The European Rail Freight Market

Competitive Analysis and Recommendations

Study on behalf of European Rail Freight Association (ERFA)

Final Report - April 2022

Produced by:

ECM VENTURES

EXECUTIVE SUMMARY

This study provides an overview of the development of the European rail freight sector over the last two decades, with a particular focus on the consequences of the market liberalization that started in the 1990s. We discuss the current market structure and competitive arena, and the important role that *challengers* (formerly referred to as *new entrants*, as well as the foreign operations of *incumbents*) played in driving rail freight growth and innovation.

The rail sector is worthy of attention as it was most successful in reducing carbon emissions by more than 60% from 1990 to 2020 – far more than any other mode of transport. This report examines the market situation in selected European markets and discusses the challenges to achieve further growth of rail freight based on interviews conducted with CEOs and other senior executives at 13 major rail freight companies. These challenges are systematically analyzed by applying an issues tree methodology. This report concludes with 10 measures to help overcome the issues and to boost volume and the modal share of rail freight.

Overall, the European rail freight market grew modestly over the last decade, a contrast with the strong development experienced between 2001 and 2008, prior to the Global Recession. Our review shows that there is an underlying stagnation or decline of dry and liquid bulk commodities, traditionally the stronghold of rail in the European transport market. On the other hand, there has been strong growth of intermodal and logistics trains over the last decade, a market segment that is primarily served and co-developed by the challengers, together with major intermodal operators and forwarding and logistics players.

Market liberalization introduced competition to rail freight markets as of the mid of 1990s. Initially, new entrants focused on market niches, but in the first decade of the 21st century they became a driving force behind efficiency improvement, international traffic development, and technical and commercial innovations. Challengers were instrumental in growing the European rail freight market and have captured nearly half of the market. With their focus on the fast-growing intermodal and logistics train segments, it is expected that their market share will further increase in the 2020s. Already now, there are several countries where the market share of incumbent has fallen below 50%, particularly in member states that privatized freight division of their national railway. In several countries there are no incumbents left due to the complete privatization or the sale of former state-owned rail freight companies.

This study distinguishes four types of rail freight players: national incumbents (with a complete rail freight offering in their home country), foreign operations of incumbents (adopting the business models of new entrants), international new entrants, and national new entrants. Industrial shippers, intermodal operators, forwarders, and logistics companies now enjoy a true choice and can award their rail freight traffic to the best provider in terms of innovation, service levels, price, etc. Competition amongst railway undertakings has also made rail more attractive compared with road as can be seen from the strong growth of intermodal and logistics trains carrying freight that would otherwise be on highways. We anticipate that competition will continue to fuel growth and an increasing modal share of rail freight until at least 2030.

The business model of challengers has proven to be superior to that of incumbents. Challengers tend to be more focused (i.e., intermodal and logistics, block trains, and international traffic), lean and agile, more cost competitive, and able to offer better service levels consistently. Above all, challengers are particularly customer-oriented and responsive. They have become role models for incumbents who have built-up their foreign operations, or when they transformed legacy organizations post-privatization.

The future growth of rail freight in Europe is hindered by numerous issues in the fields of lagging infrastructure development, poor infrastructure and traffic management, costly ERTMS / technology investments, complex and incomplete regulations, and unhealthy competition. We applied the issues tree methodology to understand the structure and interrelationships of these issues and to derive measures to remove obstacles and enable sustainable growth for rail freight. This report presents 10 measures that stem from our market research, stakeholder consultations, and expert discussions. They are aimed at railways, infrastructure managers, regulators, and competition authorities:

- Railways, especially challengers, need to further invest in expanding their asset base, implementing new technology, and continue efficiency improvements and maintaining high customer service levels.
- Infrastructure managers need to focus on accelerating TEN-T implementation, debottlenecking international corridors (including critical network nodes and access to major ports / industrial and distribution zones), deploying fast and smart digitization, improving planning and international coordination of construction works (including acceptable diversion routes), and improving internationally coordinated capacity planning and management.
- Regulators and competition authorities should focus on securing fair capacity allocation, harmonized and open ERTMS standards, fair competition, and on developing new state aid rules

With a collective and decisive effort to implement the proposed measure, the three stakeholder groups can create the platform for rail freight so succeed in shifting even more cargo from road to rail, and towards achieving a 30% rail modal by 2030. This will significantly reduce carbon emissions from the transport sector and advance the European Green Deal.

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ABBREVIATIONS AND ACRONYMS

Acronym	Description
ALE	Autonomous Train Drivers' Union of Europe
ARA	Amsterdam, Rotterdam and Antwerp (three major ports in BeNeLux)
BLG	Bremer Logistics Group
Bn	Billion
CAGR	Compound Annual Growth Rate
CD	České Dráhy (Czech Railways)
CER	Community of European Railways
CFR	Căile Ferate Române (Romanian Railways)
CNC	Core Network Corridors (Europe)
CP	Comboios de Portugal
DAC	Digital Automated Coupling
DCM	Digital Capacity Management
EC	European Commission
ECR	Euro Cargo Rail (subsidiary of EWS, and later DB Cargo, in France)
EFTA	European Free Trade Association
EIM	European Rail Infrastructure Managers (Association of)
EP	European Parliament
ERA	European Railway Agency
ERFA	European Rail Freight Association
ERTMS	European Rail Traffic Management System
ETA	Estimated Time of Arrival
ETCS	European Train Control System
ETS	Emission Trading System (of the European Union)
EU	European Union
EU 27	27 Member States of European Union (after the Brexit)
EWS	English, Welsh & Scottish Railways (now DB Cargo UK)
FCL	Full Container Load
FOT	Federal Office of Transport (Switzerland)
FS	Ferrovie dello Stato (Italian State Railways)
FTL	Full Truck Load
GKB	Graz-Koeflacher Rail and Bus Operations
HHLA	Hamburger Hafen und Logistik AG
IM	Infrastructure Manager
IRG	Independent Regulators Group - Rail

KPI	Key Performance Indicator
LCL	Less than Container Load
LG	Lietuvos Geležinkeliai
LTL	Less than Truck Load
Mn	Million
MOU	Memorandum of Understanding
NEAT	Neue Eisenbahn AlpenTransversale (New Transalpine Railway Route)
NS	Nederlandse Spoorwegen (Netherlands State Railways)
OBU	On-Board Unit
OeBB	Oesterreichische Bundesbahnen (Austrian Federal Railways)
OPRAF	Office of Passenger Rail Franchising (UK)
ORR	Office of Rail and Road (UK regulatory body since 1993)
PKP	Polskie Koleje Państwowe (Polish State Railways)
PSO	Public Service Obligation
RBC	Radio Block Center (key component of ETCS)
RFC	Rail Freight Corridor
RFI	Rete Ferroviaria Italiano (Italian Rail Infrastructure Manager)
RU	Railway Undertakings
RNE	Rail Net Europe (Initiative comprising European Rail Infrastructure Managers)
ROSCO	Rolling Stock Company (UK)
SFM	Strade Ferrata del Mediterraneo (Italian new entrant, acquired by Deutsche Bahn)
SJ	Statens Järnvägan (Swedish State Railways)
SNCB	Société Nationale des Chemins de fer Belges (National Railways of Belgium)
SNCF	Société Nationale des Chemins de fer Français (National Railways of France)
TAC	Track Access Charge
TEN-T	Trans-European Network - Transport
TOC	Train Operating Company (UK)
Tonne-km	Measure of rail activity: weight of freight carried (in tonnes), multiplied by the distance of the rail journey (in kilometers)
Tonnes	Measure of rail volume: weight of freight carried
TSI	Technical Specifications for Interoperability
TTR	Time Table Redesign
UK	United Kingdom
WSE	Warsaw Stock Exchange (Poland)

EXHIBITS

1. MANDATE AND APPROACH

The European Rail Freight Association (ERFA) mandated ECM Ventures to perform a study on the current state and key developments of the European rail freight market. The objectives of this study can be summarized as follows:

- Data analysis and mapping of the development of EU rail freight over the past 20 years
- Market analysis to understand main customer requirements (present/emerging)
- Assessment of the added values of having a diverse rail freight market
- Competitive analysis to understand the impact of market liberalization and current issues
- Recommendations on potential measures for improving rail freight performance and contributing to the European sustainability agenda (Green Deal and "Fit for 55")

This study was conducted between December 2021 and March 2022 and comprised the following activities:

- Comprehensive desk research (published studies and papers from industry associations, consultants and academia, European statistics, EU legislation, media briefings and websites of leading rail freight companies)
- Stakeholder consultations at C-level of major rail freight companies (with a focus on challengers – this term stands for new entrants and international arms of incumbents competing in the open access market for freight contracts with major shippers, intermodal operators, rail forwarding and logistics companies)
- Strategy workshops with representatives of ERFA members
- Expert consultations in several European countries
- Development of a comprehensive issues tree describing current hurdles and inefficiencies for the positive development of rail freight in Europe
- Opinions on measures to remove hurdles and enabling growth of rail freight and increasing modal shift from road, while supporting the sustainability strategy of the European Union

2. EUROPEAN RAIL FREIGHT MARKET

2.1 Historic Development

2.1.1 Main Developments up to the 1990s

Historically, rail freight in Europe suffered from a steady decline over several decades. The modal share of rail freight has decreased from a dominant 60 percent in the 1950s, and 30 percent in the 1970s, to as little as 15 percent in the 1990s. This decline was driven mainly by massive investments into road infrastructure, increasing preferences of shippers for flexible and cost competitive road freight, and by large shifts in European industry structure. While traditional sectors, like coal mining, steel production and base chemicals stagnated or declined, there was a steady rise of automotive production, light industry, and consumer products. Unfortunately, the transport requirements for these growth sectors did not fit well with the core offering of state-owned railways, that were best suited to transport dry and liquid bulk commodities, particularly over long distances. Unfortunately, long-distance rail freight was hampered by technical and administrative hurdles at border crossings, in sharp contrast with road freight that moved freely within Europe. Furthermore, state-owned railways were lacking customer-orientation and innovation. The loss of volume resulted in a vicious circle of an increasing proportion of fixed costs and operational losses, deteriorating competitiveness, and resulting in further loss of volume, and consequently increasing fixed costs proportion and operational losses again.

Policymakers in the European Union started to address this issue in the late-1980s. The basic principles for market-oriented development in the European railway sector, were initially formulated in Directive 91/440. Member states were obliged to reduce state involvement and to increase the competitiveness of railway companies. Proposed measures included the reduction of accumulated debt, the introduction of commercial financial management, the replacement of flat rate subsidies or recapitalization by contracting out public services, the separation of infrastructure accounts from those of passenger and freight businesses, and the provision of open access to the infrastructure for third parties. The EU Commission requested, that apart from payments for public service and specific funding for infrastructure provision, the railways finance their operations without further subsidization from governments. Key element of this legislation was *open access* to the railway infrastructure for international groups of railway companies crossing national borders and for international combined transport to enable intra-modal competition. Furthermore, inter-operable infrastructures were suggested as a means of removing technical barriers to entry.

2.1.2 Total Volume and Freight Performance

The European rail freight market has developed favorably over the last two decades. Today, according to Eurostat (Eurostat Rail Freight Statistics, 2022) more than 1 500 Million tonnes are transported by rail in the EU 27 countries, and European Railway Undertakings (RUs) are posting revenues of about 15 Billion EUR. The total rail freight activity reached nearly 400 Billion tonne-km. This key performance indicator (KPI) is defined by the sum of rail freight movements by multiplying their volume in tonnes with their rail transport distance in kilometers. The average distance of all rail freight movements in the European Union in 2019 can thus be calculated at 261 km. This figure suggests that most rail freight movements in Europe are short-haul and hence domestic. Modal share of rail freight stabilized over recent years and reached 17%, which leaves a lot of opportunities for further growth. Most notably, 30 years after EU 91/440 legislation on open access, according to Independent Regulators Group (IRG), the market share of new entrants and international arms of

incumbents has reached 47%. In this report we use the terminology *challengers* for all railway undertakings competing against incumbents, or among themselves, in the fully liberalized EU rail freight market.

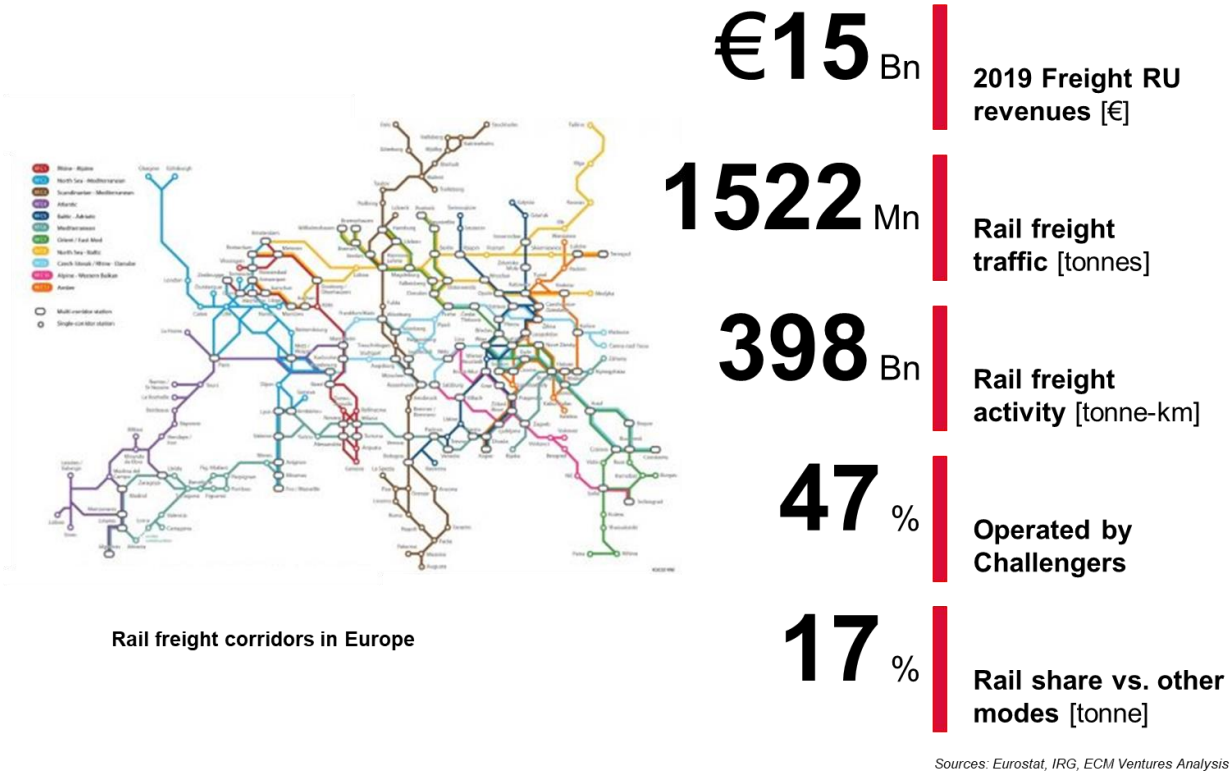


Exhibit 1: Market Profile Europe (EU 27) - Rail Freight Corridors and Key Figures

Rail freight remained a high priority for the European Commission. Regulation EU 913/2010 concerning a European rail network for competitive freight became effective on 9 November 2010. This regulation required member states to establish international market-oriented Rail Freight Corridors (RFC) meeting three key objectives:

- Strengthening the co-operation between Infrastructure Managers (IM) on the allocation of (international) paths, the deployment of interoperable systems, and on future infrastructure development.
- Finding the right balance between freight and passenger traffic along the RFCs, giving adequate capacity for rail freight in line with market needs and ensuring that common punctuality targets for freight trains are met.
- Promoting intermodal connections between rail and other transport modes by integrating terminals into the corridor management process.

Originally, there were nine Rail Freight Corridors defined, which were complemented by two additional corridors in Central Eastern and Southeastern Europe (see Exhibit 1 above). A decade after the Regulation's entry into force, however, the results achieved in member states remain insufficient, and the share of rail freight stagnates at around 17%. The ongoing evaluation of Regulation (EU) 913/2010 is an opportunity to move away from a single corridor towards a European RFC Network approach.

Development of rail freight traffic in the EU 27 countries over the last 20 years did not meet political objectives. As shown in Exhibit 2 below, based on EU data (Eurostat Rail Freight Statistics, 2022) the 2003 total volume

carried by rail was 1 367 Million tonnes and reached 1 522 Million tonnes in 2019. The average annual growth rate was thus only 0.67%, resulting in a slight decline of modal share of rail freight in Europe. This development was driven by a fundamental shift in industrial production. Dry and liquid bulk commodities posted a further decline and rail freight had to win customers in new growth segments. Between 2003 and 2019, Coal, petroleum and gas declined by 55 Million tonnes and total decline (incl. Raw Materials, Chemicals and Food) amounted to 85 Million tonnes. Conversely, there was significant growth with *other* commodities – a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. The so-called "other" segment grew from 248 Million tonnes and a 18% share of total in 2003, to 443 Million tonnes and a 29% share of total in 2019. Intermodal and logistics trains represent the single-most important growth driver of rail freight in Europe and a significant part of this traffic is on international routes.

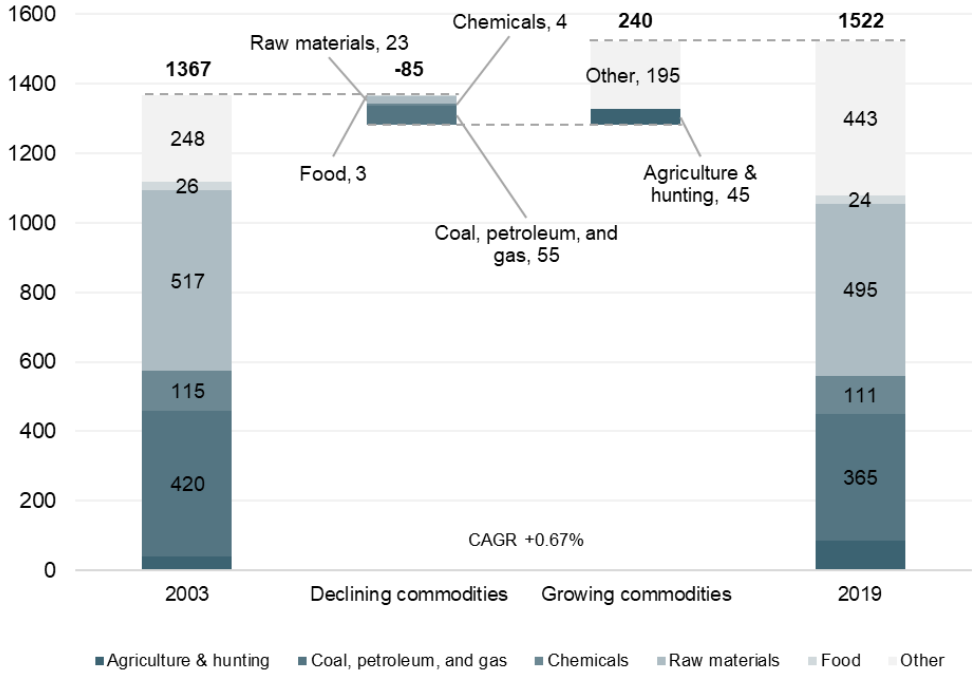


Exhibit 2: Development of Rail Freight Volume in Europe EU 27 [Million tonnes]

Challengers have been instrumental in supporting intermodal operators or marketing companies, rail freight forwarders, and logistics companies, to expand their footprint and grow volumes substantially. Intermodal trains are scheduled freight services connecting dedicated terminals in the hinterland with deep sea or river barge ports. Hence, reliable service and high levels of punctuality are mandatory to compete with road cargo, which always has the advantages of directly connecting shipper and consignee origins and destinations paired with a high degree of flexibility and short transit times (at least for short to medium distances). Intermodal traffic is the more cost and environmentally effective solution for high-density flows and distances of more than 500 km, both domestically and internationally.

In recent years the boom in e-commerce also led to higher share of parcels transported by intermodal trains, both the regular services offered by intermodal operators as well as dedicated parcel trains organized by Deutsche Post DHL. With increasing importance of sustainable transport solutions, more and more large shippers turned to dedicated logistics trains to serve their needs and leverage environmental-friendly rail freight solutions.

Rail freight activity in Europe, measured in tonne-kilometers, grew from 339 Billion tonne-km in 2003 to 398 Billion tonne-km in 2019 – a total increase of 17%, or an average annual growth of just 1%. Average distance of rail freight transport increased from 248 km in 2003 to 262 km, or 5.6% in total. While traditionally rail-compatible dry and liquid bulk commodities stagnated, merchandise goods (category "Other") grew by 60% from 87 Billion tonne-km to 139 Billion tonne-km. In 2019 this segment represented 35% of the European rail freight market. Average distance of transport for these merchandise goods declined from 350 km in 2003 to 314 km. This indicates that rail freight was winning share in heavily contested short-haul markets as well, in some large country markets at least.

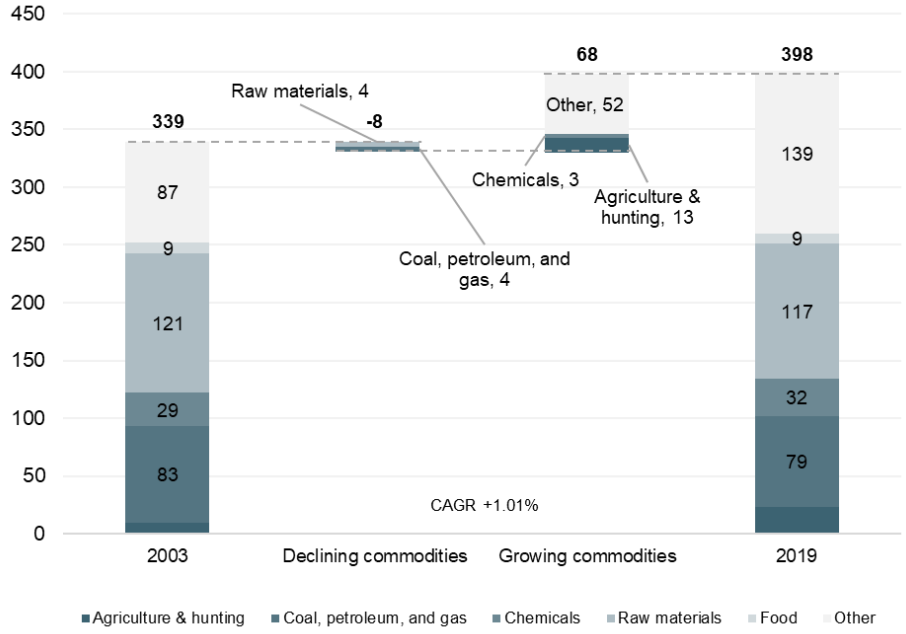


Exhibit 3: Development of Rail Freight Activity in Europe EU 27 [Billion tonne-km]

2.1.3 Market Share of Rail vs. Road and other Modes

As shown in Exhibit 4 below, rail freight activity measured in tonne-km stayed at a level of 17-18%, while road freight captured 75-76%, and transport on inland waterways represented 6-7%. Modal split varies widely from commodity to commodity, country to country, and corridor to corridor. Road transport has established itself as the dominant mode due to low cost, high flexibility, and the ability to offer door-to-door connection everywhere. While up to the Seventies of the last century there were rail sidings at every factory and major warehouse, modern manufacturing industries and distribution facilities focused on excellent road access, neglecting connectivity via rail. Consequently, rail had lost market share in literally all growing (light) industry sectors and trade markets. Rail thus had to focus more and more on dry and liquid bulk commodities, like coal, iron ore, steel, construction materials, fertilizer, oil & gas, refined products and chemicals.

Considering that the share of inland waterways depends on the availability of navigable rivers and canals, the main corridors with direct competition of road, rail and inland waterways are the rivers Rhine and Rhone. Most important are connections between ARA ports (Amsterdam, Rotterdam, Antwerp) along the river Rhine with the Rhine-Ruhr area, Rhine-Main area and further south to the City of Mannheim and the City of Basle in Switzerland.

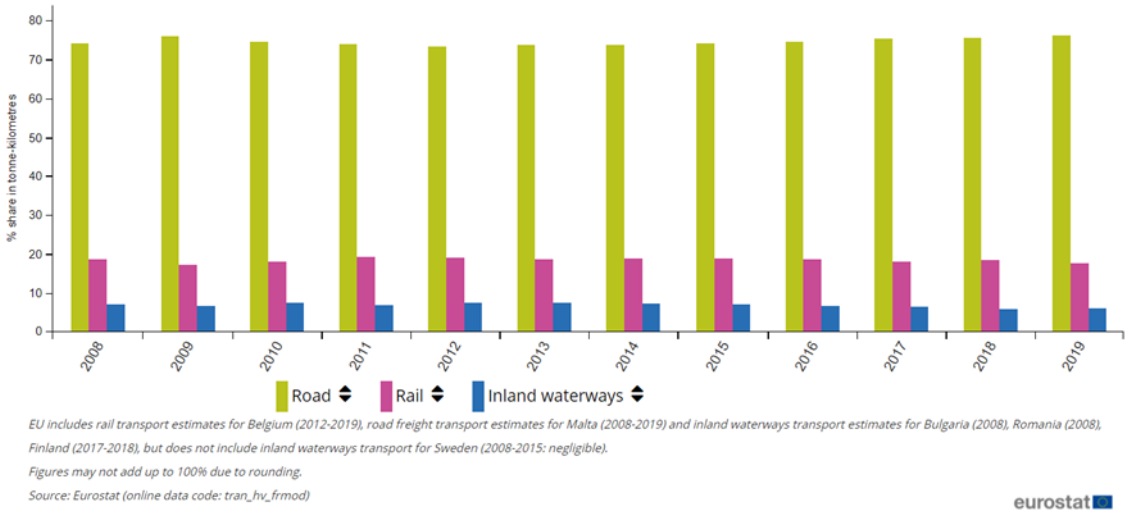


Exhibit 4: Development of Modal Split of Freight Traffic in Europe EU 27 (2008 – 2019) [Billion tonne-km]

European governments tried for decades to promote "shift to rail" measures, but with modest success. The notable exceptions are Switzerland and Austria that invested heavily in cross-alpine rail links (NEAT in Switzerland, new Brenner Tunnel, Simmering Tunnel, and Koralm Tunnel in Austria) and have maintained a high-density network of rail sidings. Furthermore, road charges for trucks were introduced at major transit routes through both countries that helped to effectively shift traffic from rail to road.

It must be noted that the introduction of ocean containers in Europe in the 1970s and the fast growth of intermodal traffic also helped to stabilize the market share of rail. Intermodal solutions combine the advantages of road and rail modes to the benefit of shippers and operators. Road hauliers pick-up containers or swap bodies at factories or warehouses and haul them to the nearest intermodal terminals. Containers and swap bodies are then loaded on platform wagons and hauled by trains over long distance – typically 500-700 km, but there are very long connections between Scandinavia and Italy or Spain and Central Europe over distances of more than 2 000 km. The last mile from destination terminal to the final customer site will be hauled by road again.

2.1.4 Regulation and Market Liberalization

The EU Commission started to liberalize the railway market in the early Nineties. The first major legislation, 91/440, had three major objectives:

- Railways to become independent operators
- Separation of (state-owned) rail operators and infrastructure managers with separate accounts and management structures
- Greater competition on the rail networks, especially for freight transport

Implementation dates of this reform varied widely between member states, as shown in Exhibit 5 below. An analysis published by the IRG (Independent Regulators Group, 2018) shows that the United Kingdom, Germany, The Netherlands and Sweden adopted these changes in the mid-Nineties, while other member states followed with significant delays only. Early adopters created benefits through introduction of competition, like better rail service offerings, lower prices to shippers, and increasing rail market share.

To accelerate market liberalization, the EU Commission issues the 1st Railway Package in 2001 with three key elements:

- Non-discriminatory access to the rail network
- Further liberalization of rail freight traffic
- Introduction of separate bodies for train path allocation to railway undertakings

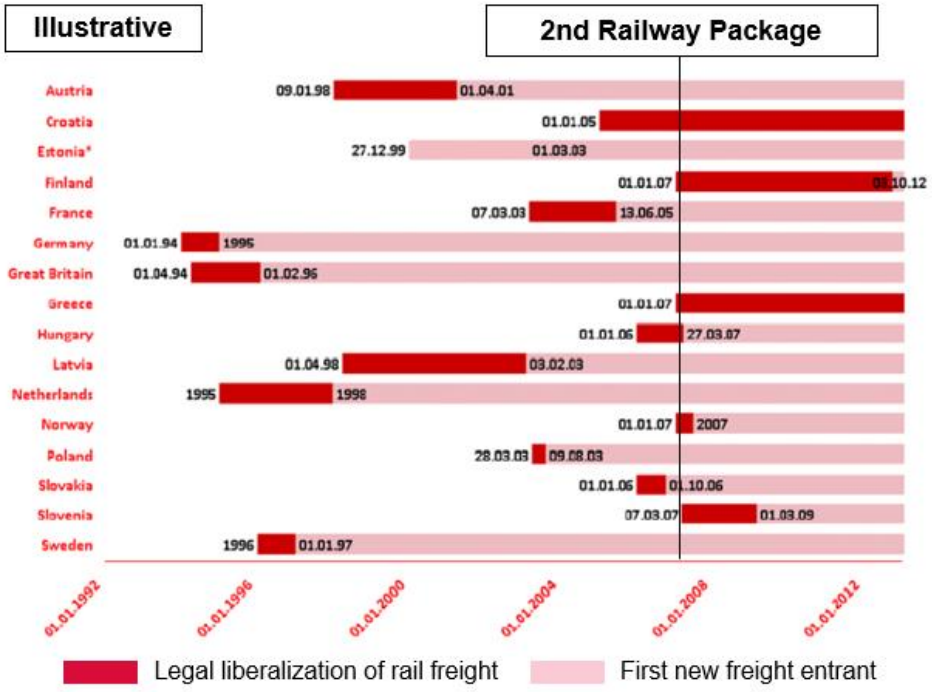


Exhibit 5: Development of Liberalization in Selected Member States

Despite those efforts, several member states seemed reluctant to open their national railway markets and the EU Commission had to issue the 2nd Railway Package focused on three key topics:

- Harmonization of safety measures and interoperability
- Complete liberalization of rail freight traffic
- Establishment of the European Railway Agency (ERA)

Consequently, as of 1 January 2007 the EU rail freight market was fully liberalized, and new entrants were able to freely compete with (national) incumbents and further gain market share. The EU Commission issued further legislation related to the rail market with the 3rd Railway Package and the recast of the 1st Railway Package, mainly focusing on passenger traffic. The so-called "Technical Pillar" of the 4th Railway Package aimed at expanding the role of the European Railway Agency (ERA, to ensure interoperability and to increase railway safety based on homogeneous European rules and standards. This legislation has high relevance for rail freight undertakings operating internationally when it comes to safety certificates for their foreign subsidiaries and multi-system locomotives.

2.1.5 Pandemic Impact

The pandemic crisis led to a drop in demand for rail freight services starting in March 2020, although the negative impact was `significantly smaller than what was experienced by passenger services. The Community of European Railways (CER) publishes a regular COVID Impact Tracker (Community of European Railway and Infrastructure Companies, 2022) with monthly data on volume and revenue changes compared with pre-pandemic levels, as shown in Exhibit 6 below. During the first half of 2020, the drop was -16% vs. 2019. In the last quarter of 2020 demand and revenue gaps continuously recovered to reach just -4% in December. With the second wave of the pandemic, the drop in volume plummeted to -14% in January 2021 and remained at a range of -8 to -10% below 2019 between March and October 2021, before recovering during November and December 2021.

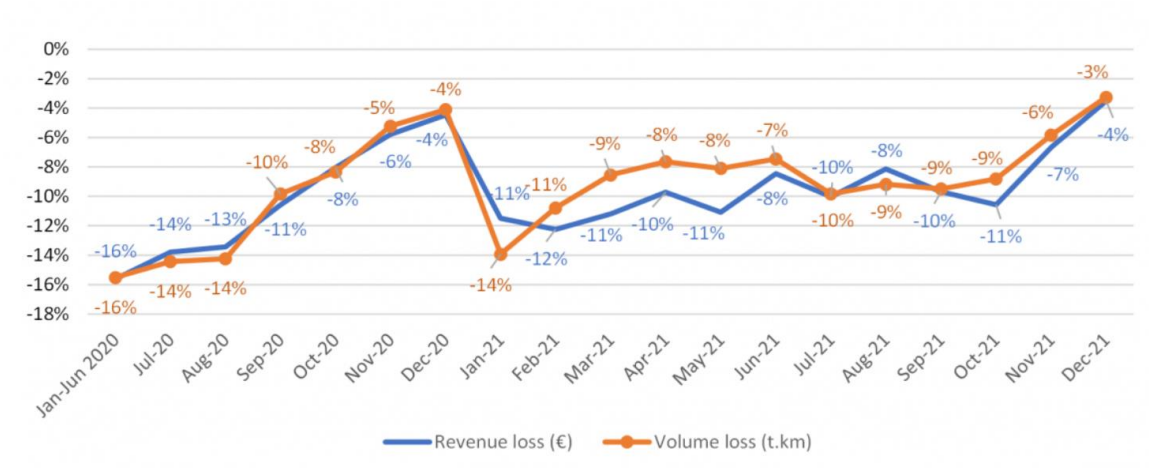


Exhibit 6: CER COVID Impact Tracker vs. 2019

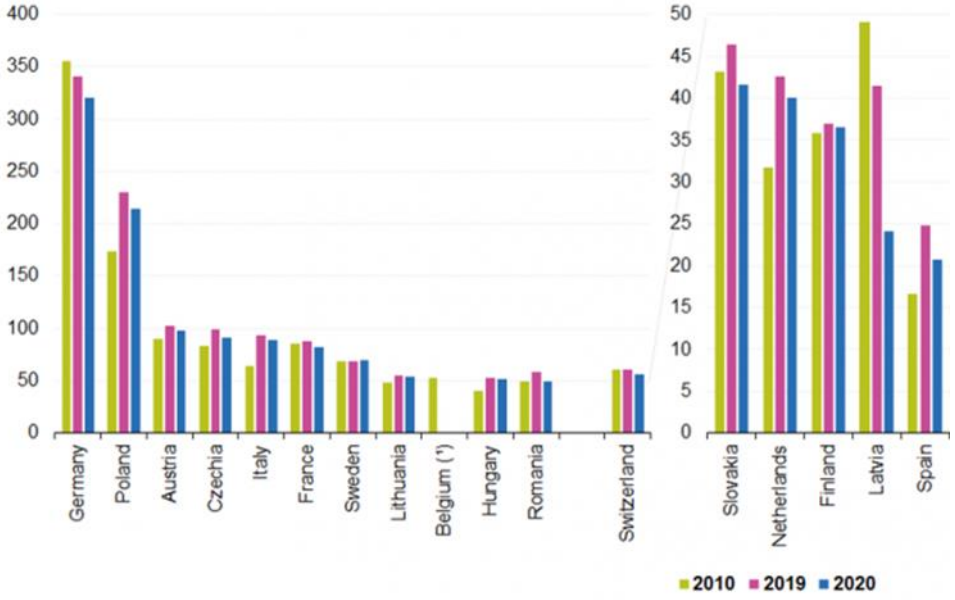
It must be noted that the CER COVID Tracker is based on inputs from CER members and reports consolidated numbers for the rail freight sector. Based on our research and input during the stakeholder consultation, we reckon that the demand for dry and liquid commodities is still more depressed compared with intermodal and logistics trains. All challengers reported at the end of 2021 that volumes were back to, or even slightly above, the 2019 levels.

The temporarily reduction of Track Access Charges (TAC) in several European countries was considered as an effective measure help to turn the tide and to stabilize demand for rail freight. In October 2020, the European Parliament endorsed Regulation (EU) 2020/1429 Establishing Measures for a Sustainable Rail Market in View of the COVID-19 Outbreak (Regulation 2020/1429 - Measures for a sustainable rail market in view of the COVID-19 outbreak, 2020), which allowed infrastructure managers to lower, waive, or defer track access charges as well as waiving reservation charges, in case of path cancellations due to the pandemic crisis.

