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Centre on Regulation in Europe



THE PROMISES OF EUROPEAN RAIL

REPORT

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LIST OF ACRONYMS

ADEME	Agence de la Transition Écologique
ART	Autorité de Régulation des Transports
ATO	Automatic Train Operation
AVR	Alta Velocità di Rete
BNetzA	Bundesnetzagentur
BSchwaG	Bundesschienenwegeausbaugesetz
BVWP	Bundesverkehrswegeplan
CBA	Cost-Benefit Analysis
CCFE	Community of European Railway and Infrastructure Companies
CdP	Contratto di Programma
CITEPA	Centre interprofessionnel technique d'études de la pollution atmosphérique
CNIT	Conto Nazionale Infrastrutture e Trasporti
DAC	Digital Automatic Coupling
DB	Deutsche Bahn
DEF	Documento di Economia e Finanza
DRSI	Safety and Interoperability Service of the Railways
EBP	Electronic Service Post
ECA	European Court of Auditors
ERA	European Union Agency for Railways
ERegG	Railway Regulation Law
ERTMS	European Rail Traffic Management System
ETS	Emissions Trading System
GBR	Great British Railways
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GPSO	Great Southwest HSL Rail Project
HSL	High Speed Line
HST	High Speed Train
IM	Infrastructure Manager
IOB	Installation Transfer Control
MaaS	Mobility as a Service
LB	Balance Laws
LuFV	Leistungs- und Finanzierungsvereinbarung
MIMS	Strategic Document of Passenger and Freight Rail Mobility
MVP	Minimal Viable Product
NS	Nederlandse Spoorwegen
NGEU	Next Generation EU
OEBB	Österreichische Bundesbahnen
OD	Origins and Destinations



PNC	Piano Nazionale Complementare
PNIEC	Piano Nazionale Integrato per l'Energia e il Clima
PNRR	Piano Nazionale di Ripresa e Resilienza
PSOs	Public Service Obligations
PTAs	Public Transport Authorities
QoL	Quality of Life
RFA	Rail Freight Action
RFF	Rail Freight Forward
RFI	Rete Ferroviaria Italiana
RRPS	Regional Rail Passenger Services
RU	Rail Undertakings
SBB	Schweizerische BundesBahnen
SCM	Smart Capacity Management
SNCB	Société Nationale des Chemins de fer Belges
SNCF	Société Nationale des Chemins de fer Français
TEN-T	Trans-European Rail Network
TER	Train Express Régional
TET	Trains d'Équilibre du Territoire
TfL	Transport for London
TTR	Timetable and Capacity Redesign
UIC	International Union of Railways
UITP	International Association of Public Transport
UNIFE	European Rail Supply Industry Association



ABOUT CERRE

Providing top quality studies and dissemination activities, the Centre on Regulation in Europe (CERRE) promotes robust and consistent regulation in Europe's network and digital industries. CERRE's members are regulatory authorities and operators in those industries as well as universities.

CERRE's added value is based on:

- its original, multidisciplinary and cross-sector approach;
- the widely acknowledged academic credentials and policy experience of its team and associated staff members;
- its scientific independence and impartiality;
- the direct relevance and timeliness of its contributions to the policy and regulatory development process applicable to network industries and the markets for their services.

CERRE's activities include contributions to the development of norms, standards and policy recommendations related to the regulation of service providers, to the specification of market rules and to improvements in the management of infrastructure in a changing political, economic, technological and social environment. CERRE's work also aims at clarifying the respective roles of market operators, governments and regulatory authorities, as well as at strengthening the expertise of the latter, since in many Member States, regulators are part of a relatively recent profession.



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EXECUTIVE SUMMARY

Rail transport is presented within the European Union as a major lever in the decarbonisation of transport. It is indeed one mode of transport which is not heavily dependent on fossil fuels, and which is characterised by increasing returns. In terms of greenhouse gas emissions and pollutants, but also in terms of accidents, space consumption and negative effects on biodiversity, it is definitely the most environmentally friendly mode of transport. However, despite these obvious advantages for passengers and freight, the development of European rail transport faces the equivalent of the glass ceiling. In absolute value, measured respectively in passengers-kilometres (p.km) and tonnes-kilometres (t.km), passenger and freight traffic are progressing in numerous countries. But in relative value, namely market share, progress is modest as indicated recently for freight by a report of the European court of auditors¹. In the Seventh Monitoring Report on the Development of the Rail Market (2021), the European Commission noted that the market share of passenger rail transport was less than 8% on the EU scale. Only three countries barely exceeded 10%: The Netherlands, Germany and France². The numbers were slightly higher for freight with a market share of 18%, but down from the rates in the 2010s.

