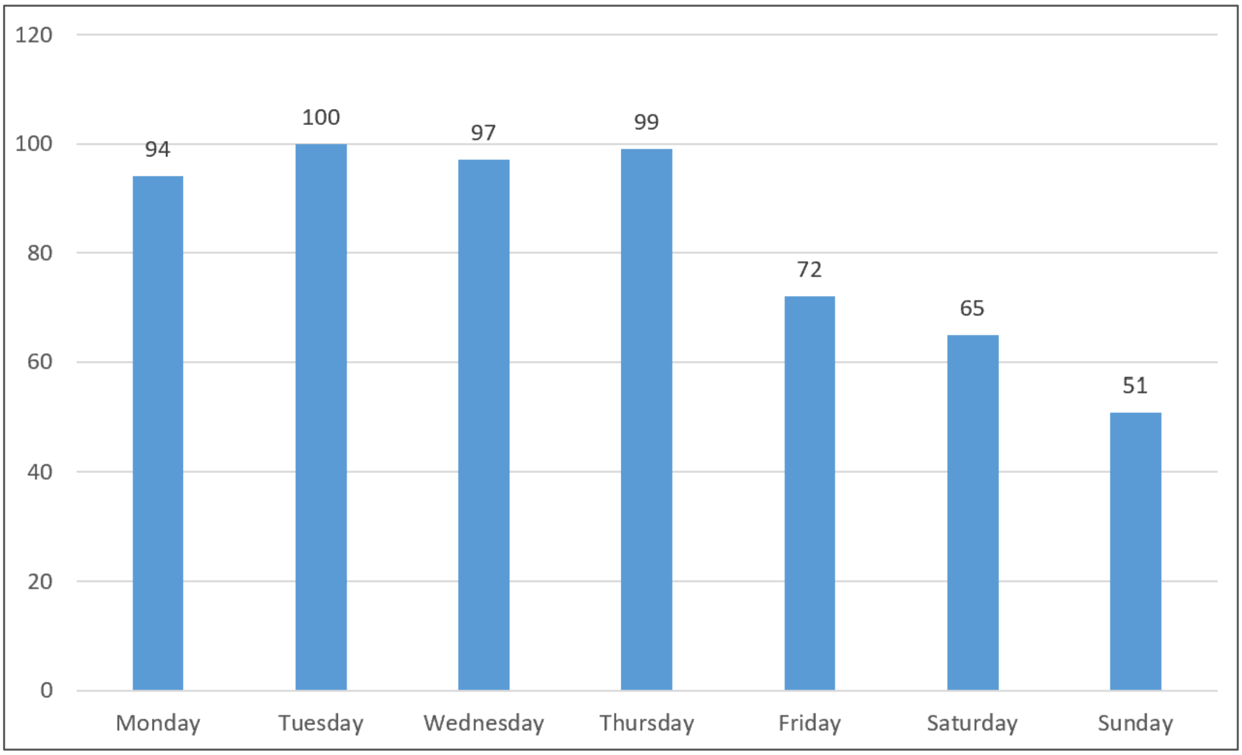
Figure 4-30: Number of vessels per hour



Source: Own creation based on data from (HHLA, 2025).

Regarding the number of vessels operating by day of the week, there is a **stable average from Monday to Thursday**, as demonstrated in Figure 4-31. This average decreases as the weekend approaches, with an average of 72 vessels on Fridays, dropping to just 51 on Sundays, half the weekday average. These results are consistent with expectations, as weekends typically involve reduced staffing and lower traffic volumes.

Figure 4-31: Number of vessels operating per day of week



Source: Own creation based on data from Port of Hamburg (2025) (HHLA COAST Report).

When comparing congestion patterns at El Morrot terminal, vessel traffic appears more structured than truck traffic. This is likely due to the nature of each mode: vessels require advanced coordination because of their size, unloading needs, and pre-planned routes, while trucks operate more flexibly, arriving at varying times and requiring less space. As a result, truck congestion builds up gradually, especially during peak hours, whereas vessel traffic shows brief peaks followed by quick declines, reflecting more deliberate scheduling to avoid sustained congestion.

4.3. SO2. Examination of the operational functions for a selected group of 11 terminals, highlighting their role in improving the efficiency of combined transport and their integration into the Trans-European Transport Networks (TEN-T)

KEY FINDINGS

- **Strategic Location and Connectivity** – Strong intermodal terminal networks often benefit from coastal access, central positioning along key corridors, and robust rail or inland waterway links.
- **Targeted Financial Support** – The 11 economically significant terminals examined in this study have received diverse funding, notably from the Connecting Europe Facility (CEF) and EU co-financed projects such as Porthos, FEDeRATED, PASS4CORE-IT, and ERFLS.
- **Innovation in Logistics** – The examined terminals have adopted a wide range of advanced solutions, including digital services for smart operations, traffic optimisation, real-time container tracking, advanced Terminal Operating Systems (TOS), automated block storage, remote-controlled gantry cranes, integrated OCR gate systems, fully automated gate access, and eco-friendly vehicles, among others.
- **Expansion and Modernisation Plans** – Undergone expansions and plan developments include road access improvements, CO_2 capture and transport projects, expanded operational areas, increased storage and handling capacity, enhanced rail networks and tracks, new high-bay storage facilities, remote-controlled ship-to-shore cranes with onshore power integration, and, at CLIP terminal, a horizontal loading system for semi-trailers onto rail wagons without cranes.

As part of Objective 2, a detailed analysis was conducted on 11 intermodal terminals to evaluate their design and operational characteristics. The aim was to assess their contribution to operational efficiency, overall functionality, and the promotion of intermodal transport. Terminals were selected based on their European relevance, strong operational performance, and representativeness of efficient infrastructure. Special emphasis was placed on their role in enhancing connectivity and integration within the TEN-T network, considering their participation in EU-funded projects and the use of innovative technologies. Selection criteria also included well-established infrastructure and availability of comprehensive data, enabling comparative analysis and reflecting the terminal's development level and capacity to support intermodal transport and TEN-T integration. The following section presents the individual analysis of the selected terminals.

4.3.1. Mercatordok Multimodal Terminal

Infrastructure characteristics

Mercatordok Multimodal Terminal, located in Ghent, Belgium, has been part of North Sea Port since 2018, resulting from the merger of the ports of Ghent, Terneuzen and Vlissingen. This cross-border integration strengthens the terminal's strategic position, facilitating operations between Belgium and the Netherlands and significantly enhancing its multimodal connectivity.

With a total area of 240,000 m², Mercatordok stands out for serving multiple transport modes, including road, rail, barge, ferry, shortsea and RoLa, making it one of Europe's most versatile terminals. Its infrastructure includes a useful rail track length of 1,360 meters. It is notable for robust equipment, including RoRo and LoLo services, mobile cranes up to 100 tonnes, multimodal gantry cranes capable of handling up to 200 tonnes, specialised reach stackers of 45 tonnes for containers and barges and translifter equipment for cassette handling of up to 90 tonnes. Additionally, it offers storage for up to 2,000 TEUs, supplemented by covered storage areas ranging from 2,000 to 7,000 m².

Services and modal connectivity

Modal connectivity and services at the terminal have improved significantly in recent years. Since March 2019, trains from Spain, France, Italy, and Turkey have been arriving at the DFDS terminal in Ghent for onward maritime transport to Sweden (RailFreight.com, 2019). This rail connection strengthens transshipment hubs in Barcelona, Le Boulou, Lyon, and Trieste, particularly facilitating the handling of non-cranable trailers. Additionally, the terminal's location adjacent to the R4WO ring road provides efficient road access, which is important for regional economic development (North Sea Port, 2024). Direct access to the Ghent-Terneuzen Canal further enhances its logistical role through inland waterway connections.

Integration with TEN-T and European Corridors

Mercatordok is part of the TEN-T Rhine-Alpine and North Sea-Mediterranean corridors. Key projects include the Seine-Nord Europe canal, Saône-Rhine and Saône-Moselle canals, and a new waterway between Ghent and Zeebrugge. Additionally, it has recently been integrated into the North Sea-Baltic rail freight corridor, elevating its role in Europe's prioritised railway network and reinforcing the port's strategic position (RailFreight.com, 2021).

Innovation and sustainability initiatives

The terminal has received substantial financial support through the Connecting Europe Facility (CEF) program. Projects include the Ghent Carbon Hub, a EUR9.6 million initiative to develop a CO_2 liquefaction terminal and regional industrial CO_2 pipeline connections, and the Porthos project (European Commission, 2025), a cross-border network transporting CO_2 from industrial sources in the ports of Rotterdam, Antwerp and Ghent to offshore storage sites in depleted North Sea gas fields (European Commission, 2022). In terms of innovation in logistic operations, Mercatordok has implemented advanced digital logistics solutions, including digital services for smarter logistical operations, exemplified by its Smart Gate project, which significantly streamlines terminal traffic.

Future development plans

Finally, regarding future developments, the terminal plans to expand road access through improvements to the R4 road, as well as strengthen its integration with North Sea Port through additional CO_2 capture and transport projects. Three key initiatives aim to further enhance its TEN-T network integration: the Seine-Scheldt project, the Vlissingen-Antwerp railway line, and improvements to the Ghent-Terneuzen rail link.

4.3.2. Constanta South Container Terminal

Infrastructure characteristics

Constanta South Terminal, located in Romania, has been operated by DP World since its acquisition in 2004. Initially spanning 322,000 m2, the terminal has significantly expanded to a current operational area of 800,000 m2, integrating two additional terminals: a RO-RO terminal and a dedicated Project Cargo terminal. With a total surface area planned at over 81 hectares, the currently operational 54 hectares allow DP World Constanta to achieve an annual throughput capacity of approximately 1,000,000 TEU.

Services and modal connectivity

The terminal infrastructure includes three rail lines, each 600 meters long, enabling simultaneous handling of three complete 30-wagon trains. These rail lines are supported by two Rail Mounted Gantry cranes (RMG), alongside a stacking yard of 5,000 m2 (DP World, 2025). The terminal's robust equipment includes 6 quay cranes, 13 Rubber Tyred Gantries (RTGs), 2 RMG cranes, and 4 reach stackers. Additional specialised terminal equipment significantly boosts handling efficiency, supporting diverse cargo and container operations.

In terms of connectivity, Constanta South Terminal has become increasingly strategically important, influenced in part by recent geopolitical developments, including the conflict in Ukraine. Previously part of the New Silk Road's Middle Corridor, Constanta now serves as a key alternative route connecting Europe to Asia (HHLA, 2025). The Middle Corridor provides an efficient link from the Romanian port across the Black Sea to the Georgian port of Poti, continuing overland to Baku and onwards to Asia. Additionally, the terminal benefits from DP World's extensive European road network, offering multimodal solutions that link Constanta to 17 major routes serving Eastern, Central, and Western Europe. Maritime connectivity further strengthens the terminal's strategic position (DP World, 2025), enabling efficient transfer of containers arriving from China on the eastern Black Sea coast to Constanta by sea, thereby supporting increased cargo throughput and greater operational diversification.

Integration with TEN-T and European Corridors

Constanta South Terminal is integrated into the TEN-T Rhine-Danube and Baltic Sea–Black Sea–Aegean Sea corridors, which underscores its strategic role within European transport networks. Reflecting its importance, Constanta has received significant funding through various initiatives, including a senior loan of up to EUR 25 million from the European Bank for Reconstruction and Development (EBRD, 2025). This loan supports the electrification project at South Constanta Port, aiming to modernise the terminal's infrastructure, develop new electric networks, transformer points, electric vehicles, and charging stations, thereby actively contributing to modernisation and efficiency. Furthermore, the terminal is undergoing railway infrastructure upgrades, with projects initiated to enhance rail connectivity and handling capabilities.

Innovation and sustainability initiatives

Innovation and sustainability initiatives at Constanta South Terminal are evident through the adoption of advanced digital solutions. Sophisticated electronic systems have been implemented, significantly improving operational efficiency and allowing customers real-time container tracking and inventory management through a web-access service.

Future development plans

Currently, the terminal is developing several ambitious expansion projects. "Terminal Multimodal Zona de Dezvoltare A" involves modernising and expanding the port's capacity (DP World, 2025). Another major initiative, "Terminal Multimodal Zona de Dezvoltare D", aims to increase the storage and cargo handling capacities by developing an additional 119,000 m2 platform and supporting infrastructure.

4.3.3. Małaszewicze Adampol

Infrastructure characteristics

Małaszewicze Adampol is a strategic logistics hub, within the Adampol intermodal operation, located in Poland. With a total area of approximately 37 hectares, the terminal plays a significant role within European and international logistics networks. Its strategic position facilitates the handling of extensive international cargo flows, particularly via the New Silk Road connecting Europe with Asia.

Infrastructure at Małaszewicze includes a robust railway system of European and Russian standards, totalling 2,300 meters in rail length. This infrastructure supports efficient operations through specialised handling equipment such as four reach stackers, each with a lifting capacity of 45 tonnes handling up to 28 movements per hour, complemented by a locomotive and a fleet of forklifts (Adampol, 2019). An additional reach stacker provides handling capabilities of 10 tonnes at 28 movements per hour. The rail terminal at Małaszewicze can store up to 20,000 TEU, with an annual throughput capacity of 160,000 TEU, underscoring its significant operational capability.

Services and modal connectivity

Małaszewicze terminal offers extensive rail services, including the Euro China Train (ECT), a regular rail connection linking major terminals across Europe, China, and South Korea. It also provides rail services to Kazakhstan, Uzbekistan, Tajikistan, and Mongolia, underscoring its role as a key Eurasian transit hub. A recently established two-way rail connection with the port of Gdańsk operates five train services per week, complemented by several weekly maritime services. This route connects Małaszewicze with important ports such as Helsinki, Oslo, Gävle, Gothenburg, Teesport, Immingham, and Felixstowe, enhancing its European connectivity. Additionally, the terminal benefits from direct access to the international E30 road and the planned A2 motorway in Poland.

Integration with TEN-T and European Corridors

Małaszewicze is integrated into the TEN-T Baltic Sea-Black Sea-Aegean Sea corridor. This strategic position is reinforced by significant investments, notably through Poland's National Recovery Plan (KPO). Adampol S.A. has received funding to expand the terminal's capabilities, aiming to significantly boost its operational efficiency and maintain its strategic importance within the TEN-T network.

Despite current geopolitical challenges, Adampol maintains ambitious investment plans, emphasising Małaszewicze's enduring role as a crucial intermodal hub in Europe.

Innovation and sustainability initiatives

Małaszewicze introduces pioneering projects, including the unique digital platform "Prilo", which significantly optimises vehicle transportation logistics across Europe (Adampol, 2022). Prilo streamlines the search for transport providers, facilitates competitive offer comparisons, and simplifies transport arrangements, enhancing efficiency and user convenience. Moreover, sustainability initiatives include modernising its vehicle fleet, exemplified by the recent acquisition of 25 eco-friendly trucks. These green trucks represent Adampol's commitment to reducing the environmental impact of transport operations.

Future development plans

Małaszewicze's strategic plans also highlight ongoing expansion efforts aimed at bolstering infrastructure, including railway network enhancements and the expansion of intermodal terminal facilities. Such initiatives underline the terminal's constant evolution and its proactive response to both market demands and global logistical trends.

4.3.4. Verona Quadrante Europa

Infrastructure characteristics

The Verona Quadrante Europa terminal, located in Italy, is an exemplary model of integrated logistics and intermodal transport, efficiently combining rail and road. The Terminali Italia intermodal terminal module within the wider complex has 24 ha., Verona Quadrante Europa is strategically situated at the intersection of major European transport routes, facilitating significant traffic flows to Central, Northern and Eastern Europe, as well as France and Spain.

The railway infrastructure encompasses a total of 10,650 meters of tracks, including the primary terminal (Modules I and II and Quadrante Europa Terminal Gate Module III) with 15 tracks of 600 meters each, and the interterminal with 3 tracks of 550 meters each (ConsorzioZai, 2025). These tracks are equipped with advanced handling equipment: four gantry cranes, three compact cranes, five loader cranes, four locomotives at the primary terminal, and three loader cranes with two self-propelling intermodals at the interterminal. This infrastructure enables an impressive operational capacity, with a maximum annual throughput of approximately 420,000 UT.

Services and modal connectivity

In terms of rail connectivity, Verona Quadrante Europa demonstrates integration with multiple European corridors. Germany dominates rail connectivity with 118 weekly rail connections, followed by Italy with 20, and other important links to major cities such as Rotterdam, Antwerp, Hamburg, Munich and Nuremberg. Its extensive rail network significantly strengthens its role as a critical European logistics node. Additionally, Verona Quadrante Europa's road accessibility is strategically designed around the intersection of the Brenner motorway (North-South) and Serenissima motorway (West-East), effectively managing international goods traffic. Future connectivity improvements include plans for a canal linking Milan, Cremona, Mantua, Legnago and Rovigo, further enhancing its multimodal capability.

Integration with TEN-T and European Corridors

This terminal forms part of the TEN-T Network, specifically within the Scandinavian-Mediterranean and Mediterranean corridors, reinforced by multiple ongoing European co-financed initiatives. Notable projects include FEDeRATED, aimed at creating a federated network of data-sharing platforms across European logistics chains to enhance public involvement and operational transparency (FEDeRATED, 2025). Another significant initiative, PASS4CORE-IT, seeks to develop a network of secure parking areas along crucial Italian transport routes, improving safety and security for heavy vehicles (RAM spa, 2025).

Innovation and sustainability initiatives

Verona Quadrante Europa consistently advances in digitalisation and automation, providing sophisticated electronic systems to optimise logistic efficiency. The entire terminal is interconnected through advanced telecommunications infrastructure. The Shipping Center exemplifies this technological integration with automated access control systems, utilising tracing technology and real-time monitoring capabilities for enhanced security and operational efficiency.