2.2 Market Segmentation

2.2.1 Main European Countries

As shown in Exhibit 7 below, the European rail freight market is concentrated on several countries. Germany, with over 320 Million tonnes represents the largest market, followed by Poland with over 220 Million tonnes. Austria, the Czech Republic and Italy, with a similar size of 90-100 Million tonnes, complete the top five. France (about 80 Million tonnes) and Sweden (about 70 Million tonnes) are also sizeable markets. Switzerland, Lithuania, Belgium, Hungary and Romania (all at around 50 Million tonnes) represent mid-sized markets. They are followed by Slovakia, the Netherlands, Finland, Latvia and Finland (all at about 40 Million tonnes). In general, there was not much change in total tonnage between 2010 and 2020. A few exceptions should be noted. Poland saw a strong increase by 40Million tonnes and the Netherlands by 10. In contrast, Germany suffered from a decrease of about 30 Million tonnes during this decade and Latvia suffered from a material decline of over 15 Million tonnes from 2019 to 2020.



Note: Countries are ranked based on 2020 data. Cyprus and Malta have no railways.
(1) 2019 and 2020 data not available.
(2) 2010 based on quarterly data.
Source: Eurostat (online data codes: rail_go_typepas and rail_go_quartal)

Exhibit 7: Development of Rail Freight Volume in Europe EU 27 and EFTA [Million tonne-km]

It should be noted that European rail freight markets have different characteristics in terms of geographic size, relevance as origins and destinations and / or transit countries. Germany and Poland are combining all these characteristics. With major deep-sea ports and strong industrial bases, they are key origin and destination markets, but are also major transit markets in Central Europe. This is also true for Austria, Italy, France, Sweden, and Slovakia, while Lithuania, Belgium, Hungary, the Netherlands, and Latvia are mainly transit countries from and to major ports.

2.2.2 Two Major Commodities Groups

As shown earlier (see Exhibit 2), most of the rail freight market consists of dry and liquid bulk commodities like agricultural products, coal, petroleum and gas, chemicals, and raw materials. This group of commodities represented 80% of total tonnage back in 2003, but its share of the total rail freight market declined to 70% in 2019. In contrast, the non-bulk commodities like food products and other merchandize goods transported mainly in intermodal and logistics trains, increased their share from 20% in 2003 to 30% in 2019 and were solely responsible for the growth of the rail freight market.

Since the 1960s railways lost most of their relevance for transport of food products and other merchandize as well as for most of the light industry products (i.e., intermediary products, components and spare parts, durable consumer goods). Only Switzerland, and to some extent Austria, marked exceptions from this trend. Consequently, the road sector benefited from growth of production volumes in those categories, while rail volumes declined, and rail's market share plummeted. The outlook for mining and production of base commodities in Europe is negative. With the transition of the energy sector and the industrial sector aiming for carbon-neutrality by 2050, the haulage of dry and bulk commodities will decline over time. In particular, the production and transport of coal will sharply be reduced in the next 10-15 years. A similar trend can be seen for fossil fuels with the transformation of the mobility and transport sector. Hence, the transport of mineral oil and refined products will likely shrink significantly in the Thirties.

Up until the strong growth of intermodal in Europe starting in the 1990s, railways were only niche players in the transport of food products and merchandize. Since then, their market share has steadily increased again. There were two prerequisites for this success. Firstly, intermodal traffic resulted from an effective collaboration between the rail and the road sector, where railways focus on the long-haul transport between terminals, and road hauliers dealt with the pickup and delivery of ocean containers and swap bodies to cover the first and last mile from shipper to terminal and terminal to consignee. For long-haul transport over distances of 500 km or much more, rail has a clear cost advantage over road as one intermodal train can haul up to 120 TEU (Twenty-Foot Equivalent Unit) with a single locomotive and driver. Secondly, railways needed to deliver seamless and punctual international train operations and offer an integrated commercial responsibility.

In the past, state-owned railways (incumbents) were operating solely on their national networks and handing over trains to their neighboring railways for international transport. Hence, there was no integrated planning of path or operation control centers, nor a single commercial responsibility for the trains. Due to this, major shippers, logistics companies, and global container lines did not find the rail offer very attractive. Aside from lower transport costs over long distances, there were no advantages, but many shortcomings. It took rather long to establish new train connections due to complex dealings amongst national railways. International trains resulted in rather long transit times due to lack of coordinated paths and border stops to change drivers and locomotives. Customers had little or no visibility on the status of their shipments and were not proactively informed of delays, even significant ones.

This pattern changed with the beginning of rail market liberalization and the appearance of new entrants. This resulted in open access on international routes, the introduction of one-stop-shop concept of infrastructure managers, the availability of multi-system locomotives that were able to run on different rail networks with specific power supply and rail control systems, and the establishment of single commercial and operational responsibility for international trains. All those developments created a step change in offering quality and ease of doing business with new entrants that focused on international intermodal and logistics trains, a segment of the European rail freight market that posted strong growth over the last two decades.

2.3 Customer Universe

2.3.1 Industrial Shippers

Traditionally industrial shippers (e.g., coal mines, steel mills, power plants, refineries, chemical plants, automakers) contracted directly with freight railways to haul their dry and liquid bulk commodities, supplies, or finished products. Typically, they expected the railway to provide special wagons (e.g., coal/iron ore hoppers, tank cars or auto carriers) and to manage the transport in block trains between mines and plants, or between plants, or to/from plants to ports/distribution centers. In many cases there was no alternative to rail transport or road transport was not cost competitive (particularly over long distances). For coal and ore, transport on inland waterways was the main competition, provided navigable rivers or canals were available to connect origins and destinations. In all these cases, large transport volumes and concentrated flows were hauled mainly over short to medium distances ranging from just under 100 km to 300 km. Thanks to large fleets of suitable freight wagons, incumbent railways became the natural partners of large industrial shippers. Especially for hazardous goods, like oil and gas, refined products, or certain chemicals, the railways benefited from legislation that prevented transport of such goods on road (except for last mile distribution, like to petrol stations). This also allowed for premium prices as shippers could not easily shift to alternate modes or choose other rail freight operators.

With growing demand for consumer products, increasing international collaboration along the value chains, globalization and just-in-time or direct-to-consumer logistics, average shipment sizes dropped significantly and industrial shippers increasingly preferred road transport for all non-bulk commodities, and for intermediary and finished products. Consequently, incumbent railways increasingly focused on traditional dry and liquid bulk commodities, often leveraging their legacy wagon fleet, thereby established an effective barrier of entry for new competitors. Small to medium-sized shippers preferred to contract with forwarding and logistics companies that would bundle small lot size transport volumes to achieve better cost efficiency and take care of order processing, customs clearance and track & trace of international shipments.

2.3.2 Forwarding & Logistics Companies

In the past, forwarding and logistics companies were mainly focused on road transport or global air & sea freight transport. With the emergence and strong growth in the intermodal market, more and more forwarders started to leverage the benefits of this dual-mode transport solution. With access to small and medium-sized shipments, and due to consolidation of (international) demand, forwarders and logistics companies became a strong force in the European transport markets. They were able to consolidate enough demand to provide capacity commitments sufficient to support the introduction new train connections – both so-called company or logistics trains, or new intermodal services. It must be noted that except for very large shippers with dry and liquid bulk transports that continued to organize their shipments internally and contract with railways directly, forwarding and logistics companies became intermediaries between railways and industrial shippers. In the Nineties, some of the larger players started to leverage the intermodal network in Europe for trunk route transport in their European less-than-truckload (LTL) networks. They pushed for better service and new international connections and demanded very low rail rates. As a result, incumbent railways were reluctant to contract with forwarders and logistics companies due to the low margins of intermodal transport and concentrated even more on the higher-margin dry and liquid bulk business.

2.3.3 Intermodal Operators

Intermodal operators in Europe were established in the late Sixties and early Seventies when ocean containers first arrived in Europe and container shipping lines were asking for cost-efficient hinterland transport. In most cases a collaborative approach of rail and road carriers prevailed, and the capital of new intermodal operators was held by (national) railways and many road carriers or forwarding companies. The transport industry opted for this model to create strong incentives for all partners along the transport value chain. The railways concentrated on building and operating the terminals, which were funded and financially supported by governments, and the haulage of trains between terminals, while road hauliers took care of first and last kilometer transport between shipper and terminal and terminal to consignee. Dedicated fleets of platform wagons to carry both ocean containers and swap bodies (in some cases also craneable trailers), were owned either by the railway or by the intermodal company directly.

While this model proved successful to introduce this new transport solution into the market and support the growth in the first three decades, it became obvious that the governance with dozens or in same case several hundred shareholders was inflexible and risk-averse, which delayed investment decisions and slowed the growth of many intermodal operators. Furthermore, there was a fundamental disconnect between the strategic and financial interest of the railways and of the road carriers. While the railways were looking for higher margins and aimed to increase their transport and terminal service charges, road carriers were pushing for lower prices and higher reliability and punctuality. After the year 2000, several intermodal operators were changing their shareholder structure or their governance model. Others suffered from deteriorated financial and operational performance and were closed or acquired by other players. Several large intermodal operating companies, such as Kombiverkehr in Germany or Hupac in Switzerland, acquired railway licenses and started to run their own trains with leased locomotive and their own drivers. As a result, the intermodal market became more competitive and innovative.

2.3.4 Container Shipping Lines and Port Operators

Already in the Nineties, several new entrants started intermodal services connecting major European ports with the hinterlands. These originally small but entrepreneurial companies included Metrans in the Czech Republic, Polzug in Poland, BoxXpress in Germany, and ERS European Rail Shuttle in the Netherlands. These companies had in common that major port operators, like HHLA /Hamburger Hafen und Logistik AG and BLG/Eurogate, or major container lines (e.g., P&O, Nedlloyd, Sea-Land – later merged with Maersk) became shareholders and helped to scale up the business. For major container lines and ports with large container terminals it was essential to offer fast, reliable, and cost-efficient hinterland connections. During the Nineties, however, they were less and less satisfied with network connections, service quality and costs of incumbent railways and their intermodal companies. Consequently, they decided to establish new railway companies / intermodal operators with a lean setup, strong customer focus and entrepreneurial culture. This group of new entrants helped bring innovation to the intermodal offerings and production models, and stronger growth to this market segment.

2.3.5 Other Logistics Players

Postal and express companies, like Deutsche Post DHL Group or UPS, started to leverage the intermodal offering to establish dedicated parcel trains to cover trunk routes in their European network. The so-called Parcel Intercity (PIC) of Deutsche Post DHL Group was first introduced in 2000 and was linking parcel hubs in Northern Germany with Southern Germany on the one hand, and connecting hubs in the East-West direction

on the other hand. The offering was focused on fast overnight transport at maximum speeds of 160 km/h to increase customer service levels, especially faster delivery. In 2021 DHL communicated nevertheless that only 2% of their domestic parcels in Germany were transported on rail. They indicated that they were planning to soon increase this share to 6% and were aiming for as much a 20% in the future, provided there would be sufficient high-speed rail paths available on main routes during the night and fast handling of containers at terminals.

UPS has been offering a China-Europe intermodal service both for Full Container Load (FCL) as well as Less-Than-Container-Load (LCL) for about one decade now and had added connections and frequency to this service to satisfy increasing customer demand for this offering, which is 60-70% less expensive than air freight and about 40% faster than regular sea freight.

2.4 Sustainability

2.4.1 Rail Freight as an Environmental-Friendly Mode of Transport

Among the strategic goals proposed in The European Commission's White Paper on Transport, it is stated that: "30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors" (European Commission - Directorate General for Mobility and Transport , 2011).

The promoted modal shift from road transport to rail freight intermodal is meant to reduce the environmental impact of freight transport in the European Union. Secondly, it can also contribute to transport energy efficiency and cost-effectiveness by the higher carrying capacities granted by rail and water transport.

2.4.2 Decarbonization and Green Deal

Climate change has a direct impact on the biosphere and ecosystems. Human activities are augmenting the greenhouse effect and pollution, leading to the loss of biodiversity. The European Commission recognized the EU's joint responsibility to counteract the negative effects of climate change, identified as a major challenge for the current generation.

In this context, the European Green Deal, a major strategic plan of change to enable and ensure Europe's transition to sustainability, constitutes the heart of the long-term vision to transform Europe's societies and economies into more responsible and environmentally aware communities by 2050. The Green Deal will bring about significant change, but it will also bring significant benefits to the European Community. Examples include, but are not limited to, improved energy efficiency and affordability, better transport, a cleaner and more biodiverse environment, a healthier food system, better consumer goods and a society and economy that is well prepared for the transition to sustainability.

The changes needed to achieve these goals are designed to be equitable and inclusive so that no person or place is left behind. The scale of change envisaged by the EU under the Green Deal requires the active and committed participation of citizens, industry, and government together.

The main Green Deal action areas/target are, according to the European Commission:

1. Increasing climate change targets for 2030 and 2050
2. Energy decarbonization and cost reduction
3. Adoption of a clean and circular economy
4. Greener industry and a more circular economy
5. Creating a pollution and toxin-free environment
6. Preserving and restoring ecosystems and biodiversity
7. Achieving a sustainable and healthy food supply from farm to table
8. Introducing smart mobility in the transport sector

2.4.3 Policy Changes Under the Green Deal

A holistic approach to policymaking will be adopted to ensure that the European green transformation is implemented across the entire socio-economic structure. This will be driven by the need to protect and restore natural capital, to use resources sustainably, and to provide an overall better experience for all EU citizens, human and non-human. This is a major undertaking that will require a wide range of resources. To this end, all available policy instruments - regulatory and legislative, market, diplomatic and budgetary - will be utilized.

The aim is to be as coherent as possible with existing and new policies, to address problematic cases and mitigate harmful deficiencies, and to create a comprehensive framework that takes individual and public needs (i.e., social, economic, and environmental) into account.

The vision of the Green Deal extends to 2050, but its most significant feature is the interim targets set for 2030. The first comprehensive package of regulations and legislation is called 'Fit for 55', as it supports the EU's target of a 55% reduction in emissions by 2030 (compared to 1990 levels).

Several important legal and regulatory instruments have been introduced in the EU to control and monitor emissions, the most important of which is the Emissions Trading System (ETS) established in 2005 to regulate and limit greenhouse gas emissions from the European electricity, heat, energy-intensive industries, and commercial aviation sectors that together account for about 40% of European emissions. The Green Deal introduces adjustments to the ETS, with the aim of increasing the targeted sector reduction target to 61%.

As for the energy sector, both its decarbonization and the transition to renewable energy sources need to be prioritized. Furthermore, most of the energy consumed in the EU (around 60%) is imported, which presents both a strategic challenge and an opportunity to transition to cleaner energy, reduce dependency on external sources, and better adjust prices for domestic consumers.

For rail, road, waterways and air, a nine-tenths reduction in emissions is required to meet the EU's climate neutral target. This will require a major shift from road freight transport to alternatives such as rail and inland water transport, freeing up the heavily congested road network. Regulatory measures such as new initiatives to achieve a 'Single European Sky' and the revision of the 'Combined Transport Directive' will play an important role in achieving large-scale emissions reductions.

2.4.4 Rail Freight Contribution in Meeting EU Requirements

Rail is often referred to as the most sustainable land transport mode. It is important to note that only a significant modal share redirection will contribute to the general objectives set by the Green Deal. Therefore, organic rail market growth is insufficient when evaluating positive factors in terms of environmental impact.

As of today, Rail has the essential role of enhancing sustainable and greened lifestyles and business. Greenhouse gas emissions from transport are constantly raising, accounting for 14% of all emissions in 2018. While representing 8% of global passenger and freight transport activity, railway represents only 2% of the transport sector emissions (UIC).

Rail is the only transport mode that constantly has reduced its specific emissions – measured on a tonne-kilometer basis – between 1990 and 2018. A recent study (EU Agency for Railways, 2021) reported that total reduction of emissions of rail transport accumulated for more than 60%, mainly due to replacement of diesel locomotives by electrical locomotives and a strong shift towards use of sustainable generation of electric energy in the railway sector. The road sector was able to reduce specific emissions by about 25%. Demand for transport services is expected to double by 2050 and increase by about 30% until 2030. In the same period in which the European Union aims to reduce total emissions compared to 1990 by 55% (“Fit for 55” initiative)

and is aiming to become *Net Zero*, or emission free, by 2050. These objectives can only be met with rail as the foundation of a seamlessly connected, sustainable mobility and transport system, which contributes strongly to reduce emissions.

Based on available technology the rail sector appears to be the only option to reduce emissions over-proportionally and to achieve the "Fit for 55" goals in 2030 for the transport sector overall. EU policy must be geared toward accelerating the shift from road to rail during the 2020s. Furthermore, as illustrated in Exhibit 8 below, rail consumes six times less energy, produced eight times less air pollution, resutling in twelve times fewer external costs to society, compared to road transport.

Exhibit 8: Greenhouse Gas Emissions by Mode of Transport (EU 27)

3. COMPETITIVE ARENA

3.1 Historic Development

3.1.1 Up to 1990 – Incumbents and Niche Players

Since World War II, all major railways in Europe were state-owned enterprises. Alongside nationwide players, there were a few medium-sized and small railways, of which some were focusing on regional passenger service, and a larger number of industrial and port railways dealing with last mile freight operations. There existed a few privately-owned industrial railways, but they were only allowed to operate on their own infrastructure as local partners of the national railways' freight divisions. Therefore, no competition existed for rail freight service, nationally or internationally. Incumbents were focused on dry and liquid bulk commodities and to some extent on intermodal and logistics trains, but total rail freight volumes stagnated or declined, and the modal share of rail shrank due to the steady growth of road cargo since the 1960s. State-owned railways posted regular losses despite continuously cutting their costs, and despite the absence of intra-modal competition. Rail service for market segments where road competition was the greatest were often downsized or discontinued by railways (e.g., LTL or palletized cargo, mail, oversized loads).

3.1.2 Nineties – Liberalization and Privatization starts

As described in chapter 2.1.4 Regulation and Market Liberalization above, the European Union started in the 1990s to bring reform to the railway industry with the aim of introducing competition and thereby drive innovation and efficiency improvements. The EU Commission issued Directive 91/440 as a framework for national legislation on rail reforms. Several countries decided to restructure their railway sector, most notably the United Kingdom, Germany, and the Netherlands. Interestingly, the main features of this European legislation had already been implemented in Sweden from 1988. Frustrated by increasing demand for subsidies at Statens Järnvägan (SJ), the government had decided to reorganize the rail sector and separated the responsibility for the rail network from that of train operations. Responsibility for infrastructure, and related subsidies, was transferred to Banverket (national rail administration), while SJ was responsible for operating passenger and freight trains on a commercial basis. Sweden also introduced open access to the rail network and opted for contracting out formerly loss-making regional rail services based on competitive tenders. The first contract for regional rail services was awarded to BK Tåg in 1989. (Nilsson, 2002). It is fair to say that Sweden provided the initial blueprint for European liberalization and privatization of the rail sector.

The UK government decided to privatize the state-owned railways and issued the Railways Act 1993. British Rail's operations were broken up and sold off, with various regulatory functions transferred to the newly created regulator, the Office of Rail and Road (ORR). The ownership of the rail infrastructure, including major stations, was consolidated at Railtrack Plc (House of Commons, Library, History of Railtrack, 2010). Track maintenance units and renewal assets were sold to 13 companies that became suppliers to Railtrack. The ownership of passenger trains was transferred to rolling stock companies (ROSCOs). The ROSCOs (House of Commons, Library, Rolling Stock , 2017) leased the rolling stock to passenger train operating companies (TOCs). Passenger rail service contracts were awarded to TOCs (National Rail, Train Operating Companies, 2022) through a new franchising system (UK Government, National Archives, 2022) overseen by the Office of Passenger Rail Franchising (OPRAF). Ownership and operations of rail freight services were passed on to four companies initially, but in the course of the privatization only two players remained (House of Commons, Library, Railways Privatization 1987-1996, 2010): English Welsh & Scottish (EWS) and Freightliner.

After reunification, the German government had to deal with the two state-owned and loss-making railways. Deutsche Bundesbahn (Western Germany) and Deutsche Reichsbahn (Eastern Germany) that together had accumulated losses of about 34 Billion EUR, and in 1993 alone had operating loss more than 8 Billion EUR. After years of detailed planning, the Germany Parliament voted in favor of the Railway Reorganization Act in December 1993 resulting in the following:

- Establishment of Deutsche Bahn AG (100% of share capital held by the Federal Republic of Germany), as a commercially oriented company with a private-sector-like organizational setup
- Within DB Group, the responsibility for railway services (long-distance, regional & commuter, freight) was separated from the one for the rail network and stations (separate management and accounts)
- Separation of public service obligations and other sovereign roles from commercial activities
- Transfer of debt accumulated by former state-owned railways towards a Federal Railway Fund
- Introduction of open access to the German rail network for all licensed railway undertakings
- Transfer of responsibility for regional and commuter services to the Federal States along with sufficient funding by the Federal Government. Such services would be tendered out in the future and contracts awarded to the bidder with the best offer (technical and financial)

In the Netherlands, dissatisfaction with the growing need for subsidies, coupled with inferior service quality, of state-owned railway Nederlandse Spoorwegen (NS), led to a similar reform. In 1995, the government decided to divide NS into a market sector (passenger, freight, stations, real estate), and a government-commissioned sector (rail network, traffic management, track maintenance). It was decided that subsidies to NS Group ("market sector") should steadily decrease and by discontinued after 1999. The rail network for passenger services was separated into a core network that would be operated under commercial conditions, and formerly unprofitable regional lines where rail services should be tendered and awarded to the best bidder. According to EU Directive 91/440, the Netherlands implemented full separation of rail operations and infrastructure, as well as open access to the national rail network (Deville & Verduyn, 2012). In the following years, NS focused on passenger services and decided to sell NS Cargo, its freight division. It concluded that the freight unit was too small and that an increase in market share, competing with road and inland waterways, made it unlikely to reach critical scale for sustained profitable operation. Hence, NS Group in early 2000 sold NS Cargo to DB Group, which started to expand internationally at that time.

Market liberalization in pioneering countries helped introduce competition as several private-sector players started to offer rail freight services based on the open access regime. New entrant challengers were rather small and focused on market niches, particularly when they were offshoots from industrial or port railways. Incumbents mostly ignored the new competition, relying on their size and pricing power when new entrants targeted their large customers and margin-rich traffics. Despite that, large industrial shippers, port operators, and container shipping lines demonstrated readiness to contract with the new players and to help them grow. The market share of new entrant challengers quickly reached 5-10% in Europe, even though some markets were not yet open, while others offered open access early on (e.g., Sweden, Germany, Poland, and the United Kingdom).

3.1.3 1st Decade of 21st Century – New Entrants Grow Up

At the turn of the millennium, most European rail freight markets were opening and an increasing number of new entrants were starting to compete with national incumbents. This group of mostly small railway undertakings comprised industrial and port railways that broadened their footprint offering block train services both for dry and liquid bulk and containerized cargo. Initially, they were linking their local industrial or port areas with other main origins and destinations. Later, they started offering block train services on a national or international level with newly acquired locomotives and newly recruited train drivers. Another

group of new entrants was linked to major port operators or container shipping lines that were looking for cost-efficient and reliable hinterland connections nationally and internationally. Finally, several newly established freight railways were founded by entrepreneurs who often were former incumbent railways employees.

A typical representative of a former industrial railway entering competition based on the open access regime was Rail4Chem. It was established in 2002 by the chemical company BASF and its logistics partners Bertschi, Hoyer and VTG. Being dissatisfied with the costs and quality of services provided by Deutsche Bahn, BASF aimed to create competition. The newly established company focused on block train services to and from BASF's major chemical sites in and around Ludwigshafen. Later, the railway offered block train and wagon group products across Germany and internationally. It acquired Short Lines BV, the first open access operator in the Netherlands, and expanded into Belgium, Switzerland, and Poland (Wikipedia, 2021). Once BASF felt that it had achieved its mission to create innovation and competition for rail freight services, it decided to sell Rail4Chem to Veolia Transport in 2008. The following year, Veolia decided to focus on passenger rail service and sold its international rail freight operations to SNCF Group, who integrated Veolia Cargo with a number of other affiliates to create Captrain, now one of the major rail freight challengers throughout Europe.

Port operators also established new rail freight companies, with a focus on container trains. For example, Eurogate, together with partners European Rail Shuttle and KEP Logistik (later part of TX Logistik), founded boxXpress.de in 2000 to operate dedicated container trains between the Port of Hamburg and Port of Bremerhaven on one end, and Southern Germany terminals in Stuttgart, Regensburg and Munich on the other end (https://www.boxxpress.de/, 2022). Earlier, HHLA, the major port operator in the City of Hamburg, entered the railway market in the 1990s to improve the hinterland connections for its container terminals. The HHLA Intermodal business unit became a 33% shareholder of Polzug Intermodal, initially a joint venture company with Deutsche Bahn and PKP Cargo, and Metrans, a privately held railway founded by Jiri Samek in 1991 in the Czech Republic. HHLA was also a 50% shareholder of TFGI Transfracht Intermodal, together with Deutsche Bahn. In 2012 HHLA agreed with DB to untangle its shareholdings. While DB became the sole owner of Transfracht, HHLA took over DB's stake in Polzug and later also the shares from PKP Cargo. In 2017 HHLA merged Polzug and Metrans and became the sole owner of this railway operator focused on international intermodal connections between major ports and the hinterland. Over the past couple of years Metrans also became a recognized player on the New Silk Road connecting China with Europe (30 years of Metrans – always ahead of its time, n.d.).

Also, in Poland many new entrants established themselves, such as Orlen KolTrans that was started in 2001 by PKN Orlen, a major oil & gas group to gain more independence from state-operator PKP Cargo. UK rail freight operator Freightliner established an affiliate in Poland in 2006 and became a leading operator for block trains carrying coal, aggregate, chemicals, etc. (Freightliner PL, s.d.). Private investors, like Waldemar Preussner and Jaroslaw Pawluk, acquired and consolidated industrial railways in the coal, chemicals and construction sectors to form PCC Rail and CTL Logistics in the 1990s. CTL Logistics was acquired by Bridgepoint, a private equity fund, in 2007, marking the rare case of PE investments into rail freight operations (Kruk, 2007). PCC Rail was acquired by DB Schenker Rail aiming to build out its European footprint (DB completes PCC Logistics takeover, 2009). Next to Freightliner, English, Welsh & Scottish (EWS) was expanding abroad and established an affiliate – later called Euro Cargo Rail (ECR) in France in 2005, which became the first and for many years the sole competitor to state-owned Fret SNCF. In 2007 EWS and their subsidiary ECR were acquired by DB Schenker Rail (François, 2007).

Whereas in the year 2000 the share of new entrants at the European rail freight market was less than 10%, by 2010 they already represented 25% of the market. The complete opening of EU rail freight markets in 2007 clearly helped the emergence and growth of new entrants but the main driver for growth was the increasing

acceptance of their service offerings by large industrial shippers and major logistics players. New entrants proved to be cost-competitive and capable of offering reliable service for national and international block trains. The growth in the number of intermodal and logistics trains was thus a result of the strengths of new entrants. While incumbents often complained that their new competitors where simply “cherry-picking,” customers recognized the benefits of working with challengers and saw them as the “better choice”. Due to a growing economy, increased efficiency, and more choices, the European rail freight market did grow significantly between 2001 and 2008.

3.1.4 2nd Decade of 21st Century – Consolidation and Pan-European Competition

The global recession in 2008/09 resulted in a significant decline in rail freight activity. Varying by commodity, the decline in the spring of 2008 was between 5% and 30% - on average the market contracted by about 20% in one year. The massive recession hit incumbents and new entrants alike, but it appeared that the new players weathered the storm much better. Their focused business model, and generally lean structure, allowed them to rapidly take measures to adjust capacity and reduce costs faster, and quickly scale up operations again when demand returned in 2010/2011. Incumbents, on the other hand, suffered from their high fixed cost base and turned to emergency measures such as retiring a part of their locomotive and freight wagon fleets. As state-owned companies, they also could not reduce their work force quickly enough and ended up posting sizeable financial losses. In some cases, recapitalization was required and further subsidies were granted to secure a functioning national railway system. The crisis also led to industry consolidation and to greater pan-European competition amongst rail freight operators. As such, the rail freight market entered another stage of development. Next to the international expansion of large new entrants, some incumbents started to build a pan-European network.

Over the last decade, the European rail freight market further matured and consolidated. As described above, several large incumbents, most notably DB Cargo, SNCF / Captrain, Rail Cargo Group and PKP Cargo have built out their international positions through mergers & acquisitions, while new entrants preferred to establish partnerships or new foreign subsidiaries to broaden and strengthen their footprint. Shippers, forwarding, logistics companies, and intermodal operators can now choose from several options, and international rail freight offerings have vastly improved. Incumbents in their respective home markets face competition from several challengers, including new entrants and foreign arms of fellow incumbents. Thanks to better service levels (i.e., transit time and reliability) of international trains, and cost efficiency on long-haul routes, rail freight helped to grow the intermodal and logistics train business across Europe. The year 2020 also marked the time when the market share (measured in train kilometers) of national incumbents and challengers (new entrants plus foreign arms of incumbents) equally became about 50% in the EU27 (plus Switzerland and Norway). The development stages of new entrants in the European rail freight market are summarized in Exhibit 9 below.

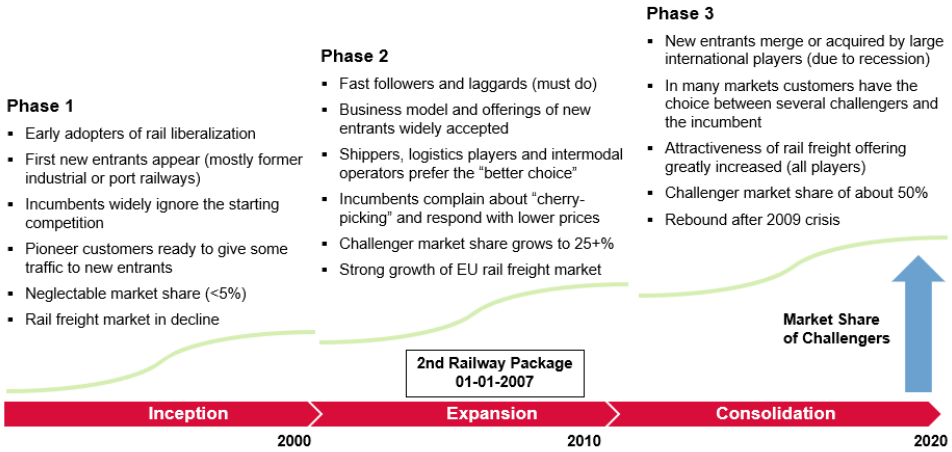


Exhibit 9: Development Stages of New Entrants in the European Rail Freight Market

3.2 Current Competitive Arena

3.2.1 National Incumbents

National incumbents are still strong players in the European rail freight market, but their historic dominance has faded as a result of market liberalization. One can distinguish three groups of countries: those with large national incumbents with international network, those with incumbents focusing on their national home market, and those that decided to privatize or divest their incumbent rail freight operators.

In the first group, we have Germany (DB Cargo), France (Fret SNCF / Captrain), Austria (Rail Cargo Group), Poland (PKP Cargo), Italia (Mercitalia / TX Logistics) and Switzerland (SBB Cargo / SBB Cargo International). The second group consists of Sweden (Green Cargo), Spain (Renfe Mercancías), Czech Republic (ČD Cargo) and Slovakia (ZSSK Cargo). Finally, in the third group of countries that decided to fully privatize or divest their rail freight operators, we have Denmark (DSB Gods, sold to DB Cargo in 1999), the Netherlands (NS Cargo, sold to DB Cargo in 2000), Hungary (MÁV Cargo, sold to Rail Cargo Austria in 2008), Belgium (Lineas, sold to private equity group Argos Wityu and management between 2015 and 2021), and Portugal (CP Carga sold to shipping line MSC in 2015, and later renamed Medway).

3.2.2 International Incumbents

Deutsche Bahn's freight division, branded Railion, later DB Schenker Rail, and now DB Cargo again, started its internationalization back in 1999 by acquiring former DSB Gods, the rail freight arm of the Danish National Railways, and in 2000 taking over NS Cargo from Dutch Railways. In 2002 it took a minority stake at newly founded bls cargo, and in 2004 it acquired the Italian freight rail operator Strade Ferrate del Mediterraneo (SFM). In 2007 it also took over the small Swiss company Brunner Railway Service, EWS (including ECR in France) and the Spanish rail freight forwarding and intermodal company Transfesa. In 2008, it took over PCC Rail in Poland. In the same year, it aso acquired Logistic Service Danubius, an open access rail freight operator in Romania. In 2009 DB Schenker Rail Group produced a total of 94 Billion tonne-km across Europe. This was more than three times the activity of PKP Cargo and nearly four times that of Fret SNCF or Rail Cargo Group, part of Austrian Railways. (Werner H.-G. , 2010). By 2019, and as shown in Exhibit 10 below, DB Cargo had built a leading pan-European presence that stretched from the Iberian Peninsula to Nordic countries, and from the United Kingdom to East and Southeast Europe, with about 28 000 employees in 16 countries (DB Cargo).

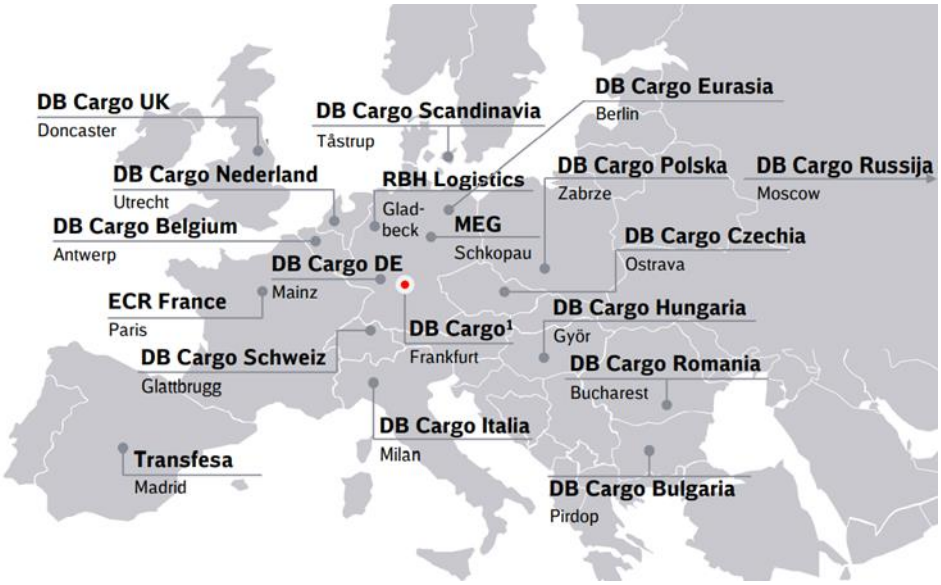


Exhibit 10: Pan-European Network of DB Cargo (2019)

SNCF Group also built out a pan-European footprint with Captrain as its international rail freight arm. It has affiliates in Germany (former Rail4Chem and other smaller acquisitions), Austria, Belgium, the Netherlands, Poland, Czech Republic, Spain, and Italy. In 2017 SNCF Group acquired a 45% shareholding in bls cargo, replacing DB Cargo that had sold its shares three years earlier. The European network of SNCF Group expanded further over the last decade covering Western, Southern and parts of Eastern Europe, as shown in Exhibit 11 below. With total volume of 33 Billion tonne-km, Rail Logistics Europe (RLE), as the group is now branded, is N° 2 in Western Europe (SNCF Logistics, 2019). In March 2022, the group made its latest acquisition with Takargo in Portugal.

Exhibit 11: Pan-European Network of SNCF Group (2019)

Rail Cargo Group (RCG), part of Austrian Railways is N° 3 in Europe with a total volume of about 28 Billion tonne-km. As shown in Exhibit 12 below, its network covers 18 countries in Central, Eastern, Southern and Southeastern Europe. About 70% of its staff works in the Austria home market (2 500+ employees) and in Hungary (1 600 employees). Rail Cargo Group started its internationalization in 2008 with the acquisition of MÁV Cargo, nowadays Rail Cargo Hungary (ÖBB kaufen ungarische MAV Cargo um 400 Mio. Euro, 2008). Since then, several smaller acquisitions have been added, including EBM Cargo (2015) and Private Car Train (2016) in Germany, and Rail Time Polska (2020) in Poland (Rail Cargo Group, 2022).