At the time of the Green Deal and the willingness demonstrated by numerous countries to increase the attractiveness of rail transport, this report first recalls that the same ambitions were already present in the EU White Papers (1991 et 2001). Why were they only partially fulfilled?

The reply to this question resides in the combination of three systemic factors which result in the glass ceiling mentioned above:

- The first factor is related to land use and dispersion of origins and destinations (ODs) and, as a consequence, the competition provided by other modes that are capable, in particular thanks to technical and organisational progress without equivalent in rail, of offering transport services that are better adapted to demand.
- This leads to the second factor, namely that rail is strongly dependent on public subsidies. They are necessary for the majority of the network, as is also the case for a large part of the road network, but also, all the more so after the pandemic, for operational needs as indicated in the recent report of the German court of Auditors³.
- The third factor is paradoxical. Even if rail is a transport mode characterised by increasing returns to scale, there is a decreasing rate of return for public spending in rail. The necessary billions devoted to it do not automatically result in an increase in market share.

To prevent the current new promises resulting in the same disappointments as the old promises, the obstacles facing rail must be tackled jointly. Firstly, by taking into account existing competition between applicants for public funds. To do so, sustainable revenues need to be allocated to rail. These might come from carbon taxation. At the same time, questions must be asked on the pricing of other

¹ https://www.eca.europa.eu/Lists/ECADocuments/SR-2023-08/SR-2023-08_EN.pdf

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0005>

³ https://www.bundesrechnungshof.de/SharedDocs/Downloads/DE/Berichte/2023/db-dauerkrise-volltext.pdf?__blob=publicationFile&v=5



transport modes, in particular road and air. Promising growing modal shares to rail, even when bringing billion of euros in various subsidies, is not enough. Rail financing and its ability to attract new customers will depend on the public funds that will be allocated to it, but also on changes in the regulation and pricing of road use. Here are our main findings and recommendations to achieve the goal of significantly reducing CO₂ emissions:

Findings

- a) Rail transport being the lowest emitter of greenhouse gases, in absolute value (million tons) as well as in relative value (gram per passenger.km), it must be developed, especially since it is also virtuous safety- and pollution-wise. But the modal shift to rail is not self-evident.
- b) In terms of modal sharing, we must be wary of the principle of substitution, which suggests that each additional passenger or ton on rail would be a passenger or ton less on the road. Transport is not a closed world where the gains of some are the losses of others. What has been observed for decades is the progression, more or less rapid, of all kinds of traffic.
- c) Climate commitments should therefore lead us to curb the development of certain types of traffic, in particular those that emit the most CO₂.
- d) Rail transport should escape this logic of rationing, but it comes up against another scarcity, that of public funds. Rail is in fact increasingly dependent on public funding, both for infrastructure and for operations. Productivity gains are needed to avoid diminishing returns of public spending on rail.

Recommendations

- a) To develop, rail transport therefore needs new financial resources, which can only come marginally from customers (passengers or goods). To guarantee sustainable revenue, public resources must be permanently allocated to it.
- b) These revenues can come from environmental taxes and in particular from the taxation of greenhouse gas emissions. In several European countries, there is a carbon tax. When this is not already the case, it could be allocated, in whole or in part, to rail transport. The same could happen in the future with the carbon quotas of the European ETS market since in the long term there will no longer be free allocations.
- c) In all European countries, there are fuel taxes. On the scale of the European Union, they represent more than 200 billion euros. The earmarking of this tax resource varies from one country to another, but part of it could benefit rail transport.
- d) In the decades to come, road will remain the main vector of transport. As it will also remain a major CO₂ emitter, its use must be regulated more strictly. Road pricing is necessary to reduce the demand and to obtain resources, part of which could be used for rail.
- e) Three forms of road pricing already exist, they could be more widely mobilised both to control demand and to free up resources: taxes on fuel and on CO₂ emissions; user fees which should be extended with the implementation of the new Eurovignette directive; rights of access to urban areas which could be coupled with “mobility passes” integrating the various urban mobility services in a logic of Mobility as a Service (MaaS).



1. INTRODUCTION

There was heavy traffic on trains in Europe during summer 2022. Almost everywhere, train occupancy rates approached or exceeded the levels seen before the pandemic. In Germany, the offer of a monthly ticket for a flat rate (€9) on regional trains was a great success. It was about time, since the successive lockdowns had greatly reduced the use of passenger trains. Would the recovery of the last few months be indicative of a new era? Could the development of rail traffic, thanks to the modal shift, become a major lever in the decarbonisation of mobility modes? The question must be raised, and it is also valid for the transport of goods. The increase in its modal share is also expected by the European Union, given that this branch of activity more than resisted the fall in GDP seen in 2020.