Future development plans

Several ongoing projects further enhance Verona Quadrante Europa's strategic position. VENETO INTERMODAL, co-financed by the Connecting Europe Facility (CEF), aims to reinforce last-mile logistics at critical regional nodes, including Verona and Padua freight villages and the Port of Venice (North Adriatic Sea Port Authority, 2025). Similarly, URSA MAJOR neo (UMneo) focuses on implementing Intelligent Transport Systems (ITS) to optimise freight traffic management along the Scandinavian-Mediterranean and Rhine-Alpine corridors, reinforcing Quadrante Europa's pivotal role in European logistics (TRIMIS, 2025).

4.3.5. CLIP Container Terminal Swarzedz

CLIP Container Terminal Swarzędz, located in Poland, functions as a key logistics hub within the European and Asian transport networks. The facility spans approximately 520,000 m² and includes nine high-storage warehouses and production halls. It is designed to support the efficient storage, handling, and transit of a wide range of goods, including automotive components.

Infrastructure characteristics

In terms of infrastructure, CLIP boasts an extensive railway system featuring hand-over tracks, shunting locomotives, railway sidings and three newly built, fully electrified tracks equipped with SRK control systems. Each track is 750 meters long, branching directly from the E20 railway line in Paczkowo, allowing seamless train operations at a dedicated 13,500 m² loading yard (CLIP Group, 2025). This infrastructure is supported by transshipment equipment including three reach stackers with a capacity of 45 tonnes, one 10-tonne reach stacker, two terminal trailers, three rail-mounted gantry cranes (RMG) each with a 40-tonne capacity, two RGT container cranes and two LOHR stations capable of unloading four trailers simultaneously. Following an EUR 80 million expansion co-financed by EU intermodal transport development programs, the terminal's capacity now reaches 10,000 TEU with eight unloading tracks totalling 6,000 meters.

Services and modal connectivity

CLIP Terminal is connected to a broad transportation network spanning Europe and extending to China. Located along the E20 rail corridor, which links Rotterdam and Beijing, the terminal is part of the Asia-Europe "New Silk Road Belt." It is served by regular rail connections to major European logistics centers including Rotterdam, Hamburg, Lyon, Milan, Verona, Budapest, Barcelona, and Kaunas. The terminal also benefits from its proximity to the A2 motorway (Berlin–Poznań–Warsaw) and the DK92 national road, supporting efficient road transport. While the terminal does not have direct maritime access, it maintains a logistical connection with the Port of Gdańsk, offering indirect sea freight options.

Integration with TEN-T and European Corridors

CLIP Container Terminal is integrally positioned at the intersection of two major TEN-T corridors: the Baltic–Adriatic and the North Sea–Baltic, reinforcing its strategic importance in European logistics. Recent initiatives demonstrate significant EU-funded efforts to enhance integration within the TEN-T network. Examples include a permanent three-times-weekly intermodal train connection established in 2020 between CLIP Terminal Swarzędz and Duisburg, Germany, utilizing EU-funded double-pocket wagons specifically designed for efficient trailer transport. Additional intermodal connections include routes to Bettembourg, Luxembourg, and Wuppertal, Germany, further expanding its comprehensive intermodal network.

Innovation and sustainability initiatives

The terminal recently installed Poland's first Lohr Railway System, enabling horizontal loading of standard road semi-trailers onto railway wagons without cranes, significantly streamlining intermodal operations (CLIP Group, 2025). Furthermore, CLIP co-founded Semicon Supply Poland, aiming to strengthen semiconductor supply chains, fostering technological advancement and innovation throughout Poland and Europe.

4.3.6. WienCont

Infrastructure characteristics

WienCont represents a pivotal multimodal logistics hub within central Europe, notably due to its prime positioning along critical TEN-T corridors. Covering a total area of 170,000 m², WienCont is specifically designed to integrate road, rail, and inland waterway modes.

The terminal is equipped with extensive rail infrastructure, including 5,700 metres of usable track, supporting the handling of significant rail traffic volumes within Europe's freight network. Cargo handling operations are supported by equipment such as three rail-mounted gantry cranes and eight reach stackers, aimed at facilitating efficient and flexible operations. The terminal's storage capacity includes space for 10,000 TEU, offering a buffer for effective container management. Its layout and equipment are designed to accommodate high throughput and a range of logistical requirements.

Services and modal connectivity

Rail connectivity is a cornerstone of WienCont's logistics offerings, providing approximately 100 block trains per week (Wien Cont, n.d.). This robust network links Vienna directly with relevant European maritime hubs such as Hamburg, Bremerhaven, Rotterdam, and Antwerp. WienCont maintains also high-frequency rail connections with key continental locations including Duisburg, Budapest, and Trieste, ensuring comprehensive coverage of central and western Europe. Road accessibility to the terminal is highly efficient, with direct links to the A4 motorway (Ost Autobahn). The terminal's location near Vienna's city centre allows for convenient truck access, supporting its logistical operations. Its proximity to the Danube River also provides access to inland waterway transport. The nearby Freudenau Harbour offers direct barge connections, facilitating the integration of inland waterways into multimodal logistics chains and contributing to the terminal's overall connectivity.

Integration with TEN-T and European Corridors

As part of Europe's TEN-T core network, WienCont is strategically positioned along the Rhine-Danube and Orient/East-Mediterranean corridors.

Innovation and sustainability initiatives

In recent years, WienCont has actively leveraged EU funding mechanisms, particularly from the Connecting Europe Facility (CEF), to enhance its operational and environmental sustainability. This funding has supported essential projects aimed at infrastructure modernisation and digital innovation. Digitalisation initiatives at WienCont include advanced terminal management systems designed to streamline operations and enhance efficiency (Wien Cont, 2025). The terminal uses smart gate systems and advanced cargo tracking technologies to streamline handling processes and improve operational efficiency. Energy-efficient LED lighting has been installed throughout the facility, and electric-powered handling equipment was introduced as part of efforts to lower overall energy consumption and reduce environmental impact.

Future development plans

Key planned expansions and upgrades include track extensions to accommodate longer, 740-metre trains, significantly enhancing rail throughput and operational efficiency. Additionally, ongoing projects aim to integrate advanced digital logistics platforms further, improving overall multimodal logistics efficiency and reliability. Strategic cooperation with EU and national initiatives is a significant aspect of WienCont's operational strategy. The terminal collaborates closely with major European funding and development programmes, ensuring alignment with broader EU transport policy objectives and securing essential financial and operational support.

4.3.7. Le Havre

Infrastructure characteristics

Le Havre intermodal terminal is a critical hub for multimodal logistics in Northern Europe. Covering approximately 60 hectares, this terminal provides comprehensive and efficient integration of maritime, rail, road, and inland waterway transport.

The terminal is equipped with 12,500 metres of rail track, supporting the efficient handling of high freight volumes. Its handling capabilities are supported by six rail-mounted gantry cranes (RMGs) and a number of reach stackers, facilitating container operations. The facility has a storage capacity of approximately 6,000 TEU (HAROPA Port, 2025), providing flexibility for container management and contributing to consistent operational performance, including during periods of high demand.

Services and modal connectivity

The terminal is well-connected by rail, offering daily services to key European destinations, including regular and frequent connections to Paris, Lyon, and other major French cities. Further, frequent shuttle services connect Le Havre directly with major European rail hubs in Germany, Belgium, and Italy, reinforcing its pivotal position within the continental logistics network. Road access to the terminal is highly efficient, facilitated by direct motorway connections via the A131 and A29, linking seamlessly to the broader French and European motorway network. Truck access is optimised by advanced gate management systems, including slot booking and OCR technologies, ensuring rapid truck processing and reduced dwell times. Maritime and inland waterway access further enhances Le Havre's logistical versatility. The proximity to the Seine River and associated inland waterways ensures seamless integration into the multimodal logistics chains.

Integration with TEN-T and European Corridors

Le Havre plays a crucial role within the European TEN-T network, specifically positioned on the North Sea-Mediterranean and Atlantic corridors.

Innovation and sustainability initiatives

The terminal has received substantial support from European Union funding initiatives, notably through the Connecting Europe Facility (CEF). Key funded projects have included infrastructure modernisation, advanced digital logistics enhancements, and sustainability-focused initiatives. Digitalisation initiatives are a core part of Le Havre's operational strategy, exemplified by the deployment of advanced Terminal Operating Systems (TOS) and smart logistics platforms. These systems provide sophisticated tracking, efficient container management, and optimised operational processes, significantly improving overall efficiency. Further, Le Havre has pilot projects ongoing, aimed at reducing environmental impacts. Key developments include the introduction of electric handling equipment, integration of renewable energy solutions, and implementation of advanced, eco-friendly logistics systems.

Future development plans

Planned upgrades include extending rail tracks to accommodate 740-metre trains, significantly boosting rail capacity and efficiency. Additional improvements are set to enhance road access infrastructure, facilitating even smoother logistics flows. The terminal maintains robust cooperation with EU and national initiatives, aligning closely with broader transport policy objectives. Through active participation in key European projects, such as the Smart Port City initiative (optimising logistics through secure data exchange between European seaports) and the Seine Axis hydrogen cluster (a major initiative led by the private firm Air Liquide to accelerate low-carbon mobility along the Seine River corridor), the terminal continuously seeks to leverage collaborative partnerships to enhance innovation and sustainability.

4.3.8. Barcelona El Morrot

Infrastructure characteristics

Barcelona El Morrot intermodal terminal, strategically situated within the Port of Barcelona, Spain, serves as a crucial node for rail and maritime freight operations in the Mediterranean region. Covering a total area of 7.75 hectares, it provides an essential multimodal interface (Port de Barcelona, 2025).

Services and modal connectivity

The terminal's rail infrastructure includes 4,360 metres of usable track, designed to facilitate efficient handling of freight trains. The terminal is equipped with advanced handling equipment, including six rail-mounted gantry cranes with a lifting capacity of 32 tonnes each, complemented by additional reach stackers. This equipment ensures rapid and efficient loading and unloading of containers, greatly enhancing terminal throughput and operational agility. Barcelona El Morrot has a storage capacity of 2,000 TEU, providing sufficient flexibility to manage container flow effectively. The layout and management systems employed at the terminal ensure smooth operational flow, accommodating fluctuations in cargo volume with minimal disruption. There is frequent rail connectivity with shuttle services to major European logistics hubs, such as Antwerp (up to ten rotations per week) and Busto Arsizio. The terminal's strategic rail connections facilitate efficient transport chains, linking southern Europe directly to significant economic and logistical centres across the continent. El Morrot terminal has convenient road access due to its location near the Ronda Litoral B-10, which connects to Spain's broader motorway network. Truck entry is managed through modern gate systems designed to support efficient vehicle flow and reduce dwell times. The terminal is situated within the Port of Barcelona, a major European maritime hub, providing direct maritime access.

Integration with TEN-T and European Corridors

Positioned as a core node within the European TEN-T network, Barcelona El Morrot terminal lies along the Mediterranean Corridor, reinforcing its crucial role in European transport logistics.

Innovation and sustainability initiatives

Significant EU funding, particularly from the Connecting Europe Facility (CEF), has supported major infrastructure improvements and digitalisation initiatives. A EUR36.1 million grant has contributed towards developing new rail infrastructure, further enhancing the terminal's operational capabilities. El Morrot has actively embraced digitalisation through the implementation of a new Terminal Operating System (TOS), which has significantly streamlined operations and improved efficiency. This advanced system provides comprehensive cargo tracking and operational management. The terminal also participates in innovative pilot projects aimed at expanding operational capabilities and reducing environmental impacts. An example is the first P400 frigo-trailer rail test between Antwerp and Barcelona, demonstrating the terminal's capacity to manage new types of freight efficiently.

Future development plans

Future expansions at El Morrot include increasing annual handling capacity to 100,000 TEU by 2028, along with crucial track extensions to accommodate trains up to 740 metres. These enhancements are set to significantly boost operational efficiency and throughput capacity, aligning closely with broader European infrastructure development goals. El Morrot maintains active cooperation with EU and national initiatives, notably through its Rail Hub Morrot Joint Venture and membership in the Smart Ports network.

4.3.9. Kombi-Terminal Ludwigshafen (Ludwigshafen KTL)

Infrastructure characteristics

Ludwigshafen KTL, strategically located within the BASF chemical complex in Ludwigshafen, Germany, is an inland intermodal hub. It spans an area of 30 hectares, thereby plays a pivotal role in managing freight traffic within Europe's central logistics corridors.

Services and modal connectivity

The terminal is equipped with approximately 7,836 metres of rail tracks, enabling it to manage high volumes of rail freight. Ludwigshafen KTL operates seven electrically powered rail-mounted gantry cranes (RMGs), each capable of lifting 41 tonnes, providing efficient and swift handling with a rate of approximately 30 container moves per hour. This infrastructure ensures smooth and rapid container transfers, significantly enhancing terminal throughput. Storage capacity at Ludwigshafen KTL is around 2,650 TEU, providing adequate flexibility to accommodate high operational demands (KTL, 2025). Advanced digitalisation measures, including the GOAL/EDIGES Terminal Operating System (TOS), enhance efficiency by optimising train loading, crane scheduling, and truck entry management through automated OCR gates, streamlining overall terminal operations. Rail services from Ludwigshafen KTL include the handling of over 20 block trains daily, high-frequency services such as two to four daily trains to Busto Arsizio and two daily connections to Verona. Additional daily services connect to Rotterdam and Lübeck, complemented by multiple weekly services (three to five times) to strategic hubs such as Hamburg, Novara, Barcelona Morrot, Duisburg, Munich, and Lyon (KTL, 2025). This comprehensive rail network positions Ludwigshafen KTL along the Rhine-Alpine corridor and makes it crucial for European freight logistics. Efficient road connectivity significantly enhances the terminal's logistical capabilities. Located less than two kilometres from critical motorway junctions (B9, A6, A650) via BASF Gate 15, the terminal features OCR kiosks and self-check-in systems, maintaining truck dwell times below ten minutes even at high throughput levels of 4,000 trucks daily. While Ludwigshafen KTL lacks direct waterway access, it benefits from proximity to the Rhine quay at Kaiserwörthhafen, merely one kilometre away within the BASF site. Containers arriving by river are transferred to KTL via internal trucks or rail shuttles from neighbouring trimodal ports like Mannheim, ensuring efficient multimodal integration.

Integration with TEN-T and European Corridors

The terminal is an integral node within the European TEN-T core network along the Rhine-Alpine corridor.

Innovation and sustainability initiatives

Targeted EU funding from the Connecting Europe Facility (CEF), specifically the ERFLS project, provided EUR0.32 million to enhance terminal telematics (Connected Europe Facility, 2025). This initiative significantly optimises logistical planning and boosts efficiency along the Rhine-Alpine axis. The terminal operates fully electric gantry cranes with energy recuperation systems, substantially reducing energy consumption. It also generates approximately 100,000 kWh annually through photovoltaic installations, powering electric trucks and terminal tractors. Additionally, energy-efficient LED lighting contributes to the terminal's minimal environmental impact. Ludwigshafen KTL actively participates in EU and national projects, reinforcing its alignment with broader European transport and sustainability goals.

Future development plans

A feasibility study is currently underway for a high-bay storage facility, designed to accommodate around 260 semi-trailers stacked six-high, significantly enhancing storage capacity for previously non-stackable load units.

4.3.10. Port of Hamburg

Infrastructure characteristics

The Port of Hamburg, situated strategically along the tidal River Elbe, is an intermodal logistics hub. Comprising several key terminals, notably Kombi-Transeuropa Terminal Hamburg (KTH) at Container Terminal Altenwerder (CTA), EUROKOMBI at EUROGATE Container Terminal Hamburg (CTH), Container Terminal Burchardkai (CTB), and Container Terminal Tollerort (CTT), it effectively integrates rail, maritime, and road transport networks. EUROKOMBI alone covers about 16.1 hectares.

Services and modal connectivity

Collectively, these terminals feature approximately 26 kilometres of rail tracks, facilitating efficient and high-volume cargo management. These terminals operate 21 rail-mounted gantry cranes (RMGs), designed for efficient handling, substantially reducing carbon emissions through predominantly electric-powered operations. Combined storage capacity across these facilities totals around 120,000 TEU. Such capacity ensures operational smoothness and effectively manages cargo flow fluctuations, particularly during peak periods. The Port of Hamburg handles daily 200 freight trains on average, connecting the port with over 40 major German inland destinations and more than 15 key European logistics hubs. Regular shuttle services operate with high frequency to economic centres such as Duisburg, Ludwigshafen, Munich, Vienna, Verona, and Busto Arsizio, reinforcing Hamburg's crucial role in pan-European rail logistics (Port of Hamburg, 2025). Road access is streamlined via the A7 motorway, Exit 30 "HH-Waltershof", directly linking the port terminals with Germany's motorway network. The comprehensive TruckGate slot booking and OCR (Optical Character Recognition) system effectively minimise truck gate dwell times to under ten minutes, enhancing operational efficiency and reducing road congestion. Terminals are directly positioned on the tidal Elbe, ensuring seamless transfer between sea vessels and other transport modes. Additionally, inland waterway connections through barges operate via the Köhlfleet and Süderelbe basins.

Integration with TEN-T and European Corridors

As part of the TEN-T core network, Hamburg occupies a strategic position on the North Sea-Baltic Corridor, with further functional connections to the Rhine-Alpine and Scandinavian-Mediterranean corridors.

Innovation and sustainability initiatives

The port has benefited from EU financial support via the Connecting Europe Facility (CEF). Funded initiatives include the Wilhelmsburg fly-over (EUR1.29 million EU contribution), reducing rail traffic conflicts, and the Alte Süderelbe western bypass (EUR1.53 million EU contribution), providing essential rail infrastructure upgrades that enhance operational efficiency at terminals such as CTA/KTH. Advanced digitalisation and automation are fundamental to Hamburg's operational strategy. The terminals feature automated block storage systems, remotely controlled gantry cranes, and integrated OCR gate technologies. These advancements substantially streamline container management and enhance operational predictability. They actively participate in pioneering sustainability projects, exemplified by the Clean Port & Logistics (CPL) hydrogen cluster. This project, operational at Tollerort and Altenwerder terminals since 2024, involves hydrogen-powered straddle carriers and fuel-cell-powered terminal tractors, highlighting the port's commitment to zero-emission technology.