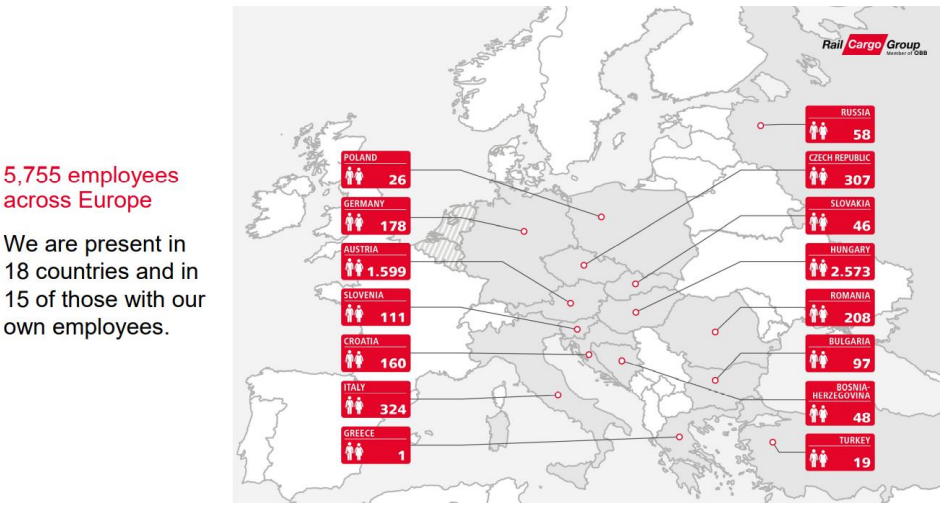


Exhibit 12: Pan-European Network of Rail Cargo Group (2021)

PKP Cargo is N° 4 in Europe with about the same size as RCG and a total production volume of about 28 Billion tonne-km and a network covering 9 countries in Central and Eastern Europe, as illustrated in Exhibit 13 below. PKP Cargo was partly privatized in 2013 (49,9% of share capital were floated) through an IPO. As the incumbent in Poland, it is still the market leader with a share of 50+%. PKP Cargo has built up a subsidiary in the Czech Republic and after the acquisition of AWT Rail Carriers in 2015 it is now the leading challenger to ČD Cargo, the incumbent in that country.

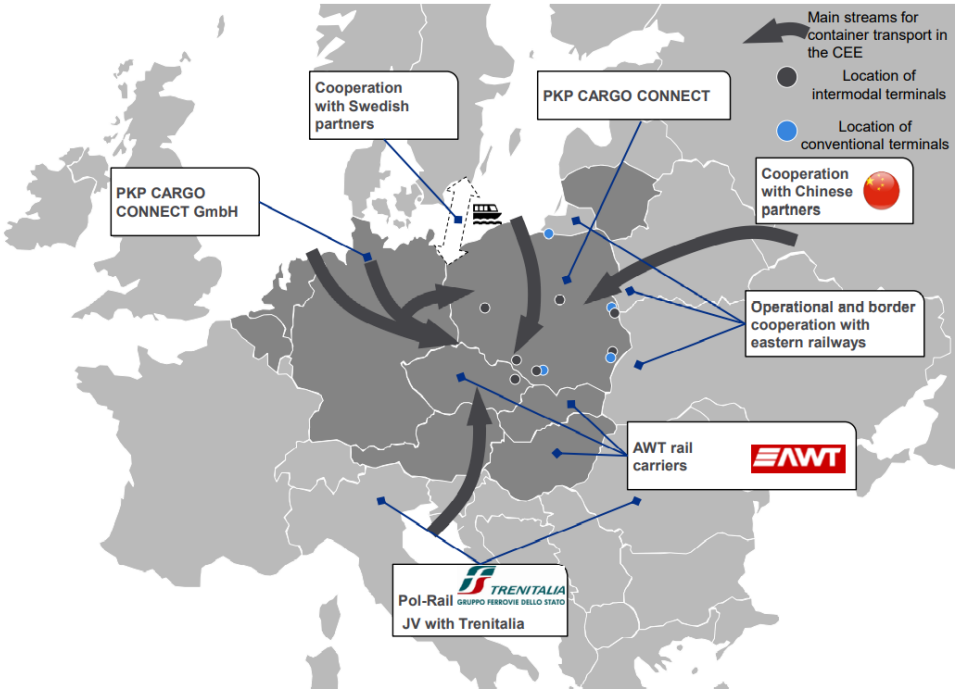


Exhibit 13: Pan-European Network of PKP Cargo (2018)

The international expansion of incumbents, that became challengers to their peers through foreign affiliates, was only one part of the development of rail freight market during this decade. New entrants also expanded internationally and broadened their footprint via affiliates that had national railway licenses and security certificates. Most notably, bls cargo, Lineas, LTE and Metrans posted strong growth and established

themselves as strong alternatives to national incumbents, and international affiliates of incumbents, like SBB Cargo International or TX Logistik (Trenitalia). Instead of growing internationally via mergers & acquisitions like incumbents, new entrants often grew by establishing strategic partnerships. Austrian carrier LTE, for example, established a strategic partnership in 2015 with Rhenus Group that acquired 50% of the share capital of Austrian construction company Porr (Rhenus becoming the new strategic partner of the GKB/LTE group, 2015). And bls cargo, after separating from the long-standing partnership with DB Cargo, found a new strategic partner with SNCF Logistics in 2017 (Agreement Reached with SNCF Logistics on Shares in BLS Cargo, 2017). Lineas acquired Dutch private railway, Independent Rail Partner, in 2021 (Lineas, the largest private rail freight operator in Europe supported by Argos Wityu, acquires the Dutch operator Independent Rail Partner, 2021).

3.2.3 Private Sector Challengers

Due to industry consolidation and M&A activity of large incumbents there are not that many truly private-sector player active in the European rail freight market. Part of the reason being that in the past the profit margins of rail freight companies had been quite small (2-5% ROS), or in many cases negative. Narrow margins and cyclical markets typically are not attractive to financial investors. Therefore, the private-sector players engaged in the European rail freight market are predominantly so-called “strategic investors.” Typical examples include Rhenus Group with 50% shareholding in Austrian rail carrier LTE since 2015 (The Rhenus Group enhances its Rail business unit by acquiring shares in LTE, 2015), MSC Mediterranean Shipping Company with 100% of Medway, the former CP Carga, since 2015 (MSC Rail completes the acquisition of CP Carga, 2016), or Bertschi Group with 25% of share capital of SBB Cargo International (Bertschi invests in SBB Cargo alongside partner firms, 2019). Logistics companies’ and ocean shipping lines’ strategic intent is to gain control over rail traction on key trunk routes or a network of hinterland connections to better link intermodal terminals and lowering their costs of rail transport.

There have been a few exceptions where financial investors acquired rail freight operators in Europe. The first recorded case has been a leveraged buy-out of Freightliner in 1996 by management with the support of UK-based PE firms 3i and Electra Private Equity (3i Private Equity and Epiris Acquires Freightliner Group, 1996). The first recorded deal in Continental Europe was Babcock & Brown acquiring 49% of share capital of Crossrail Benelux in 2007. However, Babcock & Brown divested its stake as early as 2010 due to their financial restructuring und voluntary adminisitration. The shareholder structure of Crossrail then changed several times in the following years up to when Rhenus sold 100% of its shareholding to bls cargo in 2019.

Other financial investors entering and leaving the European rail freight market have been:

- Arcapita with Freightliner Group from 2008 to 2015 (Freightliner acquired by Arcapita, 2008),
- Bridgepoint with CTL Logistics from 2008 to 2016 (Bridgepoint to buy 75 pct of Polish CTL Logistics, 2007)
- EQT Infrastructure with Hector Rail from 2014 to 2020 (EQT Infrastructure II acquires rail freight company Hector Rail AB, 2014)
- Argos Wityu with Lineas since 2015 (Argos Wityu Acquires Lineas, 2015),
- US-based railroad Genessee & Wyoming with Freightliner Group when it took over in 2015 from Arcapita (Genesee & Wyoming Inc. Enters into Agreement to Acquire Freightliner Group Limited, 2015)
- EQT Infrastructure with GB Railfreight from 2016 to 2019 (Hector Rail's owner announces intent to acquire GB Railfreight, 2016)

- Compass Partners bought CTL Logistics from Bridgepoint in 2016 (Compass Partners International Acquires CTL Logistics Sp. z o.o, 2016)
- Ancala bought Hector Rail from EQT Infrastructure in 2020 (Ancala Agrees to buy Hector Rail Group, 2020)

It appears that most private equity players have not been particularly successful with their investments in rail freight operators. The rare exceptions seem to be 3i and Electra, and subsequently Arcapita, with Freightliner Group. In many cases there have been so-called secondaries, when assets being passed on from one private equity firm to the next. Freightliner in the end was acquired by US-based railroad Genesse & Wyoming.

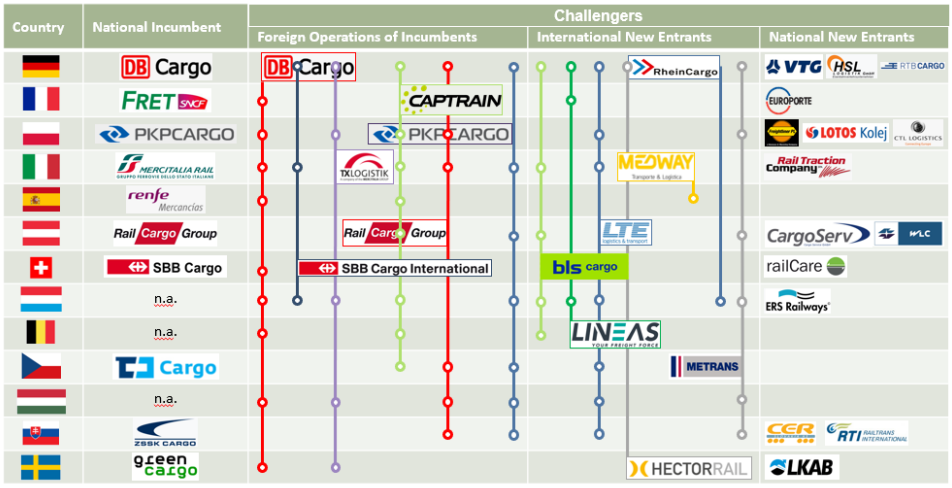
Other private sector rail freight operators are mostly operating on the national level (e.g., Lotos Kolej in Poland, railCare in Switzerland, LKAB in Sweden). This seems to confirm that over the last decade industry consolidation has progressed and that economies of scale or economies of scope really matter when offering international rail freight services in Europe.

3.2.4 Public Sector Challengers

There are a few remaining public sector players with stakes in new entrants in the rail freight market operating on an international basis. The most prominent player in this segment is bls cargo with three shareholders – Swiss regional railways BLS (52%), SNCF Logistics (45%), and Italian forwarder group Ambrogio Transporti (3%). Another large player is Metrans, wholly owned by HHLA Group, Hamburg's major port operator, with a strategic interest in intermodal connections to the hinterland in Central, Eastern and Southeastern Europe. HHLA shares are traded on the German stock market, but 69% of the share capital is owned by the City of Hamburg. Also, LTE can be seen as a challenger originally launched by public sector owners Graz-Köflacher Rail and Bus Operations (GKB), but since 2015 the privately held logistics company Rhenus holds a 50% of the share capital. Another case of a port-related challenger is Rheincargo (RheinCargo GmbH), which is jointly owned by the river port operators of the City of Cologne and City of Neuss / City of Dusseldorf. Rheincargo operates mainly along the river Rhine and holds railway licenses and safety certificates for Germany and the Netherlands.

3.2.5 Competitive Dynamics

There is presently a high level of rivalry between rail freight actors. The foreign operations of incumbents and international challengers (former new entrants) are expanding their international activities, focusing mainly on long-haul international services. Consequently, shippers, forwarding and logistics companies, and intermodal operators can choose between several capable rail freight operators within one country or along international corridors.



Source: Company Publications; ECM Ventures Analysis

Exhibit 14: Rail Freight Competitive Landscape in Selected European Countries (2022)

As shown in Exhibit 14 above, Amongst the foreign operations of incumbents, DB Cargo and Captrain (SNCF) have the broadest geographic footprints with sizeable operations in about 10 countries (in addition to their home markets). Rail Cargo Group and PKP Cargo are concentrating their international activities on Central Eastern and South Eastern Europe plus Germany, while SBB Cargo International and TX Logistik (Trenitalia) are more focused on the North South Corridors through Switzerland and Austria, connecting the ARA ports with Italy.

International new entrants are more focused in terms of the geographic areas they cover. For example, bls cargo and the much smaller Rheincargo concentrate their operations on the North-South corridor along the river Rhine. LTE is mainly connecting the ARA ports with Austria and Southeastern Europe, competing with DB Cargo and Rail Cargo Group. Metrans focuses on Central Eastern and Southern Eastern Europe, competing directly with DB Cargo, Rail Cargo Group and PKP Cargo. LINEAS (fromerly B-Cargo / Interferryboat) connects its Belgian home market, as well as the port of Rotterdam, with Germany and selected regions in France. Hector Rail and Medway are even more focused players. Hector rail was founded as a domestic challenger to Green Cargo in Sweden, and later expanded internationally, connecting Sweden with Germany via Denmark. Medway was formed when Mediterranean Shipping Company (MSC) acquired CP Carga in Portugal. The privatized rail freight operator soon started to operate international trains between Portugal and Spain, competing with Renfe Mercancías. Later, new railway operators where established in Italy and just recently in Belgium (Papatolios, 2022).

Next to these international players, there are also several challengers focusing on domestic markets and competing with national incumbents as well as international challengers. Such players include Europorte (France), RTB Cargo (Germany), Lotos Kolej (Poland), CargoServ (Austria), and railCare (Switzerland). Some of the challengers that were orginally focused on their domestic markets, such as Rheincargo or Hector Rail, have since expanded internationally, setting an example for others to follow. In the past, a significant number of former new entrants with a national operating focus have been acquired by incumbents to strenghten international operations, or have been merged with other challengers to accelerate growth and expand an internation footprint. We expect the market consolidation to continue.

3.3 Competitive Dynamics and Market Share Development

3.3.1 Business Model Descriptions

We identified four different business models in the European rail freight market and named them *Wagonload Network Operator*, *Integrated Intermodal & Train Operator*, *National Rail Freight Carrier*, and *International Rail Freight Carrier*. These business models are distinct and require specific resources, processes, and commercial positioning to prosper. The high-level descriptions of these business models are presented in Exhibit 15 below.

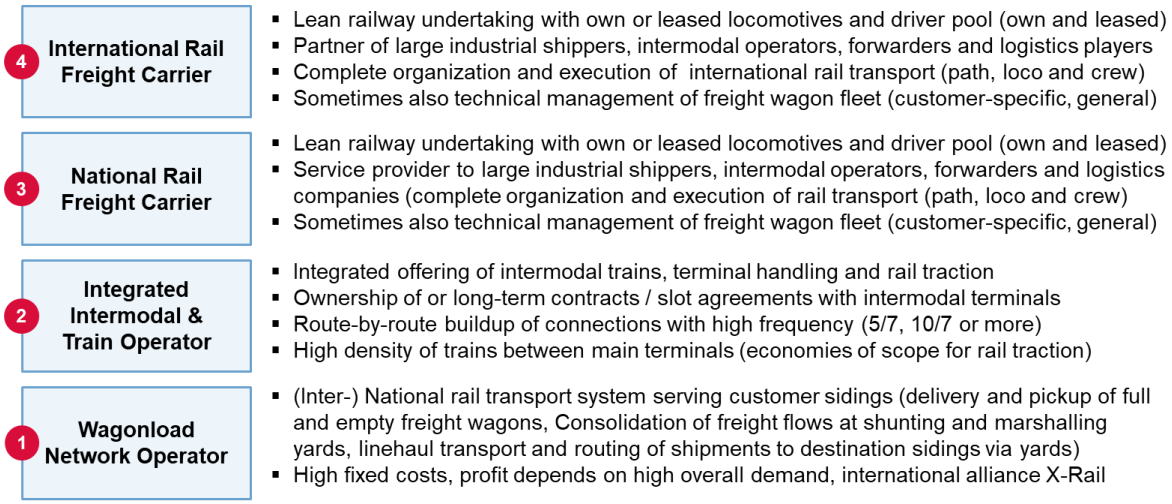


Exhibit 15: Four Business Models of European Rail Freight Operators

The business model *Wagonload Network Operator* describes one of the two business models followed by the incumbent rail freight operators in Europe. It is the legacy business model of state-owned freight railways serving a nationwide system of customer rail sidings. They involve a rather complex system comprising typically of three levels (marshalling yards, shunting yards, and sidings) and typically offers daily service on a 5-6 days per week basis. Shunting locomotives deliver empty, and pickup loaded, freight wagons to/from customer sidings. Shunting locomotives call several sidings and return to local shunting yards, where shipments from several local loops are consolidated. Mainline locomotives then pull the freight wagons to a regional marshalling yard. There, wagons are sorted by destination regions (domestic or international). Mainline locomotives then haul full trains between major marshalling yards. At the destination yards the freight wagons are resorted to their destinating shunting yards. Mainline locomotives then carry shorter trains to the shunting yards, where these trains are split up and wagon groups are pulled by shunting locomotives for local delivery. There are some synergies with unit train operations of incumbent railways as the wagonload system can be used to redistribute empty freight wagons or reposition idle locomotives, simply by hooking them up with the regular mainline trains between network nodes.

Over the last decades the shrinking wagonload networks in all European countries have been frequently restructured in attempts to restore profitability. The reasons for marginal profits or constant losses are manyfold. More and more industrial and trade customers stopped using their sidings to put cargo on rails as truck transport had become cheaper, faster and was appreciated for its flexibility. Production volume of basic industries that consumed or produced dry and bulk commodities, or heavy and bulky intermediate, or even finished products, have been shrinking. Wagonload networks have a high proportion of fixed costs and can only be profitable when there is high demand in the system. Even then, the above average density and therefore profitable flows / sidings are needed to offset losses caused by below average density flows / sidings.

In addition, challengers find it advantageous to focus on high-density flows that can be served with multi-customer trains or wagon group offerings, which in turn reduces the market addressable by the wagonload systems. Hence, the pressure for the further streamlining of wagonload networks is expected to continue for the foreseeable future.

A specific business model has emerged with the *Integrated Intermodal & Rail Freight Operator*. Generally, intermodal operators and rail freight carriers tend to be separate business models to allow for strategic focus and free sourcing of rail traction services. There are only a few examples for this business model in Europe. To some extent this combined business model can be seen at Swiss intermodal company Hupac that acquired ERS Railways, including a 47% shareholding of boxXpres.de (Hupac will acquire ERS Railways to strengthen its position in maritime hinterland logistics, 2018), and through this move can cover part of the demand for international traction services for its own intermodal trains. Other examples is MSC Mediterranean Shipping Company when it established MSC Rail to manage hinterland connections, now under the Medway brand. A first move was the acquisition of CP Carga, the formerly state-owned rail freight operators in Portugal in 2015, and the second was the establishment of a new rail freight carrier in Italy in 2020 (Action in yellow: Medway Italia's freight trains in Italy, 2020). Both Hupac and MSC control intermodal flows and can now deploy their own traction resources on the most profitable high density flows. Considering that running a profitable rail carrier operation requires scale and scope, the strategy of Hupac and MSC Rail is likely to involve growing their rail carrier activities.

The most prominent example of the integrated business model is Metrans, a fully owned subsidiary of HHLA, the port operator of the City of Hamburg. This intermodal operator has built a large network in Central Eastern Europe, connecting the port of Hamburg, and other North Sea and Adriatic Sea ports, with the hinterlands. Strategic assets include intermodal terminals in Česká Třebová, Praha, Dunajská Streda, Budapest and Posnań. Furthermore, Metrans owns and operates over 60 mainline locomotives, several shunting locomotives, and about 2 500 platform wagons for intermodal services. With this fleet, and over 1 100 employees, Metrans has achieved a scale favorable to sustainable profitable growth. Currently, the company posts revenues of about 300mn EUR. Metrans works through partnerships and allows other intermodal operators to use their terminals and/or offers to haul their trains. This enables them to achieve high utilization of their terminal infrastructure, locomotive fleet, and driver pool. The major driver of profit is a high load factor within the expanding network. It can also be seen from the network map, in Exhibit 16 (Metrans, Company Website, 2022) below, that several terminals are working as a hubs, allowing for transloading of containers to serve secondary terminals in regions with lower demand density.

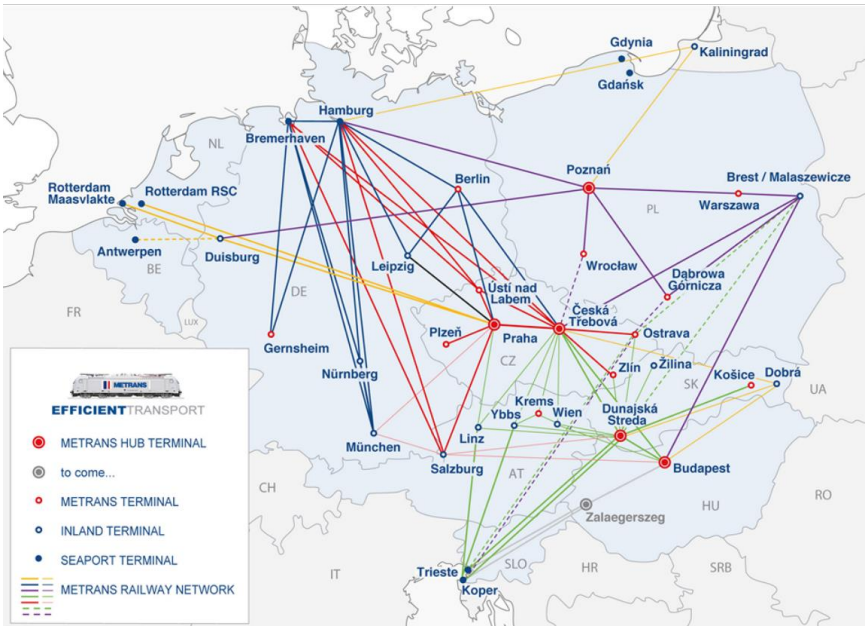


Exhibit 16: Metrans Network – Terminals and Train Connections (2021)

The business model of *National Rail Freight Carrier* tended to be the "standard model" for new entrants in the past. Nowadays, fewer players focus solely on national train connections, which remains a viable positioning in large domestic markets like Germany, Poland, the United Kingdom, or Spain. Although this is the "second business model" for incumbent rail operators in their home market, they rarely have been organized in this way. As shown below in Exhibit 17, it should be noted that Rail Cargo Group has organized it's international operation with a clear split between rail freight forwarding (acquisition and management of customer contracts, procurement and monitoring of traction services) on one hand, and rail freight carrier (provision of national and international traction services) on the other (Rail Cargo Group - Corporate Presentation, 2017).

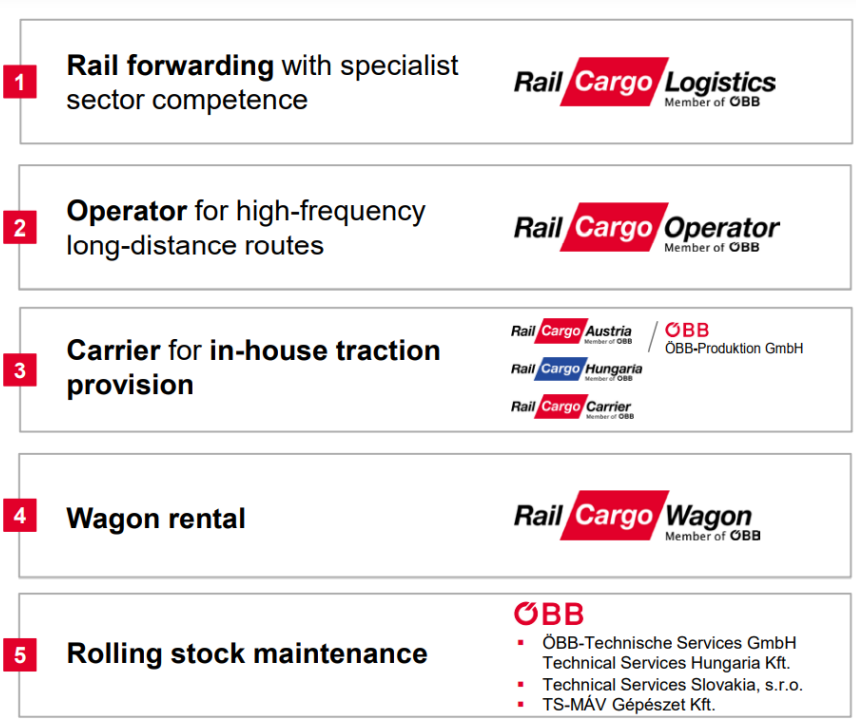


Exhibit 17: Business Model Overview Rail Cargo Group

Typical examples of the *National Rail Freight Carrier* are Freightliner PL and Lotos Kolej in Poland, WLC Cargo and CargoServ in Austria, BoxXpress, HSL Logistik, and RTB Cargo in Germany, or railCare in Switzerland. These tend to be lean organizations with minimal overheads that focus on maximizing the utilization of locomotive fleets and driver pools. Furthermore, these players typically have a clear focus (e.g., dry and liquid bulk trains with fixed train composition and routes, or intermodal trains) and aim to serve high-frequency traffic (one or more roundtrips per day). The benefits of focusing on national traffic include the deployment of fully depreciated legacy locomotives, homogeneous driver pools, dealing with a single infrastructure manager, and avoiding cross-border technical, administrative or partner interface hassles. This business model proved successful in the past, prior to industry consolidation and the growing need to serve international routes. It will remain viable for short-haul national traffic in large countries, typically for dry and liquid bulk movements and domestic intermodal trains.

The business model *International Rail Freight Carrier* has become the preferred one for both grown up new entrants and for the international arms of incumbents. Typical examples are bls cargo, Lineas, LTE, and with smaller international footprint: Hector Rail, Rheincargo and Medway. But also, Captrain (SNCF Group), Rail Cargo Group Carrier companies, SBB Cargo International and TX Logistik (Trenitalia Group) as well as the international "production companies" of PKP Cargo and DB Cargo that follow this business model. Nevertheless, new entrants have defined the standard for lean and agile rail carriers focusing on selected international routes, increasing frequency of service and utilization of their multi-system locomotive fleet and international driver pools. This was completed by a lean corporate center focusing on marketing and sales, asset management, and a 24/7 operating center simultaneously planning and managing the three main resources that international paths, locomotives, and drivers. It is important to build a very strong position on international corridors to drive unit costs down as much as possible and to thus reach a competitive advantage. It is not the size of operations that makes a winner, but the economies of scope. Some players are focusing on one corridor while others operate on several corridors, which end up looking like the broad networks typically served by incumbents. It must be noted that the focus on selected corridors allowing for high-frequency and low-cost operation will make the difference between the "also runs" and the winners who post sustainable profitable growth.

3.3.2 Main Differences between Incumbents and Challengers

The fundamental differences between incumbents and the challengers in the rail freight market have largely been discussed above. It is sometimes complicated to characterize considering that *challengers* are either legacy or new entrants, and that the international arms of incumbents were in most cases acquired from new entrants. Hence it is useful to compare the main features of what separates incumbents in their home market from challengers, as illustrated in Exhibit 18 below.

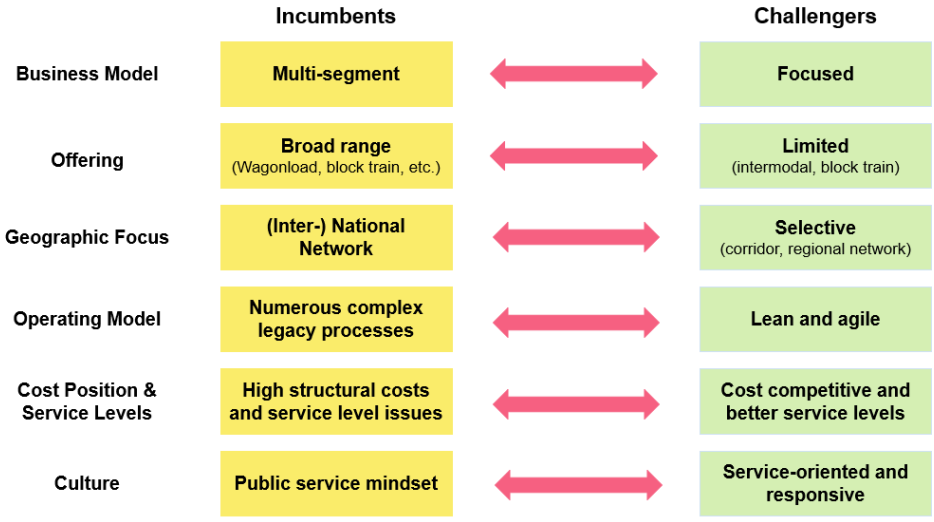


Exhibit 18: Fundamental Differences Between Incumbents and Challengers

Firstly, incumbents face the challenge of having to manage several different business models under one roof and from attempting to achieve synergies through complex organizations. In contrast, challengers manage a single business model and focus on achieving economies of scope. Where incumbents provide customers with a complete offering, including wagonload and block train services, intermodal service, wagon leasing and maintenance, challengers on the other hand propose a limited range of services. In most cases challengers focus on traction service for intermodal and logistics trains or block trains (dry and liquid bulk, automobile parts and finished cars). Where the geographic focus of incumbents is typically very broad, both on national or international basis, challengers tend to focus on selected corridors or regional networks with high demand. The operating model of incumbents is defined by numerous complex legacy processes and rules (including costly labor agreements on work time and benefits), whereas challengers constantly focus on staying lean and agile. Where the resulting cost base of most incumbents tends to be relatively high, challengers' DNA can be described as very cost competitive and focused on high service levels (i.e., high reliability, punctuality, and timely customer information). Finally, there are notable differences in culture with incumbents tending to have a public service mindset heritage, serving client homogeneously, and with a limited appetite for change. Challengers, in contrast, are service-oriented and responsive but serve only customers that fit their strategic focus and business model. Consequently, challengers are faster in adjusting their operating models to market changes.

3.3.3 Market Share Development in Europe

Over the last two decades, the shift in market share – measured in train-kilometers – away from incumbents towards challengers, has been quite remarkable. As shown in Exhibit 19 below, the share of challengers grew from a mere 10% in 2003 to about 20% in 2008, to 48% in 2020. It is expected that challengers will have overtaken incumbents in 2022 for the first time in history. This is not only a tribute to the challengers' focused business model and excellent execution, but is further driven by the steady growth of intermodal and logistics trains in the rail freight market. This segment of mainly international trains over long distances has become the stronghold of challengers while incumbents struggle to organize competitive international offerings. Even when incumbents win such contracts, their operational performances – relying on their international incumbent partners – often fails to meet customer expectations. This prompted large incumbents to establish

their own international operations by acquiring new entrants. They thus combine the lean and agile operating model and service-oriented culture of challengers with their international marketing power.

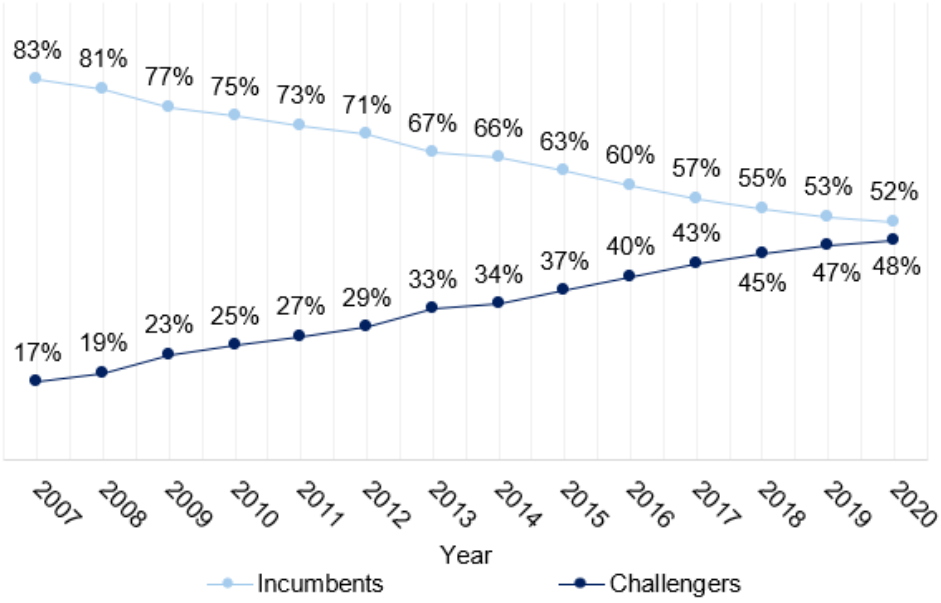


Exhibit 19: Market Share Development of Incumbents vs. Challengers

The development of market shares of incumbents versus challengers varies significantly in the different European countries, as shown in Exhibit 20 below.

1) For Switzerland market share information is only available for transalpine flows (mostly transit traffic)
Source: IRG Rail Market Monitoring Report 2020, National Regulators; ECM Ventures Analysis

Exhibit 20: Market Share of Incumbents vs. Challengers in Selected Countries (2020)

In several countries, incumbents managed to defend their strong position and still hold 60-65% of the domestic market (measured in train-km). This is the case for Fret SNCF in France, Rail Cargo Austria, and SBB Cargo in Switzerland. In other markets, challengers collectively account for more than 50% of the market. In some other

markets, incumbents remain the largest players, despite operating less than half of all freight train-kms. This is the case in Poland (PKP Cargo), Italy (Mercitalia Rail) and Germany (DB Cargo). Finally, there are several countries where there is no longer a national incumbent as the government decided to privatize or sell the rail freight arms of their national railways. This is the case for the Netherlands, Belgium, the United Kingdom, Hungary and Portugal.

3.3.4 Impact of Challengers on Rail Freight Market Growth

From observing market developments over the last two decades, the liberalization of rail freight markets in the European Union has had a measurable and positive impact. It introduced competition and helped to drive cost reduction and brought innovation to the sector. Challengers have become instrumental in winning new customers for rail freight services, and away from other modes, particularly with new intermodal and logistics trains on international routes. Without this, the European rail freight market would have very likely stagnated over the last 20 years, and modal share vs. road would have further declined.

Regardless of whether privately-owned or as foreign arms of incumbents, challengers are increasingly setting the standards in the market as they bring efficiency improvement, growth, and innovation in customer service and technology deployment. This challengers' impact is highlighted in Exhibit 21 below.

Driving operational efficiencies	• Focus on one operating model and standardized production processes • Geographic focus (corridor, regional perimeter) • High assets and resources productivity maximize sector capacity • Multisystem locomotives, international drivers, single operating centre
Enabling and driving market growth	• Response to and anticipation of (further) growth in select market segments • Scalable business model with an ability to expand capacity relatively quickly • Ready to invest in new customer relationships and transport flows / contracts
Establishing new levels of customer service	• One-stop-shop approach for all commercial & operational customer relationships • Online tracking & tracing of trains established as standard already 10 years ago • Rapid information and alternative solution to customers when disruptions occur
Pioneering new solutions / offerings	• Readiness to co-create solutions with customers (e.g., rail logistics offerings) • Introduction of and broad use of new technologies (multi-system locomotives, hybrid locomotives for last-mile, automated coupling, extra-long trains)

Exhibit 21: Challengers' Impact on Rail Freight Market

Challengers have set new standards in operational efficiencies, keeping strategic discipline, and applying execution excellence principles. By sticking to standardized production processes, and by focusing on high-demand rail corridors or regions, they constantly increased asset and resource utilization. They also were leaders in deploying multi-system locomotives and end-to-end planning and production of international train services. With their scalable operating model, they were able to rapidly expand their capacity and thereby enabling strong growth in intermodal and logistics train services across Europe. They demonstrated their readiness to invest in new customer relationships. For over a decade now, challengers have offered single points of contact for all commercial and operational customer interactions and have provided online tracking and tracing for their trains. In case of irregularities (e.g., route congestion, technical issues), they quickly inform their customers, present solutions, and communicate new expected times of arrival. Finally, they pioneered new commercial and technical solutions such as logistics trains with specific requirements, and have

introduced technologies such as multi-system locomotives, hybrid locomotive for last-mile connections without catenary, or automated coupling.

Challengers are expected to stay true to their pioneering spirit and to remain drivers of growth and innovation in European rail freight markets.