It is therefore not surprising that prospects look good for the medium-term development of rail transport, as demonstrated by the 'European Rail Manifesto'⁴ presented in June 2022 by major actors in the sector. As if in reply thereto, various funding and investment plans were announced in numerous countries like in Belgium (12/2022), France (02/2023), Germany (2022) or Italy (2022). Everywhere, it is seen as urgent to invest in the network and equipment to support a demand that requires improvement of the supply.

This optimistic vision should not however overshadow the fact that in previous decades, in terms of market share, expectations placed on rail have been somewhat disappointing. For passengers and for freight, the modal share of rail in Europe has changed little since the beginning of the century. Can the pressing need for decarbonisation change the game? This is the central question of this report. Under what conditions can rail become a key actor in the decarbonisation of mobility modes?

- In order to reply to this question, we shall start with a European overview. Behind the contrasting situations in various countries and from one category of traffic to another, the stakes are the same: how to increase the modal share of rail?
- Then, we will examine the case of four different countries: France, Belgium, Italy and Germany. In these countries, the ambitions are clearly indicated but it is a challenge to align them with the necessary funding. And even when a huge level of investments in rail infrastructure is planned, the impacts on CO₂ emissions are not clear. How can these difficulties be explained? Can they be overcome?

⁴ European Rail Manifesto, reaching EU climate goals by making rail the first choice for European travel in 2030, https://www.cer.be/sites/default/files/publication/220629_Europe-on-Rail_Manifesto.pdf

A similar document was published on a global scale in June 2022 on the occasion of the centenary of the International Union of Railways https://uic.org/IMG/pdf/uic-manifesto_rail-solutions-for-a-better-future.pdf



2. THE NEW CHALLENGES OF EUROPEAN RAIL TRANSPORT

For a long time, the European Union has supported rail transport, as recalled in Box 1. To do so, it has developed an ambitious and multidimensional policy. The successive White Papers established specific targets. Where are we 20 years later? Do the evolutions of the last 20 years signal what might happen in the next 20 years? In response to these questions, we will look at the evolution of traffic and modal shares. After recalling the major impact of the pandemic, we will seek, in light of the pressing decarbonisation need, the conditions for significant progress of traffic and modal shares of rail on a European scale, taking inspiration from the works previously published by the CERRE: the “Mobility White Paper of 2019⁵” and the report on innovation and competition in rail (C. Nash & A. Smith 2019)⁶.

Box 1: rail and the European transport policy (White Paper 2011)