Future development plans

Ongoing expansions and improvements significantly augment Hamburg's capacity and efficiency. Developments include the densification project at CTB, due for completion in 2025, and the introduction of remote-controlled ship-to-shore cranes alongside onshore power supply integrations at CTA, significantly enhancing both operational efficiency and sustainability. Strategic infrastructure projects such as the CEF-funded Wilhelmsburg fly-over and Alte Süderelbe bypass are set to increase rail throughput, facilitating more than 250 freight trains per day, and positioning Hamburg to exceed three million TEU annually by 2030. They collaborate with EU and national initiatives, particularly through involvement in CPL hydrogen projects and digital logistics improvements via TruckGate and smartPORT programmes.

4.3.11. Klaipeda Container Terminal

Infrastructure characteristics

Terminalas, situated in Klaipėda, Lithuania, stands as a pivotal logistics hub within the Baltic Sea region, playing a central role in maritime and intermodal freight operations. Spanning 32 hectares, the terminal benefits from direct access to port infrastructure and proximity to major European transport corridors, facilitating cargo flows between Scandinavia, Central Europe, and the CIS markets.

Services and modal connectivity

The terminal's berth infrastructure includes 820 meters of quay length, with a draft of 13.4 meters and the capacity to accommodate vessels up to 360 meters long (Klaipedos Container Terminal, 2025). These specifications enable efficient handling of large-capacity ships in daily operations. Cargo handling is supported by four ship-to-shore (STS) cranes, each with a 65-tonne lifting capacity, complemented by two mobile cranes capable of lifting up to 154 tonnes and eleven rubber-tyred gantry cranes with a 40-tonne capacity.

Storage and yard facilities are equally substantial, with container yard capacity reaching 23,500 TEU and warehouse space totalling 23,000 square meters. The terminal is equipped with 600 reefer plugs, enabling extensive support for temperature-controlled cargo. On the rail side, Terminalas features four dedicated railway tracks that can accommodate up to 100 wagons, streamlining port-rail integration and enhancing inland connectivity. This configuration allows Terminalas to operate as an efficient intermodal node, underpinned by advanced logistics infrastructure and strong alignment with European transport strategies.

Terminalas provides a wide range of intermodal services, including container handling, vehicle logistics, customs brokerage, and freight forwarding. It supports rail connections to inland terminals across Lithuania and neighboring countries, and benefits from daily maritime services via Klaipėda port to destinations such as Germany, Sweden, Denmark, and Poland.

The terminal also offers road transport solutions, with direct access to the A1 motorway, facilitating efficient distribution to Vilnius, Kaunas, and cross-border markets. Its multimodal capabilities enable door-to-door logistics, integrating sea, rail, and road transport under unified operational management.

Integration with TEN-T and European Corridors

Terminalas is integrated into the TEN-T North Sea-Baltic Corridor, which connects key Baltic ports with Central European logistics hubs. Its strategic location within Klaipėda port aligns with EU infrastructure priorities, supporting modal shift objectives and enhancing regional connectivity.

Innovation and sustainability initiatives

In 2024, KCT advanced its investment strategy by allocating roughly EUR 23 million to enhance operational efficiency, upgrade infrastructure, and procure new cargo-handling machinery (Klaipedos Container Terminal, 2025). The investment included the acquisition of cutting-edge equipment such as two Ship-To-Shore (STS) cranes, two Rubber Tyred Gantry (RTG) cranes, an empty container handler, and various auxiliary devices. These upgrades align with the company's objective to mitigate environmental impact and modernize terminal operations.

A key development during this period was the introduction of a fully automated gate access system at the container terminal. This innovation significantly boosted gate processing capacity while offering clear advantages for truck operators, urban traffic flow, and environmental performance. Drivers now arrive at their designated time slots and finalize entry procedures in just minutes—without having to exit their vehicles.

Future development plans

Although there is no explicit information for future plans of the Klaipeda Container Terminal, the wider complex of Klaipėda Port is investing in comprehensive rail infrastructure upgrades—including **renewal of railway lines**, improved **land connections**, and overall port-wide infrastructure modernization as part of a EUR 308million investment through 2025–2028 (Port Technology, 2025).

4.4. SO3. Mapping of the main logistics nodes connecting with the most relevant European ports

KEY FINDINGS

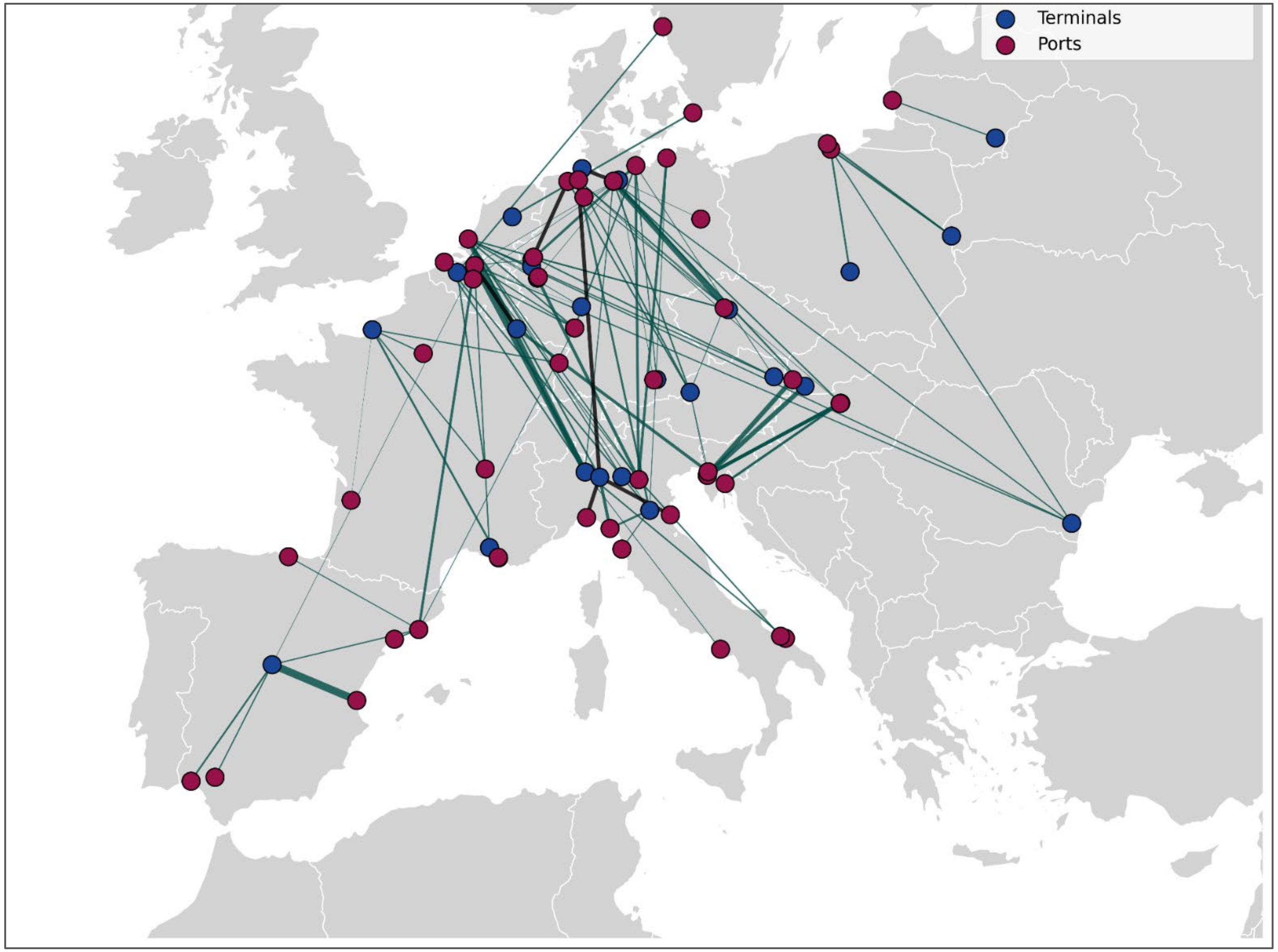
- **Top-Connected Inland Terminals** – Busto Arsizio-Gallarate, Madrid Abroñigal, and Praha-Uhříněves have the highest weekly rail service frequencies to major maritime and inland ports.
- **Insular nature of the Spanish rail system** – Madrid's connectivity is heavily driven by services to Valencia, with most traffic remaining within Spain, reflecting the insular nature of the Spanish rail system and its track gauge. Relatively low-density networks of single-track railway lines, usually combined with a low industrial base and a well-developed road freight sector additionally contribute to this outcome (UIC Freight Department, 2023).
- **Diversified vs regionalised connectivity** – Busto Arsizio-Gallarate serves multiple regions, linking to ARA ports as well as German and Italian ports; while Praha-Uhříněves is rather regionalised and primarily linked to northern German ports.
- **Central Europe's Strategic Role** – The distribution of regular rail-port services highlight the strong position of Central Europe in intermodal connectivity. There are 6 Central European terminals among the 10 with the highest number of regular rail services to main ports.
- **Very concentrated waterway navigation** - Inland waterway transport in Europe is mainly concentrated in a few countries, with the Netherlands and Germany together accounting for over 70% of the total transport volume.

This section presents the most significant intermodal connections between freight terminals and seaports within the European Union. The analysis focuses on **railway and inland waterway (IWW)** links to identify terminals with the highest levels of intermodal connectivity to EU seaports.

The accompanying map illustrates key connections between intermodal terminals—primarily located inland, though some are situated within port complexes—and seaports. The **thickness of each line** on the map represents the **number of weekly rail freight service frequencies**, providing a visual indication of connection intensity.

Connections between barge ports and seaports were also identified. However, due to the **fragmented nature of inland waterway operations** and the **lack of consistent data on service frequencies**, it was not possible to produce a comparable map for IWW connections and frequencies. For many routes, **no fixed barge schedules** are listed publicly, while **project-based and demand-driven services** are more common than in the railway sector, especially for bulk and heavy-lift cargo.

Figure 4-32: Map of the main intermodal connections between terminals and seaports



Source: Own elaboration.

Table 4-3: Railway connections and weekly trains between main intermodal terminals and main sea ports / waterway ports

(Weekly trains between brackets)	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Country	Operator	Weekly trains	Sources
BustoArsizio–Gallarate	Rotterdam (20)	Antwerp (20)	Zeebrugge (6)	Hamburg Billwerder (4)	Bari Scalo Ferruccio (6)	Napoli (3)	Italy	HUPAC	59	Link
Madrid Abroñigal	Seville (5)	Huelva (7)	Valencia (30)	Antwerp (2)	Barcelona Morrot (5)		Spain	Renfe	49	Link 1 Link 2
Praha – Uhříněves	Hamburg (Burchardkai, CTA, CTT) (22)	Bremerhaven (4)	Wilhemelmshaven (4)	Duisburg (3) (main port on the Rhine river)	Rotterdam (6)		Czechia	Metrans	39	Link
Verona – QuadranteEuropa	Rostock (10)	Travemunde (10)	Giovinazzo (6)	Rotterdam (5)	Antwerp (4)		Italy	TT Line/ HUPAC	35	Link 1 Link 2
Budapest Csepel/BILK	Koper (14)	Rijeka (12)	Hamburg (6)	Bremenhaven (2)			Hungary	Metrans	34	Link
Bologna – Interporto	Zeebruge (6)	Bari Scalo Ferruccio (8)	La Spezia (8)	Livorno (4)	Rostock (3)	Rotterdam (3)	Italy	Interporto Bologna SPA	32	Link
Koper – Luka K	Budapest Csepel (14) (Main port on the river Danube)	Dunajska Streda (18) (Main port near the river Danube)					Slovenia	Metrans	32	Link

(Weekly trains between brackets)	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Country	Operator	Weekly trains	Sources
Dunajska Streda	Koper (18)	Hamburg (Burchardkai, CTA, CTT) (7)	Bremerhaven (3)				Slovakia	Metrans	28	Link
LeHavre (LHTE)	Bordeaux (1)	Lyon (5) (main port on the Rhône River)	Paris (main port on the river Seine) (5)	Marseille (8)	Strasbourg (main port on the river Rhine) (5)		France	LHTE	24	Link 1 Link 2 Link 3 Link 4
Salzburg CTS	Hamburg (CTB/CTA/CTT via Maschen) (6)	Bremerhaven (6)	Wilhelmshaven (6)	Koper (2)	Trieste (3)		Austria		23	
Barcelona Morrot	Antwerp (10)	Ludwigshafen (main port on the river Rhine) (3)	Bilbao (4)	Tarragona (5)			Spain	HUPAC / Kombiverkehr / RENFE	22	Link 1 Link 2
Constanta South Container Terminal (DP World)	Gdansk (5)	Hamburg (5)	Antwerp (5)	Rotterdam (5)			Romania	DP World	20	Link
Melzo	La Spezia (12)	Genoa (unknown)	Ravenna (unknown)	Bari (unknown)	Rotterdam (7)		Italy	Rail Hub Milano S.p.A.	19	Link
Mercatordok Multimodal	Zeebruge (6)	Lyon (6) (main port on	Gothemburg (6)				Belgium	DFDS	18	Link

(Weekly trains between brackets)	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Country	Operator	Weekly trains	Sources
Terminal (Brussels)		the Rhône River)								
Ludwigshafen KTL	Travemunde (6)	Rotterdam (6)	Zeebruge (5)	Antwerp (5)			Germany	TT Line / HUPAC	16	Link
Małaszewicze Adampol	Gdańsk (7)	Gdynia (7)					Poland	Adampol	14	Link
WienCont	Duisburg (6)	Rotterdam (5)	Travemunde (3)				Austria	HUPAC / TT Line	14	Link 1 Link 2
Duisburg	Travemunde (10)	Antwerp (3)					Germany	HUPAC / TT Line	13	Link 1 Link 2
Hamburg	Munchen (2)	Bremen (2)	Berlin (2)	Koln (2)	Antwerp (2)	Brussels (2)	Germany	TFG	12	Link
Intermodal Terminal Bettembourg	Antwerp (n/d)	Trieste (12)					Luxembourg	CFL Terminals	12	Link
Miramas	Marseille-Fos (5)	Antwerp-Bruges (5)					France	Novatrans	10	Link
Oslo	Trelleborg (7)						Norway	TT Line	7	Link
Terminal Radomsko	Gdansk (7)						Poland	CMACGM	7	Link

(Weekly trains between brackets)	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Country	Operator	Weekly trains	Sources
Brescia	Rotterdam (5)						Italy	HUPAC	5	Link
Vilnius Vaidotay Intermodal Terminal	Klaipėda (5)						Lithuania	AB Lietuvos geležinkeliai	5	Link
München–Riem	Travemunde (4)						Germany	TT Line	4	Link
Frankfurt West	Antwerp (1)	Rotterdam (3)					Germany	Contargo	4	Link
Neuss	Rotterdam (2)						Germany	Contargo	2	Link

As already mentioned, owing to the fragmented nature of inland waterway (IWW) operations and the absence of consistent data on service frequencies, it was not feasible to produce a map equivalent to that of rail connections. For many IWW routes, fixed barge schedules are not publicly available, and services are often project-based or demand-driven—particularly in the transport of bulk goods and heavy-lift cargo—making standardised frequency mapping difficult. However, we present below a table of the main barge connections building up the European freight inland waterway network:

Table 4-4: Main inland waterway connections for freight in EU

Ports	Port 1	Port 2	Corridor	Country	Operator
LeHavre (LHTE)	Ports along Senna corridor (Rouen, Gennevilliers, Bonneuil-sur-Marne)		Seine River Corridor	France	LHTE
Cuxhaven (Cuxport)	Ports along Elbe corridor (Hamburg, Dresden, Magdeburg)		Elbe River Corridor	Germany	Cuxport
Aarau	Antwerp HTA		Rhine-Alps Corridor	Switzerland/ Belgium	
Basel	Rotterdam RSC	Rotterdam Maasvlakte	Rhine-Alps Corridor	Switzerland / Netherlands	
Dourges Conteneurs Terminal Delta 3	Dunkirk / Valenciennes wide-gauge canal		Nord–Pas-de-Calais Canal Network	France	Delta Dourges
Mannheim	Antwerp	Rotterdam	Rhine-Alps Corridor	Germany / Belgium / Netherlands	DP World
Gemersheim	Antwerp	Rotterdam	Rhine-Alps Corridor	Germany / Belgium / Netherlands	DP World
Liege	Antwerp	Rotterdam	Meuse and Albert Canal	Belgium/ Belgium / Netherlands	DP World
Basel	Antwerp	Rotterdam	Rhine-Alps Corridor	Switzerland	DP World / Swissterminal

Ports	Port 1	Port 2	Corridor	Country	Operator
Birsfelden	Antwerp	Rotterdam	Rhine-Alps Corridor	Switzerland/ Belgium / Netherlands	DP World / Swissterminal
Ottmarsheim	Antwerp	Rotterdam	Rhine-Alps Corridor	France / Belgium / Netherlands	DP World / Swissterminal
Strasbourg	Antwerp	Rotterdam	Rhine-Alps Corridor	France / Belgium / Netherlands	DP World / Swissterminal
Venlo and Born	Rotterdam		Rhine-Alps Corridor	Netherlands	Hutchison Ports Venlo
Neuss and Koln Eifeltor	Antwerp	Rotterdam	Rhine-Alps Corridor	Germany / Belgium / Netherlands	Contargo
Duisburg	Rotterdam		Rhine-Alps Corridor	Germany / Netherlands	HPEI / Contargo/ Danser
Budapest	Port along the Danube Corridor (Linz, Orsova, Giurgiu, Constanta)		Danube Corridor	Austria/ Romania/ Hungary	

Inland waterway transport (IWW) is largely concentrated in a limited number of European countries with access to major navigable rivers such as the Rhine and its tributaries, the Scheldt–Meuse system, the Danube, and the Seine, which serve as the backbone of modernised secondary canal networks. In absolute terms, the Netherlands and Germany have similarly sized IWW transport markets and jointly account for over 70% of total inland waterway transport performance in Europe (UIC Freight Department, 2023).