4. Country Market Analysis

4.1 Germany

Germany represents the largest rail freight market within the European Union. German rail reform resulted in the establishment of Deutsche Bahn AG on January 1, 1994. This was achieved by the merger of former Deutsche Bundesbahn (state-owned railway in Western Germany) and Deutsche Reichsbahn (state-owned railway in Eastern Germany) and shifting accumulated debt of both entities into a special-purpose vehicle called Deutsches Eisenbahnvermögen (German Railway Fund). In addition to this debt-free restart for DB Group, Germany implemented legislation on liberalization of passenger and freight railway services. O*pen access* to the German rail network was granted immediately and a new funding scheme for regional and commuter railway services was effective 1 January, 1996 along with the introduction of mandatory tendering for public service contracts after a limited transition period for existing contracts. As a result, the passenger and freight rail market in Germany became very competitive and new entrants were challenging Deutsche Bahn in all business segments. Today challengers have captured more the 50% of the rail freight market in Germany. Taking to account that DB Cargo is the sole provider of nationwide wagonload services, challengers are leading the market in the block train business (intermodal, logistics, automotive, bulk commodities, etc.). Highlight of the German rail freight sector are shown in Exhibit 22 below.

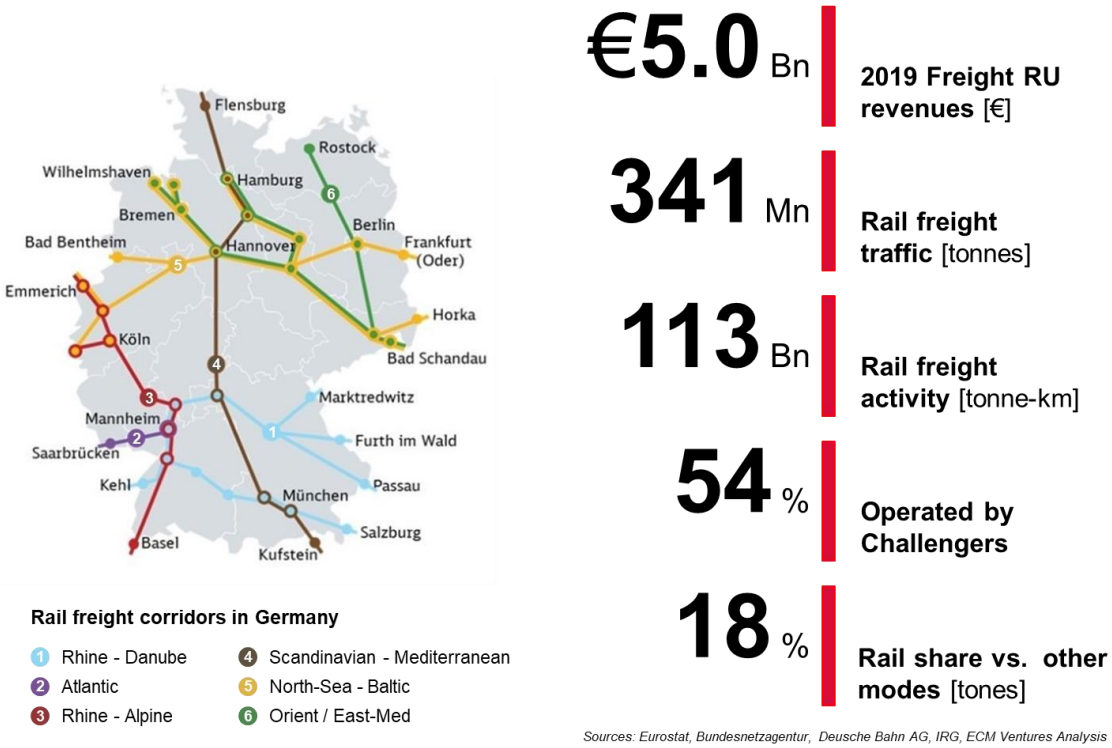


Exhibit 22: Country Profile Germany - Rail Freight Corridors and Key Figures

Germany is not only the largest rail freight market with respect to originating and terminating traffic, but also the most important transit country in Europe. Six major rail freight corridors are routed through Germany towards all directions ranging from major ports at the North Sea and the Baltic Sea as well as key industrial areas in Continental Europe. In 2019 a total of 341 Million tonnes were transported by rail, which represent a modal share of 18%. Total rail freight activity reached 113 Billion tonne-km and 54% of all freight train activity,

calculated on a train-km basis, was operated by challengers. The market share of DB Cargo recently fell below 50%.

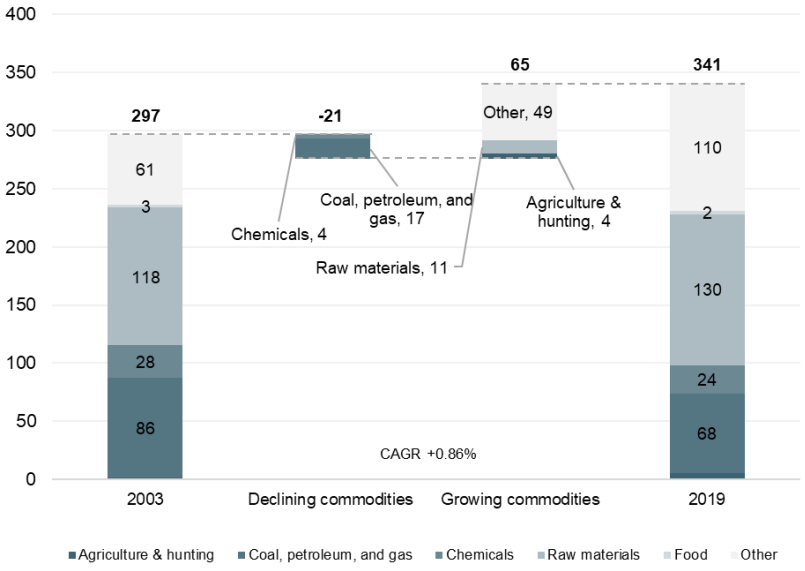


Exhibit 23: Development of Rail Freight Volume in Germany [Million tonnes]

As shown in Exhibit 23 above, the German rail freight market grew at a modest rate of 0.9% on average from 297 Million tonnes in 2003 to 341 Million tonnes in 2019 (Eurostat; ECM Ventures analysis, n.d.). Despite the little growth in absolute terms, there was a significant shift away from traditional bulk commodities, like coal, petroleum, oil and gas, towards "other" – a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. The so-called "Other" segment grew from 61 Million tonnes, or 20% of total volume in 2003, to a share of 32% in 2019 or 110 Million tonnes in total. The growth in rail freight volume stems from winning new customers and shifting merchandise goods from road to rail transport, mainly in the *combined transport* (*intermodal)* segment.

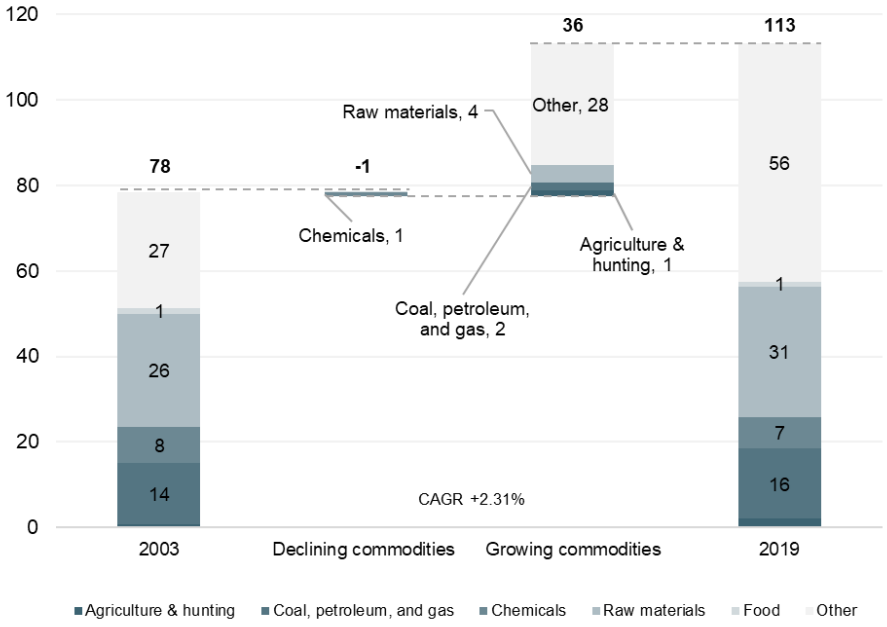


Exhibit 24: Development of Rail Freight Activity in Germany [Billion tonne-km]

Looking at rail freight activity in Exhibit 24 above, measured in tonne-km, it grew annually by 2.3% on average from 78 Billion tonne-km in 2003 to 113 Billion tonne-km in 2019 (Eurostat; ECM Ventures analysis, n.d.). Rail freight activity is multiplying tonnage of trains with average distance. From this analysis it can be noted that the average distance of rail freight transport in Germany grew from 262 km in 2003 to 331 km or 26% in total. While traditionally rail dry and liquid bulk commodities posted modest growth, merchandise goods (category "Other") doubled their volume from 27 Billion tonne-km to 56 Billion tonne-km. In 2019 this segment represented half of the German rail freight activity. Average distance of transport for these merchandise goods grew from 443 km in 2003 to 509 km or 15% in total. All other segments consolidated posted a modest increase of average distance of transport from 214 km back in 2003 to 247 km in 2019. The growing market segment of "Other," which mainly comprises of intermodal traffic, typically has twice the average distance compared with traditional rail commodities. This also indicates a higher share of international traffic, where challengers are focusing their activities, while incumbent DB Cargo, alongside its wagonload network, focuses on dry and liquid bulk commodities.

As shown in Exhibit 25 below, Intermodal traffic has more than doubled and, except for a sharp decline in 2009 as result of the global recession, posted steady growth over the last two decades reaching 47 Billion tonne-km in 2019 (Eurostat; ECM Ventures analysis, n.d.). It should be noted that in Germany, semi-trailers (unaccompanied) represent about 34% of the intermodal market, which is much higher than in any other European market. Containers and swap bodies account for the other 2/3 of the intermodal market. The growth in intermodal over the last 10 years is primarily attributable to semi-trailers. This indicates increasing success in shifting cargo from road to rail, but not in competition with road carriers. It is rather a new form of cooperation between rail and road, where intermodal trains serve the long-haul and road haulers take care of the local pickup and delivery of cargo.

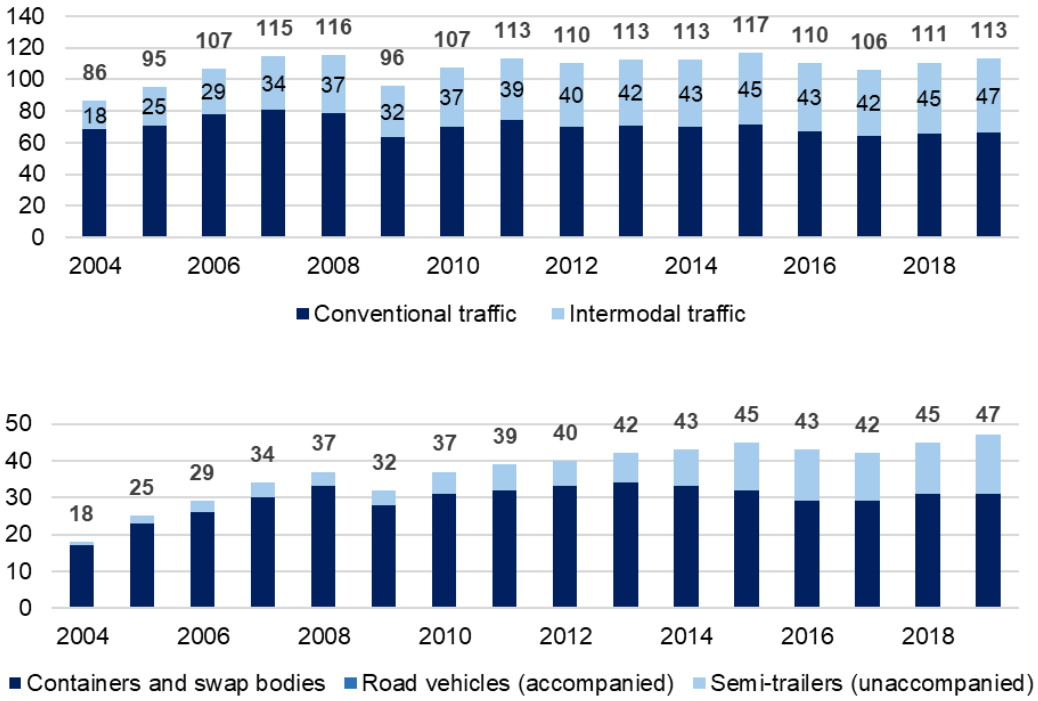


Exhibit 25: Development of Intermodal Traffic in Germany [Billion tonne-km]

Looking at international rail flows in Exhibit 26 below, the Netherlands stand out as the largest origin country for rail flows to Germany (about 19 Million tonnes), followed by Italy (13 Million tonnes), Austria (8 Million

tonnes), The Czech Republic (8 Million tonnes), Belgium (6 Million tonnes) and Poland (5 Million tonnes) (Eurostat; ECM Ventures analysis, n.d.).

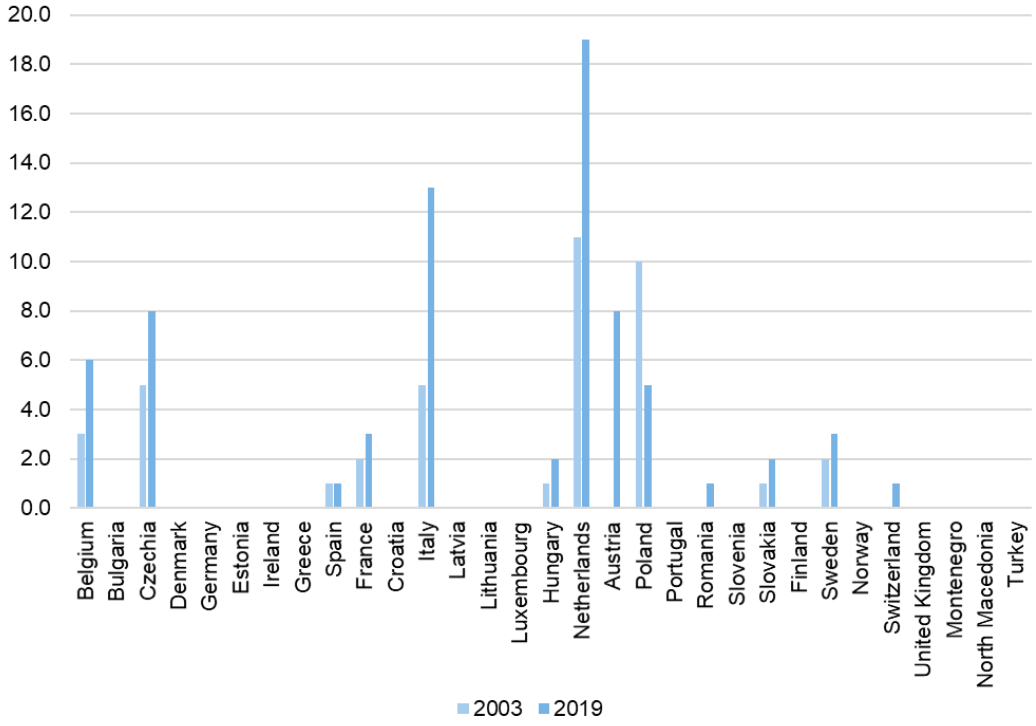


Exhibit 26: Incoming Rail Freight Volume to Germany [Million tonnes]

The Netherlands and Belgium are key origins due to the major ports of Rotterdam, Amsterdam, Antwerp and Zeebrugge with a high share of intermodal traffic, while Italy, Austria, The Czech Republic, and Poland are supplying raw materials, components and finished goods for German industry and trade sectors. Hence, traffic will be a mix of traditional block trains for dry and liquid bulk commodities and intermodal trains. Most significant growth was recorded for The Netherlands (+73%) and Italy (+170%) driven by a strong increase in intermodal traffic.

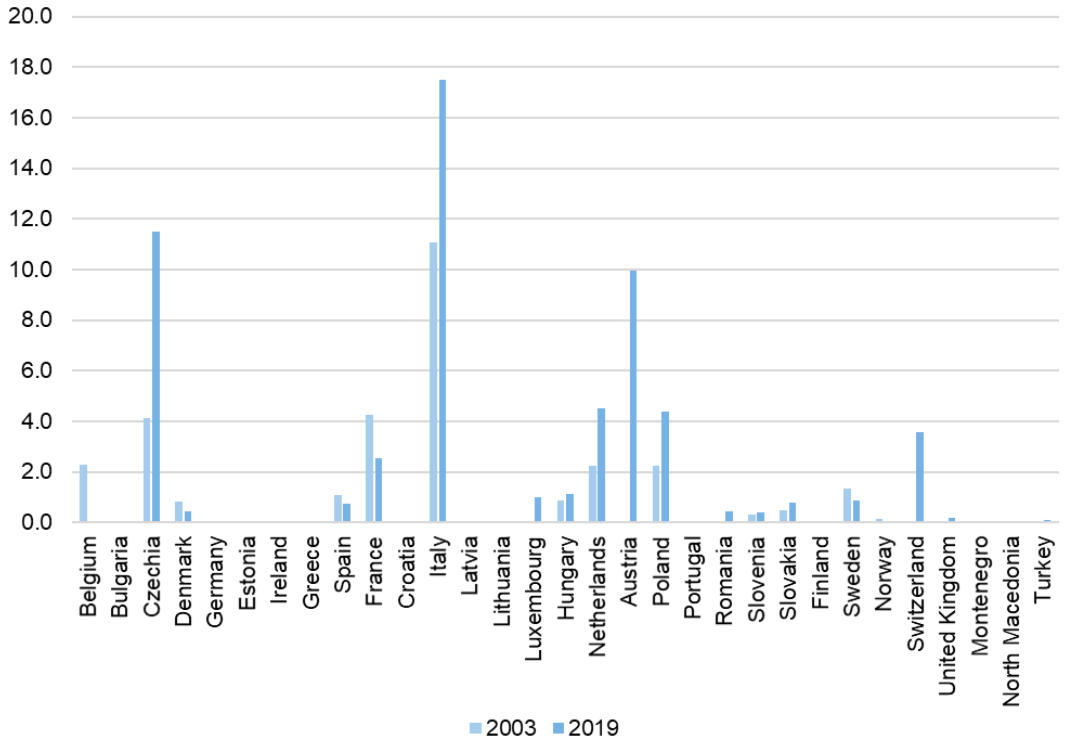


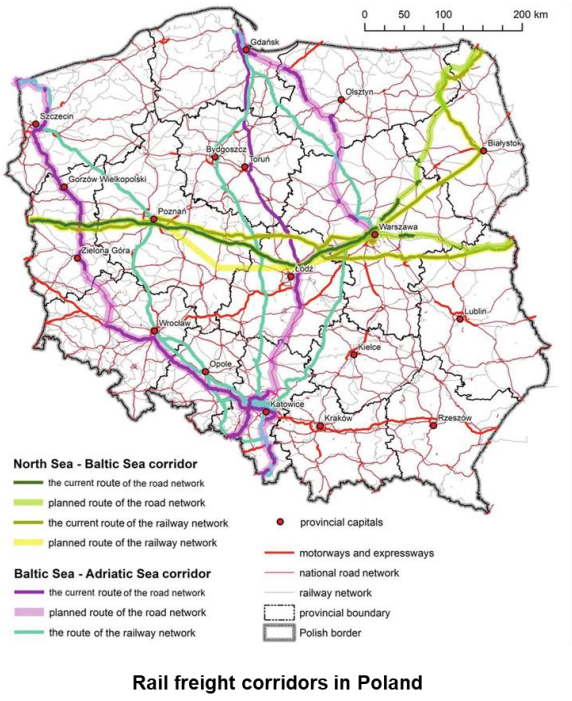
Exhibit 27: Outgoing Rail Freight Volume from Germany [Million tonnes]

As shown in Exhibit 27 above, Italy (17.5 Million tonnes) is the most important destination country for rail freight originating in Germany, followed by The Czech Republic (11.5 Million tonnes) and Austria (10 Million tonnes). Smaller volumes are shipped to The Netherlands (4.5 Million tonnes), Poland (4.5 Million tonnes) and Switzerland (3.5 Million tonnes). Volumes to Italy (+60%) and The Czech Republic (+180%) grew significantly over the last two decades and both countries are key destinations for intermodal trains from German ports or ARA ports (Antwerp-Rotterdam-Amsterdam) located in Belgium and in the Netherlands (Eurostat; ECM Ventures analysis, n.d.).

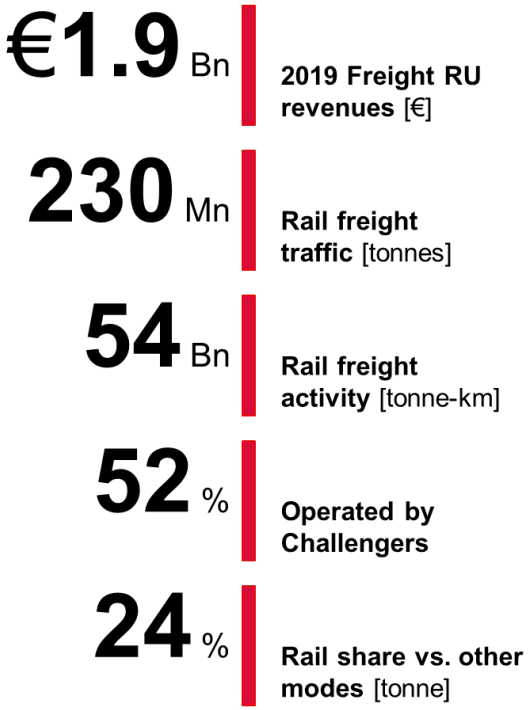
4.2 Poland

Polish rail freight accounts for €1.9 Billion of revenues and is the second-largest market after Germany. PKP Cargo is the market leader, it was spunoff in 2000 from Polskie Koleje Państwowe (PKP), the Polish state railways after a restructuring program which had the mother company split into 24 entities. Since 1 October 2001, PKP Cargo is part of PKP S.A. Group which is the largest shareholder (with a 33% share). On 30 October 2013, PKP Cargo was listed on the Warsaw Stock Exchange (WSE). The company became the first rail freight operator in Europe to go through an IPO. Outisde Poland, PKP Cargo operates in Germany, the Czech Republic, Slovakia, Austria, Belgium, the Netherlands, Hungary, and Lithuania.

The liberalization of the Polish rail freight market has been formally established by the Railway Transport Act of 1997 which introduced the concept of "licensed operator" (i.e., railway undertaking), an entity authorized to provide railway services. In the following two years (1998 - 1999), 21 operators (including PKP) were granted freight licenses in Poland creating a highly competitive market which, today, is 52% served by challengers.



Rail freight corridors in Poland



Sources: Eurostat, IRG, ECM Ventures Analysis

Exhibit 28: Country Profile Poland - Rail Freight Corridors and Key Figures

As shown in Exhibit 28 above, Polish corridors connect the main Polish and European seaports of Gdańsk, Gdynia, Świnoujście, Rotterdam, Amsterdam, Zeebrugge, Antwerp, Hamburg, and Bremerhaven with industrial areas in the Polish hinterland . In 2019 a total of 230 Million tonnes were transported by rail, which represents a modal share of 24% compared to road and maritime transport. Total rail freight activity reached 54 Billion tonne-km.

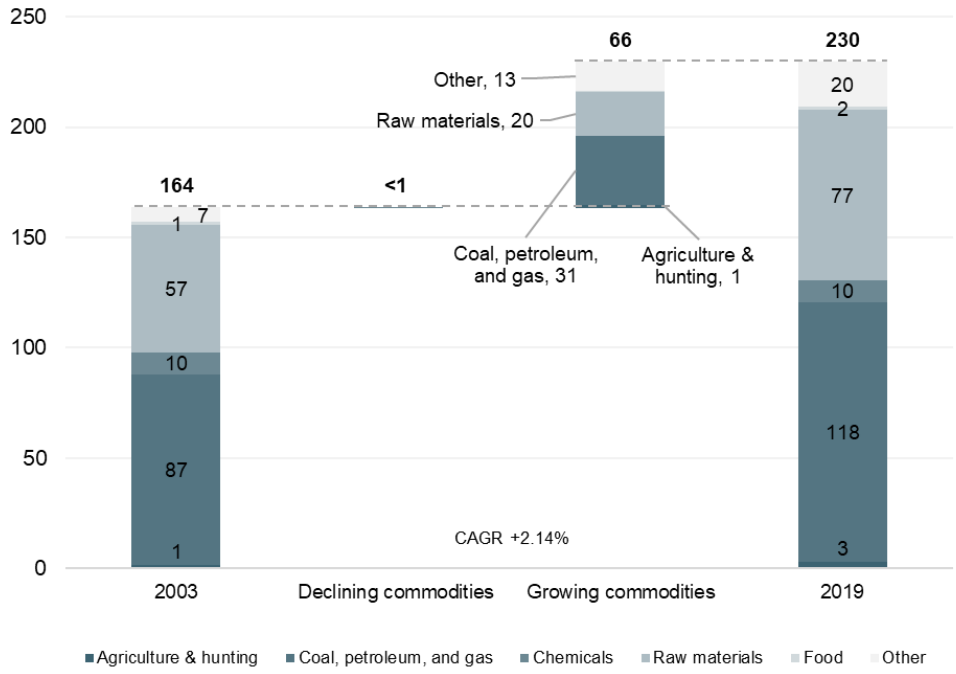


Exhibit 29: Development of Rail Freight Volume in Poland [Million tonnes]

As shown in Exhibit 29 above, the Polish rail freight market experienced growth within the last 18 years with a positive 2.14% CAGR in the period 2003 – 2019, rising from 164 Million tonnes in 2003 to 230 Million tonnes in 2019 (Eurostat; ECM Ventures analysis, n.d.). This trend has been particularly driven by the development of the country that occurred in the late 1990s and early 2000s when Poland joined the European Union.

Industrialization and development of the country enhanced the production and usage of coal and other fossil fuels which accounted for about half of the growing commodities column in Exhibit 29 above, and raw materials. This development is rather exceptional in the EU and Poland still appears as a very traditional rail freight market with a dominant share of dry and liquid bulk commodities. A significant share of the growth (20%) is attributable to “other” commodities – a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. The so-called “Other” segment grew from 4% in 2003 to a share of 8% in 2019 or 13 Million tonnes in total.

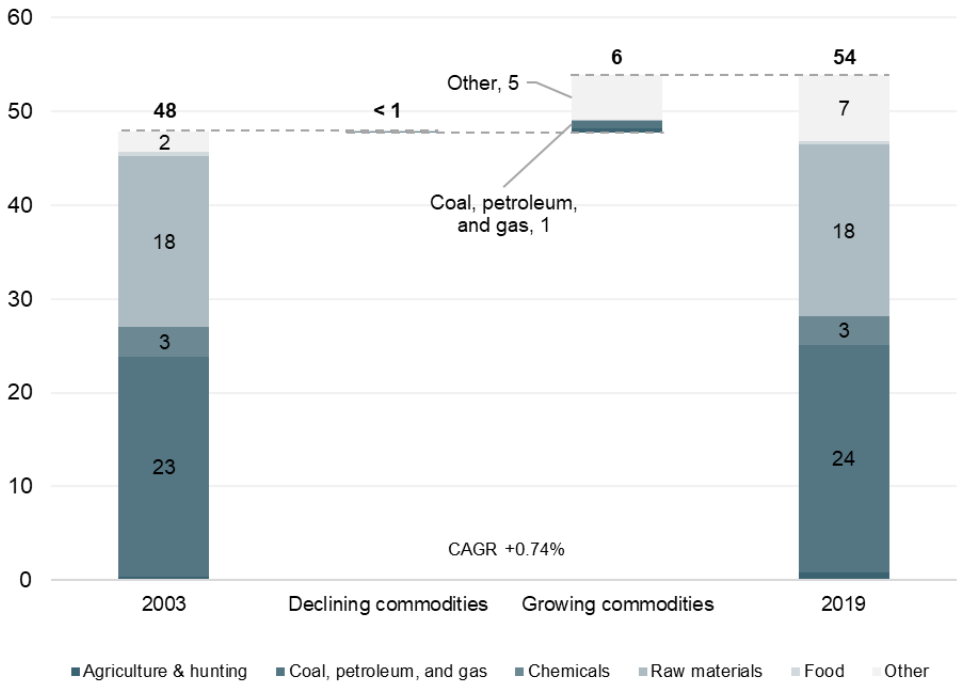


Exhibit 30: Development of Rail Freight Activity in Poland [Billion tonne-km]

As for the rail freight activity measured in tonnes-kilometers, shown in Exhibit 30 above, the market experienced a growth from 48 Billion Tonne-Kms in 2003 to 54 Billion Tonne-Kms in 2019 (0.74% CAGR). While traditional bulk commodities, such as fossil fuels, accounted only in a limited measure to the overall growth, the "Other" commodities category (described above) increased its size from 2 Billion Tonne-Kms to 7 Billion Tonne-Kms in 2019, representing 12% of the Polish rail freight market.

The growing market segment of "Other", mainly comprises intermodal traffic. In 2019, while the overall rail activity decreased by 7%, the intermodal traffic increased by 16% compared to the previous year in terms of rail freight activity. Average distance of rail freight transports in Poland decreased from 292 km in 2003 to only 235 km in 2019 – likely caused by more short-haul transport of dry and liquid bulk commodities. This is confirmed by the increase of average distance for intermodal and logistics trains from 286 km in 2003 to about 350 km in 2019. As shown in Exhibit 31 below, Intermodal traffic in Poland still has a relatively small market share compared with other countries in Europe but is expected to grow strongly over the next couple of years.

As for the competitive landscape, PKP Cargo alone accounted for the largest share in intermodal transport (44.1%). Nevertheless, the importance of the challengers in this market segment is growing year by year. Among rail carriers, the following companies recorded a significant share in terms of intermodal transport in 2019: Captrain Polska, PCC Intermodal, DB Cargo Polska, and LTE Polska. Their total market share, given the volume of freight served, was approximately 39%. Due to its geographic location and the booming e-commerce industry, Poland can further develop the market of intermodal transport.

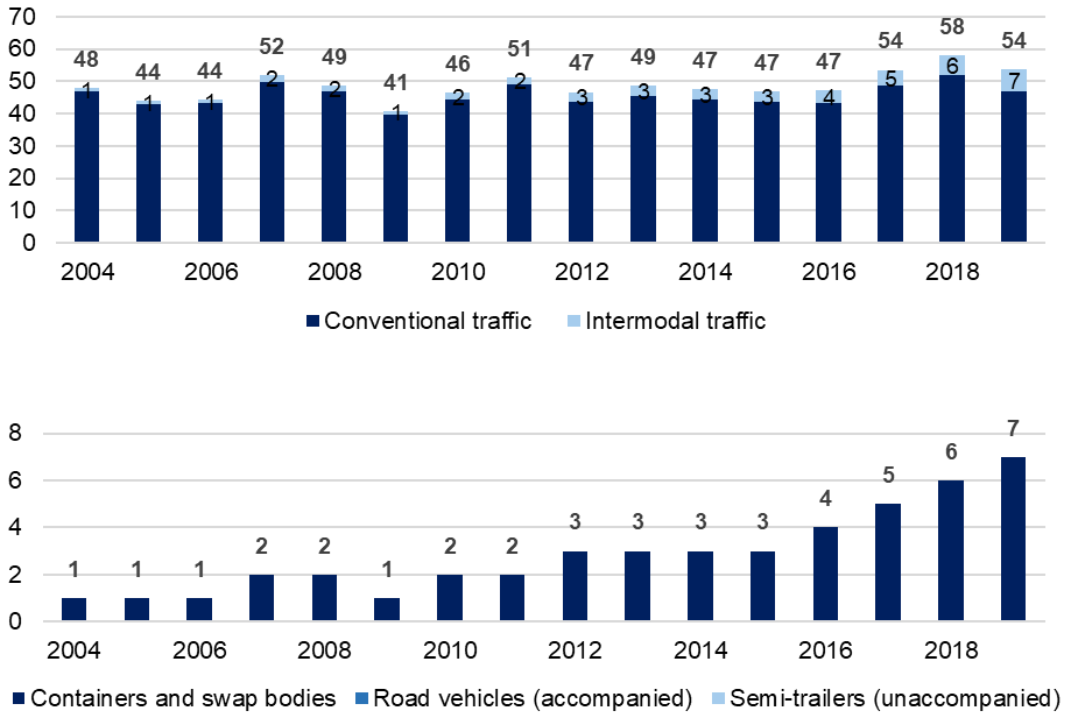


Exhibit 31: Development of Intermodal Traffic in Poland [Billion tonne-km]

As for international rail flows, shown in Exhibit 32 below, the Czech Republic and Germany stand out as the largest origin countries (about 1.8 and 2.9 Million tonnes in 2019 respectively), followed by Slovakia (1 Million tonnes), and other countries represented in Exhibit 32 accounting for less than 2 Million tonnes cumulative.

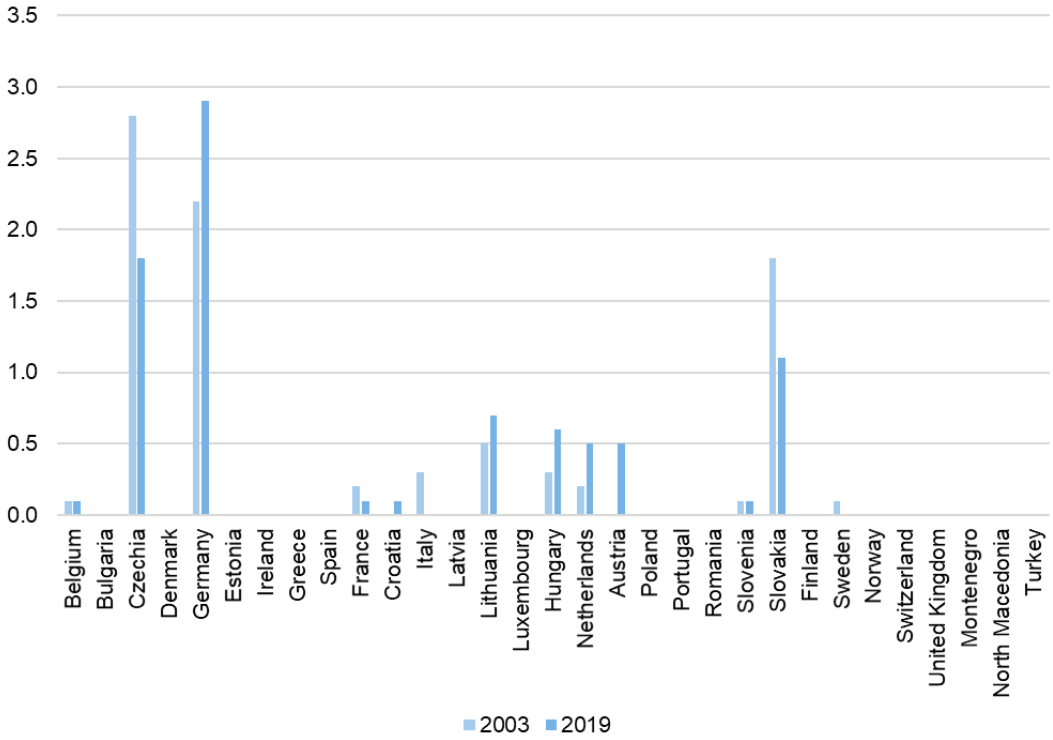


Exhibit 32: Incoming Rail Freight Volume to Poland [Million tonnes]

Looking at the outgoing traffic in Exhibit 33 below, it appears to be very concentrated toward Czech Republic (6 Million tonnes), Germany (4 Million tonnes), Slovakia (2 Million tonnes), and Austria (2 Million tonnes).