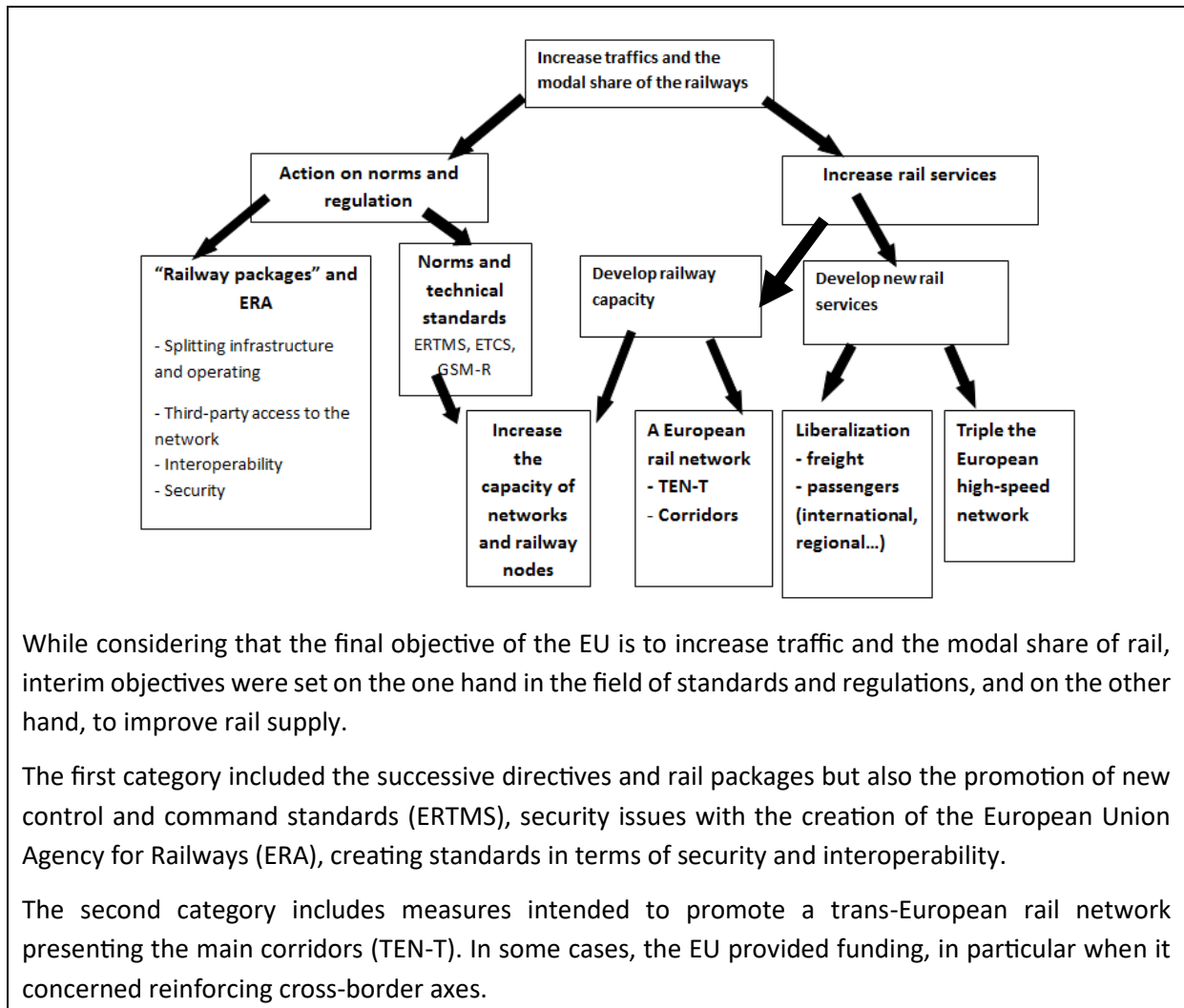
In its 2011 White Paper on transport, the EU set specific objectives for rail such as the tripling of the European High-Speed Line (HSL) network by 2030. In the freight sector, the cumulated modal share of rail and waterway should reach 30% of the land flow of goods of more than 300 kilometres and 50% by 2050.

To achieve these results, the EU, in successive rail packages, favoured the opening up to competition of the various rail services. But it also activated other levers of modernisation. As summarised in figure one, its activity developed in numerous sectors (Crozet Y. 2016).

From objectives to means: the EU's rail arsenal

⁵https://cerre.eu/wp-content/uploads/2020/05/cerre_whitepaper2024_mobility.pdf

⁶https://cerre.eu/wp-content/uploads/2020/05/190201_IssuePaper_RailInnovation_Final-compressed.pdf



2.1 Traffic and modal shares: contrasting situations

In 2001, the White Paper on transport⁷ addressed all modes of transports but stressed the key role of rail and sought to revitalise it. It evoked nothing less than a cultural revolution to reverse a tendency of decline. It celebrated a promising document signed by the International Union of Railways (UIC), the Community of European Railway and Infrastructure Companies (CCFE), the International Association of Public Transport (UITP) and the European Rail Supply Industry Association (UNIFE). For 2020, these key actors announced, thanks to an increase in infrastructure capacity, a significant increase in the modal share of rail for the transport of passengers and goods. How have things evolved for both?

⁷ European Commission, European transport policy for 2010, time to decide, 2001
<https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELEX:52001DC0370&from=en>



Passengers: traffic and modal shares

A first way of comparing the ambitions and progress noted involves observing the evolution of traffic before and after the publication of the 2001 White Paper.