4.5. SO4.1 Mapping of distances (as the crow flies and broken down by road/rail/inland waterways) between the most relevant European port facilities and the major land intermodal freight terminals in terms of destination/origin of operational intermodal maritime transport alongside

KEY FINDINGS

- Considering all the different routes analysed, the distances (as the crow flies) separating these pairs of origin-destination show **a mean of 602 km and a median of 548 km.**

Road:

- The road distances separating these pairs of origin-destination show **a mean of 793 km and a median of 682 km.** The standard deviation for the road distances examined is of 591, which means that the values vary quite widely from the average, **indicating high variability or dispersion in the data**[12]**.**

Rail:

- The rail distances separating these pairs of origin-destination show **a mean of 797 km and a median of 749 km.** The standard deviation for the rail distances examined is of 525, which means that the values vary quite widely from the average, **indicating high variability or dispersion in the data**

- On average, **rail routes are slightly longer than road routes**, both in mean and median terms.

- The **rail median overhead** (**36.7%** over "as the crow flies" distance) is notably higher than the **road median** (**24.5%** over "as the crow flies" distance), suggesting that rail routes may be less direct or more circuitous for shorter or typical trips.

In line with the specific objective SO4.1 a distance mapping has been successfully developed and is presented in the accompanying color-coded graph.

Using publicly available datasets, it was possible to compile comprehensive distance data for both **road networks** and **straight-line ('as the crow flies') measures**. These dimensions have been encoded using a calibrated colour scale to facilitate comparative assessment of connectivity across the network.

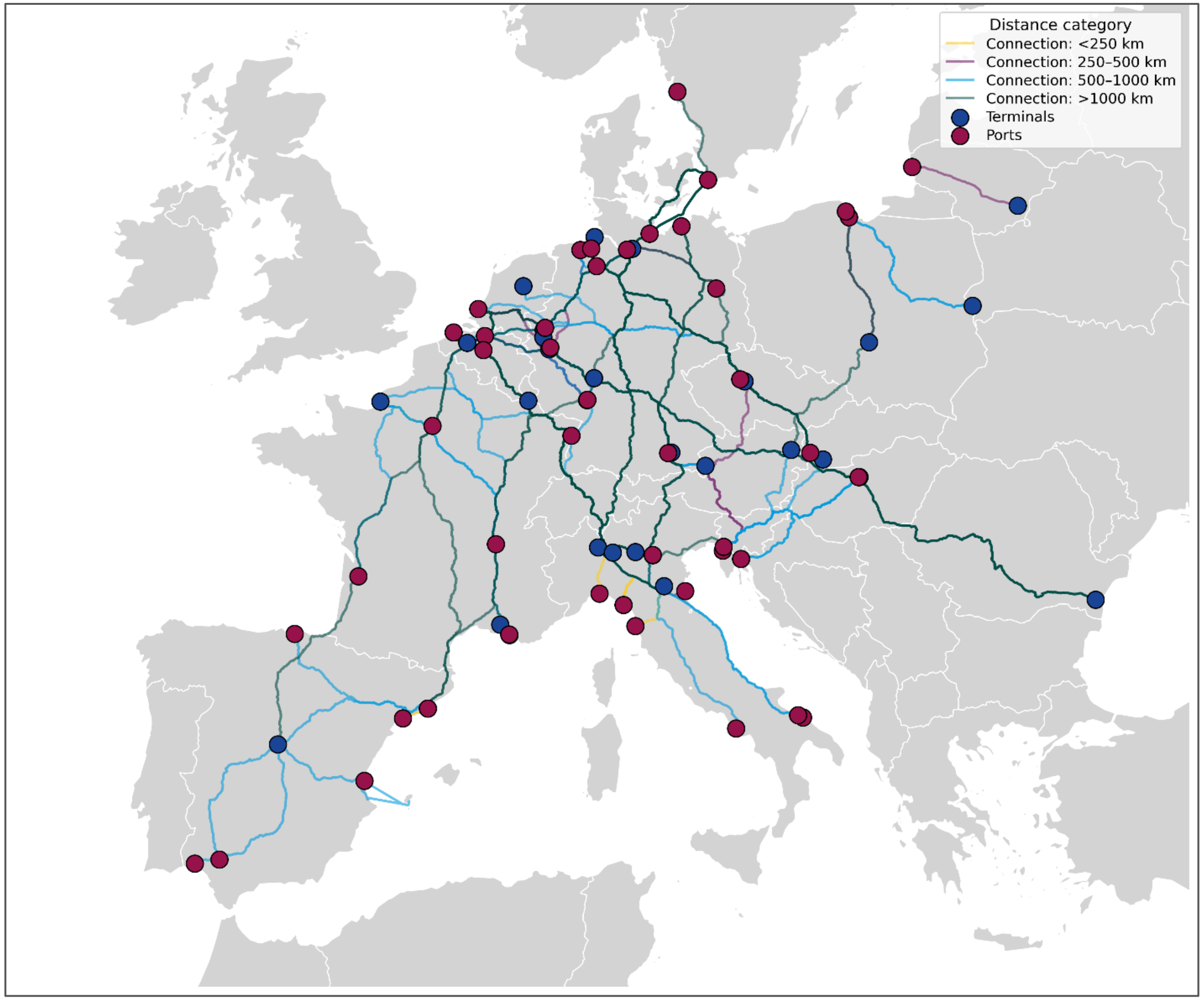
Due to limitations in publicly accessible geospatial and operational datasets, it was **not yet feasible to construct equivalent mappings for rail and inland waterways**. These remain under further technical review, and additional time will be required to assess data availability, network granularity, and potential methodologies for derivation. We identified a shapefile of the rail network, and we are working to overcome the limitation of the difficulty to distinguish between passenger and freight lines. In addition, we will attempt to design an algorithm to calculate distances based on the rail lines closest to

[12] For road transport, data values mostly range from around 50 to 2,500, with many values clustered around the 500-1,500 mark. A standard deviation of 591 means that, on average, the values deviate from the mean by about 591 units, which is a substantial portion of the data range.

the ports / terminals. Unlike the road network, where this algorithm was already implemented using a package, for the rail network this functionality is not yet available and will need to be developed.

Ongoing work will focus on evaluating the practicality of rail and inland waterway integration within the same framework, with a view toward full completion of the mapping exercise in subsequent phases.

Figure 4-33: Map of road distances between intermodal terminals and main seaports



Source: Own elaboration.

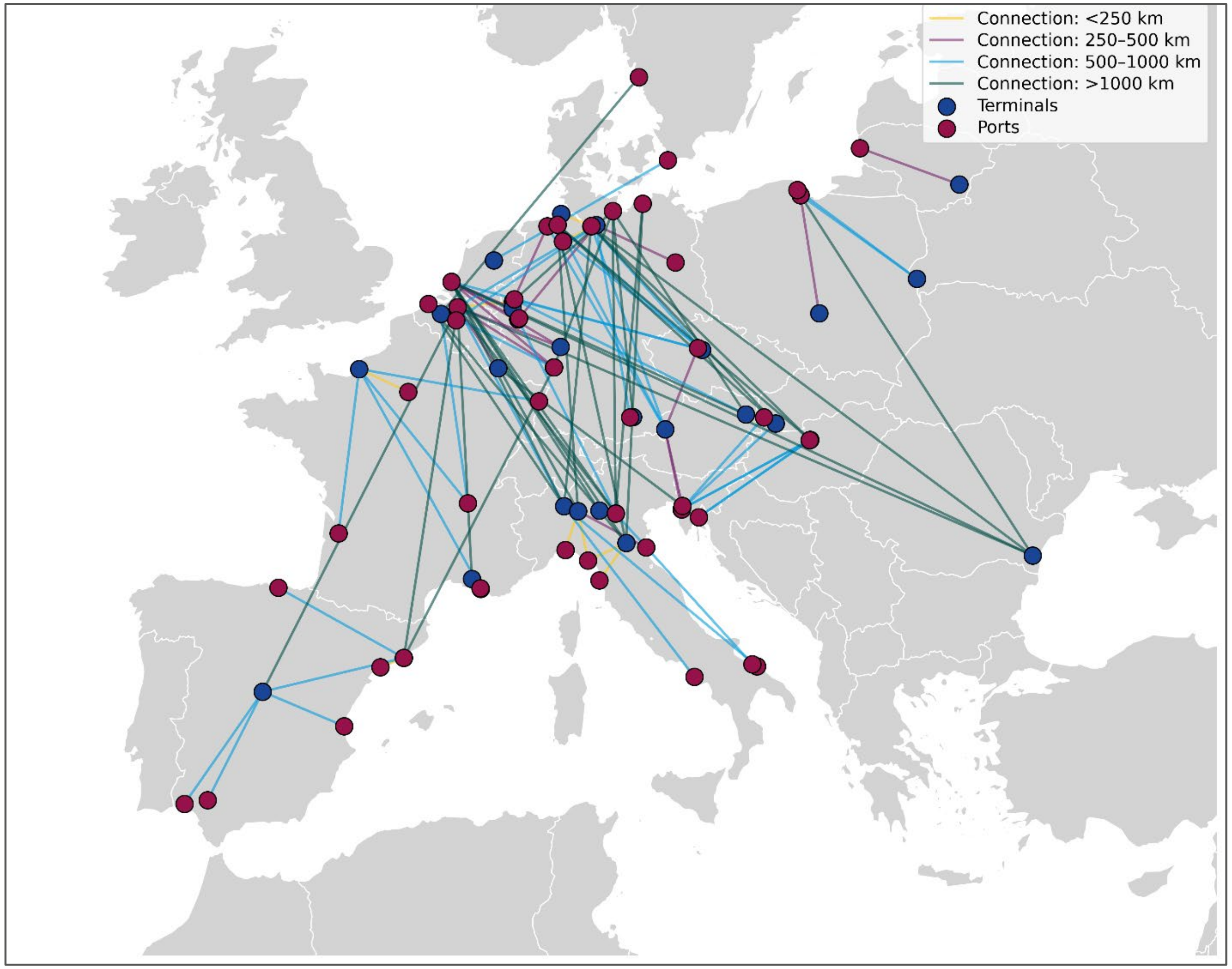
(Road distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
BustoArsizio–Gallarate	Rotterdam (1,051)	Antwerp (934)	Zeebrugge (1,005)	Hamburg Billwerder (1,100)	Bari Scalo Ferruccio (924)	Napoli (812)	Italy
Madrid Abroñigal	Seville (545)	Huelva (623)	Valencia (373)	Antwerp (1,619)	Barcelona Morrot (620)		Spain
Praha – Uhříněves	Hamburg (Burchardkai, CTA, CTT) (645)	Bremerhaven (675)	Wilhemelmshaven (717)	Duisburg (717) (main port on the Rhine river)	Rotterdam (941)		Czechia
Verona – QuadranteEuropa	Rostock (1,209)	Travemunde (1,807)	Giovinazzo (794)	Rotterdam (1,211)	Antwerp (1,094)		Italy
Budapest Csepel/BILK	Koper (592)	Rijeka (573)	Hamburg (1,192)	Bremenhaven (1,221)			Hungary
Bologna – Interporto	Zeebruge (1,242)	Bari Scalo Ferruccio (1,366)	La Spezia (226)	Livorno (195)	Rostock (1,349)	Rotterdam (1,288)	Italy
Koper – Luka K	Budapest Csepel (Main port on the river Danube) (583)	Dunajska Streda (560) (Main port near the river Danube)					Slovenia
Dunajska Streda	Koper (560)	Hamburg (Burchardkai, CTA, CTT) (1,021)	Bremerhaven (1,050)				Slovakia
LeHavre (LHTE)	Bordeaux (670)	Lyon (646) (main port on the Rhône River)	Paris (main port on the river Seine) (185)	Marseille (950)	Strasbourg (main port on		France

(Road distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
					the river Rhine) (689)		
Salzburg CTS	Hamburg (CTB/CTA/CTT via Maschen) (922)	Bremerhaven (952)	Wilhelmshaven (958)	Koper (376)	Trieste (365)		Austria
Barcelona Morrot	Antwerp (1,390)	Ludwigshafen (main port on the river Rhine) (1,278)	Bilbao (622)	Tarragona (106)			Spain
Constanta South Container Terminal (DP World)	Gdansk (2,150)	Hamburg (2,225)	Antwerp (2,411)	Rotterdam (2,499)			Romania
Melzo	La Spezia (232)	Genoa (177)	Ravenna (302)	Bari (1,166)	Rotterdam (1,088)		Italy
Mercatordok Multimodal Terminal (Brussels)	Zeebruge (59)	Lyon (main port on the Rhône River) (765)	Gothemburg (1,251)				Belgium
Ludwigshafen KTL	Travemunde (1,157)	Rotterdam (499)	Zeebruge (513)	Antwerp (412)			Germany
Małaszewicze Adampol	Gdańsk (528)	Gdynia (567)					Poland
WienCont	Duisburg (976)	Rotterdam (1,209)	Travemunde (1,551)				Austria
Duisburg	Travemunde (459)	Antwerp (182)					Germany

(Road distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
Hamburg	Munchen (782)	Bremen (130)	Berlin (284)	Koln (436)	Antwerp (556)	Brussels (594)	Germany
Intermodal Terminal Bettembourg	Antwerp (270)	Trieste (1,089)					Luxembourg
Miramas	Marseille-Fos (58)	Antwerp-Bruges (1,052)					France
Oslo	Trelleborg (796)						Norway
Terminal Radomsko	Gdansk (419)						Poland
Brescia	Rotterdam (1,156)						Italy
Vilnius Vaidotay Intermodal Terminal	Klaipėda (316)						Lithuania
München–Riem	Travemunde (866)						Germany
Frankfurt West	Antwerp (395)	Rotterdam (483)					Germany
Neuss	Rotterdam (252)						Germany

Considering all the different routes presented in the previous table, the road distances separating these pairs of origin-destination show **a mean of 793 km and a median of 682 km**.

Figure 4-34: Map of as the crow flies' distances between intermodal ports and seaports



Source: Own elaboration.

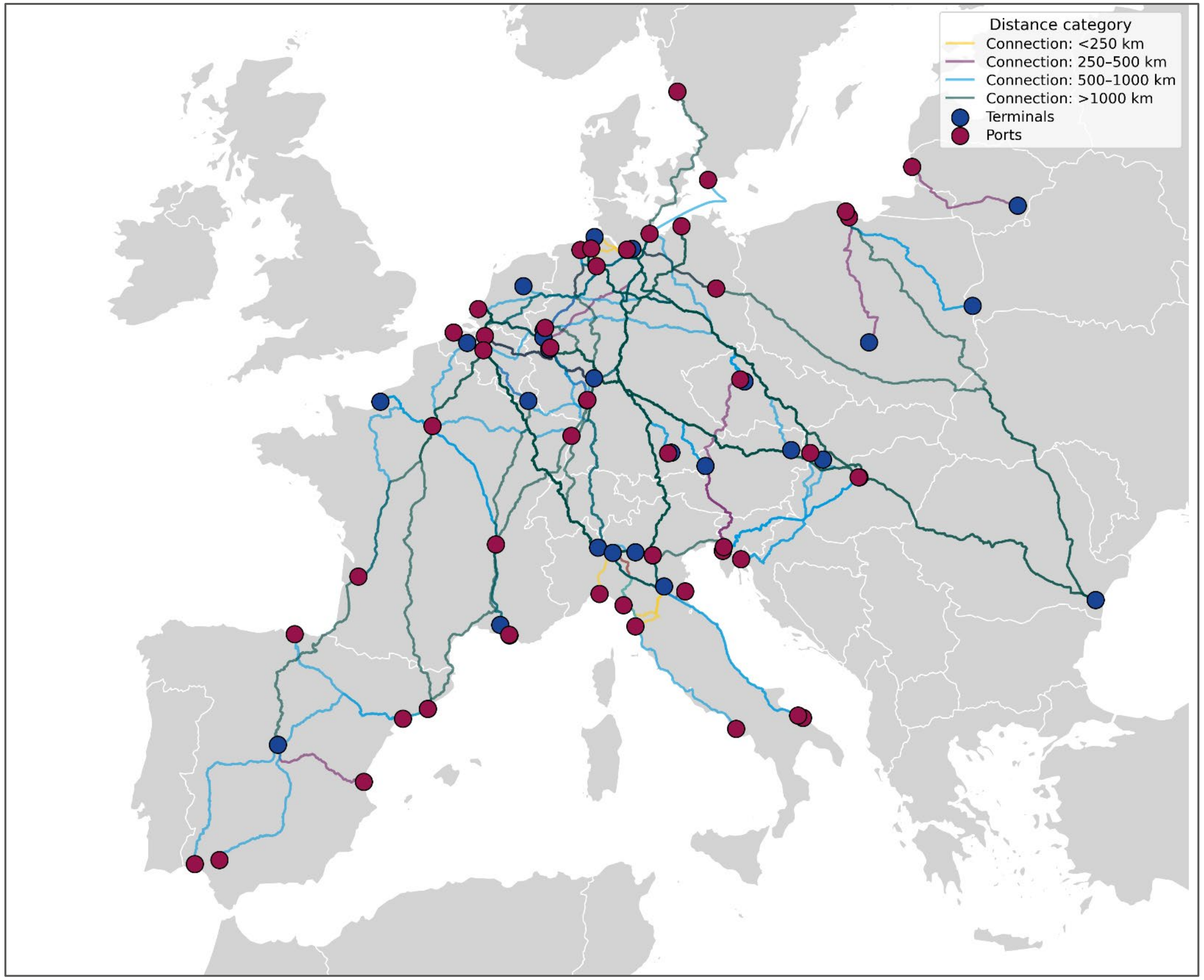
(As the cow flies distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
BustoArsizio–Gallarate	Rotterdam (782)	Antwerp (704)	Zeebrugge (954)	Hamburg Billwerder (1,147)	Bari Scalo Ferruccio (900)	Napoli (853)	Italy
Madrid Abroñigal	Seville (561)	Huelva (639)	Valencia (398)	Antwerp (1,722)	Barcelona Morrot (660)		Spain
Praha – Uhříněves	Hamburg (Burchardkai, CTA, CTT) (647)	Bremerhaven (757)	Wilhemelmshaven (777)	Duisburg (770) (main port on the Rhine river)	Rotterdam (987)		Czechia
Verona – QuadranteEuropa	Rostock (1,298)	Travemunde (1,213)	Giovinazzo (745)	Rotterdam (1,189)	Antwerp (1,073)		Italy
Budapest Csepel/BILK	Koper (604)	Rijeka (567)	Hamburg (1,163)	Bremenhaven (1,272)			Hungary
Bologna – Interporto	Zeebruge (1,217)	Bari Scalo Ferruccio (1,310)	La Spezia (222)	Livorno (200)	Rostock (1,417)	Rotterdam (1,270)	Italy
Koper – Luka K	Budapest Csepel (607) (Main port on the river Danube)	Dunajska Streda (609) (Main port near the river Danube)					Slovenia
Dunajska Streda	Koper (638)	Hamburg (1,019) (Burchardkai, CTA, CTT) (7)	Bremerhaven (1,129)				Slovakia