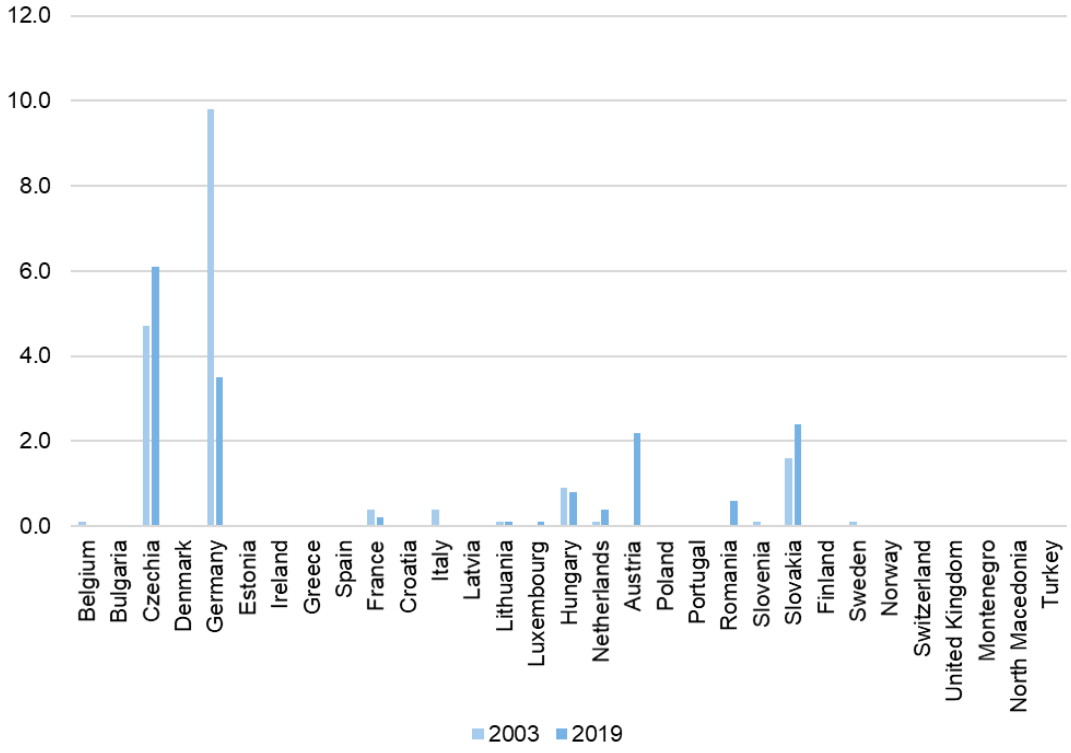


Exhibit 33: Outgoing Rail Freight Volume from Poland [Million tonnes]

4.3 France

France is historically a major European rail market. It has been operated by SNCF since 1938. Open access regime was introduced in law in 2003 and the first "private" trains appeared in 2005. Domestic competition became reality in March 2006 and competitors took up 15% of the freight traffic within just three years. Passenger rail competition has been slow to emerge in France where the first high speed challengers appeared only in 2021. Whereas regions are now allowed to tender commuter services, four have done so, and one region has picked a competitor to SNCF from 2025 onwards. By the end of 2023 tendering of regional passenger services will be mandatory.

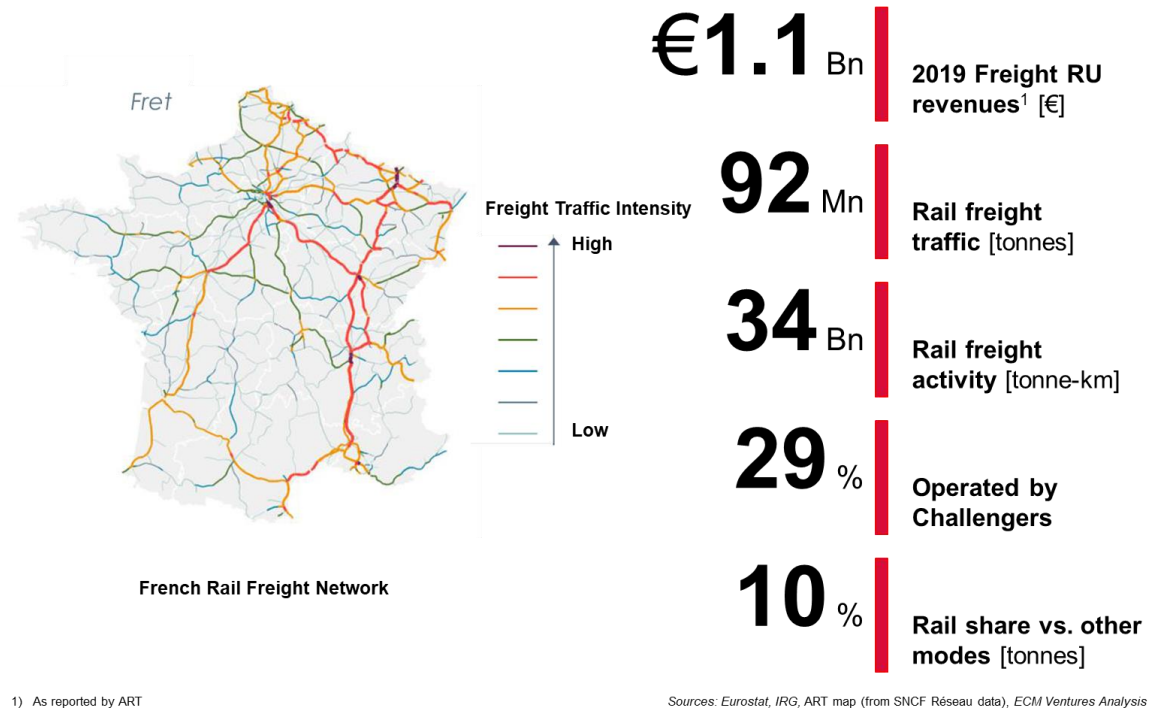


Exhibit 34: Country Profile France - Rail Freight Routes and Key Figures

France, as illustrated in Exhibit 34 above, is the third largest rail freight market in Europe, but accounts for less than one-third of Germany's volume. France is an important transit country, particularly for flows connecting Northern Europe and Spain. In 2019 a total of 92 Million tonnes were transported by rail, which represent a modal share of 10%. Total rail freight activity reached 34 Billion tonne-km and 29% of all freight trains based on train-km were operated by 15 challengers, mainly ECR, Europorte, and Regiorail. The market share of the legacy carrier, Fret SNCF, has declined to 55% (measured in trains-km) but is just over 70% when taking SNCF subsidiaries into account as shown in Exhibit 35 below (Autorité de Régulation des Transports, 2021).

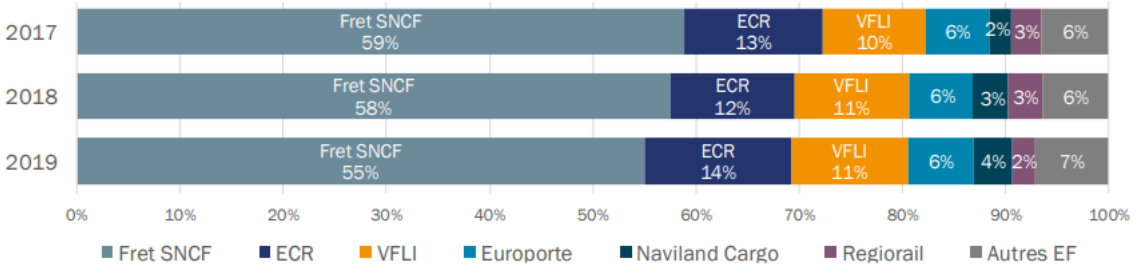


Exhibit 35: Share of train-km offered by freight railway undertakings in France

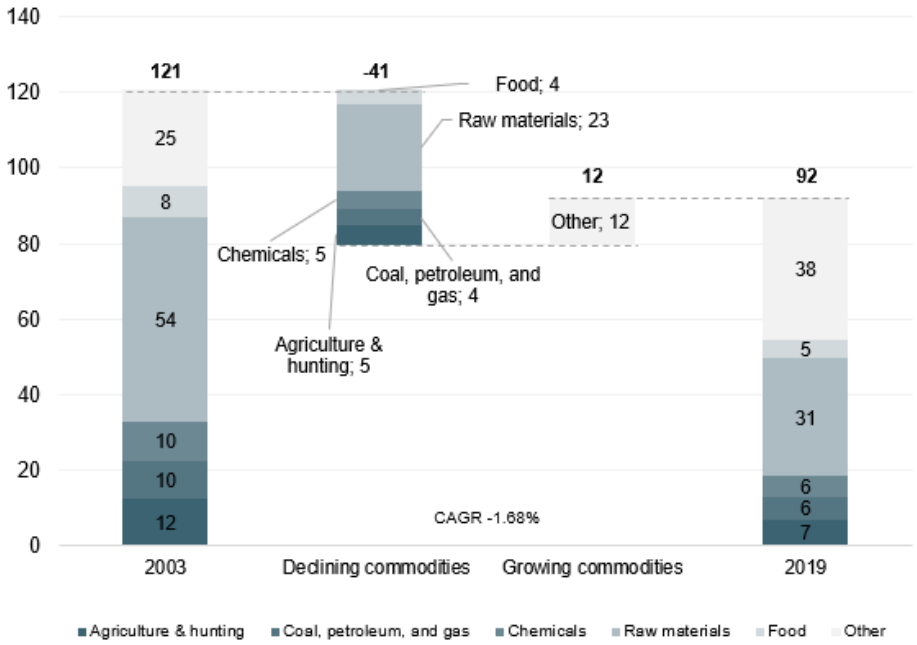


Exhibit 36: Development of Rail Freight Volume in France [Million tonnes]

As shown in Exhibit 36 above, the French rail freight market declined from 121 Million tonnes in 2003 to 92 Million tonnes in 2019, or -1.7% on average per year (Eurostat; ECM Ventures analysis, n.d.). There was a significant shift away from traditional bulk commodities, like raw materials (-3.4% per year), chemicals (-3.1% per year), coal, petroleum, and gas, towards "other" commodities – a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailer. The share of so-called "Other" segment grew at an average annual rate of 2.7%, from a share of 21% in 2003 to a share of 41% in 2019, or 38 Million tonnes in total.

Looking at rail freight activity measured in tonne-km, it declined by 2% on average per year from 47 Billion tonne-km in 2003 to 34 Billion tonne-km in 2019. Rail freight *activity* is multiplying tonnage of trains with average distance. From this analysis it can be stated that the average distance of rail freight transport in France shrank from 388 km in 2003 to 370 km or -4.6% in total.

The transport of raw materials declined in volume by 6 Billion tonne-km, but the average distance carried grew slightly from 277 km to 290 km. Merchandise goods (category "Other") remained flat at 16 Billion tonne-km. In 2019, this segment represented 47 percent of the French rail freight market activity. Average distance of transport for these merchandise goods shrank from 640 km in 2003 to 421 km in 2019 or -34% in total. Yet, the distance carried was 1.3 times longer compared with traditional rail commodities (333 km in 2019). This also reflects a higher share of international traffic, where challengers are focusing their activities, while incumbent Fret SNCF operates a domestic wagonload network and is very active on dry and liquid bulk commodities.

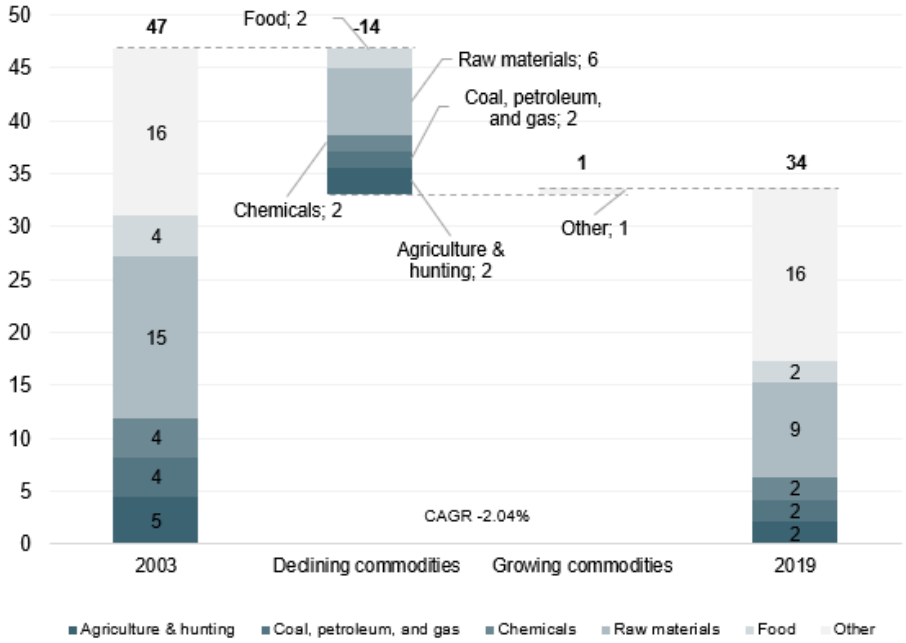


Exhibit 37: Development of Rail Freight Activity in France [Billion tonne-km]

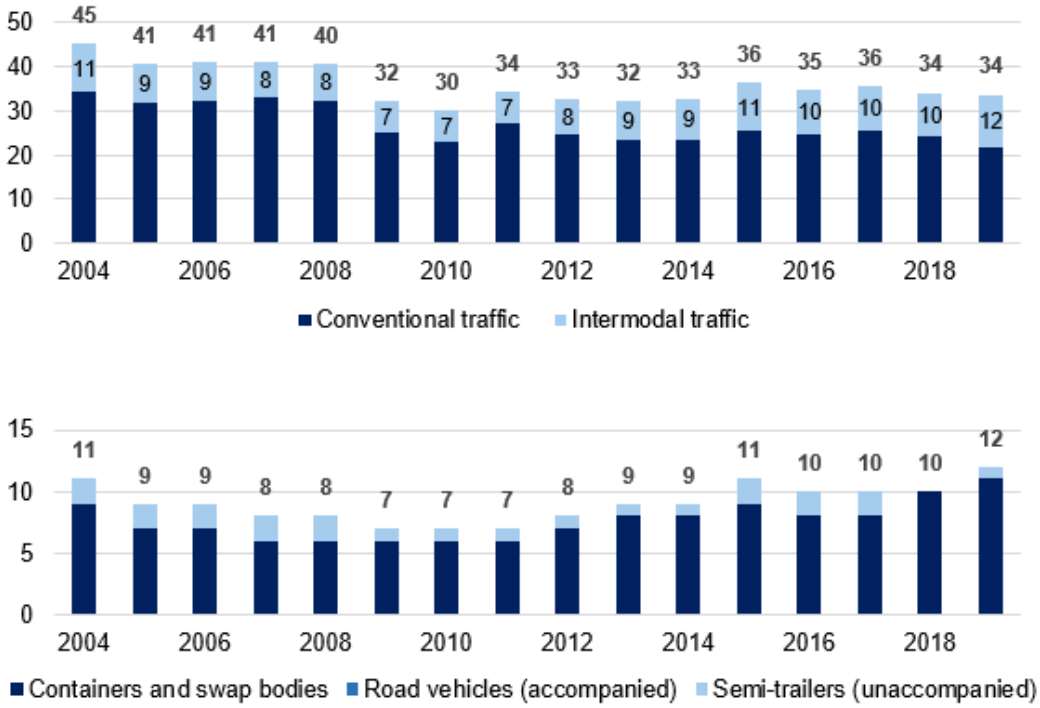


Exhibit 38: Development of Intermodal Traffic in France [Billion tonne-km]

As shown in Exhibit 38 above, intermodal traffic had been declining slowly until 2012 when it started to regain momentum. By 2019, intermodal transport accounted for 12 Billion tonne-km. This was partly due to the development of long-distance rolling motorway services, particularly between Bettembourg (Luxemburg) and Barcelona (Spain), with a majority of that activity being with unaccompanied trailers, as illustrated in Exhibit 39 below (Autorité de Régulation des Transports, 2021).

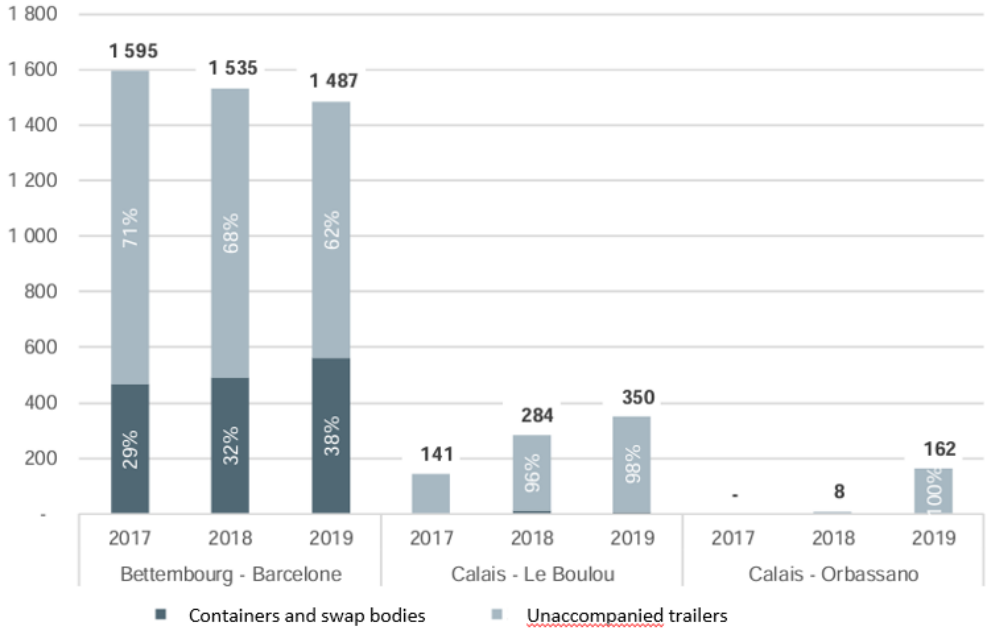


Exhibit 39: Development of the Three Rolling Motorways in France

International rail flows account for 30% of all rail tonnage in France in 2019. Inbound volume to France amounts to 12 Million tonnes, while exports account for 16 Million tonnes. Although the country-level data is incompletely reported by Eurostat, Exhibit 40 shows that Belgium stands out as the largest origin country (4.4 Million tonnes), followed by Germany (1.8 Million tonnes), Italy (1.4 Million tonnes), and the Netherlands (0.4 Million tonnes). Belgium is the leading origin due to the major ports of Antwerp and Zeebrugge that are well positioned to serve Northern and Eastern France.

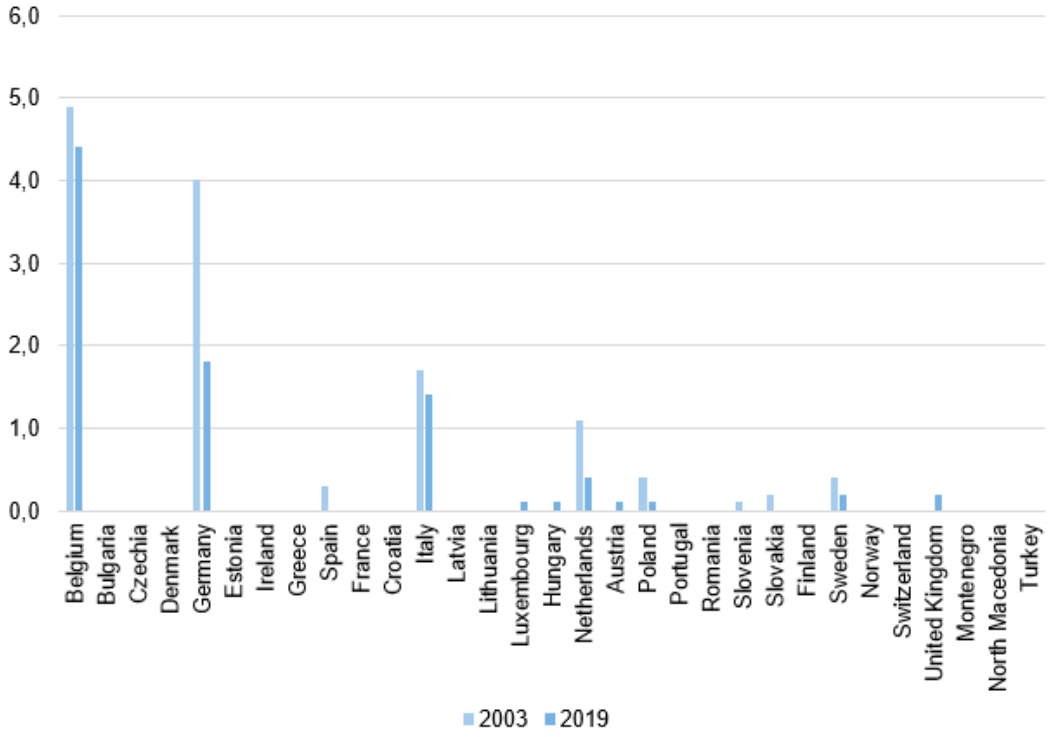


Exhibit 40: Incoming Rail Freight Volume to France [Million tonnes]

As for rail tonnage flowing out of France, as shown in Exhibit 41 below, the leading destination countries are Belgium, Italy and Germany. Based on the years for which data is available at the country level, it is clear that it has been declining consistently in all countries.

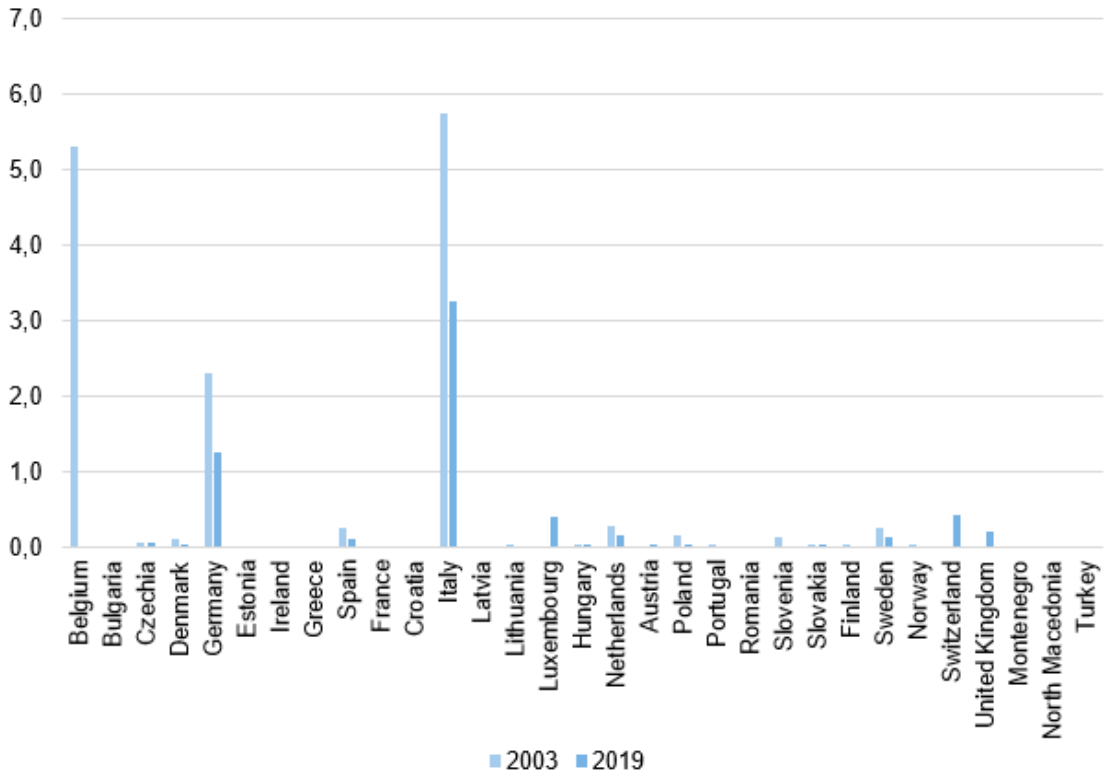
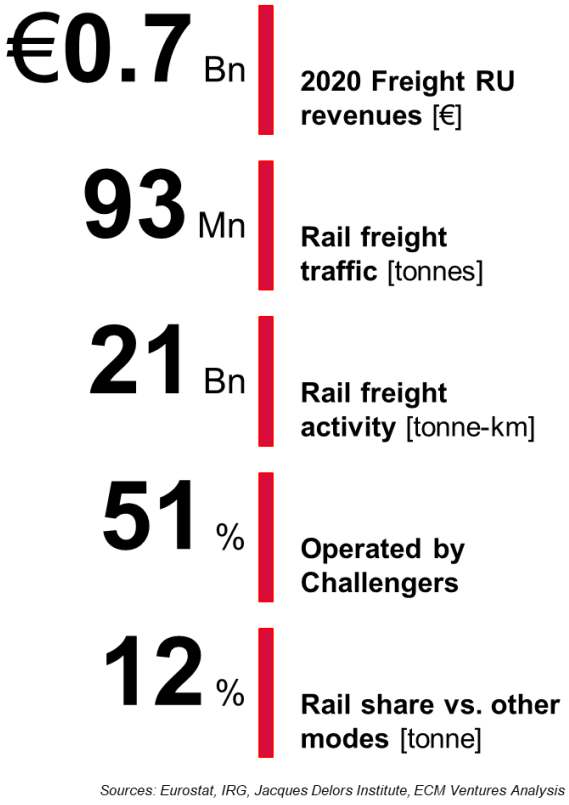


Exhibit 41: Outgoing Rail Freight Volume from France [Million tonnes]

4.4 Italy

The process of liberalization and privatization encouraged by the European Union to introduce a degree of competition in the rail industry has been diligently endorsed by Italian legislators. Nevertheless, the implementation of these policies has been quite slow showing how European directives can encounter resistance at national level. Even though these delays have been common to many other Member States, at the same time, other countries have been able to quickly implement the policies and have already, in some cases, completed the liberalization process.

Railway network in Italy



Sources: Eurostat, IRG, Jacques Delors Institute, ECM Ventures Analysis

Exhibit 42: Country Profile Italy - Rail Freight Routes and Key Figures

In 1905, the railway nationalization process was undertaken and *Ferrovie dello Stato* (FS), the state-owned railway company, came to birth. In 1985, based on Law 210/85, Ferrovie dello Stato, was replaced by *Ente Ferrovie dello Sato*, a new entity created having legal personality and complete financial autonomy although still subject to the supervision of the Minister of Transportation. In 1992, following the first European guidelines on the restructuring of the railway industry, the company was reorganized leading to the creation of *Ferrovie dello Stato - Società di Trasporti e Servizi per Azioni*. The new company remained 100% owned by the Italian government. In 1999 the company was divided into multiple entities: Passenger, Regional Transport, Cargo, Infrastructure, and Technology and Rolling Material. In the early 2000s, the company's two main broad divisions, service and infrastructure, were definitely separated and two different independent entities were created: *Trenitalia Società per Azioni (SpA),* responsible for transport service of both passenger and freight, and *Rete Ferroviaria Italiana SpA* (RFI), responsible for the design, construction, commissioning, management and maintenance of the rail infrastructure. Both of them being subsidiaries of *Ferrovie dello Stato Holding*,

were created after the reorganization of the group and are 100% controlled by the Italian Ministry of Economy and Finance.

The Legislative Decree n. 188 of 2003, referred to as *First Railway Package*, was corroborated by the Legislative Decrees n. 162 and n.163 of 2007, referred to as *Second Package*, and the Legislative Decree n. 15 of 2010 referred as *Third Package*, recognized to the railway companies located in the EU, the right to access the entire Italian rail network. Moreover, the infrastructure manager (RFI) ensures that access is provided in a fair, equal, and non-discriminatory base to all rail operators. The liberalization of the market encouraged numerous players to start operations in Italy for which challengers now account for 51% of train activity.

In 2019 a total of 93 Million tonnes were transported by rail, which represents a modal share of 12% compared to road and maritime transport. Total rail freight activity reached 21 Billion tonne-km.

As shown in Exhibit 43 below, the Italian rail freight market experienced growth between 2003 and 2019, at the annual rate of 1.41%, growing from 74 Million tonnes in 2003 to 93 Million tonnes in 2019 (Eurostat; ECM Ventures analysis, n.d.).

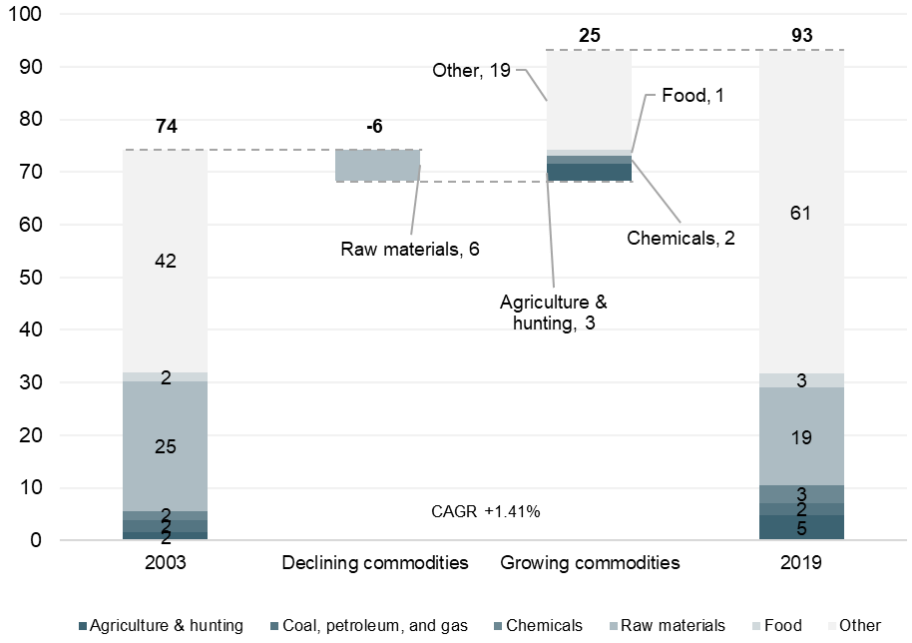


Exhibit 43: Development of Rail Freight Volume in Italy [Million tonnes]

This trend is characterized by a strong increase in the so called “other commodities”, a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. The “Other” segment grew from 56% of rail tonnage in 2003 to a share of 65% in 2019 or 61 Million tonnes in total, accounting for nearly two thirds of the total market. This trend is even more evident while looking at how the intermodal segment grew during the same period, as shown in Exhibit 45 below.

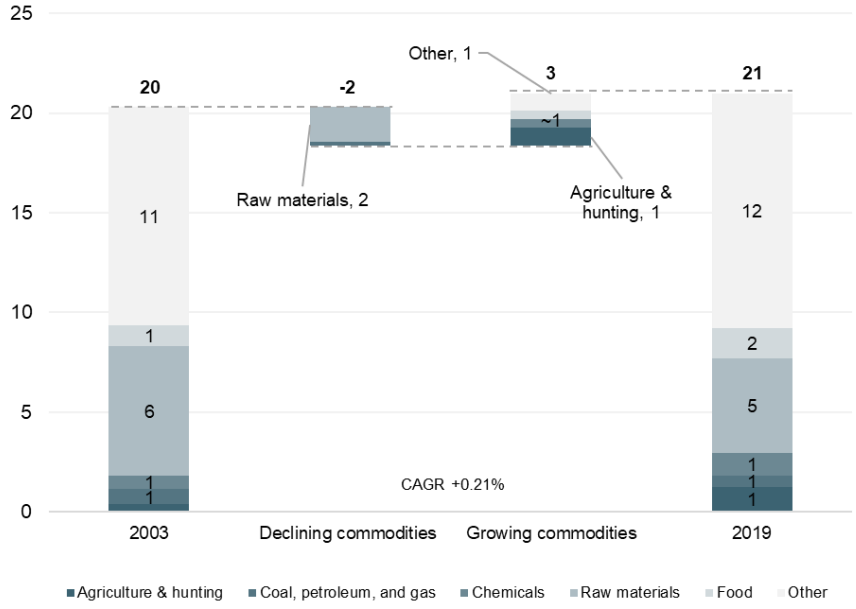


Exhibit 44: Development of Rail Freight Activity in Italy [Billion tonne-km]

As shown in Exhibit 44 above, rail freight activity measured in tonne-km remained almost constant (positive 0.21% CAGR in the 2003 - 2019 period), despite the increase measured in tonnes. Rail freight activity is obtained multiplying tonnage of trains with average distance. From this analysis it can be inferred that the average distance of rail freight transport in Italy shrank from 270 km in 2003 to 225 km in the 2019 or -20% in total.

The highest growth in the Italian market is traceable to the "Other" segment, mainly consisting in intermodal traffic, which during the analyzed period grew from 9 Billion tonne-km in 2004 to 12 Billion tonne-km in 2019, accounting for more than half of the rail freight activity mostly concentrated in the category "Containers and swap bodies," as shown in Exhibit 45 below.

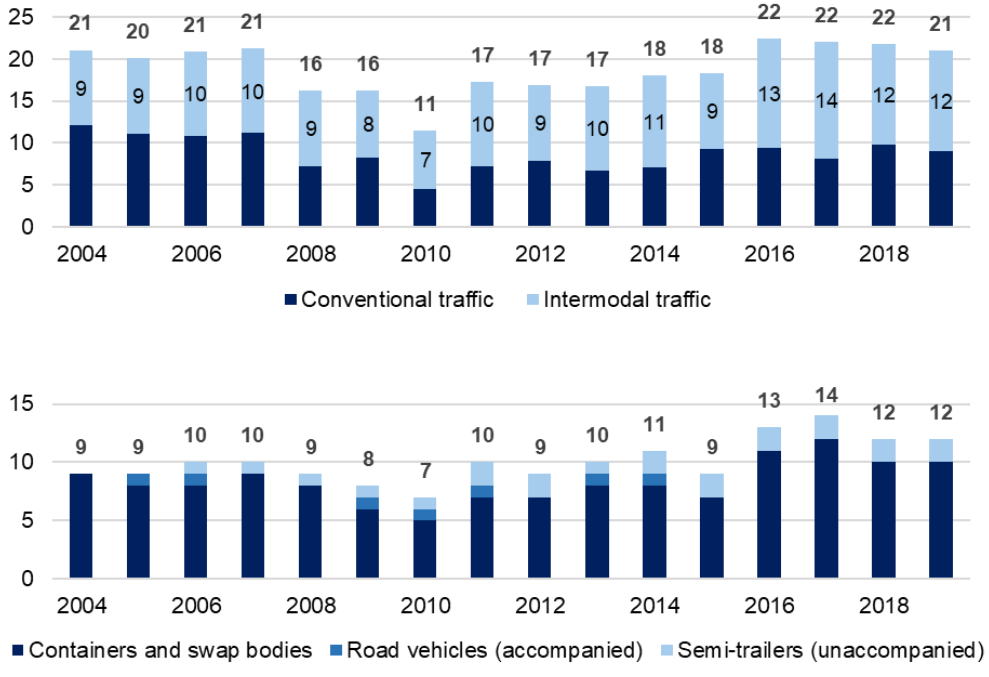


Exhibit 45: Development of Intermodal Traffic in Italy [Billion tonne-km]

As for international rail flows, shown in Exhibit 46 below, Germany stands out as the largest origin country (about 14 Million tonnes in 2019), followed by France (about 4 Million tonnes in 2019), and Belgium, Austria, Netherlands, and Hungary (about 10 Million tonnes in 2019 combined).

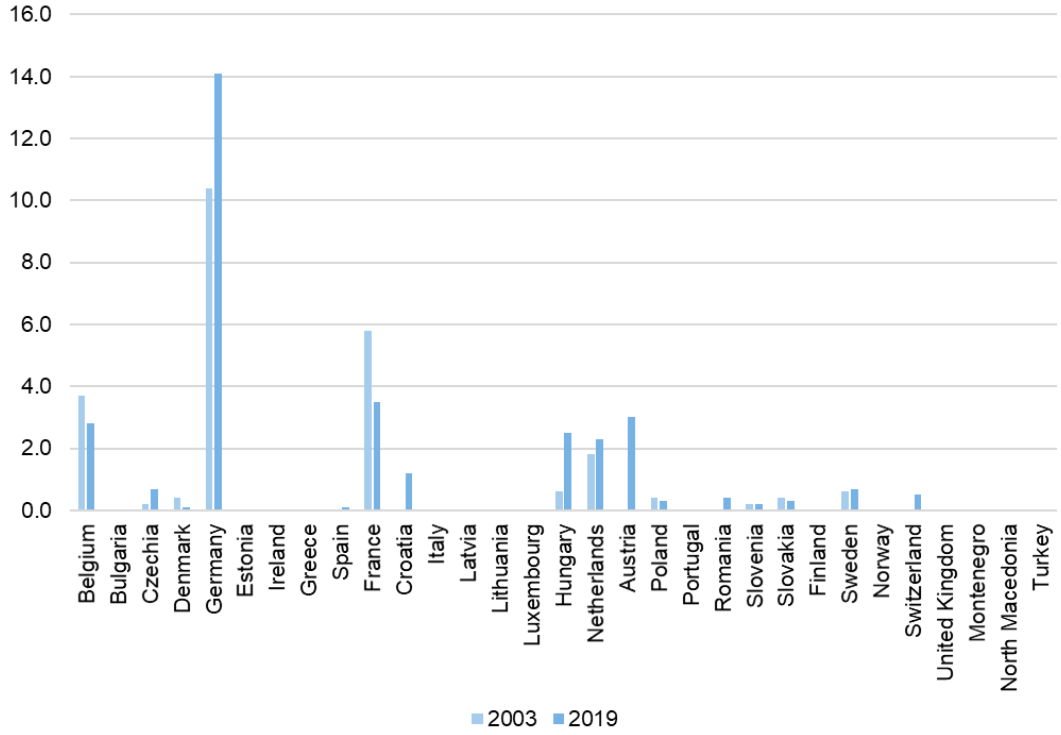


Exhibit 46: Incoming Rail Freight Volume to Italy [Million tonnes]

Looking at the outgoing flow, in Exhibit 47 below, it appears very concentrated towards Germany (10 Million tonnes in 2019), with France, Austria, and Netherlands following with about 5 Million tonnes in 2019 combined.