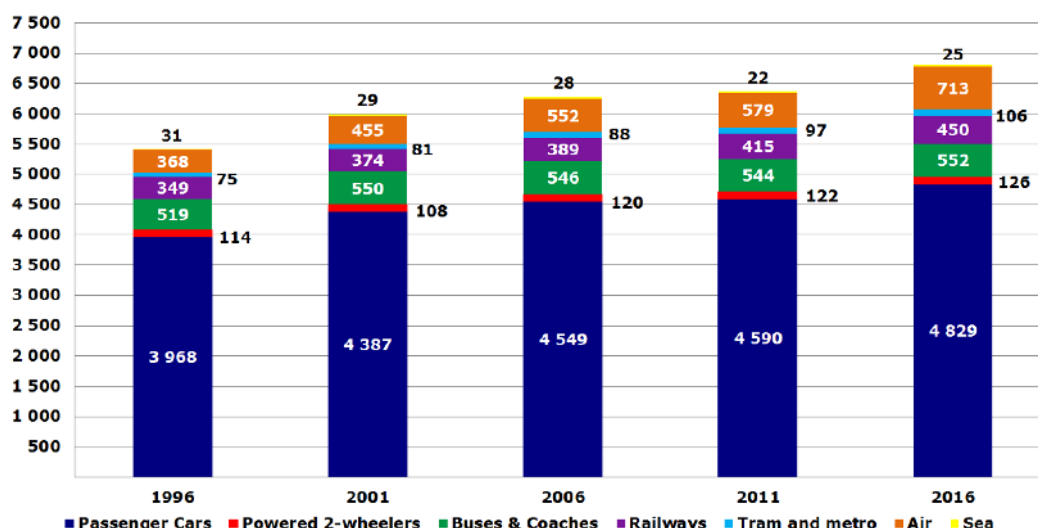


Figure 1: Passenger traffic in Europe (1996-2016 in billions of passengers-km)

Source: Modal Shift in European Transport, a way forward, 2018

Figure 1 shows a total passenger traffic growth tendency. In 20 years, it has increased from 5,424 to 6,801 billion passengers-km, i.e., a progression of 25%. But the different modes are not all in the same boat. Rail is doing slightly better than average (+29%) and car slightly less (+21%) but air transport has grown by 93%. Whereas in 1996 it represented the same volume as rail, in 2016 it was 58% higher. The success of air travel results in part from the deregulation measures adopted by the European Union. Since 1993, European air transport has been totally open to competition. New entrants, in particular low-cost companies, have profoundly changed this market which, in terms of liberalisation, has become the best student in the European class. Competition has resulted in a continued growth in traffic thanks to the reduction in relative prices. The latter is explained by an occupancy rate which is higher, but also by aircrafts with greater fuel economy as demonstrated in figure 2. The technical advances made by the aircraft industry have thus also played a key role in the success of the sector.

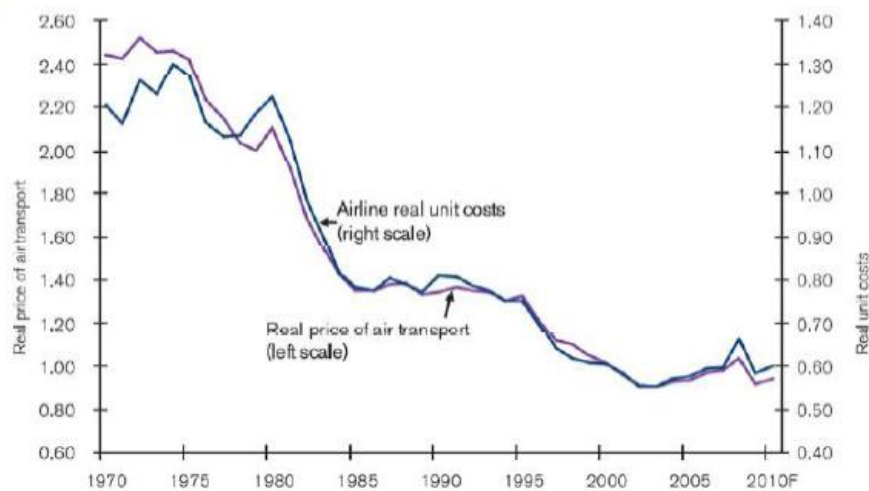


Figure 2: Evolution of real unit prices and costs of air transport

Source: Nash DC. & Smith A. (2019). The future of rail: Regulation and competition for an innovative industry, CERRE, p. 12

Rail transport has benefited from a lot of technical progress (greener trains, smarter signalling, improved tracks...) but, mainly because of the cost on infrastructures, not at the same level than air transport. The relative costs of rail infrastructure have rather tended to increase so that in order to increase traffic, a great deal of investment had to be made. This investment did not respond to the same priorities from country to country. Among the countries that witnessed progress in the number of passengers using rail, two large categories are evident.

- **The first corresponds to countries that have sought to improve the existing supply, and in particular regional transport.** This is the case for countries such as Sweden, Austria, the Netherlands and Great Britain. In the latter, traffic has increased markedly, as indicated in figure 3. At the price of an organisational *big bang* (disappearance of the historic operator British Rail in 1994) and a high number of public subsidies to regenerate the network, the number of passengers almost tripled between the beginning of the 1980s and 2019. In terms of passenger-km it is a multiplication by 2.4, in comparison with 2.1 for the Netherlands and 1.6 for Belgium.