(As the cow flies distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
LeHavre (LHTE)	Bordeaux (783)	Lyon (647) (main port on the Rhône River)	Paris (main port on the river Seine) (215)	Marseille (978)	Strasbourg (main port on the river Rhine) (721)		France
Salzburg CTS	Hamburg (CTB/CTA/CTT via Maschen) (900)	Bremerhaven (932)	Wilhelmshaven (952)	Prague (373)	Koper (386)	Trieste (349)	Austria
Barcelona Morrot	Antwerp (1,353)	Ludwigshafen (main port on the river Rhine) (1,276)	Bilbao (669)	Tarragona (88)			Spain
Constanta South Container Terminal (DP World)	Gdansk (1,603)	Hamburg (2,036)	Antwerp (2,392)	Rotterdam (2,438)			Romania
Melzo	La Spezia (229)	Genoa (148)	Ravenna (304)	Bari (1,167)	Rotterdam (1,062)		Italy
Mercatordok Multimodal Terminal (Brussels)	Zeebruge (55)	Lyon (752) (main port on the Rhône River)	Gothemburg (1,312)				Belgium
Ludwigshafen KTL	Travemunde (646)	Rotterdam (512)	Zeebruge (565)	Antwerp (464)			Germany
Małaszewicze Adampol	Gdańsk (533)	Gdynia (553)					Poland

(As the cow flies distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
WienCont	Duisburg (1,002)	Rotterdam (1,212)	Travemunde (957)				Austria
Duisburg	Travemunde (475)	Antwerp (218)					Germany
Hamburg	Munchen (812)	Bremen (185)	Berlin (288)	Koln (475)	Antwerp (637)	Brussels (682)	Germany
Intermodal Terminal Bettembourg	Antwerp (237)	Trieste (1063)					Luxembourg
Miramas	Marseille-Fos (45)	Antwerp-Bruges (1,046)					France
Oslo	Trelleborg (791)						Norway
Terminal Radomsko	Gdansk (469)						Poland
Brescia	Rotterdam (1,133)						Italy
Vilnius Vaidotay Intermodal Terminal	Klaipėda (364)						Lithuania
München–Riem	Travemunde (856)						Germany
Frankfurt West	Antwerp (431)	Rotterdam (479)					Germany
Neuss	Rotterdam (232)						Germany

Considering all the different routes presented in the previous table, the distances (as the crow flies) separating these pairs of origin-destination show **a mean of 602 km and a median of 548 km.**

Figure 4-35: Map of railway distances between intermodal ports and seaports



Source: Own elaboration.

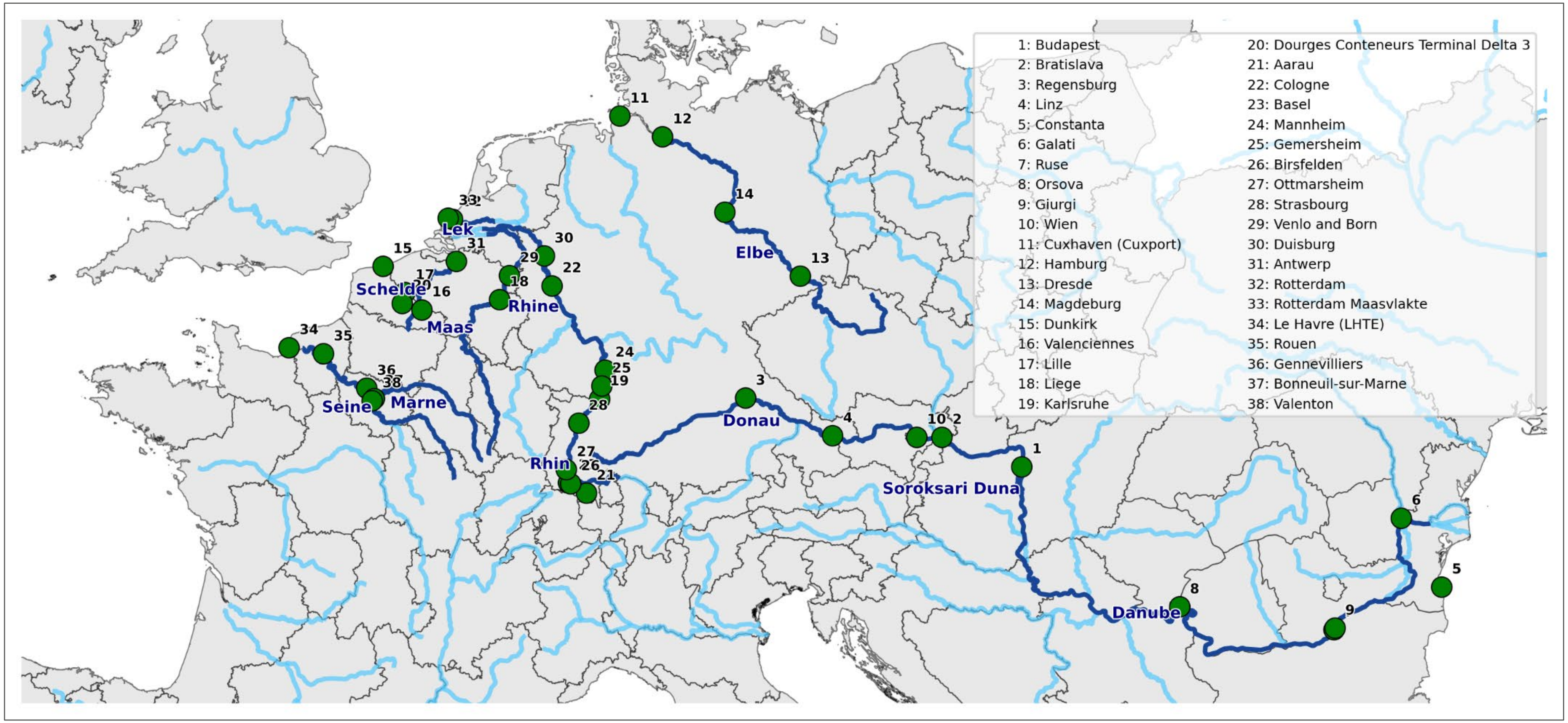
(Rail distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
BustoArsizio–Gallarate	Rotterdam (1,007)	Antwerp (892)	Zeebrugge (1758)	Hamburg Billwerder (880)	Bari Scalo Ferruccio (820)	Napoli (691)	Italy
Madrid Abroñigal	Seville (393)	Huelva (450)	Valencia (309)	Antwerp (1,356)	Barcelona Morrot (506)		Spain
Praha – Uhříněves	Hamburg (Burchardkai, CTA, CTT) (501)	Bremerhaven (570)	Wilhemelmshaven (589)	Duisburg (574) (main port on the Rhine river)	Rotterdam (762)		Czechia
Verona – QuadranteEuropa	Rostock (973)	Travemunde (947)	Giovinazzo (659)	Rotterdam (882)	Antwerp (808)		Italy
Budapest Csepel/BILK	Koper (464)	Rijeka (431)	Hamburg (929)	Bremenhaven (1003)			Hungary
Bologna – Interporto	Zeebruge (967)	Bari Scalo Ferruccio (1,016)	La Spezia (138)	Livorno (147)	Rostock (1,062)	Rotterdam (978)	Italy
Koper – Luka K	Budapest Csepel (462) (Main port on the river Danube)	Dunajska Streda (389) (Main port near the river Danube)					Slovenia
Dunajska Streda	Koper (402)	Hamburg (821) (Burchardkai, CTA, CTT) (7)	Bremerhaven (891)				Slovakia

(Rail distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
LeHavre (LHTE)	Bordeaux (518)	Lyon (540) (main port on the Rhône River)	Paris (main port on the river Seine) (165)	Marseille (789)	Strasbourg (main port on the river Rhine) (556)		France
Salzburg CTS	Hamburg (CTB/CTA/CTT via Maschen) (672)	Bremerhaven (714)	Wilhelmshaven (724)	Prague (273)	Koper (255)	Trieste (245)	Austria
Barcelona Morrot	Antwerp (1,110)	Ludwigshafen (main port on the river Rhine) (1,031)	Bilbao (483)	Tarragona (87)			Spain
Constanta South Container Terminal (DP World)	Gdansk (1,325)	Hamburg (1,687)	Antwerp (1,944)	Rotterdam (1,982)			Romania
Melzo	La Spezia (158)	Genoa (128)	Ravenna (250)	Bari (898)	Rotterdam (815)		Italy
Mercatordok Multimodal Terminal (Brussels)	Zeebruge (48)	Lyon (598) (main port on the Rhône River)	Gothemburg (912)				Belgium
Ludwigshafen KTL	Travemunde (518)	Rotterdam (403)	Zeebruge (421)	Antwerp (342)			Germany
Małaszewicze Adampol	Gdańsk (416)	Gdynia (433)					Poland
WienCont	Duisburg (780)	Rotterdam (969)	Travemunde (745)				Austria

(Rail distance in km between brackets)	Sea port 1	Sea port 2	Sea port 3	Sea port 4	Sea port 5	Sea port 6	Country
Duisburg	Travemunde (399)	Antwerp (161)					Germany
Hamburg	Munchen (610)	Bremen (106)	Berlin (250)	Koln (364)	Antwerp (469)	Brussels (497)	Germany
Intermodal Terminal Bettembourg	Antwerp (226)	Trieste (719)					Luxembourg
Miramas	Marseille-Fos (40)	Antwerp-Bruges (852)					France
Oslo	Trelleborg (569)						Norway
Terminal Radomsko	Gdansk (373)						Poland
Brescia	Rotterdam (847)						Italy
Vilnius Vaidotay Intermodal Terminal	Klaipėda (287)						Lithuania
München–Riem	Travemunde (647)						Germany
Frankfurt West	Antwerp (327)	Rotterdam (378)					Germany
Neuss	Rotterdam (195)						Germany

Considering all the different routes presented in the previous table, the rail distances separating these pairs of origin-destination show **a mean of 797 km and a median of 749 km.**

Figure 4-36: Map of main routes on navigable inland waterways



Source: Own elaboration.

Table 4-5: Distances between main inland waterway ports (km)

	Port 1	Port 2	Port 3	Port 4	Port 5	Corridor
Le Havre (LHTE)	Rouen (120)	Gennevilliers (228)	Bonneuil-sur-Marne (263)	Valenton (267)		Seine Corridor
Cuxhaven (Cuxport)	Hamburg (88)	Dresde (580)	Magdeburg (355)			Elbe Corridor
Aarau	Antwerp HTA (820)					Rhine-Alps Corridor
Cologne	Antwerp (250)					Rhine-Alps Corridor
Basel	Rotterdam RSC (830)	Rotterdam Maasvlakte (830)				Rhine-Alps Corridor
Dunkirk	Valenciennes (140)	Lille (80)				Liaison Dunkerque-Escaut waterway corridor
Mannheim	Antwerp (480)	Rotterdam (640)				Rhine-Alps Corridor
Gemersheim	Antwerp (520)	Rotterdam (670)				Rhine-Alps Corridor
Liege	Antwerp (130)	Rotterdam (160)	Venlo and Born (110)			Meuse and Albert Canal
Birsfelden	Antwerp (830)	Rotterdam (880)				Rhine-Alps Corridor
Ottmarsheim	Antwerp (820)	Rotterdam (870)				Rhine-Alps Corridor
Strasbourg	Antwerp (750)	Rotterdam (800)				Rhine-Alps Corridor
Venlo and Born	Rotterdam (200)					Rhine-Alps Corridor
Neuss and Koln Eifeltor	Antwerp (200)	Rotterdam (240)				Rhine-Alps Corridor

	Port 1	Port 2	Port 3	Port 4	Port 5	Corridor
Duisburg	Rotterdam (230)	Basel (650)				Rhine-Alps Corridor
Budapest	Linz (450)	Orsova (493)	Giurgi (797)	Constanta (1,632)	Wien (290)	Danube Corridor
Bratislava	Constanta (1,600)					Danube Corridor
Regensburg	Galati (1,850)					Danube Corridor
Linz	Ruse (1,250)					Danube Corridor

Main source: own calculation based on Google Maps; (European Commission, 2017); (EFIP, 2011); River Seine (Lower) | Detailed Navigation Guides and Maps | French Waterways; Elbe River | Germany, Czech Republic & Europe | Britannica; Inland Waterways Europe: A Key for Sustainable Transport.

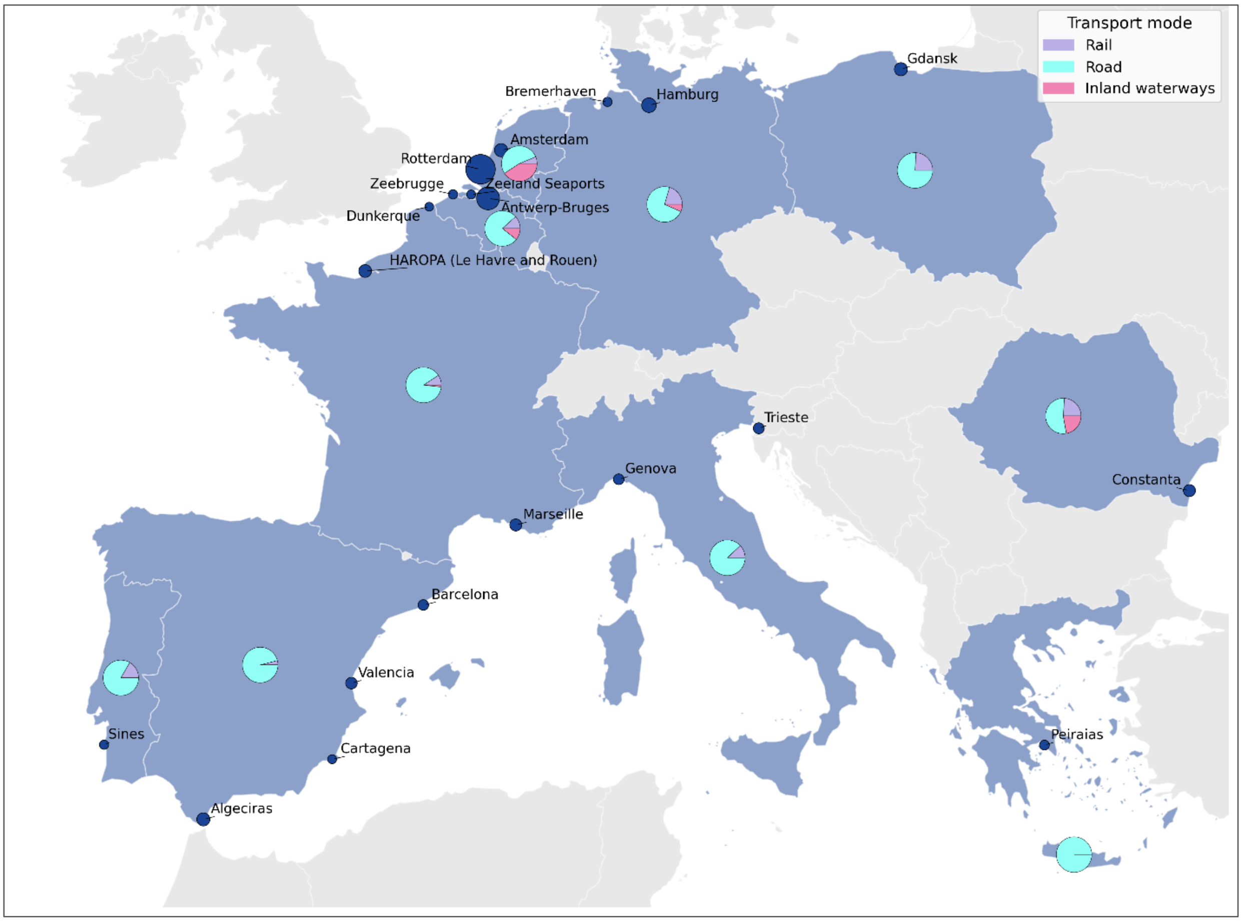
4.6. SO4.2 Analysis of the relevant annual loads registered in the most important seaports in EU

KEY FINDINGS

- EU seaports handled 3.4 billion tonnes of freight in 2023, marking a 3.9% decline from 2022. This was primarily due to reduced trade with Russia and broader global economic challenges.
- Rotterdam remains the leading EU port with 11.9% of total throughput, followed by Antwerp-Bruges and Hamburg, each offering distinct strengths in liquid bulk, container traffic, and Europe-Asia trade.
- Ports such as Gdańsk, Algeciras, Amsterdam, HAROPA, Marseille, and Constanța play strategic roles in regional connectivity, specialisation, and diversification of Europe's maritime logistics.
- Liquid bulk cargo accounted for the largest share of EU port traffic at 37.9%, followed by containerised goods at 22.7%, reflecting industrial demand and global supply chain dynamics.
- Despite the overall decline in volume, the EU's diverse and geographically distributed port network remains essential for trade resilience and adaptability to shifting geopolitical and economic conditions.