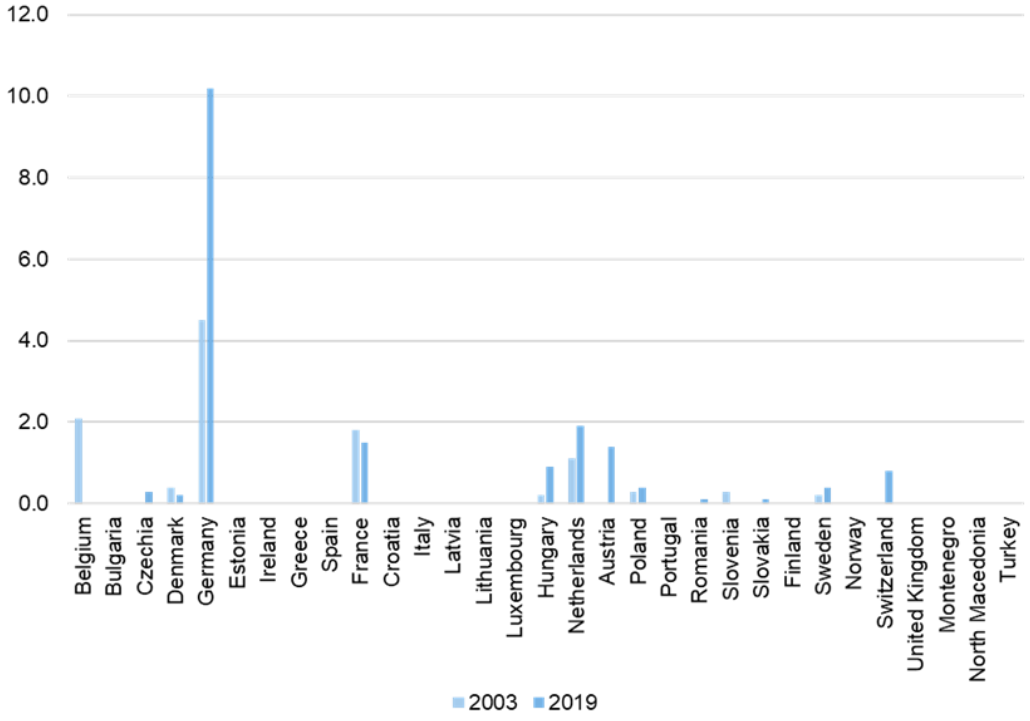


Exhibit 47: Outgoing Rail Freight Volume from Italy [Million tonnes]

4.5 The Netherlands

Until 1994, Dutch Railways (NS) was the only state-owned rail transport company operating in the Netherlands. It was a private limited liability company with the Dutch State as its sole shareholder. It was managed by two independent organs: a managing board, and a supervisory board. Both bodies were accountable for their performance to the general meeting of shareholders (i.e., they reported to the Dutch government, and to the Ministry of Finance).

NS was the only provider of all the domestic rail transport activity, both passengers and freight. Railway undertakings were only allowed to enter the country under specific conditions controlled by NS.

The introduction of the EU Directive 91/440 on the development of the Community's railways implied a restructuring on the sector to allow fair access to the market to non-state-owned companies and so, to create a competitive environment.

NS saw its tasks reduced to provided rail passenger transport, for which a 10 year exclusive concession is issued every 10 years from the Minister of Infrastructure. This means that despite the liberalization, 90% of rail passenger transport is still exclusively provided by NS.

The liberalization of the rail freight industry created a suitable playground for challengers that currently account for the 100% of the market.

Rail freight corridors in the Netherlands

€0.3 Bn — **2019 Freight RU revenues** [€]

43 Mn — **Rail freight traffic** [tonnes]

7 Bn — **Rail freight activity** [tonne-km]

100 % — **Operated by Challengers**

6 % — **Rail share vs. other modes** [tonne]

1) Data estimated based on EU avg. price per tonne-km

Sources: Eurostat, IRG, ECM Ventures Analysis

Exhibit 48: Country Profile the Netherlands - Rail Freight Routes and Key Figures

In 2019 a total of 43 Million tonnes were transported by rail, which represents a modal share of 6% only compared to road and maritime transport. This is one of the lowest modal shares for rail in Europe. Total rail freight activity reached 7 Billion tonne-km.

The Dutch rail freight market experienced growth between 2003 and 2019, with an annual growth of 2.29%, growing from 30 Million tonnes in 2003 to 43 Million tonnes in 2019. This growth has been driven by a large increase in the so called "other commodities," a conglomerate of merchandise goods typically not specified as

they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. As shown in Exhibit 49 below, the "Other" segment grew from 40% of rail tonnage in 2003 to a share of 46% in 2019 or 20 Million tonnes in total, accounting for more than two thirds of the total market.

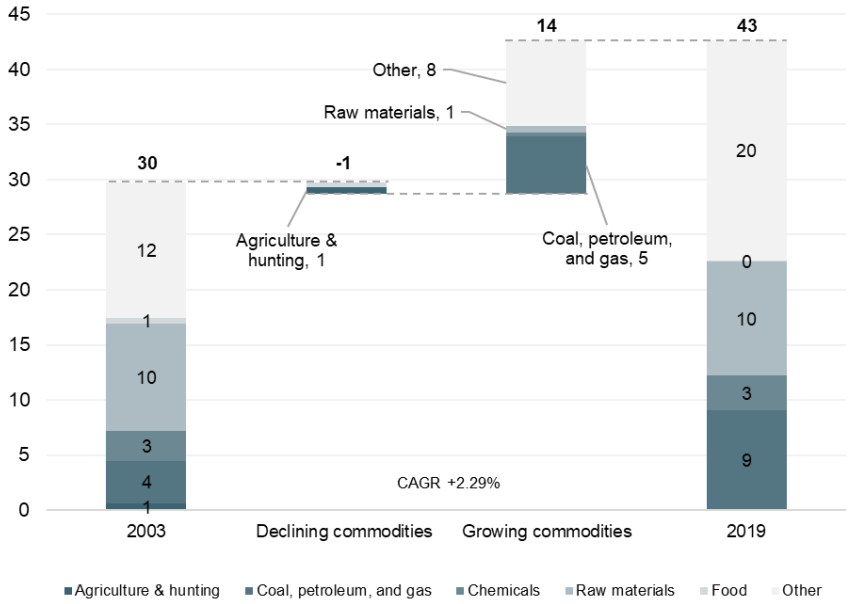


Exhibit 49: Development of Rail Freight Volume in the Netherlands [Million tonnes]

As for rail freight activity measured in tonne-km, and shown in Exhibit 50 below, it grew at a similar pace than the traffic (2.59% CAGR in the 2003 - 2019 period). Rail freight activity is obtained multiplying tonnage of trains with average distance. From this analysis it can be stated that the average distance of rail freight transport in the Netherlands slightly decreased, from 166 km in 2003 to 162 km in the 2019 (-2%).

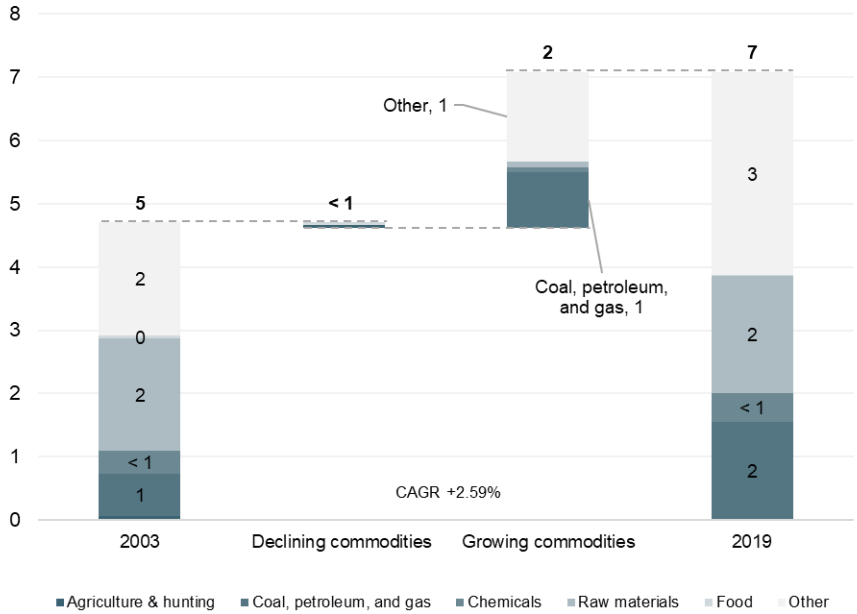


Exhibit 50: Development of Rail Freight Activity in the Netherlands [Billion tonne-km]

The highest growth in the Dutch market is traceable to the “Other” segment, mainly consisting in intermodal traffic, which during the analyzed period grew from 2 Billion tonne-km in 2004 to 3 Billion tonne-km in 2019, accounting for almost half of the rail freight activity particularly concentrated in the category “Containers and swap bodies”, as shown in Exhibit 51 below.

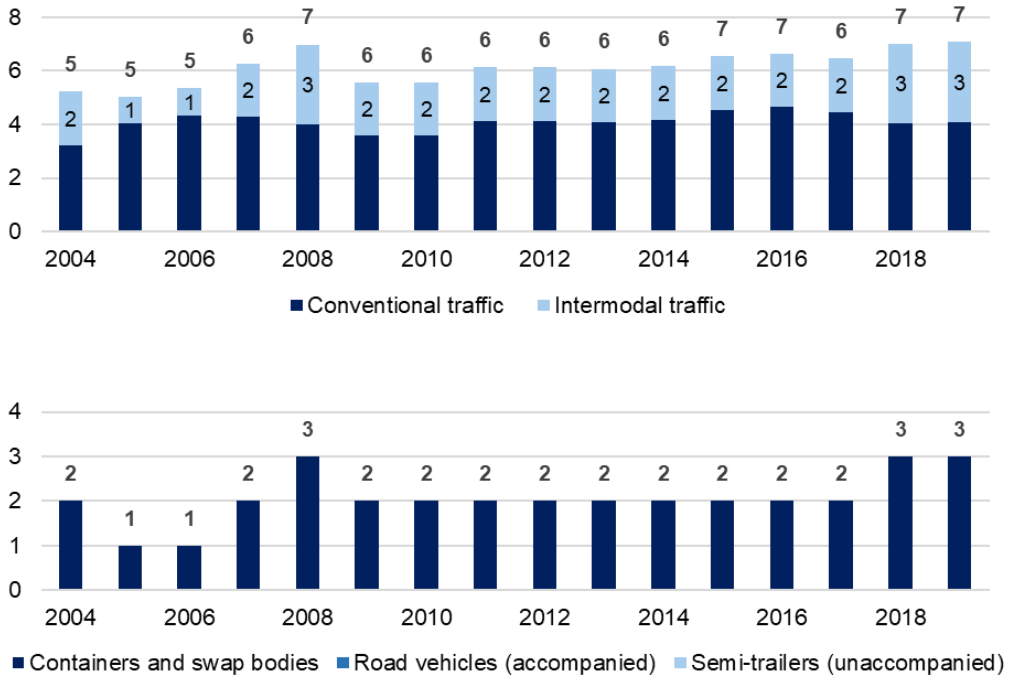


Exhibit 51: Development of Intermodal Traffic in the Netherlands [Billion tonne-km]

As for international rail flows, shown in Exhibit 52 below, Germany, Italy, and Belgium stand out as the largest origin country (about 2.5 Million tonnes, 2.3 Million tonnes, 1.9 Million tonnes respectively in 2019), followed by Poland, Austria, and France (about 1 Million tonnes in 2019 combined).

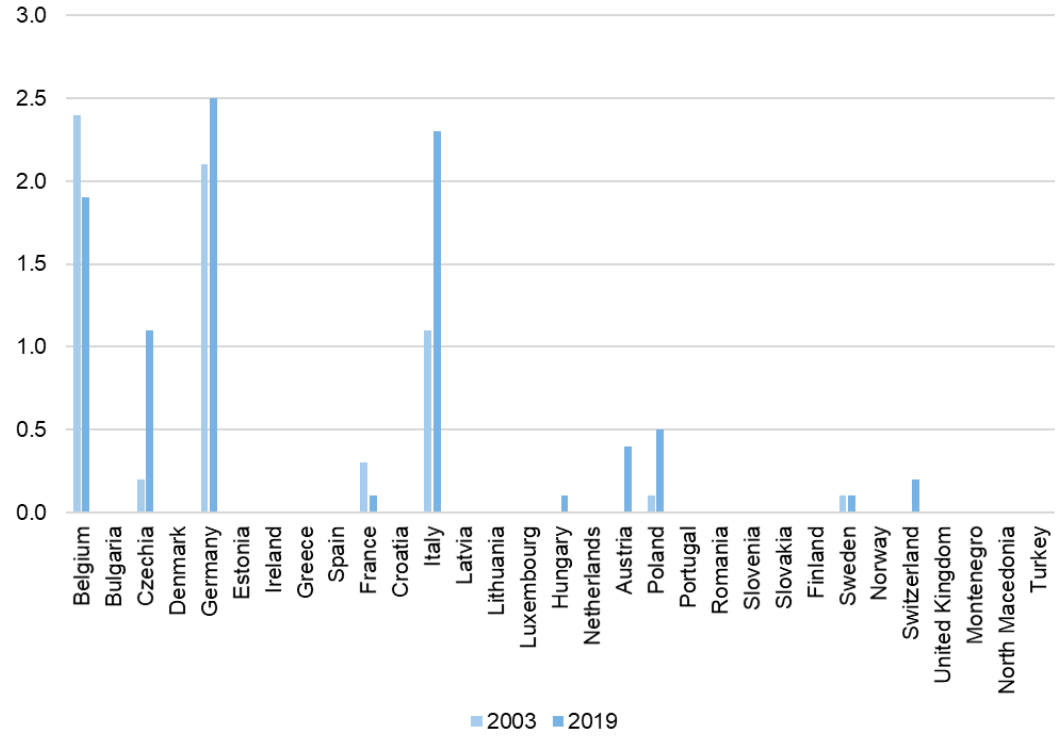


Exhibit 52: Incoming Rail Freight Volume to the Netherlands [Million tonnes]

As for the outgoing international rail flows, shown in Exhibit 53 below, Germany and Italy are the main destination (about 17 Million tonnes and 3 Million tonnes respectively in 2019).

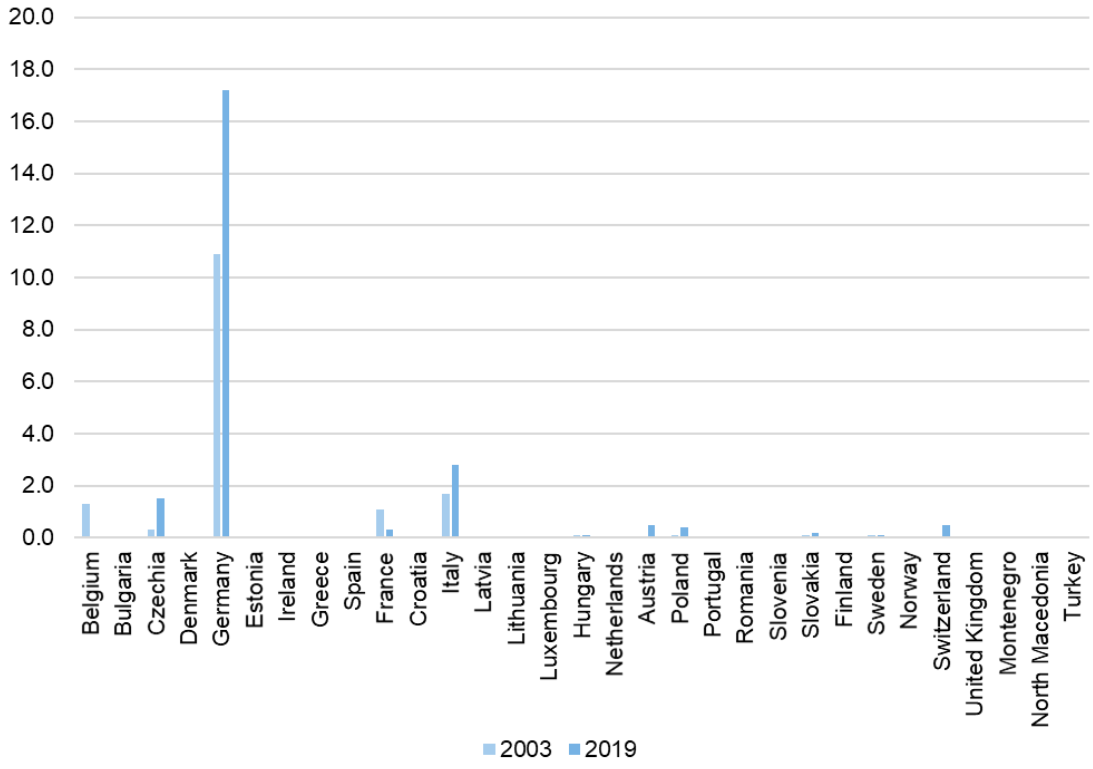


Exhibit 53: Outgoing Rail Freight Volume from the Netherlands [Million tonnes]

4.6 Belgium

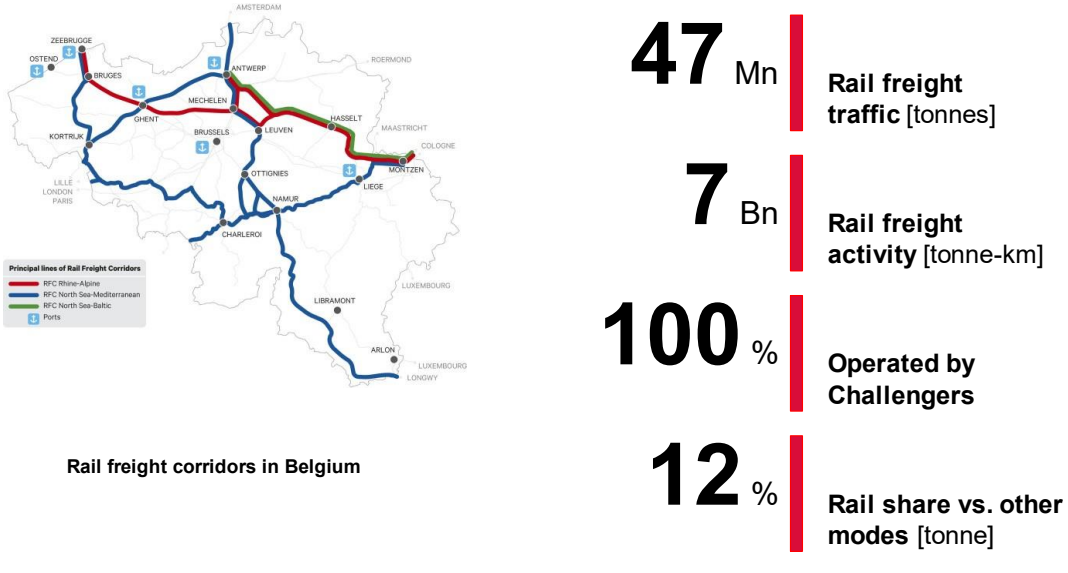
In 1991 the Belgian incumbent national railway company, Société Nationale des Chemins de fer Belges (SNCB) / Nationale Maatschappij der Belgische Spoorwegen (NMBS), became an autonomous public enterprise starting the process which liberalized the national market anticipating de-facto the European legislation.

The company was granted with autonomy vis-à-vis the government for those activities not considered public service defined in a management contract between SNCB and the State. These obligations included ensuring a minimum level of passenger services, developing, maintaining, and managing the rail infrastructure.

Since the Law of 22 March 2002, amending the previous 1991 legislation, SNCB has also been required to keep separate accounts for each business segment. On 1 January 2005, SNCB was split into three distinct entities: Infrabel, acting as infrastructure manager; SNCB, the rail operator; and SNCB-Holding, parent company of both Infrabel and SNCB. Each of the three companies was established as an autonomous public enterprise with the status of limited liability company under public law, but still under the almost full ownership of the Belgian government.

The new established rail operator was organized into separate divisions for domestic passenger transport (SNCB Mobility), international passenger transport (SNCB Europe), and freight transport (SNCB Logistics). On 1 February 2011, SNCB Logistics became an autonomous rail operator, taking the form of a private limited liability company owned 93.14% by SNCB and 6.86% by SNCB-Holding.

Currently, the market is dominated by challengers. In 2019 a total of 47 Million tonnes were transported by rail, which represents a modal share of 12% compared to road and maritime transport. Total rail freight activity reached 7 Billion tonne-km.



Rail freight corridors in Belgium

1) Data estimated based on EU avg. price per tonne-km

Sources: Eurostat, IRG, ECM Ventures Analysis

Exhibit 54: Country Profile Belgium - Rail Freight Routes and Key Figures

As shown in Exhibit 55 below, the Belgian rail freight market shrank in the period from 2003 to 2019, with a negative 1.03% annual growth, dropping from 56 Million tonnes in 2003 to 47 Million tonnes in 2019. This decrease is due mostly to the transport of chemicals, agriculture products, and raw materials. Nevertheless,

in the same period there was a decisive shift towards so called “other commodities”, a conglomerate of merchandise goods typically not specified as they are transported in ocean containers, continental cargo boxes, swap bodies or trailers. The “Other” segment grew from 7% of rail tonnage in 2003 to a share of 44% in 2019 or 21 Million tonnes in total, accounting for about half of the total market.

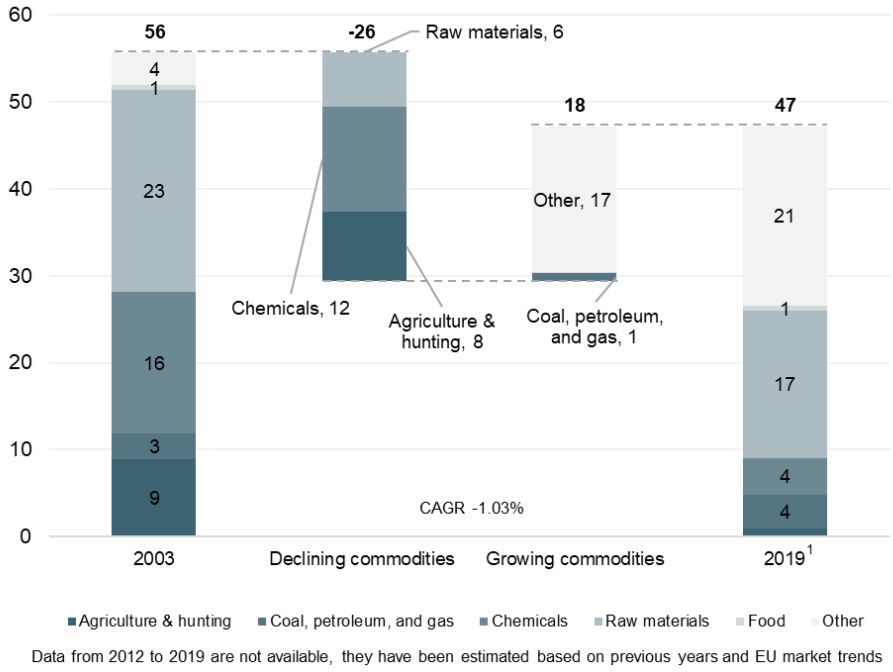


Exhibit 55: Development of Rail Freight Volume in Belgium [Million tonnes]

As for the rail freight activity measured in tonne-km, shown in Exhibit 56 below, it decreased with a -0.73% CAGR in the 2003 - 2019 period. Rail freight activity is obtained multiplying tonnage of trains with average distance. From this analysis it can be stated that the average distance of rail freight transport in Belgium increased, from 142 km in 2003 to 148 km in the 2019 (4%) (Eurostat; ECM Ventures analysis, n.d.).

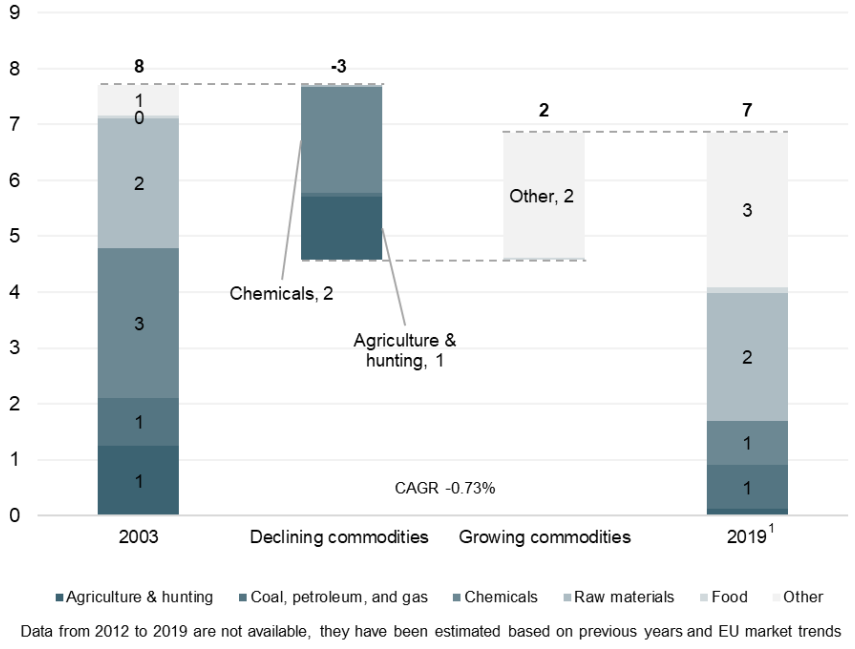


Exhibit 56: Development of Rail Freight Activity in Belgium [Billion tonne-km]

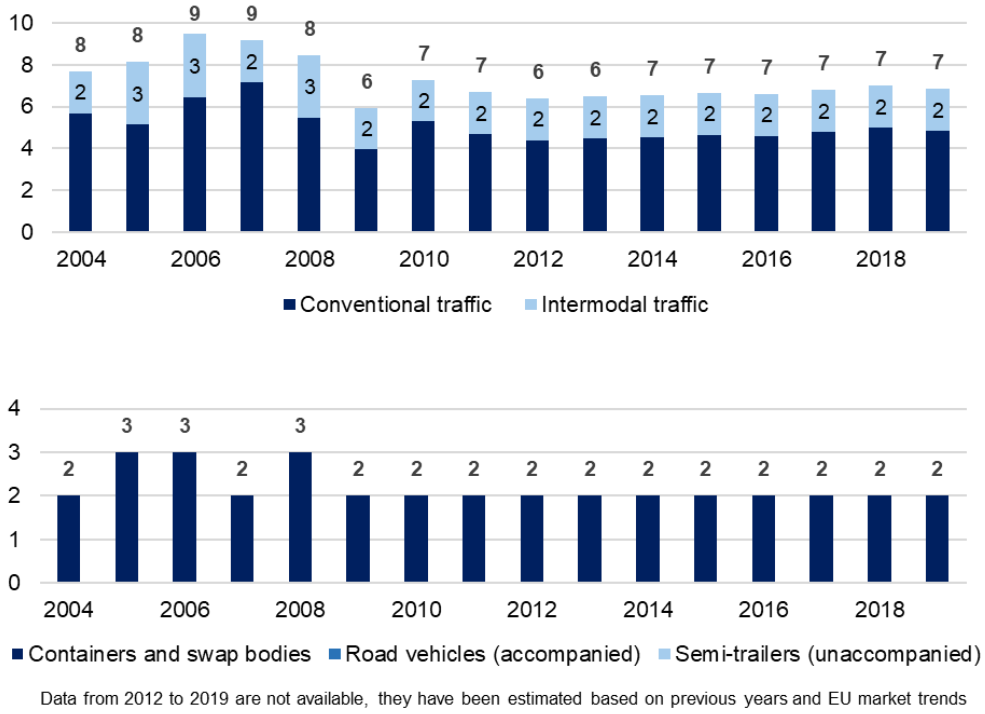


Exhibit 57: Development of Intermodal Traffic in Belgium [Billion tonne-km]

As for international rail flows, France, Germany, Italy, and Netherlands stand out as the largest origin country in Exhibit 58 below (about 5 Million tonnes, 3.5 Million tonnes, 3 Million tonnes, 1 Million tonnes respectively in 2019), followed by Sweeden, Spain, and Luxemburg (about 1 Million tonnes in 2019 combined).

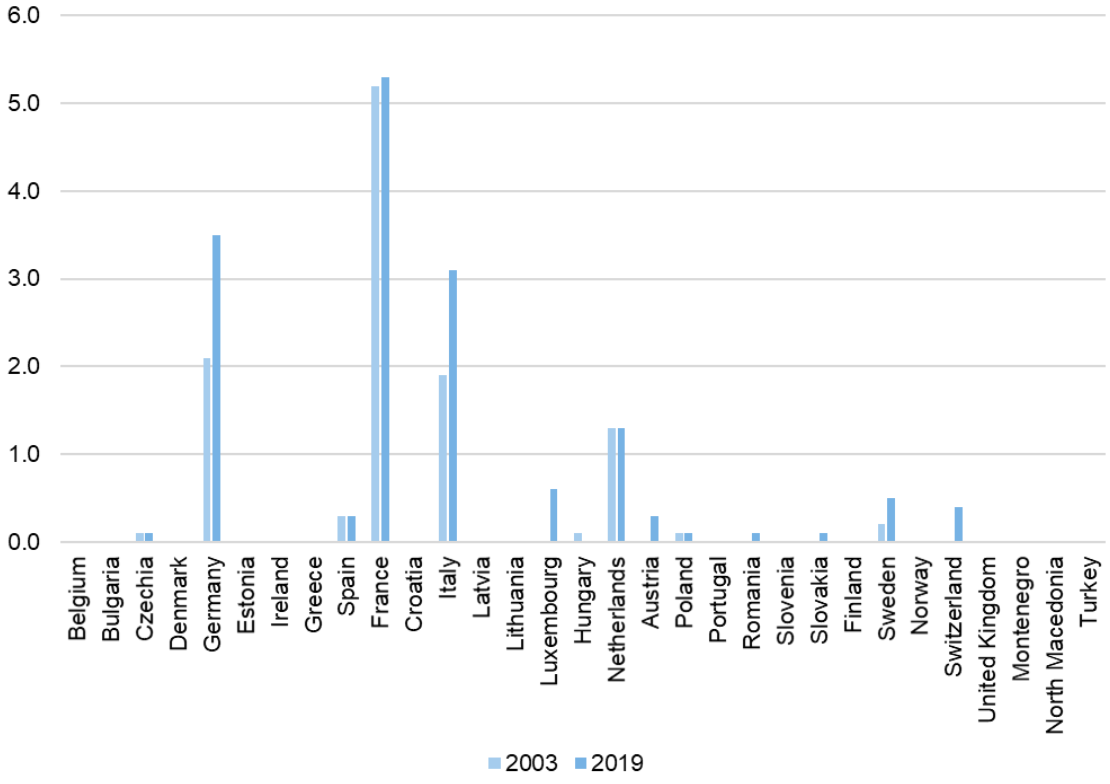


Exhibit 58: Incoming Rail Freight Volume to Belgium [Million tonnes]

As for the outgoing international rail flows, in Exhibit 59 below, Germany, France, Italy, Switzerland, and Netherlands are the main destination (about 3.9 Million tonnes, 3.9 Million tonnes, 3.8 Million tonnes, 1.0 Million tonnes, and 1.1 Million tonnes respectively in 2019).

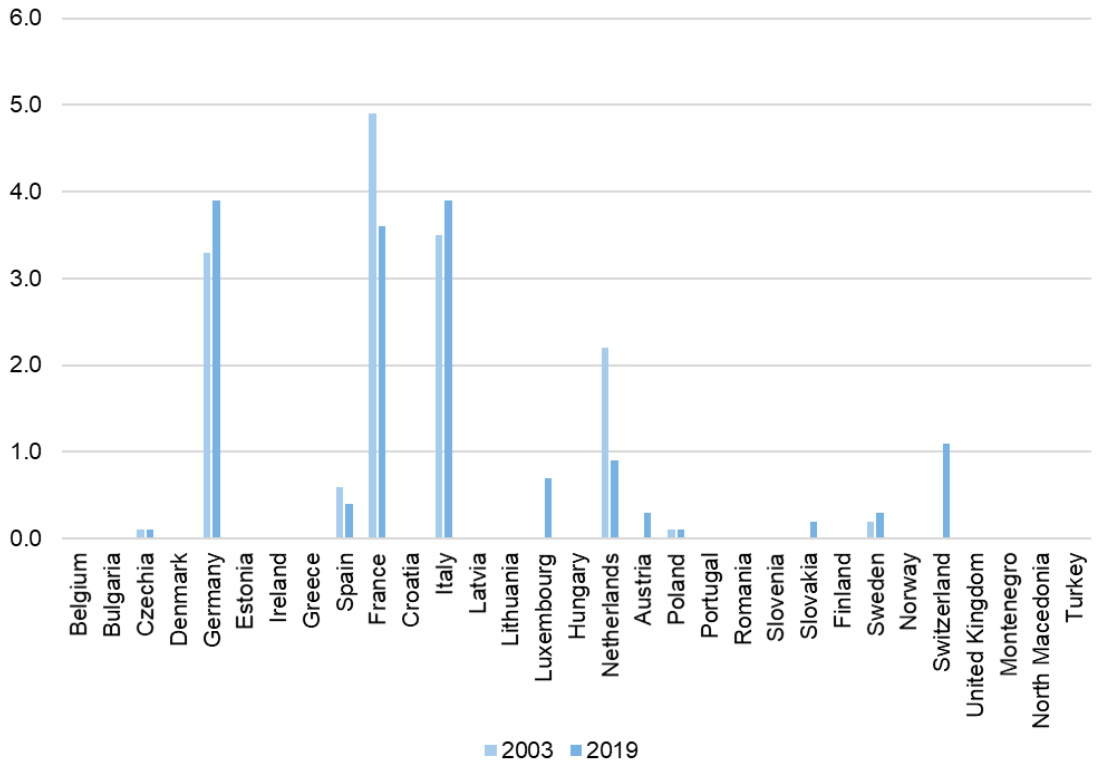


Exhibit 59: Outgoing Rail Freight Volume from Belgium [Million tonnes]

4.7 Portugal

The Portuguese freight market had historically been operated by the freight division of state-owned railway Comboios de Portugal (CP). The main commodities carried were coal, cement, and paper. CP Carga had operated a wagonload business in the past. Intermodal traffic has been developing rapidly, particularly in connection with port activities in Leixoes and Sines and with international services linking Portugal and Spain. The freight division of Portuguese Railways CP Cargo was privatized in 2016 and became Medway, acquired by Mediterranean Shipping Company (MSC), a global ocean shipping player. Medway accounted for 85% of rail freight traffic in 2020 while two other undertakings accounting for the remaining 15%.