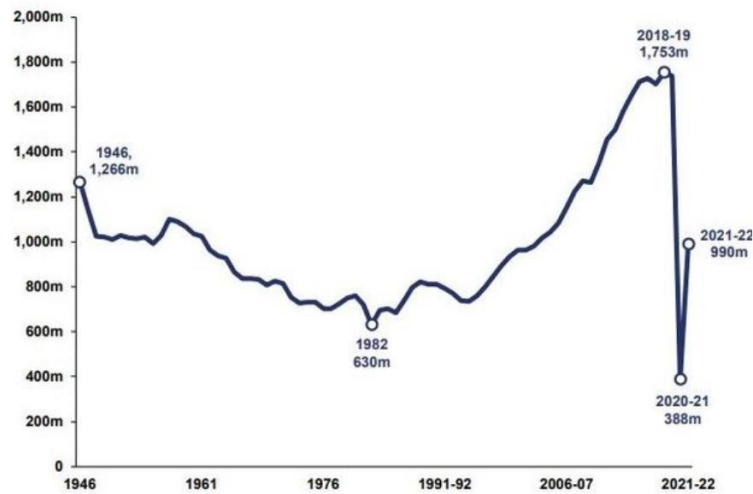


Figure 3: Evolution in the number of train passengers in Great Britain (million) ⁸

The success of Great Britain has for some time been considered as an illustration of the benefits of deregulation and opening to competition, but the pandemic highlighted the failings of the franchising system. A re-nationalisation of the railway system is ongoing in Great Britain. In several other European countries, priority was given in 2020 to subsidies required to balance the accounts of the historic operators (see below).

- **The second category covers countries that bet on high-speed rail in order to relaunch traffic.** This mainly concerns France, Spain and Italy and partly Belgium. For this reason, a network of new lines has been created in these countries. High speed rail has thus accompanied a modal transfer in favour of rail for certain origin-destinations. This has been the case on routes such as Brussels-Paris, Paris-Lyon, Milan-Rome, Madrid-Barcelona, Lille-Paris or Strasbourg-Paris. But, as we have seen, this has not hindered the development of air transport as a result of the great diversity of destinations that it offers. With the creation of stations dedicated to high-speed rail in several large airport hubs (Paris, Frankfurt, Schiphol...), trains have become more of a complement to, rather than a substitute for, air transport. Furthermore, as Figure 4 demonstrates for Italy, the attractiveness of HST has evolved in part to the detriment of traditional trains. Therefore, the success of HST is not leading to a radical change of the modal split between rail on one hand, and road and air on the second hand.

⁸<https://www.business-live.co.uk/economic-development/latest-rail-passenger-figures-uk-24304258>

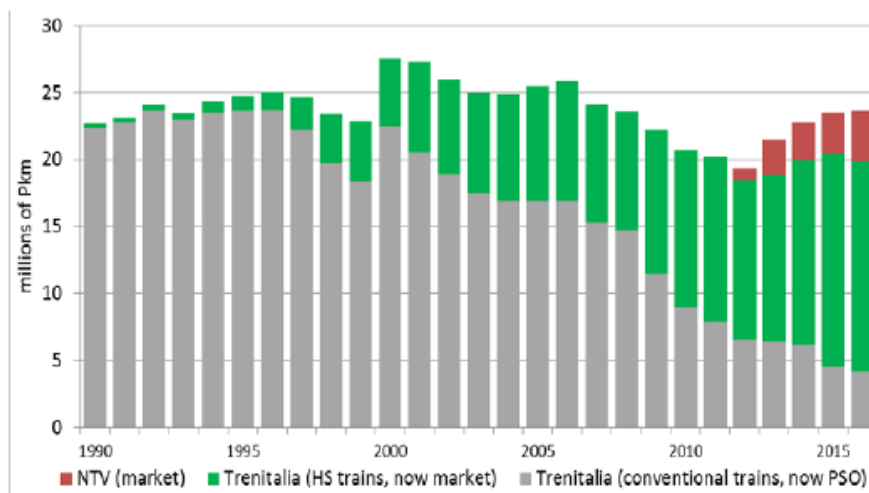


Figure 4: Evolution of long-distance rail traffic in Italy

Source: Paolo Beria (2019), Evolving long distance passenger services, working paper

On the whole, as demonstrated in figure 5, the modal share of rail transport has remained practically unchanged from 1996 to 2016, and the use of the car remains largely dominant, whereas air transport, without counting travel outside of Europe, already represents more than 10% of the total. We are therefore far from the ambitions stated in the White Papers of 2001 and 2011.