The following map and table present the 20 most important EU seaports based on the total gross weight of cargo handled. Due to the lack of consistent and homogeneous data regarding the specific transport modes through which this cargo arrives at each individual port, the modal split shown corresponds to the overall freight transport modal distribution of the Member State in which each port is located. This approach provides a general indication of how the national freight modal distribution may influence the transport patterns and logistics operations at these key ports.

Figure 4-37: Annual loads handled by the 20 most important ports and corresponding freight modal split



Source: Own elaboration.

Table 4-6: Total gross weight handled by main EU seaports

Port	Country	Year	Total gross weight
Rotterdam	Netherlands	2023	401,596
Antwerp-Bruges	Belgium	2023	242,243
Hamburg	Germany	2023	99,603
Amsterdam	Netherlands	2023	80,760
Gdansk	Poland	2023	79,782
Algeciras	Spain	2023	79,486
HAROPA (Le Havre and Rouen)	France	2023	75,564
Marseille	France	2023	67,261
Constanta	Romania	2023	67,223
Valencia	Spain	2023	62,250

Port	Country	Year	Total gross weight
Trieste	Italy	2023	55,614
Genova	Italy	2023	53,056
Barcelona	Spain	2023	51,460
Peiraias	Greece	2023	45,238
Zeebrugge	Belgium	2021[13]	40,130
Sines	Portugal	2023	39,840
Bremerhaven	Germany	2023	39,189
Cartagena	Spain	2023	37,397
Zeeland Seaports	Netherlands	2023	36,554
Dunkerque	France	2023	35,386

Source: Own elaboration based on Eurostat data **[tran_hv_ms_frmod]**.

In 2023, European Union seaports collectively handled approximately **3.4 billion tonnes** of freight, marking a **3.9% decline** compared to 2022[14]. This downturn is largely attributed to reduced trade volumes with Russia and broader global economic challenges[15]. Despite this contraction, several key ports across the EU continued to play vital roles in sustaining Europe's maritime logistics, each with distinct specializations and strategic advantages.

Leading EU Seaports

Rotterdam (NL) remains the undisputed leader among EU ports, handling nearly **11.9%**[16] of the Union's total seaborne freight. Its **strategic location**, **deep-water access**, and extensive terminal infrastructure enable it to operate as a major gateway for **liquid bulk cargo**, **containerised goods**, and **transshipment traffic**. Rotterdam's efficiency and capacity make it a cornerstone of Europe's maritime and intercontinental trade flows.

Antwerp-Bruges (BE) follows closely behind, with strengths in **container traffic** and **chemical cargo**, supported by its proximity to major industrial regions and strong hinterland connections via rail. This integration into the continental freight network enhances its role as a key logistics platform for Western Europe.

Hamburg (DE), Germany's largest seaport, remains a critical node in **Europe-Asia container trade**. It is especially active in handling traffic to and from China. However, its **inland location** along the Elbe River and **tidal constraints** limit its scalability compared to Rotterdam and Antwerp.

Amsterdam (NL) complements the Netherlands' port system with a focus on **dry bulk goods** and **energy products**, including coal and oil. While it doesn't match Rotterdam's scale, Amsterdam's specialization strengthens the overall versatility of Dutch maritime logistics.

[13] Data not available for more recent years.
[14] EU ports handled 3.4 billion tonnes of freight in 2023 - News articles - Eurostat.
[15] Maritime transport of goods - annual data - Statistics Explained - Eurostat.
[16] Maritime transport of goods - annual data - Statistics Explained - Eurostat.

Gdańsk (PL) has emerged as one of the EU's fastest-growing ports, now ranking **7th in overall throughput**. Its growth is driven by increasing **Baltic Sea trade**, major **infrastructure investments**, and the expansion of **LNG** and **container terminals**, positioning it as a rising logistics hub in Northern and Eastern Europe.

Algeciras (ES), located at the strategic **Strait of Gibraltar**, functions primarily as a **transshipment hub**, linking European trade with **Africa and Latin America**. Its ability to handle large container vessels and its pivotal location make it crucial for southbound and cross-Mediterranean shipping routes.

HAROPA (FR) (a combined entity of Le Havre, Rouen, and Paris) and **Marseille** represent France's dual-port system. HAROPA serves the **northern industrial corridor**, facilitating container and bulk movements, while Marseille supports **Mediterranean trade**, with a notable share of **bulk** and **Ro-Ro (roll-on/roll-off)** traffic connecting Southern Europe with North Africa.

Constanța (RO), the largest EU port on the **Black Sea**, plays a key role in **grain exports**, **oil imports**, and acts as a logistical bridge to **Central and Eastern Europe**. Its relevance has grown in light of shifting trade routes and the need for resilient supply chains in the eastern part of the EU.

Cargo Composition

Across all EU ports, **liquid bulk cargo** (such as oil and chemicals) accounted for the largest share at **37.9%**, followed by **containerised goods** at **22.7%**. These categories continue to dominate port throughput, reflecting both Europe's industrial needs and the globalized nature of modern supply chains.

Despite recent declines in total volume, the **diversity, specialisation, and geographic distribution** of EU ports remain essential to Europe's trade resilience, offering a multi-nodal network capable of adapting to shifting economic and geopolitical dynamics.

4.7. SO5. Analysis of average distances travelled to and from the intermodal nodes at Member State level in Germany, Italy, Lithuania and Spain

KEY FINDINGS

- Significant variation in total truck distances across countries is linked to both the **number of routes and truck density per route**. Italy, with twice as many routes as Spain, records over three times the total road distance, reflecting higher truck activity and concentrated freight corridors.
- **Germany** and **Lithuania** show the **shortest average edge lengths**. Germany's figures suggest a dense, highly connected network with frequent short-haul movements, while Lithuania's low values reflect its smaller geography, limited intermodal infrastructure, and localised freight flows.
- **Italy** ranks third in average edge length, nearly double that of Germany. This reflects a mix of regional and long-distance flows, shaped by its industrial base, mountainous terrain, and strong connectivity with major intermodal hubs and ports.
- **Spain** shows the highest average edge length, driven by fewer but longer-distance routes. This indicates weaker intermodal integration, limited alternative transport modes, and structural constraints such as lack of inland waterways and incompatible rail gauge.
- Overall, **intermodal connectivity varies widely across Member States**, influenced by geography, infrastructure, and modal integration. Spain's challenges highlight the impact of systemic barriers on cross-border freight efficiency and intermodal development.

Intermodal transport aims to minimise the use of road transport, limiting road segments to the initial or final leg of the freight journeys. For this reason, Objective 5 of this study focuses specifically on these road segments, particularly those that start or end at intermodal terminals. The aim is to analyse the distances travelled by road in four selected EU Member States, chosen to represent a diversity of characteristics and contexts. The selected MS are Germany, Italy, Spain and Lithuania. These countries show a diverse distribution of transport modes, a different integration of railway in logistics and diverse levels of intensity of intermodality, which are relevant for the analysis.

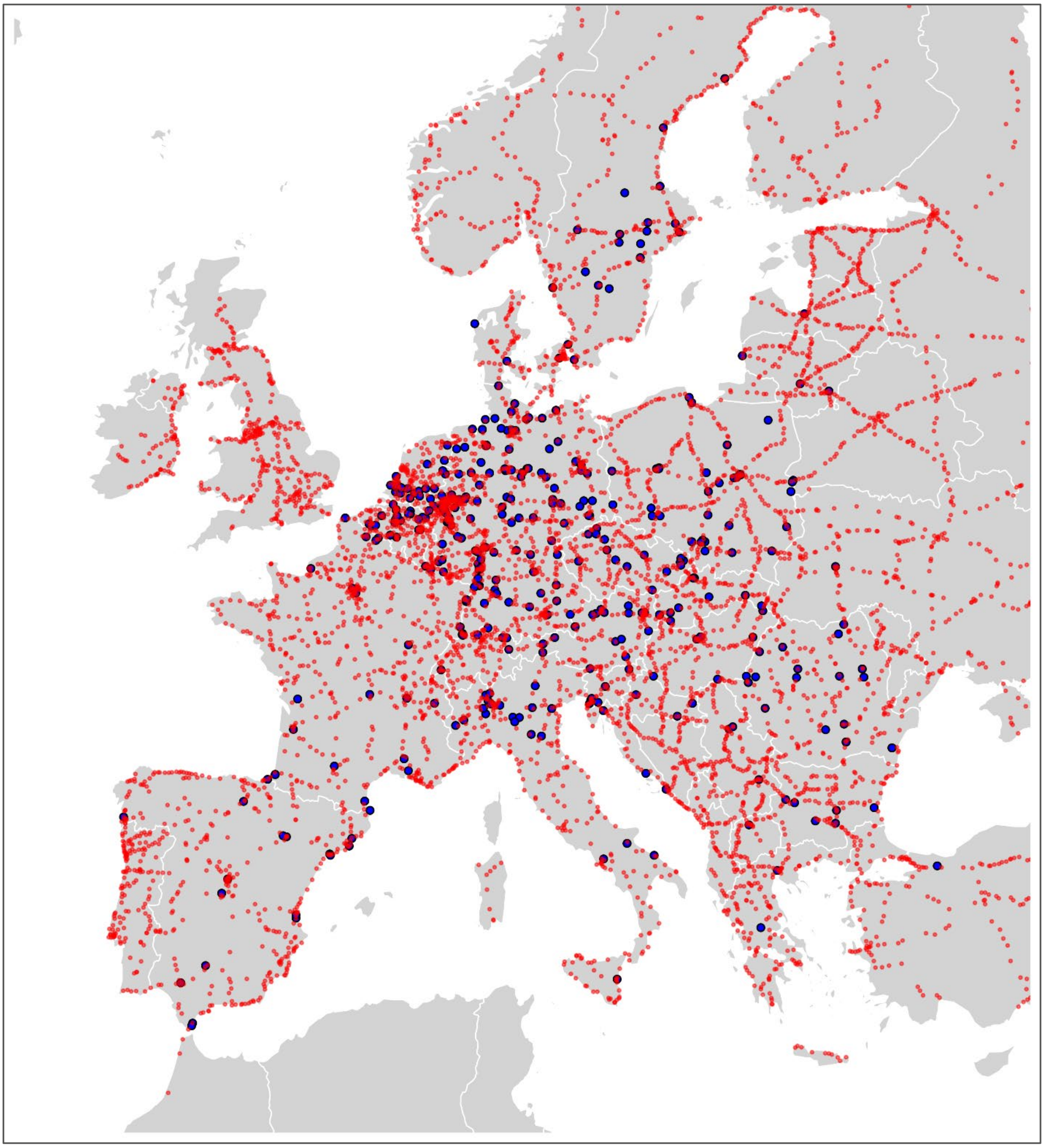
To carry out this analysis, the Synthetic European Road freight transport flow data based on ETISplus (Speth, Sauter, Plötz, & Signer, 2021) has been used. This dataset models truck traffic flows across 1,675 European regions and maps them onto the highway network using Dijkstra's algorithm. The project collected Europe-wide freight volumes and calibrated the resulting origin-destination matrices with real world traffic flows. For the current dataset, the truck results of the ETISplus project were updated using current Eurostat data from 2019. **Despite being six years old, the dataset remains the most comprehensive publicly available source for mapping road freight flows with sufficient granularity to enable alignment with the intermodal terminal network.** The original dataset contains detailed information on "edges"—short traffic segments linking two nodes—where each node is geolocated using latitude and longitude coordinates. By matching these nodes and edges, which represent freight flows, with the locations of intermodal terminals previously identified for SO1, it was possible to determine routes to and from the terminals. These routes were then assigned corresponding traffic volumes based on the dataset[17].

Some limitations given by the nature of the original dataset should be indicated. The sample of (Speth, Sauter, Plötz, & Signer, 2021) covers highways, four-lane roads and smaller roads but excluded regional traffic (traffic within the same NUTS-3 region), since the regional resolution is not high enough to represent them properly. This means that routes with both origin and destination located within the same NUTS-3 region were excluded from the original analysis. Furthermore, the original dataset estimates vehicle trips based on freight volumes, applying an average loading factor of 13.6 tonnes and assuming a 25% share of empty trips. These assumptions may influence the results and should be considered when interpreting the findings. As such, the dataset should not be considered as providing complete coverage, but rather as a representative sample of truck activity between intermodal nodes.

In the map, it is possible to observe the overlap of both datasets:

[17] We matched the nodes identified by latitude and longitude in the original Synthetic European Road freight transport flow dataset—based on ETISplus and Eurostat—with the intermodal terminals identified in SO1. The matching process yielded a 75% success rate, indicating that 75% of the intermodal terminals used in the analysis could be aligned with nodes in the original Synthetic European Road freight transport flow dataset.

Figure 4-38: Matching the road freight traffic flows with identified intermodal terminals in EU



Source: Own elaboration based on Synthetic European Road freight transport flow data based on ETISplus and Eurostat and the identification of intermodal terminals based on data extracted from Agora and intermodal terminal websites.

Therefore, this objective takes a comparative approach, aiming to highlight differences in road freight usage between countries, while considering their specific national features to understand how road transport is integrated into intermodal chains in each case. The following 4-7 displays the summary of information for the four selected countries:

Table 4-7: Annual truck kilometres to and from identified intermodal nodes

	Germany	Italy	Spain	Lithuania
Total annual vkm for trucks, having identified nodes as origin or destination (millions of km)	**3,718**	**1,422**	**452**	**9**
Mean length of edge (km)	4.53	8.84	21.53	3.19
Median length of edge (km)	3.47	5.02	8.07	2.50
Mean number of annual trucks per route	**3,453,271**	**4,756,853**	**2,241,162**	**354,961**
Total number of truck journeys	801,158,880	185,517,263	47,064,395	3,194,651
Number of typical routes from sample	232	39	21	9
Number of intermodal terminals identified in SO1	143	24	19	5
Vkm / number of identified intermodal terminals	26 M	59.3 M	23.8 M	1.8 M

Source: Synthetic European Road freight transport flow data based on ETISplus and Eurostat.

Based on the analysis of the collected data in Table 4-6, several insights can be drawn. Looking at the first row of the Table 4-6 referring to the total distance travelled by all trucks heading to or from the terminal, significant differences can be observed across countries. These differences are initially expected, as a higher number of routes generally correlates with a higher total distance travelled. For example, while Italy records roughly twice as many routes as Spain, its total road distance is more than triple that of Spain. This discrepancy leads to a deeper analysis of the average number of trucks per route, which is also significantly higher in Italy, doubling that of Spain.

A relevant metric for this study is the average length of the edge, that is, the average road segment distance to or from the terminal. It must be clarified that in the original dataset whose data was extracted for this study, the length between nodes is measured as the distance "as the crow flies", for which the values are expected to be slightly lower than they would be measuring the actual distance by road. Germany and Lithuania show the shortest average distances. In the case of Germany, the shorter edge lengths indicate a highly connected network with frequent, short-haul movements between nodes. The large number of routes corresponding to Germany suggests granular distribution of nodes and extensive intermodal coverage.

Lithuania's smaller geographic size compared to the other countries should be considered, as it could naturally result in shorter road segments. The lowest figures across the board for Lithuania reflect its smaller economy and limited intermodal infrastructure. The short edge lengths indicate localised freight movements, possibly near border crossings or ports like Klaipėda. The very low number of km per identified intermodal terminal provides an idea of the short distances of a relatively small EU MS, the low intensity of intermodality and the modest size and capacity of Lithuanian intermodal terminals where the only highlights are the port of Klaipedos and Vilnius Vaidotai Intermodal Terminal. The Baltic states (Estonia, Latvia and Lithuania) have historically had a high share of rail freight transport due to transit connections with Russia, which also contributes to a source of competition for road freight (UIC Freight Department, 2023).

Italy ranks third in terms of average edge length, with distances almost twice those of Germany. This may reflect a mix of regional and long-distance flows and suggest a higher reliance on road transport in Italy, although the country's geographical features, such as the elongated shape and mountainous terrain, could also influence this outcome. Italy shows the **second-highest truck activity** based on its strong industrial base and connectivity with large intermodal nodes (notably, Busto Arsizio and Verona) and import-export ports (e.g. Genoa, Trieste) which drive high freight volumes. A high number of trucks per route, indicates concentrated freight corridors, possibly between the mentioned key logistics hubs.

Finally, Spain shows the highest average edge length by a considerable margin. At first glance, this may appear surprising, however, a closer look at the data reveals a median value of 8.85 km, which indicates the presence of outliers inflating the mean. Despite this, Spain still registers the longest routes overall. Longer mean edge length suggests fewer but longer-distance routes, likely due to geographic spread and fewer intermodal nodes. It may also reflect a lower availability or accessibility of alternative transport modes, and possibly a weaker integration of road with rail, as it does not have inland waterways. The lower total vehicle-kilometres (vkm) to and from intermodal nodes recorded in Spain compared to Italy and Germany supports the earlier observation of a less densely integrated intermodal network. This may be attributed in part to structural limitations within the Spanish transport system. Notably, Spain has virtually no inland waterway navigation, and its rail network operates on a different gauge than the standard used across most of Europe. This gauge disparity presents a significant barrier to cross-border freight rail services, thereby constraining the potential for broader intermodal connectivity. As a result, intermodal operations in Spain are largely confined to domestic routes, as reflected in the primary connections serving terminals such as Barcelona El Morrot and Madrid Abroñigal.

4.8. SO6. Analysis of key challenges in accessibility and connectivity, with a focus on infrastructure bottlenecks and inefficiencies in freight handling, aimed at identifying potential improvements

KEY FINDINGS

- **Rail freight remains below target**: Despite stabilisation since 2020, rail freight accounted for only 17% of the EU transport market in 2022—half of the 2030 target—highlighting the scale of effort still required.
- **Inland waterways in decline**: Persistent challenges, including the 2018 Rhine drought, have reduced inland waterway freight share from 7% to 5%, weakening modal diversity and reinforcing road dominance.
- **Untapped modal shift potential**: Over 42% of container road movements exceed 300 km, yet high break-even distances (600–900 km) and infrastructure gaps limit the competitiveness of rail and waterborne alternatives.
- **Cost barriers to multimodal transport**: Transhipment, delays, complex contracting, and payload constraints create structural disadvantages for intermodal freight, especially on short and medium-distance routes.
- **Combined Transport shows resilience**: With 59% growth since 2010 and continued expansion until 2023, Combined Transport has become a key pillar of EU freight, adapting to shifting demand and economic disruptions.