Railway network in Portugal

€0.1 Bn **2019 Freight RU revenues** [€]

10 Mn **Rail freight traffic** [tonnes]

2 Bn **Rail freight activity** [tonne-km]

100 % **Operated by Challengers**

13 % **Rail share vs. other modes** [tonne]

Sources: Eurostat, IRG, ECM Ventures Analysis

Exhibit 60: Country Profile Portugal - Rail Freight Routes and Key Figures

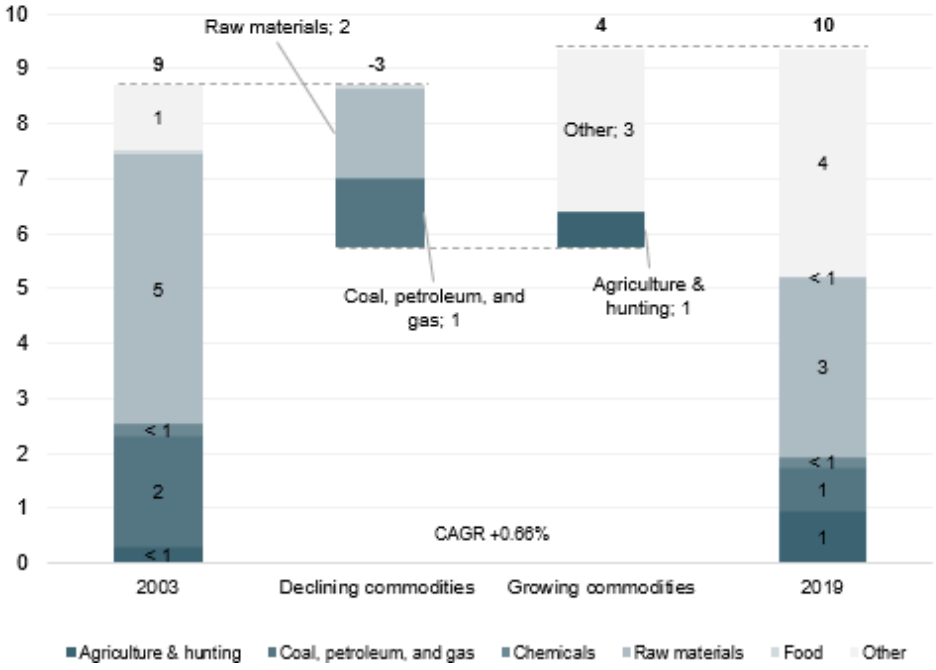


Exhibit 61: Development of Rail Freight Volume in Portugal [Million tonnes]

As shown in Exhibit 61 above, the Portugal rail freight market grew in tonnage by just 1 Mn ton in a sixteen-year period, but there was a significant shift with the decline of raw materials (particularly cement), and coal, and the multiplication by four of "other" (mostly intermodal) tonnage (Eurostat; ECM Ventures analysis, n.d.).

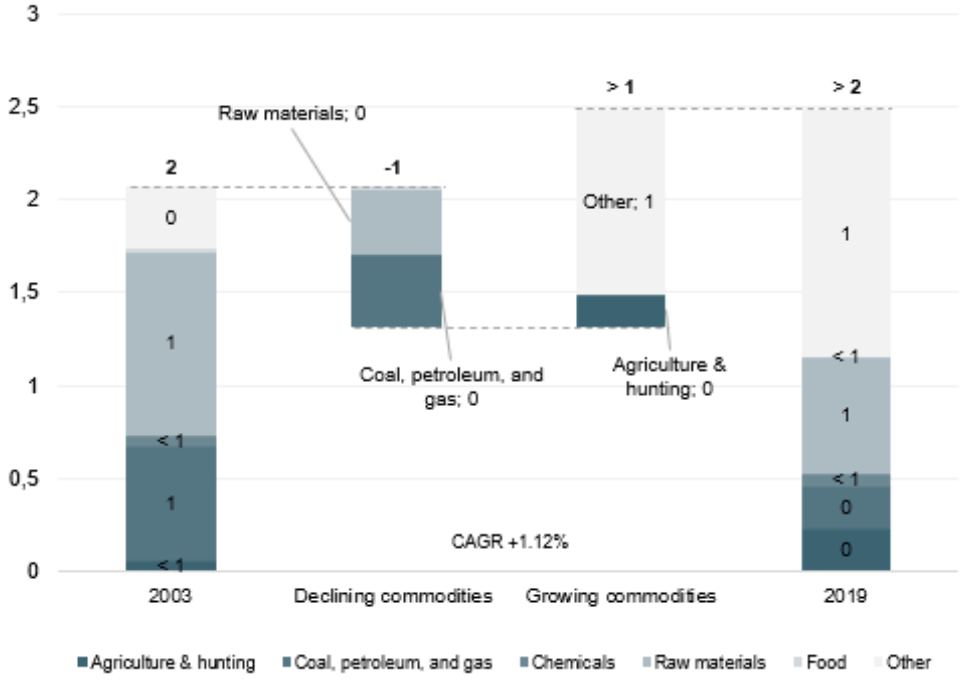


Exhibit 62: Development of Rail Freight Activity in Portugal [Billion tonne-km]

Looking at rail freight activity measured in tonne-km, as shown in Exhibit 62 above, it grew by 1.4% on average per year from 2.1 Billion tonne-kmin 2003 to 2.7 Billion tonne-km in 2019. Rail freight *activity* is multiplying tonnage of trains with average distance. From this analysis it can be stated that the average distance of rail freight transport in Portugal grew from 238 km in 2003 to 265 km or 11% in total.

The transport of general commodities declined in activity by 3.4% annually on average, while the average distance carried declined slightly from 231 km to 212 km. Merchandise goods (category “Other”) grew in activity by an average of 11.4% a year. In 2019 this segment represented 56 percent of the Portugal rail freight market activity. Average distance of transport for these merchandise goods grew from 280 km in 2003 to 330 km in 2019 or 18% in total. Yet, the distance carried was 1.6 times longer compared with traditional rail commodities (212 km in 2019).

5. Current Challenges and Potential Mitigation Measures

5.1 Methodology

ECM Ventures applied a three-step methodology to produce this report, including its recommended measures:

- Extensive market research on the development of European rail freight markets, on major players' business models, and on the evolving EU rail sector regulations and their impacts
- C-level stakeholder interviews and workshops with representative rail freight challenger companies in Europe to understand their views on current market development, their perceived impact of current regulations on competition, their assessment of hurdles to sustained profitable growth, and to discuss possible mitigation measures
- Development of a comprehensive *issues tree* that captures the current challenges of the European rail freight sector covering the areas of infrastructure development, traffic management, technology deployment, complexity / gaps in current regulation and unhealthy competition

This study, including stakeholder interviews, was conducted between December 2021 and March 2022. While it considers the impact of the SARS CoV-2 pandemic started in 2019, the analysis does not address the effects the war in Ukraine, started by the February 2022 Russian attacks, will have.

The team spoke with CEOs and other senior executives at 13 challengers in the European rail freight market, as illustrated in Exhibit 63 below. In addition, the team interviewed several industry experts with a combined sector expertise of 100+ years and conducted two strategy workshops with representatives of ERFA members. We analyzed our comprehensive interview notes to derive the main issues that were hindering the positive development of the rail freight market in this decade. The results of our market research and the stakeholder and expert interviews, augmented by the two strategy workshops, were used to develop the issues tree discussed in the next paragraphs.

Exhibit 63: Overview on Stakeholder Interviews

5.2 Rail Freight Issues tree

5.2.1 Overview

ECM Ventures applied an *issues tree* methodology to deal with a very complex set of challenges – identifying and describing the main issues that hindered the development of rail freight in Europe. An issues tree helps break down complex problems into distinct, smaller, components. Primary issues are broken down into smaller issues or branches. These issues can then be further broken down into even smaller issues or branches. This can be continued until we get a long list of small issues that can be addressed with mitigation measures.

The issues tree that stems from our analysis is shown in Exhibit 64 below. The five main topic areas that emerged are: *lagging infrastructure development* (limiting the future rail freight growth in Europe), *poor infrastructure / traffic management* (main drivers of route interruptions and significant freight train delays), *costly ERTMS / technology investments* (creating disproportional costs for challengers), *complex / incomplete regulation* (both implementation issues and additional needs) and *unhealthy competition* (caused by cross-subsidization at incumbents and subsidy schemes).

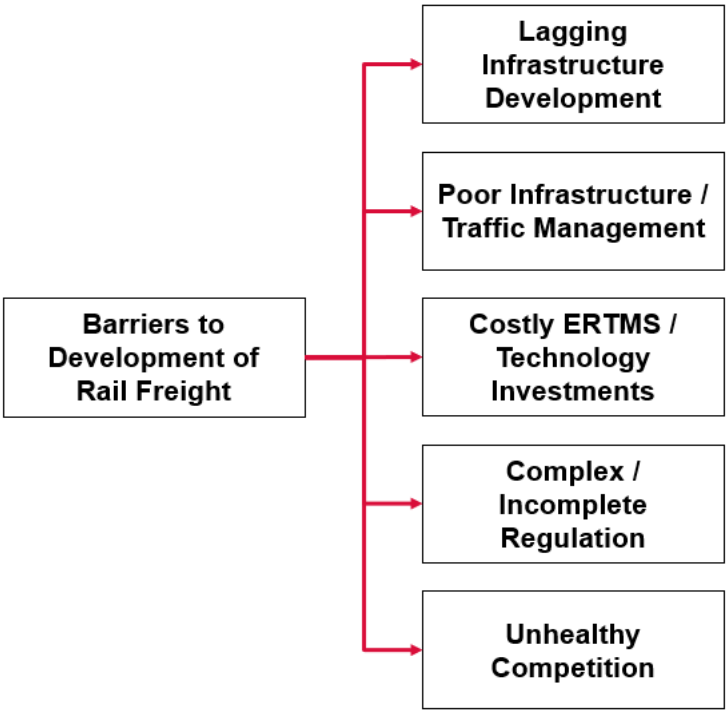


Exhibit 64: Issues Tree Overview

5.2.2 Detailed Discussion of Main Issues

The five main topic areas are divided up into sub-issues and detailed below. These are described and selected examples are given based on our research as well as our stakeholder and expert interviews. The first main topic area, *Lagging Infrastructure Development,* is broken down into three sub-issues illustrated below in Exhibit 65: *Insufficient Capacity*, *Delayed Capacity Expansion* and *Insufficient Infrastructure Quality / Performance*. The sub-issue *Insufficient Capacity* is then sub-divided into five detailed issues: *Main Routes Congested*, *Network Nodes Congested*, *Border Crossing Delays*, *Lack of Enroute Passing Tracks* and *Lack of Staging / Parking Tracks (Borders / Shunting)*.

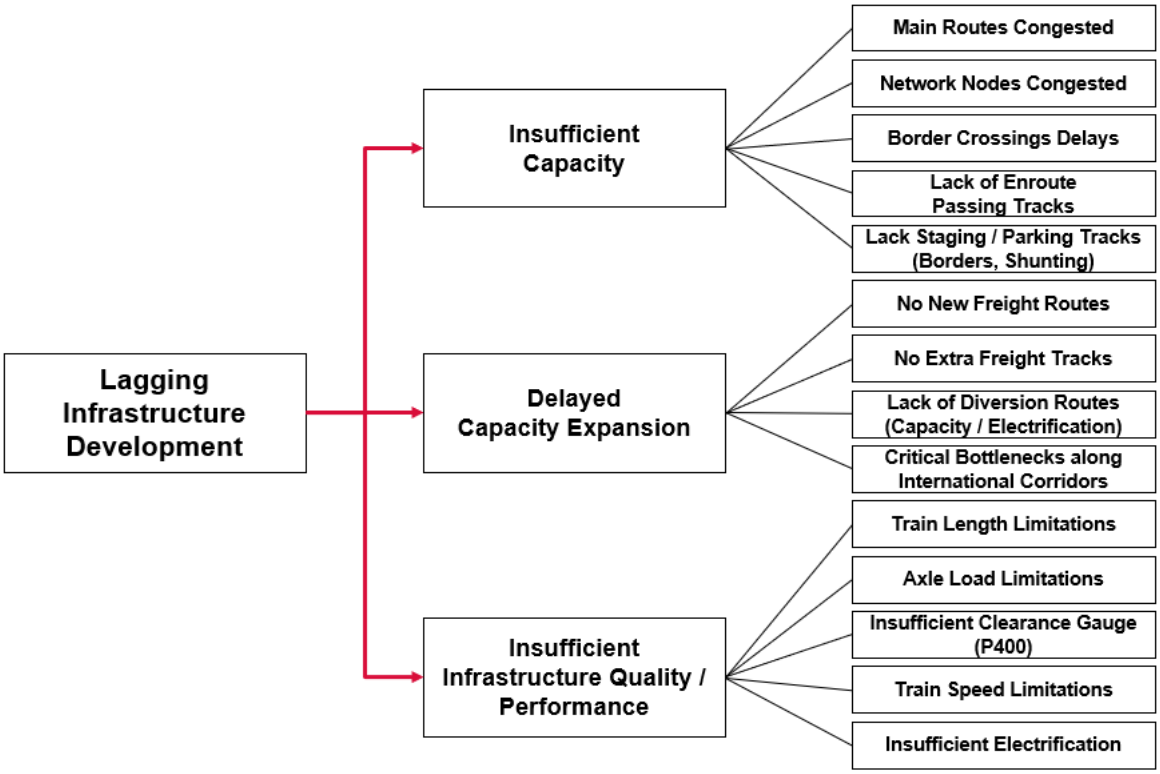


Exhibit 65: Topic Area "Lagging Infrastructure Development"

The next paragraphs discuss the *Insufficient Capacity* issue in more detail. The total length of congested EU railway track has almost doubled from 2015 to 2018. In total, congestion affected 2 261 kilometers of track in the 27 countries of the EU. More than half affected the defined European Rail Freight Corridors: 1 339 kilometers (European Commission, 2021). Congested railway tracks are a major barrier for the growth of the rail freight industry, particularly as passenger trains are treated in priority for capacity allocation, which further reduces the available capacity for rail freight.

Congestion in major rail freight corridors is worsened by capacity constraints at main network nodes, typically located at major cities or metropolitan areas. There, mass transit systems operate with high train frequency along with long-distance domestic and international trains that receive priority access in and out of passenger rail stations. Consequently, rail freight services are either routed at night hours, or on available day paths that require high amounts of dwell time in passing tracks to make way for passenger trains. The day-time freight journeys not only increase transit time of freight trains, but also reduce available capacity because they operate at different speeds and don't stop in stations thus requiring more headway (distance required for safe braking) between trains.

Despite efforts by infrastructure managers to improve international path planning and application processes, there are still too many border crossings at which paths for freight trains do not match. This is for example the case when the Betuweroute in the Netherlands meets the German network from Emmerich to Duisburg, or in the Upper Rhine valley in Germany when it links to the four tracks in Switzerland to the Gotthard and the Loetschberg-Simplon routes. These bottlenecks de facto reduce the capacity and causes operational issues (e.g., dwell time, delays, etc.) with consequences for customers, drivers, terminals, etc.

Over the last two decades, several infrastructure managers have abandoned and/or removed passing tracks in an effort to simplify networks and to reduce costs. However, they underestimated the negative effects it would have on international freight trains. With the lack of enroute passing tracks on mixed use routes, freight

trains cannot let faster passenger trains go by, and capacity for freight is thus curtailed. Finally, rail freight companies complain that there are not enough staging and parking tracks available at border crossings or for shunting purposes. These further limits the available capacity for freight trains and the ability to consolidate or deconsolidated groups of wagons for customers that cannot justify or accommodate full length trains.

The sub-issue *Delayed Capacity Expansion* is sub-divided into *No New Freight Routes*, *No Extra Freight Tracks*, *Lack of Diversion Routes (Capacity, Electrification)* and *Critical Bottlenecks along International Freight Routes*. With the notable exception of the Betuweroute, connecting the port of Rotterdam with Germany, commissioned in 2007, there have been no significant new rail routes dedicated to freight built in Europe. The European rail network is thus considered by governments and infrastructure managers as mixed use. Investments in new infrastructure are evaluated on the basis of the combined benefits for long-distance, regional passenger and freight services. Considering the inherently lower economic contribution of freight trains (due to road and waterway competition), it is difficult to justify significant freight line investments unless there is a strong political will to address environmental issues or to shift road traffic to rail. This issue is worsened by the long planning and approval periods for major infrastructure projects in Europe.

Consequently, rail freight operators have asked for other solutions to add capacity like upgrading selected secondary lines for them to become electrified international freight routes. This comes at the cost of requiring freight trains to run longer distance to take the secondary line detours. It should be noted that initiatives to upgrades secondary lines have made little progress to date. While rail operators are making concrete proposals, infrastructure managers continue to be reluctant, probably due to the lack of adequate national funding schemes for the upgrades or concerns that residents would protest against noises caused by freight trains.

Insufficient Infrastructure Quality / Performance comprises five detailed issues: *Train Length Limitations*, *Axle Load Limitation*, *Insufficient Clearance Gauge (P 400*,) *Train Speed Limitations* and *Insufficient Electrification*. A good illustration of these issues can be found in the comprehensive study analyzing the bottlenecks along the Amber Rail Freight Corridor connecting the port of Triest in Italy with Slovenia, Hungary, Slovakia and Poland (Kontúr Csoport Ltd and TRENECON Consulting and Planning Ltd., 2020). As illustrated in Exhibit 66 below, all the issues hindering efficient freight transport can be found on a line that is just 40 km long: Low axle loads, no electrification, low train speed, train lengths limitations, and no ERTMS. To make matters worse, the timeframe given to comply with Technical Specifications for Interoperability (TSI) range from 2030 to 2050 and on that basis this route is not part of the TEN-T scheme. With comparable situations along many other European Rail Freight Corridors, combined with the lack of diversion routes, the lack of needed capacity for growing rail freight traffic is expected to accumulate over the next decade.

From-to	Length (km)	Section quality by the compound index	Infrastructure deficiency / bottleneck	Capacity bottleneck currently / future	Time frame to comply TSI	TEN-TEN-T compliance	Bottleneck type
Budaörs-Kelenföld	5.6	acceptable	Axle load low	no / expected	2030	Does not comply with TEN-T	infrastructure & future capacity
Pinnye-Fertőszentmiklós	6.9	acceptable	No ERTMS	no / expected	2050	Main parameters already fulfilled but no ERTMS	infrastructure & future capacity
Balotaszállás elágazás-Harkakötöny elágazás	1.7	very poor	Axle load low, train speed very low, no ERTMS	no / not expected	no obligation (non-TENT-T)	Does not comply with TEN-T	infrastructure
Sátoraljaújhely-Slovenské Nové Mesto (state border)	0.5	very poor	No electrification, train length very low, line speed low, no ERTMS	no / not expected	no obligation (non-TENT-T)	Does not comply with TEN-T	infrastructure
Hatvan A elágazás-Hatvan D elágazás	3.8	very poor	Axle load low, train speed very low, no ERTMS, significant restrictions	no / not expected	no obligation (non-TENT-T)	Does not comply with TEN-TTEN-T and significant restrictions	infrastructure
Vasvár-Pácsony	10.1	very poor	Axle load low, very high gradient, no ERTMS	no / not expected	2050	Does not comply with TEN-T, limitations due to high gradient cannot be eliminated	infrastructure
Angyalföldi elágazás-Rákosrendező elágazás	1.0	poor	Axle load low, train speed very low, no ERTMS	no / not expected	no obligation (non-TENT-T)	Does not comply with TEN-T	infrastructure
Újszászi elágazás-Paládicspuszta elágazás	1.1	poor	Axle load low, train speed very low, no ERTMS, significant restrictions	no / not expected	2050	Does not comply with TEN-T and significant restrictions	infrastructure
Egervár-Vasboldogasszony-Zalaszentiván	7.5	poor	Axle load low, no ERTMS	no / not expected	2050	Does not comply with TEN-T	infrastructure
Kőbánya felső-Rákos	3.1	poor	Axle load low, line speed low, no ERTMS	no / not expected	2030	Does not comply with TEN-T	infrastructure

Exhibit 66: Selected Example for Bottlenecks at RFC Amber

As shown in Exhibit 67 below, the topic area *Poor Infrastructure / Traffic Management* is broken down into six sub-issues: *Lack of Attractive Alternate Routes*, *Capacity Reduction Due to Construction of Blockages*, *Insufficient Recovery Plans after Irregularities*, *Lack of Attention to International Freight Traffic*, *Insufficient International Coordination of Construction Works* and *Path Application & Allocation Process Issues*.

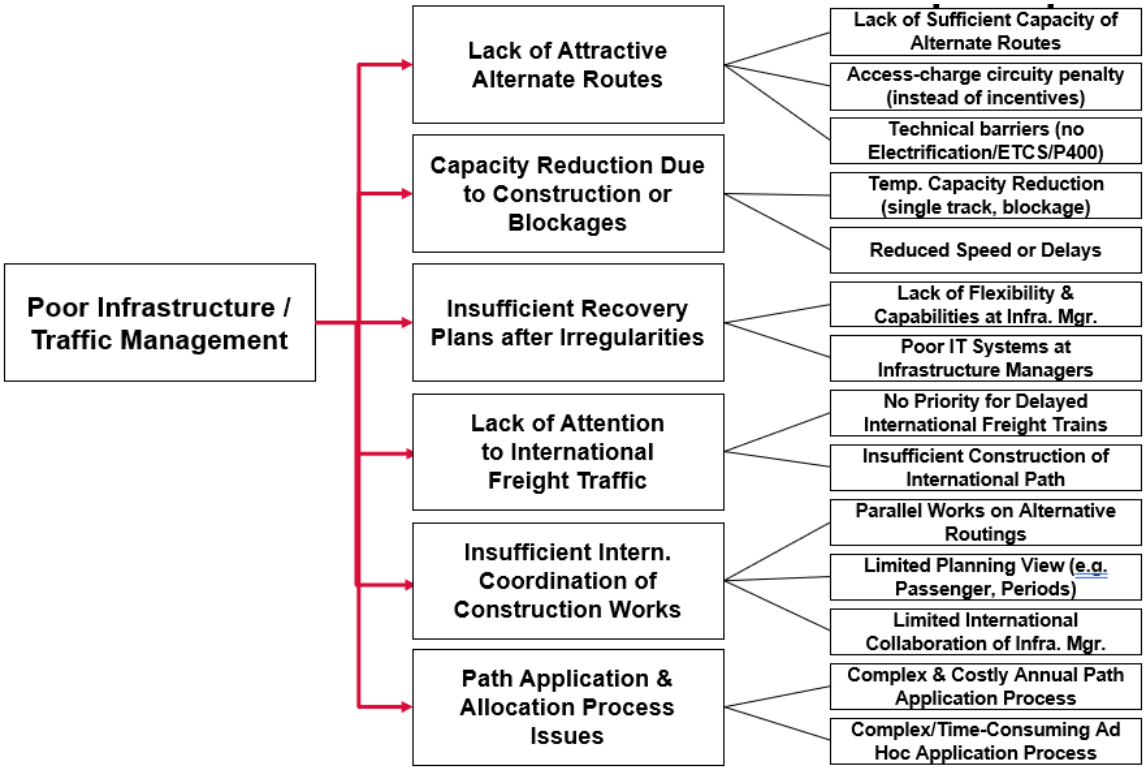


Exhibit 67: Topic area «Poor Infrastructure / Traffic Management»

The Lack of Diversion Routes was mentioned above in the discussion of Infrastructure Development, a long-term challenge. Considering the growing number of construction and maintenance works along rail freight corridors, the lack of diversion routes is a pressing short-term issue as well. Currently, infrastructure managers

concentrate on planning construction works and on communicating the resulting line blockages, or temporary capacity reduction. They however mostly fail to identify viable diversion routes for freight trains that could avoid severe capacity reductions or blockages. Rail freight companies are likely to prefer longer routings over canceling customer trains. This would require of course that capacity on diversion routes be added, and that limitation such as the lack of electrification, axle load or train length limitations be overcome. Finally, there is a circuity penalty in the current access charging systems whereby trains on a diversion have to pay the total distance covered by the train. This additional cost either reduces the competitiveness of rail vs. other modes, or it reduces the profitability of freight operator which is often limited due to competitive pressures.

Today, construction works are resulting in temporary route closures or capacity reductions that result in increased train transit times, and often in unplanned delays as well. This problem is compounded when there are multiple construction sites along an international freight route. Insufficient international coordination of construction works further increases the negative impact of such works and can lead to significant blockages.

Rail freight operators complain to infrastructure managers about insufficient recovery plans after irregularities. Despite frequent irregularities, such as route blockages after accidents, landslides or floods, there seem to be insufficient structured plans and procedure to recover train operations in a rapid and standardized way. It remains unclear, whether such plans exist or not or whether such plans can't be executed. Several stakeholders pointed to the fact that many infrastructure managers' legacy IT systems are outdated and can only support stable operations and are inadequate in business recovery situations. After major irregularities it can take over a week to fully recover operations on major international freight routes, which is obviously not acceptable for rail customers and is costly for freight operators.

This challenge is well illustrated by the case of the 15 March 2021 landslide in the Middle Rhine Valley near Kestert that blocked the route for several weeks. The core problem from the perspective of railway operators did not lie in resolving this problem faster, but in the lack of agility by the infrastructure manager. Harsh criticism was applied on the infrastructure manager since both the recovery and the traffic management measures appeared as inconsistent and harmful for rail freight. Poor crisis management was observed at similar events in 2017, 2019 and 2020. The rail freight industry is under the impression that infrastructure manager do not give enough attention to dealing with frequent track blockages. In addition, the long diversion routes proposed by infrastructure managers added as much as 300 kilometers to the journey for trains connecting North Sea Ports with Southern Germany, Switzerland, and Northern Italy as they are now transiting through Kestert, Siegen and Saarbrücken. These routes make it very challenging for rail freight operators to plan for personnel, locomotives and terminals, and result in a domino effect of delayed departure. What surprised rail operators in this crisis was that the network manager avoided diverting traffic via the Rhine's left bank tracks (Middle Rhine Valley remains closed for freight traffic till Easter, 2021).

There seems to still be a lack of attention to international freight traffic, and delayed freight trains are not getting priority against passenger trains. This in turn causes further delays. Also, it appears that the planning of international paths for freight trains is far from perfect. There are cases of paths that do not match at border crossing, resulting in trains being held back at borders and having to wait for an *ad hoc* path, typically at slower speeds. In other cases, mentioned, infrastructure managers fail to consider frequent random checks of freight trains at outer borders of the Schengen Area. Consequently, freight trains that are inspected miss their planned path and must wait for available *ad hoc* paths.

Finally, there is the sub-issue of *Path Application and Allocation Process* as stakeholders complain about the complex and costly annual path application, as well as the complex and the time-consuming *ad hoc path* application processes. While the establishment of European Rail Freight Corridors and the One-Stop-Shop concept has led to some improvements, there are still issues when trains run beyond the corridors. The same has been observed for regular requests for *ad hoc* paths when the official reserve capacity for a given Rail

Freight Corridor has already been consumed. Also, the need to book paths eight months prior to the start of the new annual timetable season does not fit well with rail freight customers who face significant seasonal demand swings, or for the need to respond quickly to new customer demands with additional capacity. This path application and allocation process among European infrastructure managers will continue to create a sizeable challenge for rail operators for the foreseeable future.

As shown in Exhibit 68 below, the topic area *Costly ERTMS / Technology Investments* is determined by five sub-issues: *ERTMS Roll-out Infrastructure*, *ETCS Installation Locomotives*, *Obsolescence of Legacy Train Control Systems*, *Automated Coupling and Break Testing* and *Regulation of Locomotive Approvals / Certifications*.

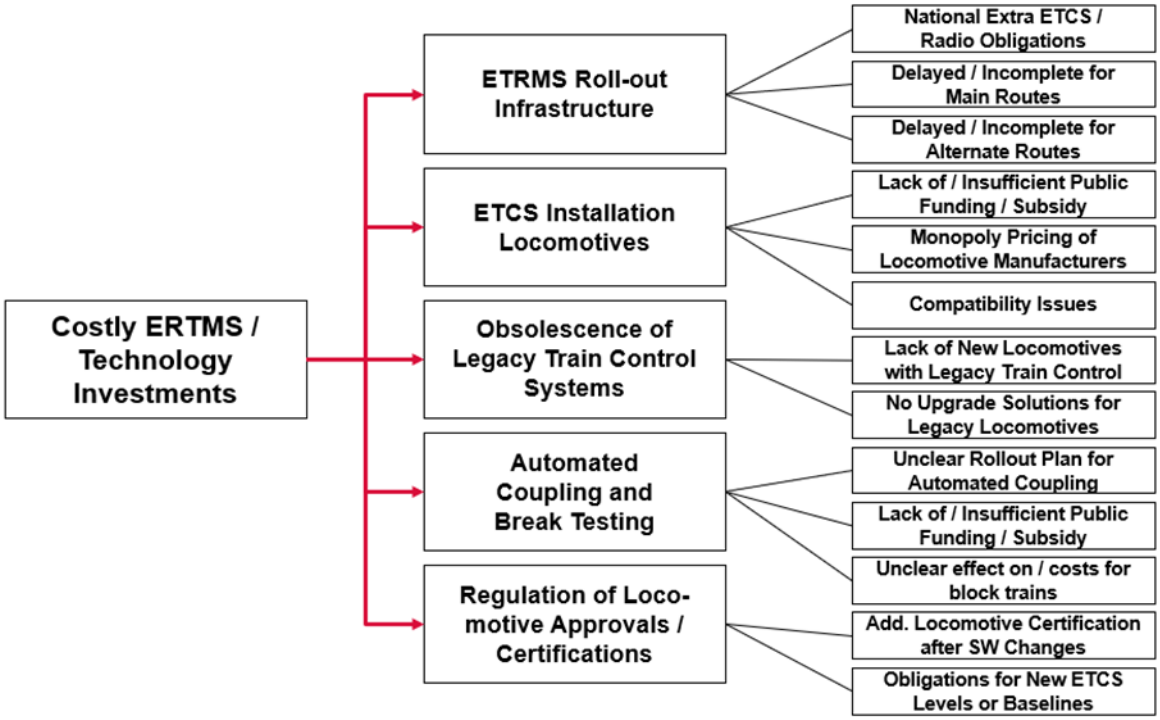


Exhibit 68: Topic Area "Costly ERTMS / Technology Investment"

The sub-issue *ERTMS Roll-out Infrastructure* is broken down into three issues: *National Extra ETCS /Radio Obligations*, *Delayed / Incomplete Rollout for Main Routes* and *Delayed / Incomplete Rollout for Alternate Routes*. It is well known that the rollout of ERTMS is significantly delayed. According to the latest figures available to EIM, the association of European Rail Infrastructure Managers, in 2017 out of 51 000 km of the Core Network Corridors (CNC), only 4 400 km (8%) have been equipped with ERTMS. The Rhine-Alpine corridor is the best in class in terms of ERTMS rollout with currently 13% of the track length equipped. However, European institutions recognize that the overall slow pace of ERTMS deployment places the target of 30% of the CNC equipped with ERTMS by 2030 at risk of not being achieved (European Rail Infrastructure Managers, 2020). The issue is not only the slow roll-out, but the high cost imposed to rail freight operators running trains on international routes. This is due to the need to install not only one ETCS system on their locos, the original intent of the approach, but several country packages for trains to run without switching locomotives at borders, but also through patches of a route where legacy train control systems are changed to ERTMS. Similar issues occur with additional national requirements for on-board radio systems. There are also several specific national requirements to be followed that result in extra equipment and training costs.

The sub-issue *ETCS Installation Locomotives* comprises three detailed issues: *Lack of / Insufficient Funding / Public Subsidy*, *Monopoly Pricing of Locomotive Manufacturers* and *Compatibility Issues*. Current funding

programs by member states offer different schemes. Generally, the amount provided per locomotive ranges from 60 000 EUR to 120 000 EUR, which is only a fraction of the total cost of ETCS installation that ranges from 250 000 EUR to 400 000 EUR, depending on the number of required country packages. Several stakeholders complained about monopoly pricing by locomotive manufactures. Despite the promise made by the European Commission when issuing the first regulations regarding ERTMS, ETCS on-board units are not standardized equipment, like a personal computer, but proprietary developments of the different locomotive manufacturers, who can price them freely. Finally, there are compatibility issues between the different on-board systems and infrastructure managers' national versions of ERTMS.

As a detailed case study on a pilot line in Belgium revealed, there are compatibility issue of ETCS resulting from different type of rolling stock and on-board units and the need for new software releases for the Radio Block Center (RBC), as well as additional certifications that are needed for some rolling stock before they can be allowed for safe operations on a route equipped with ETCS Level 2. The conclusion was that "ETCS L" is not yet at its full potential due to the migration of rolling stock. After 2025, more benefits (are expected) by removing the signals and shifting to ETCS Level 3" (Werner Y. , 2019). In other words, rail freight operators will face extra costs for another decade given the slow pace of implementation.

The sub-issues *Obsolescence of Legacy Train Control Systems* contains two detailed issues: *Lack of New Locomotives with Legacy Train Control Systems* and *No Upgrade Solutions for Legacy Locomotives*. With added delays for completing the ERTMS rollout on Core Network Corridors (CNC), these issues are getting more pressing. It has been reported from Poland and Portugal that rail freight carriers cannot deploy modern multi-system locomotives as they are not able to run on parts of the route where legacy train control systems are not replaced by ERTMS and no legacy train control system packages being available for modern locomotives. Hence, they need to continue with the switch of locomotives at border crossings. A similar situation exists for legacy locomotives, where several types will never get availability of suitable ETCS on-board units to upgrade them for international traffic.

The sub-issue *Automated Coupling and Break Testing* is broken down into three detailed issues: *Unclear Rollout Plan for Automated Coupling*, *Lack of / Insufficient Funding / Public Subsidy* and *Unclear Effects on Costs for Block Trains*. The EU rail sector signed a Memorandum of Understanding (MOU) in July 2020 aiming to introduce Digital Automated Coupling (DAC) by 2030. Train assembly, by coupling and decoupling, is one of the two main procedures in train operations along with train driving and is done manually today. Its automation is of the utmost importance to increase productivity and to reduce operating costs, especially for the wagonload business of incumbents. Europe is trailing the world in this respect, as it is the last continent to use standard manual couplers. DAC technology will generate additional benefits, like providing electricity and a data bus line across the entire train, automated brake testing, electro-pneumatic brakes, and will enable real-time train consist checks which is a key requirement by infrastructure managers for the introduction of ERTMS level 3 (also scheduled for 2030). The EU DAC Delivery Program has been set up under the umbrella of the Shift2Rail Joint Undertaking, but no concrete plans have been published so far (Memorandum of Understanding between European Railways and Rolling Stock Keepers for the European Digital Automatic Coupling (DAC) for rail freight , 2020). With only 8 years remaining, and about 500 000 freight wagons to be equipped with Digital Automated Couplers, it is unlikely that the ambitious goal of retrofitting the complete fleet will be achieved by 2030. While the benefits will only be fully realized once the whole fleet has been converted, costs will increase proportionally to the number of converted freight wagon fleet and thus accumulate in a way similar to the situation observed for ERTMS. Furthermore, the question remains as to how to schedule this huge retrofit program as mixed fleets of freight wagons with and without DAC will no longer be compatible. It should be noted that freight wagons operated in fixed compositions (like for

intermodal) the benefits of DAC will be minimal, while the most notable impact will be expected for wagonload traffic.

The Sub-issue *Regulation of Locomotive Approvals / Certifications* is broken down into *Additional Locomotive Certification after SW Updates* and *Obligation for (Upgrade to) New ETCS Levels or Baselines*. Both issues create additional costs rail freight operators and have a negative impact on locomotive availability.

As shown in Exhibit 69 below, the topic area *Complex / Incomplete Regulation* is sub-divided into five sub-issues: *Safety Certificates*, *Priority of Freight vs. Passenger Trains*, *Discrimination / Antitrust Claims*, *Driver Shortage* and *Level Playing Field for Road vs. Rail*.