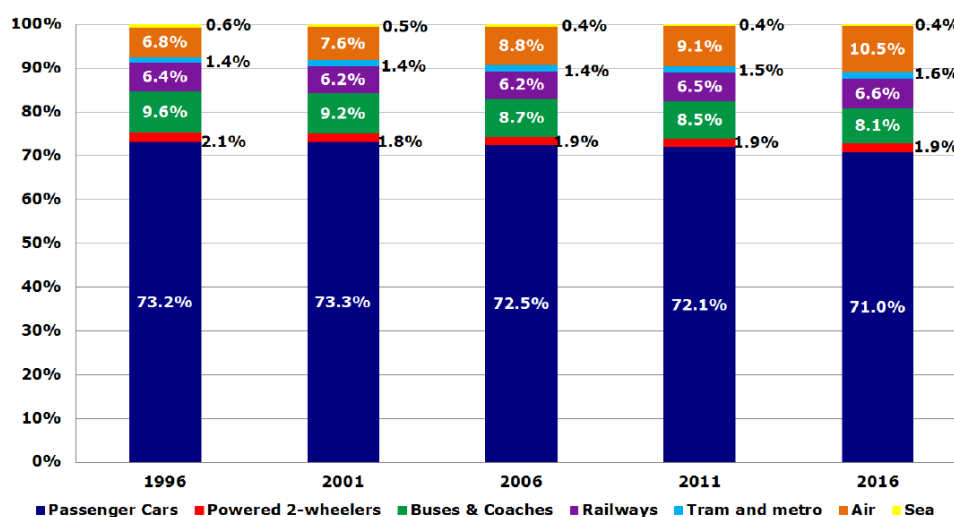


Figure 5: Evolution of modal share of passenger traffic (1996-2016)

Goods: traffic and modal share

For freight, progress is even more disappointing than for passengers. Not because of the competition from air transport but because of the growing significance of road transport. From 1996 to 2016, tonnes-km transported by road increased by 38.5% (1.6% per year) whereas rail freight only progressed by 4.5% (Figure 6), in particular due to a decline after 2006.

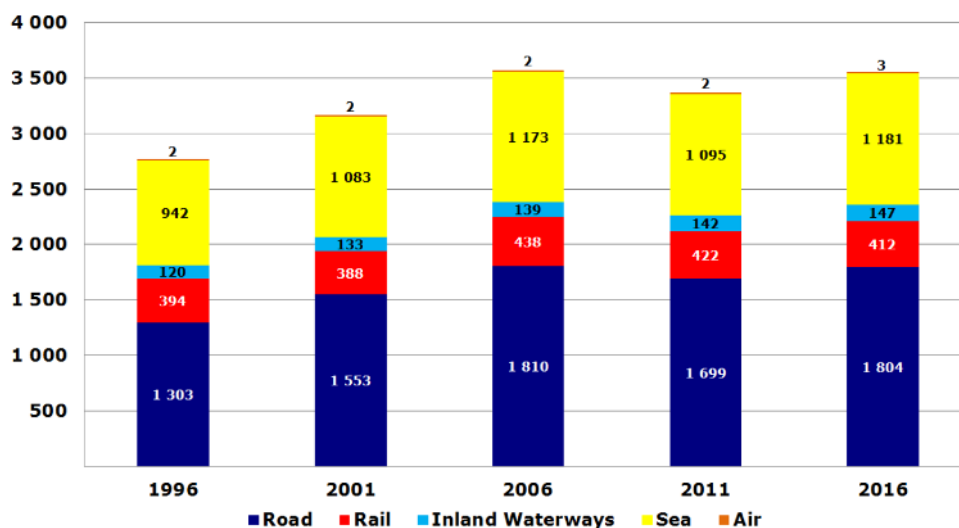


Figure 6: Evolution of goods traffic in Europe (1996-2016)

The result of this weak performance was, against expectations, a drop in the modal share of rail freight (figure 7). At the same time, road transport progressed and took over half of the total traffic, even up to 76% if only land transport is considered. The causes of this were presented in a previous study by CERRE⁹ (see box 2).