4.8.1. Modal share developments and competitive positioning

After a gradual decline between 2013 and 2020, the rail freight share of the European transport market has stabilised, in part due to the growth of combined transport, as detailed in the next section. Nonetheless, in 2022, rail freight accounted for only 17% of total market share—half the EU's 2030 target—indicating the scale of effort required to meet policy goals (UIC Freight Department, 2023).

In contrast, inland waterway navigation (IWW) has experienced a persistent decline in market share. The turning point came with the severe drought on the Rhine in 2018, which reduced navigability and disrupted operations. Even after water levels recovered, volumes did not return to pre-drought levels, and IWW's share fell from 7% to 5%. This erosion has further reduced the diversity of modal options in key corridors, reinforcing road transport's dominance.

Eurostat data from 2023, the latest available year, reveal significant untapped modal shift potential: 42.1% of laden container movements by road are over distances exceeding 300 kilometres, theoretically making them candidates for transfer to rail or waterborne transport. Intermodal rail and waterways modes only become cost-competitive when transporting a large amount of freight over long distances (Behrends, 2012) because of the additional cost of pre and post-haulage operations (Bergqvist, 2016). However, in practice, the break-even distance[18] for intermodal competitiveness can exceed 300 km, depending on cost structures, operational efficiency, and infrastructure availability, possibly ranging between 600 and 900 km (Ricardo, 2024). In small countries, e.g., Denmark, where transport distances are short, and with increasing terminal charges, intermodal freight transport solutions remain more

[18] Break-even distance refers to the minimum transport distance at which intermodal freight—such as rail or waterborne transport—becomes economically competitive with road-only haulage, after accounting for additional costs like transshipment and pre- and post-haulage.

expensive than road transport (Port of Esbjerg, 2015). Without adequate facilities and network capacity, even technically suitable flows remain locked into the road mode.

Multimodal transport faces structural cost disadvantages compared with unimodal road haulage, stemming from its inherent operational complexity (Ricardo, 2024). Four main categories of additional cost are identifiable:

1. **Transhipment costs**, averaging up to EUR 50 per lift, can make intermodal operations uneconomical for shorter journeys—especially under 400 km. Stakeholder consultations for the support study to the revision of the CTD (Ricardo, 2024) confirm the significance of this factor, with 62% rating it as a strong negative influence on competitiveness.

2. **Delays and longer transit times** arising from transfers between modes, estimated at EUR150 per shipment, deter shippers seeking speed and predictability. This factor was highlighted by 55% of surveyed stakeholders. Rail transport is often cost-competitive, but it always has a longer transit time than other transport modes (MRA, 2025). Loading and unloading operations at terminals increase transit time and thus reduce preference for intermodal transport (Xu, 2022). Moreover, the yard dwell time of freight trains ranges between 10 and 50% of the total transit time in Europe.

3. **Load unit costs and payload constraints** result from the purchase or leasing of containers and from the weight of units reducing payload capacity. While the Weights and Dimensions Directive partially offsets this by allowing higher weight limits for containerised transport, 42% of stakeholders still report this as a significant cost factor (Ricardo, 2024).

4. **Contractual and transactional costs** linked to organising multiple operations and engaging multiple parties, estimated at EUR 85 per shipment, are cited as a strong impact by 26% of respondents (Ricardo, 2024).

One significant challenge is the lower costs of driving on the road. Because non-road modes generally offer lower unit transport costs only over longer distances, these extra costs often outweigh savings for short and medium-distance flows. This explains the persistent dominance of road transport even where alternative modes are available. In Europe, cargo centres are located relatively close together, resulting in shorter average transport hauls than in regions such as North America. However, rail transport is naturally more competitive over long distances and on high-density traffic corridors, as is often the case in North America.

4.8.2. Overview of growth trends for Combined Transport and market shifts in the EU

Over the past decade, Combined Transport has emerged as a critical pillar of the EU freight system, showing sustained long-term expansion despite short-term disruptions. Between 2010 and 2023, total Combined Transport volumes grew by 59%, reflecting substantial modal development. Even in the most recent five-year period from 2018 to 2023, growth persisted at nearly 9%. The intermodal wagon fleet expanded by 40% between 2013 and 2023, while Combined Transport rail freight performance rose by 8.7% in the 2018–2023 period, according to the International Union of Railways (UIC Freight Department, 2023)

This upward trajectory was interrupted in 2023, when transport volumes declined sharply. The downturn was linked to a confluence of adverse conditions: price hikes and a broader economic slowdown following the energy crisis triggered by the Russian invasion of Ukraine, the prolonged closure of the Fréjus rail tunnel between France and Italy due to a landslide, and industrial action in France (UIC Freight Department, 2023). While the overall freight market contracted, Combined Transport demonstrated relative resilience compared with conventional rail freight, underlining its growing structural importance to the European economy.

The market's evolution has been further shaped by structural shifts in freight demand. Historically, block trains carrying bulk commodities such as coal, ores, and petroleum formed the backbone of European rail freight. As de-industrialisation and the transition to a low-carbon economy have reduced volumes in these sectors, demand is increasingly driven by consumer goods and internationally sourced products (ERFA, 2022). This has created rising demand for flexible, small-volume logistics solutions. However, the traditional Single Wagon Load model struggles to compete with road transport on cost and service flexibility, constraining its uptake in these growing segments.

4.8.3. Infrastructure capacity and network limitations

Infrastructure constraints are a recurring barrier to modal shift. A European Commission study on transhipment technologies has identified general capacity limitations across road, rail, and inland waterways on the main north–south corridors of the TEN-T network. These limitations occur both along corridor sections and at nodal points such as terminals. Without targeted capacity increases—particularly for rail and inland waterway segments—additional traffic cannot be accommodated, and modal shift objectives cannot be fully realised (European Commission, 2022).

For terminal provision, the Commission has estimated that a minimum density of one terminal every 850 km is required along each TEN-T Core Network corridor to ensure sufficient accessibility. Yet, many existing terminals face operational constraints (European Commission, 2013). Usable track lengths vary substantially: earlier datasets such as Agora report shorter averages, while more recent sources like SGKV indicate longer tracks, suggesting patchy infrastructure upgrades. Where track capacity is limited, train length and frequency are restricted, directly undermining rail's efficiency and competitiveness.

The vulnerability of critical infrastructure was starkly demonstrated by the Fréjus tunnel closure from August 2023 until early 2025. As the main rail freight link between France and Italy, its year-and-a-half disruption severely constrained cross-border flows and highlighted the need for resilient design and coordinated contingency planning for Alpine crossings and other strategic nodes (Rail Target, 2025).

Port-related bottlenecks also affect network performance. Major northern European hubs such as Rotterdam, Antwerp, Hamburg, and Bremerhaven are experiencing yard utilisation rates exceeding 85–90% (Ricardo, 2024). These high occupancy levels reduce operational flexibility and contribute to congestion. Inland access constraints exacerbate the issue: low water levels in the Rhine have limited barge capacity, while berth waiting times have increased by up to 77% in Bremerhaven and 50% in Hamburg, delaying hinterland transfers and reducing reliability.

4.8.4. Limited capacity inside terminal environment

A case study has demonstrated that inefficiencies in ten European intermodal freight transport chains are primarily attributable to limited capacity within terminal environments, which constitutes a significant operational barrier (Ahmed Karam, 2023). Across Europe, many existing rail terminals are situated in or near urban areas, where spatial constraints hinder the possibility of capacity expansion.

Transshipment operations at most terminals rely on vertical handling equipment, such as reach stackers and gantry cranes. These systems are time-intensive and carry a higher risk of cargo loss or damage. Furthermore, approximately 80% of European trailers are not designed for vertical lifting, thereby limiting the potential for large-scale modal shift from road to rail (Islam, 2016).

As an alternative, various horizontal transshipment technologies that require less space, fewer personnel, and shorter handling times could be developed. However, the high capital investment associated with these systems presents a major obstacle to their adoption, particularly when the benefits of intermodal transport remain uncertain or difficult to quantify.

The absence of advanced digital applications leads to a range of operational challenges, including inefficient document management, errors in cargo retrieval, and increased vulnerability to cargo theft. The deployment of integrated ICT systems (such as real-time container tracking, advanced Terminal Operating Systems (TOS), automated block storage, remote-controlled gantry cranes, integrated Optical Character Recognition (OCR) gate systems, fully automated gate access) at intermodal freight transport terminals is therefore essential to ensure efficient interface management and facilitate seamless freight transfers between transport modes (European Court of Auditors, 2023).

4.8.5. Service quality and reliability

Shippers have increasingly adopted just-in-time operations, requiring a transport system with high service frequency—measured in frequent weekly departures—and availability on a 24/7 basis. However, several studies have shown that the low frequency of freight trains and port calls, combined with limited terminal opening times, significantly reduces the flexibility of intermodal transport solutions. Low train frequency poses a particular challenge for shippers whose volumes cannot fill an entire train, and it increases planning complexity and administrative costs, offsetting potential savings in both transport costs and emissions compared to road transport (Office of Rail and Road, 2025).

In addition to frequency, service reliability is critical for meeting the demands of just-in-time supply chains, hub-and-spoke operations, and port deadlines. Many shippers cite reliability as the most important factor in choosing between modes and in considering a shift from road to sea or rail. Intermodal freight transport tends to have lower reliability due to the need for mode changes at terminals, where operations can be disrupted by resource shortages, accidents, extreme weather, or mismanagement. For example, Combinant (Combined Terminal Antwerp) and Novatrans (a rail freight operator) reported that the average reliability of freight trains is only 50%, meaning that just half of shipments arrive within 30 minutes of their promised delivery time (Ahmed Karam, 2023). Such low performance often drives shippers back to road transport, which offers greater flexibility to respond to disruptions, such as rerouting to avoid congestion. The high variability in the yard dwell times impairs the overall service reliability of intermodal rail transport.

Intermodal freight transport is associated with an elevated risk of freight loss and damage due to the multiple transshipment stages involved at terminals (Kumar, 2020). In recent decades, there has been a marked increase in the volume of goods requiring temperature-controlled conditions during transit, including perfumes, pharmaceuticals, packaged food, and other temperature-sensitive products. However, railway rolling stock has not sufficiently adapted to these requirements, primarily due to the absence of modern features such as onboard electricity in freight wagons. Consequently, freight damage may also occur in cases where temperature-controlled trailers or containers are unavailable, or where continuous temperature monitoring is lacking for refrigerated units stored at intermodal freight transport terminals (Kumar, 2020).

4.8.6. The need for a denser network of intermodal terminals to compete with only-road

Small towns located along major transport corridors frequently lack access to intermodal freight transport terminals, resulting in a continued reliance on road transport by local freight customers. To unlock the benefits of intermodal freight transport, a denser network of small-scale terminals is required (El Yaagoubi, 2022). Such a network would also enhance operational flexibility by enabling traffic diversion to alternative terminals in the event of disruptions, such as the blockage of a primary rail route. However, increasing terminal density may also lead to higher fixed infrastructure costs and elevated transport network overheads.

4.8.7. Lack of electrified rail network

Electric trains use less energy than diesel trains, and therefore, they can improve operational costs and emissions of intermodal rail transport (Islam, 2016). In Europe, around 57% of the rail network is electrified, and the use of electric traction among freight rail is even lower, requiring train operators to run a train with two locomotives (electric and diesel) or change from electric to diesel (CER, 2025). This increases capital costs and lead times, making operations more expensive

4.8.8. Lack of "single selling point"

Intermodal freight transport chains are sometimes managed by different operators, e.g., rail operators and freight forwarders. However, shippers and consignees typically prefer purchasing transport services from a single operator, i.e., an intermodal freight transport service provider, who will take the liability for delay, loss, or damage of the cargo and select the best combination of modes and carriers to achieve the needs of shippers or consignees (Ahmed Karam, 2023).

4.8.9. Policy Framework and data gaps

The Combined Transport Directive (CTD) was designed to support modal shift, but its current provisions are limited in scope and effectiveness. Road legs can exceed non-road segments without affecting eligibility for support, and some short-distance IWW–road combinations are excluded altogether (Ricardo, 2024). Moreover, the CTD lacks an automatic review mechanism to align national support measures with changing market conditions, resulting in outdated or misaligned incentives.

Data limitations hinder informed policymaking. Member States do not systematically collect or report comparable information on combined transport, due in part to differing definitions of intermodal and multimodal transport. The European Commission stopped regular reporting in 2002, with only sporadic updates through studies in 2014 and 2017. The absence of reliable, up-to-date statistics constrains monitoring, evaluation, and targeted intervention. The absence of comprehensive and standardised European-level datasets on the characteristics of intermodal terminals is part of this problem and has been highlighted throughout this report with practical examples.

Promoting intermodal transport also depends on the extent of the governmental support, which could be regulations and subsidies, e.g., more stringent environmental regulations, road pricing policies, investment for intermodal freight transport infrastructure, and higher fuel and energy prices. Road pricing policies can increase road haulage costs and put external pressure on road freight transport companies to change their overall business strategy by considering intermodal rail transport in the future (Eng-Larsson, 2012).

4.8.10. External shocks and market resilience

Recent years have seen a series of shocks exposing vulnerabilities in the freight transport system. The post-2022 energy crisis significantly raised operational costs across all components of Combined Transport. Terminal operations, which rely heavily on electrically powered handling equipment, have seen sharp cost increases. Rail traction costs rose dramatically, with electricity prices spiking by up to 1,000%, prompting some operators to revert to diesel locomotives or decline additional traction requests (UIC Freight Department, 2023). First and last mile road legs were similarly affected by rising diesel prices.

These pressures were compounded by sector-specific demand reductions. Energy-intensive industries such as chemicals and automotive—both major users of Combined Transport—reduced output in response to high energy prices, leading to service cuts in certain corridors due to lack of demand.

Geopolitical disruptions have further complicated operations. For example, since December 2023, attacks on shipping in the Bab al-Mandab Strait have forced rerouting of container vessels around the Cape of Good Hope, extending Asia–Europe transit times by approximately one week.

4.8.11. Strategic outlook and policy recommendations

The persistence of capacity bottlenecks, cost disadvantages, policy gaps, and vulnerability to shocks underscores the need for a coordinated EU-level response. Priorities include:

1. Clarify and modernise the definition and scope of Combined Transport
    - Define combined transport operations explicitly to focus on intermodal operations saving at least 40% of external costs compared to a road-only alternative in line with the recent Commission proposal (a performance-based approach instead of a mode-based or distance-based approach). This conclusion is based on four main findings:
        - the large variability of distances from main intermodal terminals to maritime or inland waterway ports across the EU,
        - we found short edges in both Germany and Lithuania for very different reasons. Germany's shorter average distances reflect a highly connected and dense network with frequent short-haul trips and extensive intermodal coverage. In contrast, Lithuania's short distances are due to its smaller geographic size, localised activity and limited intermodal infrastructure which does not "attract" loads from longer distances. To put it in simple terms, a distance-based approach would address in equal terms the intermodal scenario of Germany and the one of Lithuania,
        - external costs (e.g., emissions, congestion, accidents) do not increase linearly with distance; short trips in urban areas can cause disproportionately high costs compared to longer trips in less populated regions, and
        - distance thresholds can exclude beneficial intermodal operations that fall outside arbitrary distance ranges but still offer substantial external cost reductions.
    - Ensure the legal definition supports modern logistics needs, including small-volume and flexible shipments driven by consumer goods and international trade to align with changing market dynamics.
    - Maintain a comprehensive public register of intermodal terminals, documenting key data such as capacity, distance to the nearest port, and other relevant operational characteristics.
    - Align support measures to exclusively benefit operations meeting clear sustainability and modal shift criteria.
2. Promote infrastructure capacity and terminal network expansion together with electrification
    - Encourage the development of a denser network of small-scale, urban-proximate terminals to enable local access to intermodal options and provide operational resilience through alternative routing.
    - Require coordinated planning and investment in resilient infrastructure, especially at critical nodes and alpine crossings, learning from the Fréjus tunnel disruption.
    - Address track gauge incompatibilities and improving cross-border interoperability.
    - Support accelerated electrification of the rail network and development of dual-mode. locomotives to reduce operational complexity and costs associated with locomotive changes.

- Integrate incentives for the use of low-emission traction systems and renewable energy sources for rail operations within combined transport chains.

3. Support capacity improvements in terminal operations

- Provide fiscal incentives and EU co-funding mechanisms to modernise terminal handling equipment, favouring horizontal transshipment technologies that reduce space usage, handling times, and cargo damage risks.
- Encourage the rollout of integrated ICT systems for document handling, cargo tracking, and theft prevention to improve operational efficiency and service reliability. Among these technologies, as reported by some of the 11 terminals we examined in detail, it is relevant to mention: real-time container tracking, advanced Terminal Operating Systems (TOS), automated block storage, remote-controlled gantry cranes, integrated Optical Character Recognition gate systems, fully automated gate access.
- Establish a transparency requirement for terminal services and capacities, enabling shippers to make informed modal choices.

4. Enhance service quality and reliability

- Support policies that increase freight train service frequency, including incentivising 24/7 terminal operation, to meet the needs of just-in-time supply chains.
- Promote digital tools and real-time monitoring systems to reduce variability in yard dwell times and improve reliability.
- Establish a framework for a "single selling point" for intermodal transport services, ensuring shippers can contract with a single provider responsible for multimodal / intermodal operations, including liability for delays or damages.

5. Address cost structure and competitiveness challenges

- Introduce targeted subsidies or tax incentives to reduce or offset transshipment and modal transfer costs, particularly for short and medium-distance flows below the intermodal break-even distance.
- Encourage innovation in load unit design and management to maximise payload capacity while complying with weight and dimension regulations.
- Foster regulatory measures such as road pricing to increase the competitiveness of rail-based combined transport relative to road haulage.