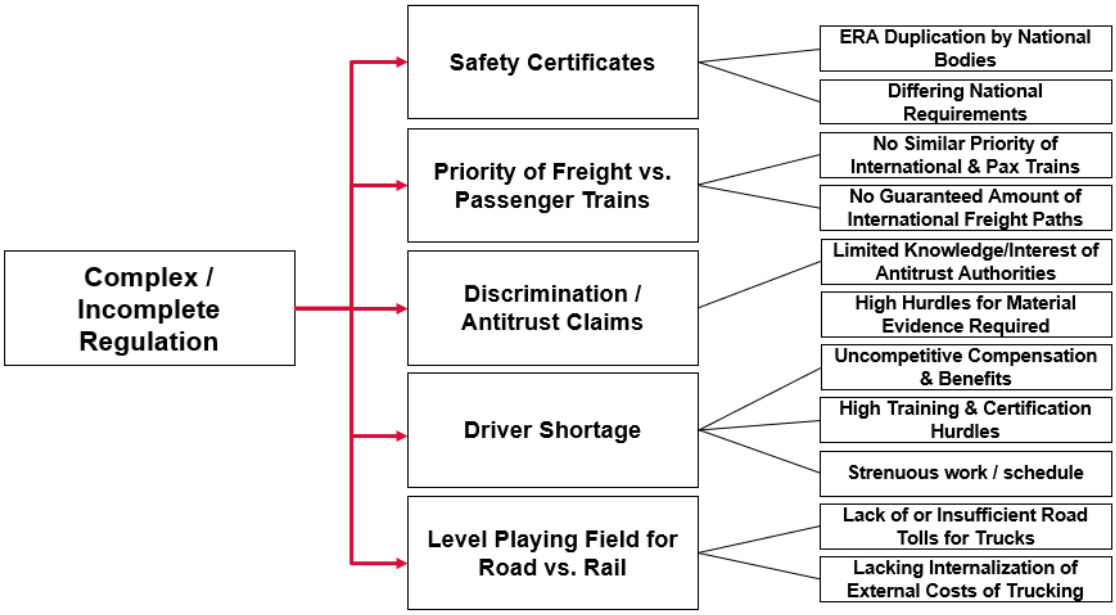


Exhibit 69: Topic Area "Complex / Incomplete Regulation"

The Sub-issue *Safety Certificates* contains two detailed issues: *ERA Duplication by National Bodies* and *Differing National Requirements*. While the legislation is clear in theory, in practice there is still the request by some national safety agencies to define additional requirement and issue their own certificates. This cancels out the intended benefits of making ERA the sole responsible body for safety certificates.

The Sub-issue *Priority of Freight vs. Passenger Trains* comprises of *No Similar Priority of International Freight Trains and Passenger Trains* and *No Guaranteed Amount of International Freight Paths*. While there are general priorities for international trains vs. domestic train services, it was not clearly defined on the European level what priority rules shall apply for international freight trains. This remains, with a few exceptions, the responsibility of infrastructure managers. The regulatory framework is far from homogeneous across Europe, as can be seen from Exhibit 70 below. Only in Denmark, and in several countries in Eastern and Southeastern Europe, are priority rules defined under national laws. The priority rules themselves differ widely according to Rail Net Europe (RNE) (Overview of priority rules in operation, 2020). For instance, in Romania in the priority ranking of CFR, international freight trains are N° 6, behind local/regional passenger trains. In Germany, the category international freight trains does not exist, but rail operators can opt for more expansive "express / fast trains" that will get prioritized vis-à-vis regular trains (passenger / freight). In Croatia passenger trains always get priority down to local trains, and "Express Freight Trains" and "Fast Freight Trains" follow as N° 10 and N° 11 in the ranking. In Belgium, international freight trains also don't exist. "Fast Freight Trains >100

km/h)" are ranked N° 9 and "Slow Freight Trains 80-100 km/h" follow at N° 12. In Hungary, the section priority 1 is reserved for passenger trains (international / national) and freight trains only gets priority 2. There was no single example cited where international freight trains were getting priority vs. passenger trains. These examples confirm that rail freight does not seem to be a priority for infrastructure managers neither on domestic nor international routes.

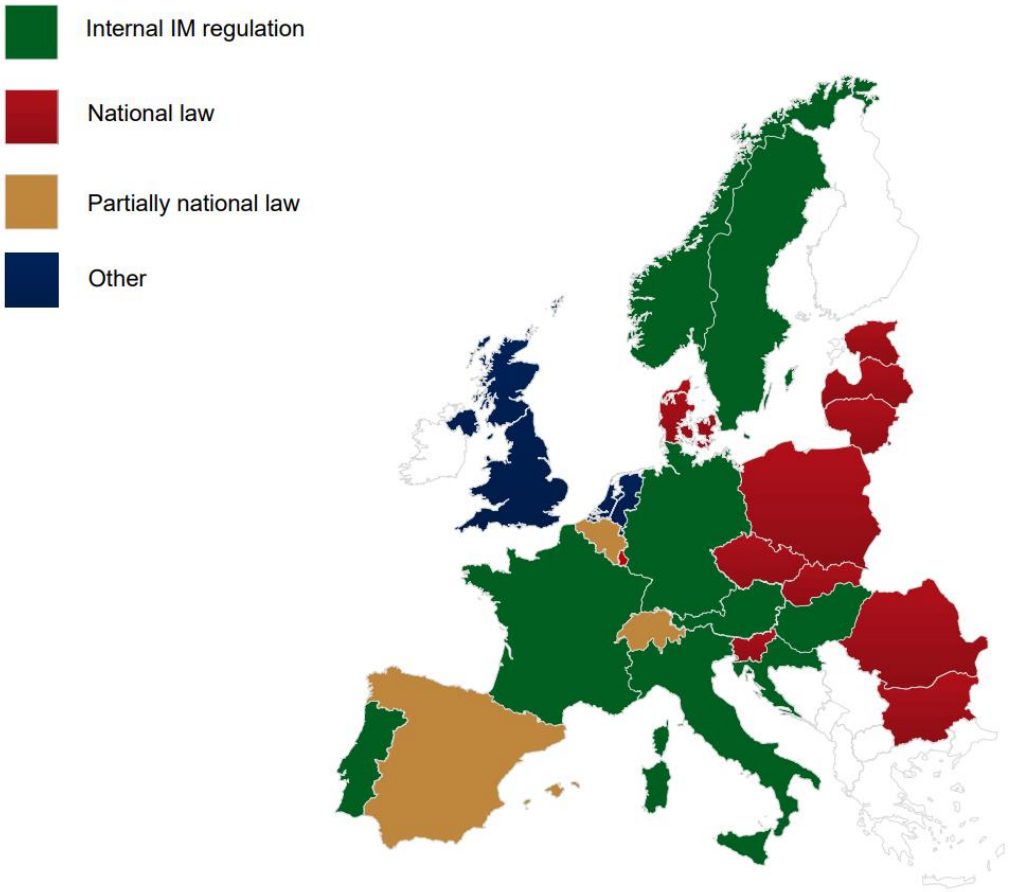


Exhibit 70: Overview on legal status of priority rule in rail operations

The Sub-issue *Discrimination / Antitrust Claims* is broken down into *Limited Knowledge of Antitrust Authorities* and *High Hurdles for Material Evidence Required*. Stakeholders interviews highlighted the fact that most antitrust authorities in member states are responsible for a broad portfolio of sectors, in most cases including utilities and telecoms. Even within the rail sector, their focus appears to be primarily on the passenger business and passenger rights in case of delays or cancelled trains. They also complain that there are high hurdles for material evidence to substantiate a case (e.g., low bid prices due to internal cross subsidies of incumbent rail freight companies). In fact, there have been very few cases recorded on the European level regarding rail freight services. There were rulings against České Dráhy (CD), the Czech Railways in 2016 and against Lietuvos Geležinkeliai, the Lithuanian Railway in 2017 (Paukste, 2019). Lately, the EU Commission has fined Deutsche Bahn (DB), Austrian Railways (ÖBB), and Belgian Railways (SNCB) for sharing information on competitive bids and customer allocation scheme, an illegal practice (Antitrust: Commission fines three EU railway companies €48 million for customer allocation cartel, 2021).

The rail freight sector suffers, just like the road haulage sector, from a growing *driver shortage* problem. This sub-issue is broken down into *Uncompetitive Compensation / Benefits*, *High Training and Certification Hurdles*

and *Strenuous Work / Schedule*. Compared to passenger train services, rail freight locomotive drivers face a much higher proportion of night shifts. Crew rosters are less predictable and extra shift are often required, resulting in a lower ability to plan personal activities. Finally, given the higher rate of freight train delays, driving shifts tend to run longer than those of passenger train drivers. The long formal training and rigorous testing to obtain a train driver certification discourages candidates to apply for driving jobs with railways.

Since the beginning of 2016, training standards in the European Union have been harmonized. All train drivers have to acquire a train driver's license. This license covers the basic knowledge necessary for a train driver in all countries. Then, specific technical complementary certificates for each country are added. Train drivers may only drive a train when they have acquired both certificates. When working in cross-border traffic, train drivers need a complementary certificate and must possess a B1 level of language competency for each country they work in. Switzerland has opted for a more flexible solution by requiring an A1+ language competency only. This system has proven to be satisfactory while addressing all safety concerns. In 2018, train driver trade union representatives (ALE) and private rail freight companies agreed that English should be adopted in the future as a common second operational language for rail, facilitating cross-border rail services in Europe (EU railway companies should 'get going' with language pilots, 2018).

The Sub-issue *Level Playing Field Road vs. Rail* is divided into *Lack of or Insufficient Road Tolls* and *Lacking Internalization of External Costs of Trucking*.

As shown in Exhibit 71 below, most European countries have already introduced road tolls for trucks, but their level varies widely, and next to mileage-based systems there are still several cases of time-based systems (e.g., annual or short-term passes). In October 2018, the European Parliament (EP) endorsed legislation to introduce a mileage-based toll system for all heavy trucks and busses by 2023, aiming to achieve more fairness for users and protecting the environment (Road charges in the EU: a fairer and environmentally friendlier system, 2018). Despite this effort for standardization, member states will remain responsible for setting the price per kilometer and will have the option not to levy tolls. In 2019, road truck tolls varied from 0.04 in Poland to 0.47 EUR per km in Austria. In France, motorways were free of charge in Alsace/Lorraine, Auvergne and Bretagne, and around urban areas (Information sur les péages pour la France). An attempt to implement a distance-based tax on freight vehicles on all French roads was revoked following protests in 2014, despite the full deployment of a comprehensive technology for measuring road use nationwide. In comparison, Switzerland charged between 0.10- 1.10 EUR per km. It appears obvious that most member states only charge a minimum and that whatever cost levied on truck traffic is insufficient to compensate for externalities caused by heavy truck traffic on roads (i.e., congestion, air pollution, greenhouse gas emissions, accidents, noise) (On the road in Europe – How much you have to budget for in toll charges in 2019, 2018).

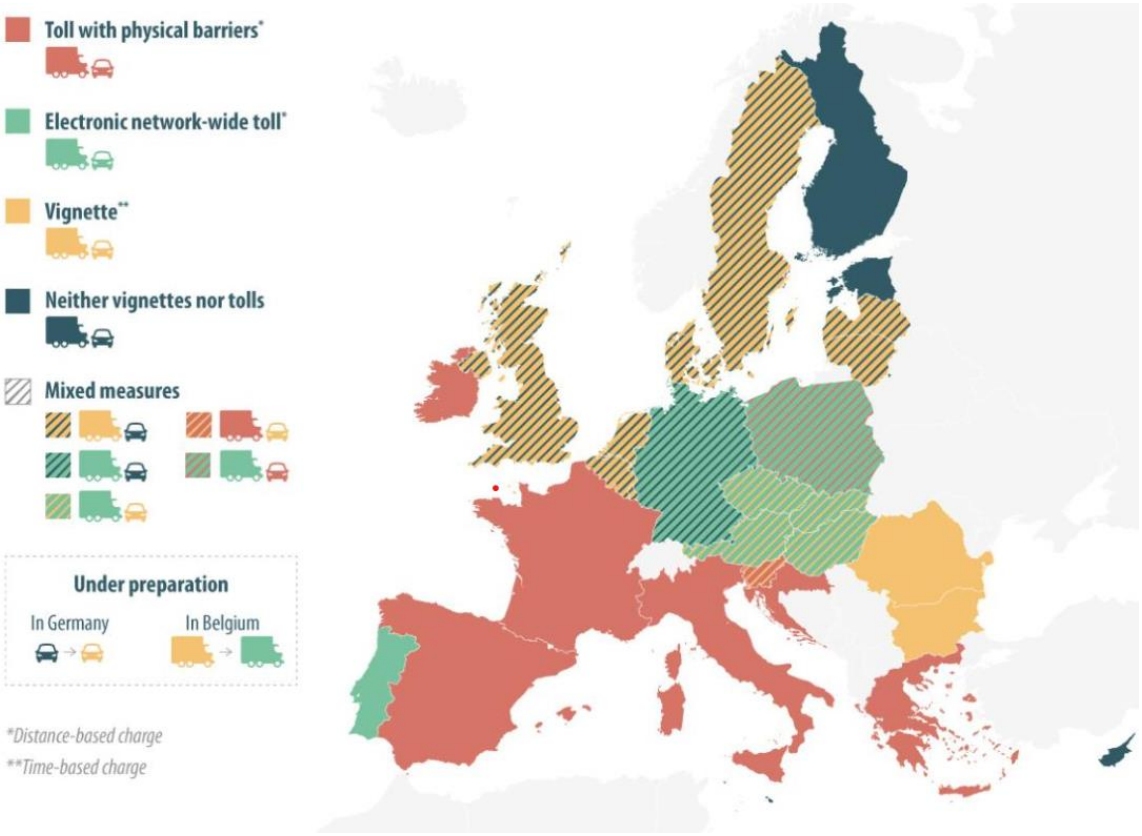


Exhibit 71: Road Charges Situation

As shown in Exhibit 72 below The topic area Unhealth Competi*tion* is sub-divided into five sub-issues: *Advantages for Locomotive Drivers of Incumbents, Bundling and Predatory Pricing, Cross-Subsidization, Government Subsidies* and *Irrational Behaviour of Challengers*.

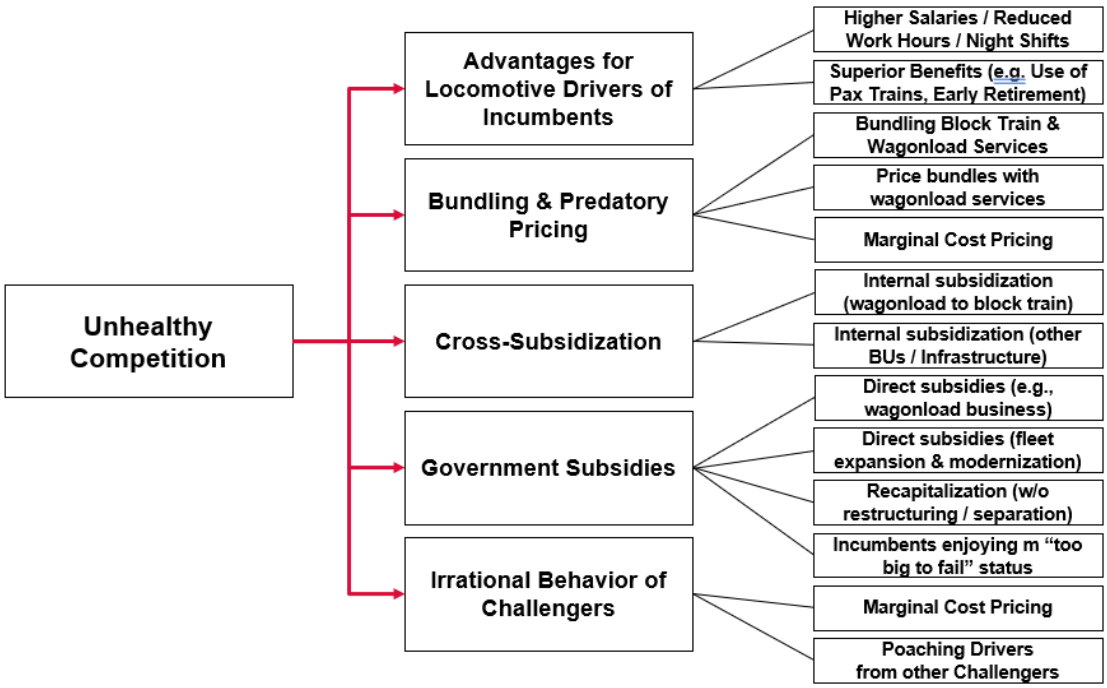


Exhibit 72: Topic Area "Complex / Incomplete Regulation"

The Sub-issue Advantages for Locomotive Drivers of Incumbents contains two detailed issues: *Higher Salaries / Reduced Work Hours / Night Shifts* and Superior Benefits (e.g Use of Pax Trains, Early Retirement). While in general specific collective labor agreements are valid for the railway sector (incumbents and challengers) in each member state of the European Union, there typically are individual labor agreements regarding work hours, compulsory break times, roster and shift planning for state-owned railways that result in more relaxed work schedules for locomotive drivers. In addition, the integrated railways can offer benefits not available for challengers, like free travel passes to use all passenger trains of incumbents on the way to / from the shifts as well as for private trips. Many state-owned railways traditionally offer early retirement schemes, which add to the more beneficial terms and conditions at legacy players making it more difficult for challengers to recruit, train and retain qualified locomotive drivers.

The Sub-issue *Bundling & Predatory Pricing* consists of three detailed issues: *Bundling Block Train & Wagonload Services, Price Bundles with Wagonload Services* and Marginal Cost Pricing. Legacy rail freight operators can offer their customers hybrid service options that combine block train and wagonload services. For instance, a shipper having sufficient volume for a direct block train to a destination only at 2-3 days per week can be offered to get direct block train service for all days where a certain threshold of number of cars is met, while at all other days the individual freight wagons will be fed into the wagonload network. Such an offer cannot be matched by challengers as they always need to serve their customers with a block train or at least a wagon group service (e.g., half a block train). With only a few wagons provided by the shipper at certain days such an offering will not be profitable.

In addition, incumbents often quote special price bundles for hybrid offerings of block train and wagonload services (i.e., the lower price for a wagon hauled in a block train will also offered for transport in the wagonload system). Such bundles cannot be matched by challengers as they do not have access to the incumbent's wagonload network. Even if they were granted access on a wagon by wagon basis for repositioning, the incumbent would likely ask for a direct cost plus overhead (and profit margin) price.

As discussed in chapter 3.3.1 Business Model Descriptions, incumbents do not separate their wagonload and block train businesses. They are rather operated as an integrated system and the block train business does not have to cover the full cost of their operation. For instance, the redistribution of empty freight wagons (typical for many block train services for dry and liquid bulk commodities) and the repositioning of idle locomotives will be taken care of by the wagonload system at no additional cost to the block train operation. The challengers need to bear such costs and as a consequence will not bid for such traffic or will appear not cost competitive in the eye of the customer as the incumbents can quote a lower price. Furthermore, incumbents often apply cost calculations that consider the majority of their operations as fixed costs and only add the marginal costs for a specific traffic when bidding for new business. This approach leads to price quotes that are lower than the "bottom up" calculations of challengers, which reflect all resources needed to operate trains on behalf of a specific customer.

The Sub-issue *Cross Subsidization* contains two detailed issues: *Internal Subsidization (e.g. Wagonload to Block Train)* and *Internal Subsidization (Other BUs / Infrastructure)*. Legacy freight railways are integrated operations with one pool of locomotives, freight wagons and drivers as well as integrated planning and traffic managerment units. Therefore, specific subsidies provided by governments to loss-making wagonload operations result in an indirect support to the block train business, which benefits from economies of scale for rolling stock and driver pools as well as shared planning and management units.

In some cases there also exists internal subsidization with other business units (e.g., regional / long-distance passenger operations), when there are shared locomotive or driver pools. Furthermore, in some countries the infrastructure division provides part of the services for the wagonload service of incumbent rail freight operators, may it be the operations of marshalling yards or even the local loop pick up and delivery services

at a very low cost (due to subsidies for wagonload operations). Such practices enable the incumbent rail freight operators to quote prices that are not covering all costs of their operations and allowing them to retain business that otherwise would have been lost to challengers.

The Sub-issue *Government Subsidies* contains four detailed issues: *Direct Subsidies (e.g. Wagonload Business), Direct Subsidies (e.g. Fleet Expansion / Modernization, Recapitalization (w/o Restructuring, Separation)* and *Incumbents Enjoying "Too Big to Fail" Status*. As mentioned above, governments are often providing subsidies for wagonload business in order to support their political goals for shifting cargo from road to rail or to maintain rail freight's modal share, at least. While such objectives and direct subsidies can be acceptable, it must be understood that with the current integrated operation of wagonload and block train services of incumbent rail freight players, those subsidies can result in unfair competition for block train offerings between incumbents and challengers.

Often the state-owned rail freight companies do not earn their cost of capital and cash flow is not sufficient to renew their rolling stock fleet. Under the headlines of accelerated ETCS rollout, or making rail even more sustainable, special funding schemes are made available to acquire new locomotives or modernize the locomotive or wagon fleet. While such subsidies are acceptable when they are available for incumbents and challengers alike, they are not acceptable when special programs are designed to the sole benefit of state-owned incumbents. Over the last two decades several cases of recapitalization of loss-making incumbent rail freight operators were reported. Approvals by the European competitve authorities (DG Comp) have been granted under certain preconditions (e.g., restructuring of operations), but not always did the state-owned railways comply with these restrictions. In other words, recapitalization measures do not result in a restructuring of ailing state-owned railways, but become a direct substitution to a loss-making operation and hinder challengers' ability to gain market share in an open and fair competition.

This type of behaviour was further supported by strong union presence at incumbent railways. They point to thousends of jobs being endangered and call for strikes to increase the pressure on governments to extend financial support to their national railways and to fund just another bailout. Over the last decade the number of such incidents has decreased and it must be said that several smaller member states of the European Union resolved this issue by fully privatizing or selling their national rail freight operators (e.g. United Kingdom, Denmark, the Netherlands, Hungary, Belgium and Portugal).

The Sub-issue *Irrational Behaviour of Challengers* breaks down into two detailed issues: *Marginal Cost Pricing* and *Poaching Drivers from Other Challengers*. Finally, it must be noted that Challengers themselves are from time to time displaying a kind of irrational behaviour when competing for business. It happened that some players priced block train offers artificially low compared with calculations from competition. As all cost components are well known and the factor costs deem to be very similar for all competitors one must assume that the "lowest offer" was produced applying marginal cost pricing. For instance, excess capacity of locomotives, avoiding repositioning of idle locomotives, filling unused capacity at driver's rosters might have led to the application of marginal cost calculations. While such actions potentially will help to cure a short term issue, this will result in artificially low price levels in the market place and limit the capacity of challengers to invest in new offerings and grow their business base.

It also was reported that from time to time that not only some incumbents tried to poach locomotive drivers from challengers offering higher salaries and superior benefits, but challengers in some countries have turned to similar action when hit by high attrition or when they miscalculated mid-term demand for their driver pool growth. We recommend to end such "irrational behaviour" as poaching of competitors drives will result in a "net zero" game, where the scarce capacity of qualified drivers will not be increased, but the cost for this key resource to further growing rail freight in the European market.

5.3 Potential Improvement Measures

Based on our research, stakeholder consultation, and expert interviews, we have identified 10 areas for improvement measures to help rail freight grow and enabling it to make a disproportionate contribution to the Green Deal of the European Union. Rail Freight Forward (Rail Freight Forward, 2018) and other industry representatives, academia and experts are united in their belief that boosting rail freight is the best macro-economic solution for supporting sustainable European economic growth. This requires transforming rail freight into a high-performing, efficient, and sustainable backbone transport system for a European multimodal logistics industry. The visionary goal, *30 by 2030*, or achieving a 30% market share for rail freight by 2030, requires decisive action not only from rail undertakings, but also from infrastructure managers, policy makers, and authorities. The measures described below and highlighted in Exhibit 73 and Exhibit 74 are deemed necessary to strive towards this goal.

Measure N°1 focuses on the timely implementation of TEN-T program for rail. The EU Commission should strictly monitor implementation and make sure that projects supporting the growth of international rail freight will not be further delayed. A particular emphasis should be placed on the full implementation of required standards for freight trains (740m length, 22,5 tonnes axle load, P400 profile) throughout the major Rail Freight Corridors. In this process, the long-term capacity requirements for rail freight (Vision “30 by 2030”) should be considered independently from project prioritization for international passenger rail services. In order to allow for seamless connections and removing key bottlenecks, access to major ports and industrial and distribution zones need to be added to capacity expansion programs for Rail Freight Corridors.

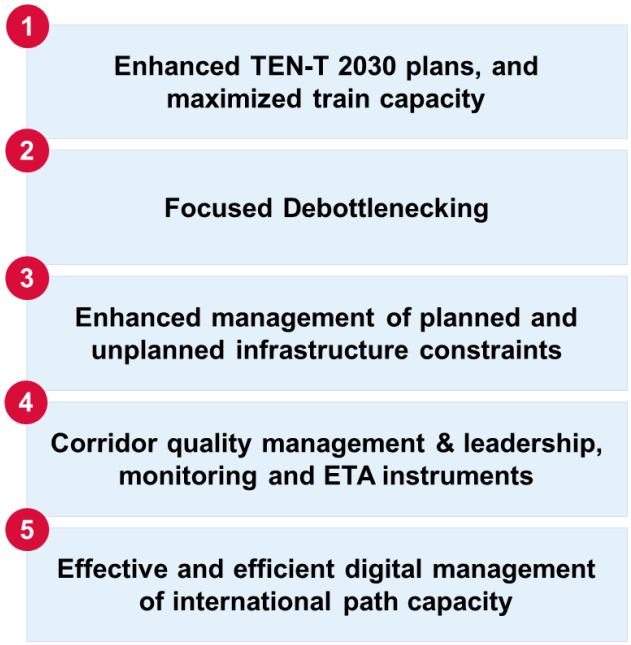


Exhibit 73: Overview of Measures 1-5

Measure N°2: Next to the long-term network expansion in line with the future capacity needs of rail freight in Europe, there is a pressing short term need to remove existing bottlenecks in a fast and decisive way. This second measure will require collective effort by infrastructure managers – both their traffic management and construction departments – on a European level. We propose a European 'task force’ for debottlenecking key routes and network nodes. This often requires rather small construction projects that usually do not get prioritized.

Measure N° 3 focuses on *Enhanced Management of Planned and Unplanned Infrastructure Constraints*. The critical points and line segments where external events (e.g., floods, landslides, falling rocks) frequently lead

to blockages are well known. Therefore, infrastructure managers must develop contingency plans that can be immediately deployed when such events occur. This will greatly reduce their negative effects on international freight trains (e.g., freight trains delays, train cancellations, missed international paths). Such contingency plans should also include viable options for ad hoc diversions that require minimal extra distance and transit time. Infrastructure manager should define investment priorities for alternate routes / deviations in their national networks to provide extra capacity for freight trains, particularly until new capacity from major infrastructure programs becomes available along main rail freight corridors. There is already quite some extra capacity available in legacy networks that can be used to help rail freight grow in Europe. The international contingency management capability of infrastructure managers should be strengthened to ensure better and faster response to route blockages along main rail freight corridors. Finally, the access charge regimes should be reviewed for international freight trains. At a minimum, there should be no extra cost for deviations due to route blockages. In the long run, infrastructure managers should introduce new charging schemes for international freight trains that are based on the direct distance ("as the crow flies") between origins and destinations. This would help attract more traffic away from road, particularly where rail freight operators are currently uncompetitive due to higher track access charges, including energy, to due lengthy alternate route.

Measure N° 4 focuses on *Corridor Quality Management & Leadership, Monitoring and ETA Instruments*. This proposal is to further improve international path constructions so as to eliminate remaining inconsistencies, particularly at border crossings, and to strengthen the international corridor One-Stop-Shop setup (Corridor One Stop Shop, n.d.) for path application, but also for the coordination of international construction works planning, and for business recovery when irregularities occur. The rail freight industry would also welcome more consistent quality management based on Estimated Time of Arrival (ETA) data. Rail Net Europe (RNE) started a program to calculate the estimated time of arrival at a higher rate of precision than with linear methods used in the past. Following the successful implementation of previous phases, the ETA Program has set the goal to improve the accuracy of ETA by helping Infrastructure Managers (IMs) take into account different sources, and to introduce ETA calculation based on an algorithm using artificial intelligence. The implementation of the new calculation method had been planned for 2020/21. While these efforts are welcome, the planned implementation has been delayed.

Measure N° 5 focuses on *Effective and Efficient Digital Management of International Path Capacity* for rail freight. In October 2021 Europe's major infrastructure managers and railway undertakings have endorsed a joint vision on Digital Capacity Management (DCM). DCM will contribute to freeing up capacity on congested lines and to boosting modal shift to rail for both passenger and freight traffic. A strong call for investments in Digital Capacity Management is linked to its role as a major game changer to reach Green Deal targets for the transport sector. DCM is an integral part of the European program "Timetable Redesign (TTR) for Smart Capacity Management" (Rail Sector Agrees on a Common Vision on Digital Capacity Management, 2021). This initiative needs to be fully supported be the EU Commission with future legislation and adequate funding. The measures implemented by infrastructure managers to ensure adequate capacity increase to accommodate growing rail freight in international corridors should be closed monitored. Transparent and public information about plans and actual capacity allocation to rail freight is necessary to that effect. Digital Capacity Management will also help better international planning of freight paths and alignment of infrastructure mangers when scheduling construction works along major Rail Freight Corridors.

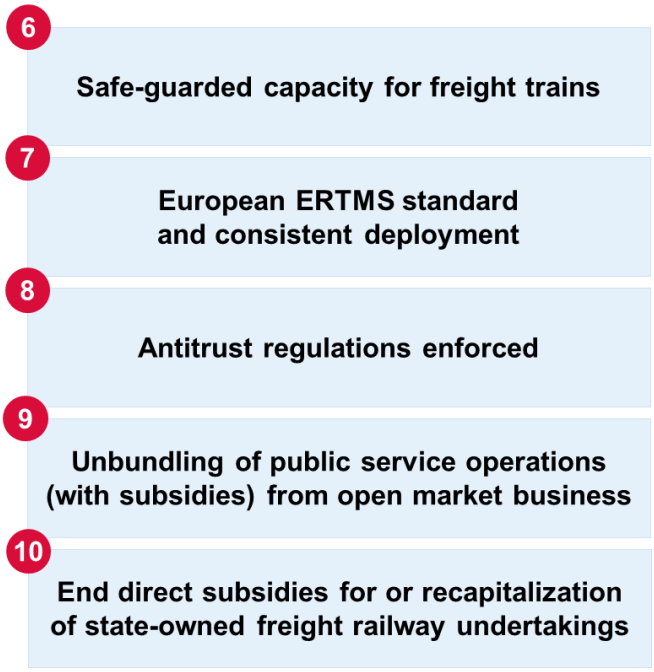


Exhibit 74: Overview of Measures 6-10

Measure N° 6 targets *Safe-guarded Capacity for Freight Trains*. As described above in this report, the constant growth of intermodal and logistics trains has kept the modal share of rail freight in Europe stable, despite drops in traditional rail freight commodities. To strive towards the political goal of boosting rail freight's modal share towards 30% by 2030, infrastructure managers need to set themselves related targets in their mid-term plans for capacity expansion and allocation of (international) train paths to rail freight. This stepwise capacity expansion to support growth of rail freight should be safe guarded by transparent concepts and plans for freight paths along the main Rail Freight Corridors and other international route. For example, the Swiss Federal Office of Transport (FOT) introduced a network usage concept, as well as plans to secure equitable future capacity, for freight and passenger traffic on the Swiss rail network. Their aim is that future demands for freight and passenger transport can be met. Train path are planned and allocated to the different types of traffic, for freight traffic in terms of both quantity and quality, with a long-term view, so as to avoid a displacement by the expansion of passenger traffic. The network usage plans secure train paths in detail for each timetable years. The plans are drawn up by the infrastructure managers six years prior to the timetable year in question and are updated as required. Swiss FOT approves the network usage plans at the request of the infrastructure managers. These plans are binding for infrastructure managers and the authorities and serve as a basis for train path allocation (Network usage concept and network usage plans, n.d.).

We recommend defining similar network usage concepts and plans for the European Rail Freight Corridors to create mid and long-term plans that consider passenger and freight trains on an equal footing and ensure sufficient capacity (pre-defined paths) with the required standards for international freight trains.

Measure N° 7 concerns one harmonized *European ERTMS Standard and Consistent Deployment*. International railway operators need to rely on a single standard and not suffer from the proliferation of proprietary versions of On-Board Units (OBU) of the respective manufacturers of rolling stock / rail control systems. This has become even more important with the further delayed full implementation of ERTMS on the European core network. Also, national specificities in ERTMS equipment (e.g., radio systems) need to be prohibited. The multitude of hardware and software *base lines* and *releases* only add to the cost of rail operators without generating tangible benefits prior to completion of ERTMS rollout. To introduce competition for On-Board Units (OBUs), ERTMS interfaces should be declared an open standard that is monitored by ERA. By doing that, new providers will be invited to offer better, fully-compatible, and more cost-efficient solutions.

Measure N° 8 calls for *Enforcement of Antitrust Regulations*. Transport was defined as a European market and there should be an antitrust authority solely responsible for Rail and Road (plus other surface transport) established at the EU level. This would create more focus on this important sector and help accumulate knowledge and expertise to deal with the complexities of this market. Only regional complaints should be dealt with at national level, provided European authority declares them as being of national interest, only. Finally, the integrated regulation and arbitration of all surface transport modes will ensure a level playing field and fair competition amongst all modes and players.

Measure N° 9 calls for *Unbundling of Public Service Operations (with Subsidies) from Open Market Business*. Today, incumbent railways operate in both segments within their home markets. Due to their integrated operating models, the true costs of wagonload versus block train business are not clearly separated, which can lead to internal cross-subsidization. The repositioning of empty freight wagons, for example, provided by the national wagonload systems, creates a significant cost advantage when incumbents are offering one way block train services (typical for dry and liquid bulk commodities). In comparison, challengers need to run empty trains to reposition their empties. Also, when public subsidies are granted to incumbents to maintain a certain network coverage of the wagonload system, they cannot be monitored in a transparent way to ensure that the money is used for solely for that purpose. Therefore, we recommend unbundling of freight services (wagonload vs. block train) in cases when subsidies are granted to incumbents' rail freight operations. The separation of PSO-related operations from open market activities will ensure fair and transparent competition between incumbents and challengers. Unbundling will also lead to the provision of local production services (e.g., first/last mile delivery and pickup, brake testing and load controls, shunting and marshalling) to all rail freight players in an open and transparent manner, and at the same costs. PSO contracts for wagonload systems could be tendered out or alternatively operated by the national infrastructure managers.

Measure N° 10 aims at *Ending Direct Subsidies to or Recapitalization of State-Owned Freight Railway Undertakings*. The EU State Aid Directives should make the full separation of a businesses a prerequisite for receiving recapitalization or subsidies. This should not only be the case at the level of infrastructure versus railway operations, but at the level of wagonload (if receiving subsidies) and block train businesses. Generally, subsidies should be used to shift freight traffic from road to rail and should no longer be provided to support loss-making businesses of state-owned rail freight operators.

6. CONCLUSIONS AND RECOMMENDATIONS

On 9 December 2020 the European Commission presented its Sustainable and Smart Mobility Strategy with an action plan of 82 initiatives for the years 2021-2024. It laid the foundation for how the EU transport system can achieve its green and digital transformation. As outlined in the European Green Deal, the transport sector needs to achieve a 90% cut in emissions by 2050. The EU Commission expects that rail freight will double by 2050 and that a fully operational and multimodal Trans-European Transport Network for sustainable and smart transport will have been implemented by then (Sustainable and Smart Mobility Strategy – putting European transport on track for the future, 2020).

Our analysis confirmed that rail freight was the only mode of transport that managed to reduce carbon emission between 1990 and 2020 by more than 60%, at a comparable overall transport volume. Emission from road cargo increased by about 25% along with an increase of total volume of 65%. In other words, the rail sector achieved an absolute reduction of carbon emission by 60% compared to only 25% for road cargo. The most effective way to reduce carbon emissions in the EU transport market until 2030 will be a collective effort to shift more cargo to the railways as emission free heavy trucks will not be introduced in large numbers before the end of this decade. Hence, the vision "30 by 2030" aiming to boost rail freight's modal share to 30% should guide the way to give rail freight absolute priority both in competing with road cargo, and also within the rail sector to drive down carbon emissions of the transport sector in the fastest possible way.

The ten measures that stem from our market research, stakeholder consultations, and expert discussions are aimed at railways, infrastructure managers and to regulators and competition authorities:

- Railways, especially challengers, need to further invest in expanding their asset base, implementing new technology, and continue efficiency improvements and maintaining high customer service levels.
- Infrastructure managers need to focus on accelerating TEN-T implementation, debottlenecking international corridors (including critical network nodes and access to major ports / industrial and distribution zones), deploying fast and smart digitization, improving planning and international coordination of construction works (including acceptable diversion routes), and improving internationally coordinated capacity planning and management.
- Regulators and competition authorities should focus on securing fair capacity allocation, harmonized and open ERTMS standards, fair competition, and on developing new state aid rules

With a collective and decisive effort to implement the proposed measure, the three stakeholder groups can create the platform for rail freight so succeed in shifting cargo from road to rail, and towards achieving a 30% rail modal by 2030. This will significantly reduce carbon emissions from the transport sector and advance the European Green Deal.

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