6. Strengthen national policy frameworks and monitoring

- Require Member States to adopt national policy frameworks dedicated to facilitating combined transport uptake, including clear targets aligned with EU climate and modal shift goals.
- Implement a mandatory, harmonised data collection and reporting system at EU level for combined transport flows to improve monitoring, evaluation, and policy responsiveness.
- Establish a mechanism for automatic and periodic review of the Directive's provisions to adapt to evolving market conditions and technological developments.

7. Facilitate market resilience against external shocks

- Promote contingency and risk management plans for critical infrastructure (e.g., tunnels, terminals) and transport corridors to enhance resilience against natural disasters, industrial actions, and geopolitical disruptions.
- Encourage diversification of transport routes and terminal options within transport contracts to mitigate disruption risks.

8. Enable regulatory flexibility to maximise infrastructure use

- Introduce EU-wide exemptions from temporary driving bans (e.g., weekend, night restrictions) on short road legs of combined transport to better utilise terminal and non-road infrastructure capacity.
- Ensure that the Directive's framework allows flexible adaptation to operational realities while maintaining environmental and safety standards.

These recommendations aim to inform the European Parliament's position on the Directive by providing a clear rationale for its revision after 12 years and outlining priority actions that could help enhance the role of Combined Transport in advancing competitive, low-carbon trade systems across the EU.

5. REFERENCES

- Adampol. (2019), *Adampol general presentation*. Available at: https://www.transportevents.com/presentations/gdynia2019/ADAMPOL.pdf.
- Adampol. (2022, August 4), *PRILO a new way to transport vehicles*. Available at: https://www.adampolsa.com.pl/en/prilo-a-new-way-to-transport-vehicles/.
- Agora Intermodal Terminals Working Group (2024), *Terminal map.*
- Ahmed Karam, A. J. (2023), *Analysis of the barriers to multimodal freight transport and their mitigation strategies.* European Transport Research Review.
- Behrends, S. &. (2012), *The effect of transhipment costs on the performance of intermodal line-trains.* Logistics Research, 4(3), pp. 127-136.
- Bergqvist, R. &. (2016), *The last mile, inbound logistics and intermodal high capacity transport-the case of Jula in Sweden.* World Review of Intermodal Transportation Research, 6(1), pp. 74-92.
- CER. (2025, February 4), *Empowering rail: The Rail Sector's insights for affordable energy*. Retrieved from CER: https://www.cer.be/cer-press-releases/empowering-rail-the-rail-sectors-insights-for-affordable-energy.
- CLIP Group. (2025), *CLIP Group installs the first Lohr Railway System in Poland*. Available at: https://clip-group.com/en/clip-group-installs-the-first-lohr-railway-system-in-poland/.
- CLIP Group. (2025), *Intermodal terminal*. Available at: https://clip-group.com/en/intermodal-terminal/?utm_.
- Connected Europe Facility (2025), *European Rail Freight Line System (ERFLS)*. Available at: https://www.egtc-rhine-alpine.eu/files/2021/04/ERFLS_publishversion.pdf.
- ConsorzioZai (2025), *Interporto Quadrante Europa*. Available at: https://quadranteeuropa.it/en/.
- DP World (2025), *Area A Project*. Available at: https://www.dpworld.com/romania/services/projects/area-a.
- DP World (2025), *DP World new road groupage network*. Available at: https://www.dpworld.com/romania/services/DP-World-New-Road-Groupage-Network.
- DP World (2025), *Facility overview*. Available at: https://www.dpworld.com/romania/services/facility-overview.
- EBRD (2025), *GrCF W2 E2 - DP World - CSCT Electrification*. Available at: https://www.ebrd.com/home/work-with-us/projects/psd/54712.html#.
- EFIP (2011), *Response of the European Federation of Inland Ports on the Roadmap to a Single European Transport Area, Commission's White Paper on Competitive and Sustainable Transport (COM(2011) 144 final).*
- El Yaagoubi, A. F.-S. (2022). *A logistic model for a french intermodal rail/road freight transportation system. .* Transportation Research Part E: Logistics and Transportation Review, p. 164, 102819.
- Eng-Larsson, F. &. (2012), *Modal shift for greener logistics–the shipper's perspective.* International journal of physical distribution & logistics management, 42(1), pp. 36-59.

- ERFA (2022), *The European Rail Freight Market - Competitive Analysis and Recommendations.*
- European Commission (2013), *Staff Working Document – "Methodology for Planning the Trans-European Transport Network (TEN-T).*
- European Commission (2017), *Study on the TEN-T Core Network Corridor Rhine-Alps.*
- European Commission (2022), *Comparative evaluation of transhipment technologies for intermodal transport and their cost – Final report.* Publications Office of the European Union.
- European Commission (2022), *Comparative evaluation of transhipment technologies for intermodal transport and their cost: Final report.* European Commission, Directorate-General for Mobility and Transport. Available at: https://www.cde.ual.es/wp-content/uploads/2022/04/MI0722130ENN.en_.pdf.
- European Commission (2022, December 8), *Connecting Europe Facility: over € 600 million for energy infrastructure in support of the European Green Deal and REPowerEU*. Available at: https://energy.ec.europa.eu/news/connecting-europe-facility-over-eu-600-million-energy-infrastructure-support-european-green-deal-and-2022-12-08_en.
- European Commission (2025, March 19), *CEF Energy: visiting Porthos, the CO2 transport backbone in the port of Rotterdam area*. Available at: https://cinea.ec.europa.eu/news-events/news/cef-energy-visiting-porthos-co2-transport-backbone-port-rotterdam-area-2025-03-19_en?utm_.
- European Commission (2025), *Ten-TEC Map Viewer*. Available at: https://webgate.ec.europa.eu/tentec-maps/web/public/screen/home.
- European Court of Auditors (2023), *Special Report 08/2023: Intermodal Freight Transport – EU still far from getting freight off the road.*
- Eurostat (2023), *Total length of railway lines.*
- FEDeRATED (2025), *FEDeRATED web page*. Available at: https://federatedplatforms.eu/.
- HAROPA Port (2025), *Le Havre Multimodal Terminal*. Available at: https://www.haropaport.com/en/terminal-multimodal-du-havre.
- HHLA (2025), *Change of track on the Silk Road*. Available at: https://hhla.de/en/magazine/middle-corridor-silkroad.
- HHLA (2025), *Next ship arrivals in Hamburg*. Available at: https://hhla.de/en/customers/information/ship-arrivals.
- HHLA (2025), *Report Vessel Operations: Sailing list*. Available at: https://coast.hhla.de/report?id=Standard-Report-Segelliste.
- Islam, D. M. (2016). *How to make modal shift from road to rail possible in the European transport market, as aspired to in the EU Transport White Paper 2011.* European transport research review, 8(3), p. 18.
- Karas, A. (2024). The Role of Intermodal Transport in the Decarbonization of Seaports. *European Research Studies Journal*, pp. 1014-1021.
- Klaipedos Container Terminal (2025), *Facilities and services*. Available at: https://www.terminalas.lt/en/galimybes-paslaugos.
- KTL (2025), *Services*. Available at: https://ktl-lu.de/en/services/.

- KTL (2025), *Train connections*. Available at: https://ktl-lu.de/en/information/train-connections/.
- KTL Kombi-Terminal Ludwigshafen (2025), *Tagesganglinie*. Available at: https://ktl-lu.de/information/tagesganglinie/.
- Kumar, A. &. (2020), *Analyzing interrelationships and prioritising the factors influencing sustainable intermodal freight transport system: A grey-DANP approach.* Journal of Cleaner Production, p. 252, 119769.
- MRA (2025), *Europe Rail Freight Transportation Market 2025-2033 Analysis.*
- North Adriatic Sea Port Authority (2025), *TEN-T/CEF Programme*. Available at: https://www.port.venice.it/en/projects-and-sustainability/research-and-development-projects/european-projects-2014-2020/ten-t-cef-programme/.
- North Sea Port (2024, May 28), *Work starts on R4 East and West: complete, safer redesign for ring road around the Ghent part of North Sea Port*. Available at: https://en.northseaport.com/work-starts-on-r4-east-and-west-complete-safer-redesign-for-ring-road-around-the-ghent-part-of-north-sea-port.
- Office of Rail and Road (2025), *Freight rail usage and performance. January to March 2025.*
- Office of Rail Transport (2022), *Main intermodal train routes in Poland.*
- Port BCN (2025), *Temps Acces a Terminals*. Available at: https://serveis.portdebarcelona.cat/tempsacces/default/reservesavui?nomterminal=APMT.
- Port de Barcelona (2025), *Port de Barcelona web page*. Available at: https://www.portdebarcelona.cat/ca.
- Port of Esbjerg, &. G. (2015), *A/S A study on an intermodal terminal at the Port of Esbjerg.*
- Port of Hamburg (2025), *Eurokombi Terminal*. Available at: https://www.hafen-hamburg.de/en/address/eurokombi-terminal-gmbh/.
- Port Technology (2025, March 3), *Klaipėda Port put €308 million towards infrastructure*. Available at: https://www.porttechnology.org/news/klaipeda-port-put-e308-million-towards-infrastructure/.
- Rail Target (2025, January 23), *Fréjus Railway Is Reopening in March, But How Long Will It Remain Relevant?* Retrieved from Rail Target: https://www.railtarget.eu/technologies-and-infrastructure/frejus-railway-france-italy-landslide-10021.html.
- RailFreight.com (2019, February 22), *Port of Ghent now open for freight trains*. Available at: https://www.railfreight.com/intermodal/2019/02/22/port-of-ghent-now-open-for-rail-freight-trains/.
- RailFreight.com. (2021, February 25), *North-Sea Baltic corridor now includes North Sea Port.* Available at: https://www.railfreight.com/railfreight/2021/02/25/north-sea-baltic-corridor-now-includes-north-sea-port/.
- RAM spa. (2025), *PASS4CORE-IT*. Available at: https://www.ramspa.it/en/pass4core.
- Ricardo. (2024), *Impact assessment support study on amendment of the Combined Transport Directive.*

- Rodrigue, J.-P. (2024), *The Geography of Transport Systems.* New York: Routledge.
- Speth, D., Sauter, V., Plötz, P., & Signer, T. (2021), *Synthetic European road freight transport flow data based on ETISplus.* Mendeley Data, V1.
- Statistics Poland (2024), *Intermodal transport in Poland in 2023.*
- TRIMIS (2025), *URSA MAJOR neo*. Available at: https://trimis.ec.europa.eu/project/ursa-major-neo.
- UIC Freight Department (2023), *2022 Report on Combined Transport in Europe.*
- Wien Cont (2025), *Commissioning of a new control system*. Available at: https://www.wiencont.com/en/news/neues-leitsystem-en.
- Wien Cont (n.d.), *Non-stop terminal services*. Available at: https://wiencont.com/downloads/WienCont.pdf.
- Xu, W. &. (2022), *Research on optimization of expressway logistics path based on the advantages of multimodal transport in the environment of internet of things.* Wireless Personal Communications, 126(3), pp. 1981-1997.

6. ANNEX I: SUMMARY OF THE INCEPTION PHASE BY STUDY OBJECTIVE

Objective SO1: Mapping of intermodal terminals

The objective SO1 aims to provide a comprehensive mapping of intermodal terminals, including details on their transhipment capacities, current levels of use during peak demand periods, the range of transport modes served (e.g., rail, inland waterways, maritime), and the types of services offered.

During the discussion, it was noted that data on the current level of use during the most requested time slots is not readily available at the EU level. As a potential alternative, Ricardo proposed developing an illustrative case study based on one intermodal terminal or a small subset of terminals to exemplify usage patterns. However, it was agreed that relying on a single terminal would not provide a sufficiently representative view. Therefore, the study will include a sample of three intermodal terminals, allowing for broader and more balanced insights into operational usage.

Objective SO2: Operational functions of selected terminals

Objective SO2 seeks to examine the operational functions of a representative group of ten intermodal terminals[19], particularly in terms of their contribution to the efficiency of combined transport and their integration into the Trans-European Transport Network (TEN-T).

For the criteria to select the terminals, it was agreed the need for both geographical coverage and the consideration of transport leg distance as key selection criteria. Ricardo interprets this to mean that terminals should reflect a diversity of transport leg lengths within combined transport chains, particularly those with medium and long-haul rail components. Additionally, the availability of reliable data will be considered a key factor in terminal selection. It was also agreed that the sample should include a balanced mix of land-based, maritime, and inland waterway terminals, to ensure modal diversity.

Objective SO3: Mapping of the main logistics nodes connecting with the most relevant European ports

There were no specific remarks on this objective

Objective SO4.1: Mapping of distances between the most relevant European port facilities and the major land intermodal freight terminals

There were no specific remarks on this objective

Objective SO5: Average distance travelled by road to access intermodal terminals

In relation to SO5, which requests an indicative assessment of the average distance travelled by road to access intermodal terminals, we proposed a case study approach covering three Member States (MS). It was subsequently requested that the sample include two additional MS. The agreement was a sample comprised by Germany, Italy, Spain and Lithuania, ensuring thus geographical coverage and different scales of logistics activity.

Objective SO6: Analysis of challenges in accessibility and connectivity

For SO6, which focuses on analysing key challenges related to accessibility and connectivity—including infrastructure bottlenecks and inefficiencies in freight handling—we proposed addressing this objective through a 10-page analytical section within the final report.

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[19] A total of eleven terminals were ultimately selected to ensure adequate geographical representativeness.

This Objective is to be reported in the next version of the study report, due on 28 August 2025. It was agreed that this section will also include policy-relevant recommendations, which are consistent with the nature and intent of an accompanying expertise study.

7. ANNEX II: DETAILS ON OUR APPROACH

In response to the specific objectives outlined above, research has been conducted over June-August 2025. The identified sources and outcomes for each of the six specific objectives, as well as gaps/ questions resulting from available data to address each of the requested objectives are indicated in the table below.

Table 4-8: Proposed approach for each of the objectives

Specific objectives	Sources used	Outcome	Gaps with the original proposal and corrective actions
SO1. Provide a mapping of intermodal terminals, specifying their transhipment capacities, current level of use during the most requested time slots, transport modes served (rail, inland waterways, sea, etc.), and sample services offered.	Dataset produced based on the resources of Terminal Interest Group – Agora and from Studiengesellschaft für den Kombinierten Verkehr e.V. (SGKV), which translates to the German Promotion Centre for Intermodal Transport TENTec Map Viewer Eurostat: Gross weight of goods handled in main ports by direction and type of cargo - quarterly data	Maps showing different aspects of intermodal terminals (capacity, equipment, services)	-Cross-checking Agora data with SGKV -Use terminal websites for 11 case study terminals -Ad hoc website searches during data cleaning Data on the current level of utilisation during peak demand periods is not available at present. As an alternative, three illustrative case studies were developed to provide indicative insights.
SO2. Provide an examination of the operational functions for a selected group of 10 terminals, highlighting their role in improving the efficiency of combined transport and their integration into the Trans-European Transport Networks (TEN-T).	Dataset produced based on the resources of Terminal Interest Group – Agora Webpages of ports: Rotterdam, Antwerp-Bruges, Hamburg, Valencia, Barcelona and other relevant ports.	Written case studies	Selection of 11 case studies based on geographical coverage and the consideration of transport leg distance, as agreed during the Inception meeting.
SO3. Provide a mapping of the main logistics nodes connecting with the most relevant European ports	Synthetic European road freight transport flow data based on ETISplus 2024 UIC Report on Combined Transport in Europe SDI - geospatial data catalogue by the European Environment Agency Shortsea: transport chains simulator	Map of connections	The main connections between nodes and seaports were identified based on weekly train services serving both points.

Specific objectives	Sources used	Outcome	Gaps with the original proposal and corrective actions
SO4.1 Provide a mapping of distances (as the crow flies and broken down by road/rail/inland waterways) between the most relevant European port facilities and the major land intermodal freight terminals in terms of destination/origin of operational intermodal maritime transport alongside SO4.2 Provide an analysis of the relevant annual loads registered along major intermodal connections.	European Transport Maps (Map – Intermodal) EC: Map Finder Chart for European Transport Corridors (41528897-a27b-4768-ab61-c98df2681f41_en) TENTec Map Viewer Routescanner Google Maps sea-distances.org	Map of distances between most relevant European port and land intermodal terminals	For SO4.1, based on available GIS packages, we were able to build a map of distances as the crow flies and road distances. For SO4.2, we conducted the analysis for the 20 main ports. No data available to identify modal split within each port, thus, we offer the proxy of national modal split.
SO5. Where data availability allows, provide an indicative assessment of the average distance travelled by road to access intermodal terminals with a focus on identifying possible differences across Member States and among the main transport modes	Origin-Destination Traffic flow data for HGVs in the EU, from a previous Ricardo's study	Written case studies	Comparative approach covering Germany, Italy, Spain and Lithuania to ensure a representative sample.
SO6. Provide an analysis of key challenges in accessibility and connectivity, with a focus on infrastructure bottlenecks and inefficiencies in freight handling, aimed at identifying potential improvements	Ricardo's Combined Transport Directive Impact Assessment	Written section of report (10 pages max)	This is done based on literature review, limited to no more than 10 pages of text, and delivered. A comment on the lack of comprehensive and standardised European-level datasets on intermodal terminal characteristics is included

This study, provided by the Policy Department at the request of the TRAN Committee, serves as an evidence base to support policy discussions and contributes to a future revision of the Combined Transport Directive.

It identifies and analyses a subset of the network of **intermodal freight terminals** across the European Union, offering insights into their **location**, **served transport modes**, **physical area**, **handling capacity (in TEUs)**, **loading equipment**, and **additional services provided**. The report includes selected case studies that illustrate targeted actions aimed at improving the **efficiency and effectiveness** of terminal operations. Furthermore, it maps the **main connections between inland and port-based terminals** and key European seaports. A dedicated analysis is also presented on the **average distances travelled to and from intermodal terminals** in four selected EU Member States, providing context on logistical patterns and accessibility.

Together, these findings lay the groundwork for informed policy development with a view to incentivise the expansion of the EU's multimodal freight transport framework.

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