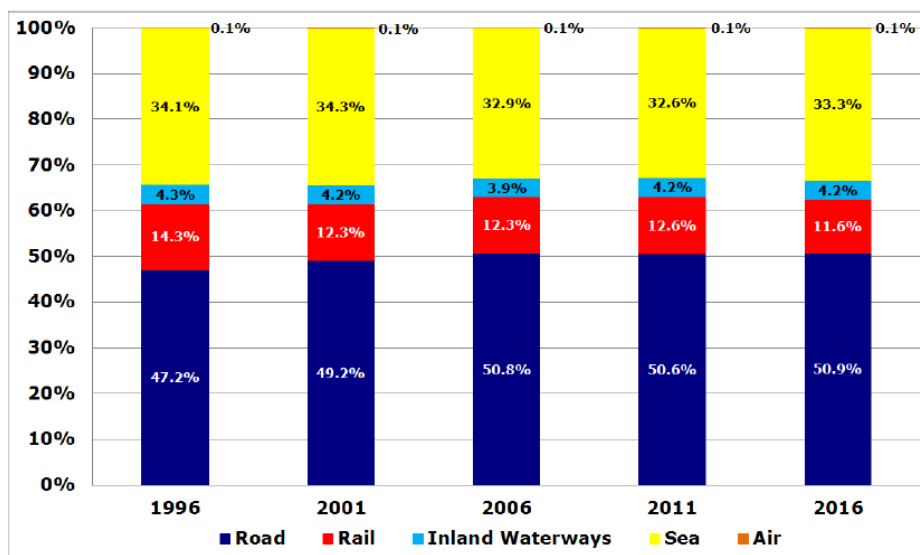


Figure 7: The modal share of goods transport in Europe (1996-2016)

The opening up of goods rail transport to competition is a necessary condition to energise this branch of activity, but it is not a sufficient condition to create the desired modal shift from road to rail.

⁹https://cerre.eu/wp-content/uploads/2014/12/141211_CERRE-RailFreight_Policy-Paper_Final.pdf



Box 2: the structural weaknesses in rail freight in Europe

The difficulties faced by rail freight may be tackled by distinguishing demand issues and supply issues:

Demand issues

For goods, rail dominated the scene 100 years ago. The fact that it has become secondary or even marginal in some countries is not an accident of history. To be convinced, it is enough to observe that in the majority of central European countries, the end of the planned economy coincided with a strong decline in rail freight. The diversification of products transported, the increase in the added value per tonne, the development of “just in time” and “tight flows” have reduced the relevance of rail. The latter is suitable for heavy transport and for distances over 300 kilometres or even 500 kilometres.

However, the international division of work and the logistics circuits that accompany it mean that very large distances are covered by maritime transport. Once unloaded from the container ports, the distances covered are modest since they rarely transit from the port to the final recipient. In fact, they make small jumps between the various warehouses and consolidation / deconsolidation sites. The result is that the natural markets for rail freight are either in decline (coal, bulk, steel) or mature and with little perspective of volume growth (cereals, cars, chemical products). Products that are growing in traffic (containers) only circulate on corridors that are generally connected to large ports. The 2008 crisis reinforced these tendencies to the extent that rail freight is an activity that overreacts to economic fluctuations. Furthermore, the industry now represents a reduced share of GDP, thus the production of cars and steel is in decline.

Supply issues

Rail freight has been subject to strong intermodal competition. Road transport was deregulated in Europe in the middle of the 1980s. There followed a rapid growth in the number of road transport and freight companies, the number of lorries circulating on the roads and the diversity of loads transportable by road (tankers, refrigerated lorries or managed temperature lorries, etc.). The generalised decline in the market share of rail transport was therefore exacerbated from the 1980s onwards. The response to this evolution emerged slowly in the form of opening up to competition of rail freight which happened about 20 years after road transport. Although late, the results are encouraging. Opening up to competition is often reflected by a general growth in traffic and by incentives to improve the productivity of existing companies. These trends are set to continue.

But the very nature of rail transport, specifically the fact that the rail paths are planned, prevents a generalised free access to the network. The consequence is that the number of new entrants in the sector has been relatively low, as has the success rate of companies. The number of exits from the market is close to the number of entrants in the market everywhere, and the profitability of the sector is modest when it is not negative. The result of these factors is a market structure that is, if not monopolistic, at least defined by the domination of one firm over more than 50% of the traffic.

By comparing the modal shares of rail freight in the 15 countries that were already members of the European Union in 2000 and in the 13 countries that joined the European Union in the years 2000s, a



worrying evolution emerges. In the latter countries, many of which came from the block of planned economies, the modal share of rail rapidly declined in favour of road. As demonstrated in Figure 8, it was as if there was an optimal modal share in the form of 80-20, the road representing at least four times the volumes transported by rail.

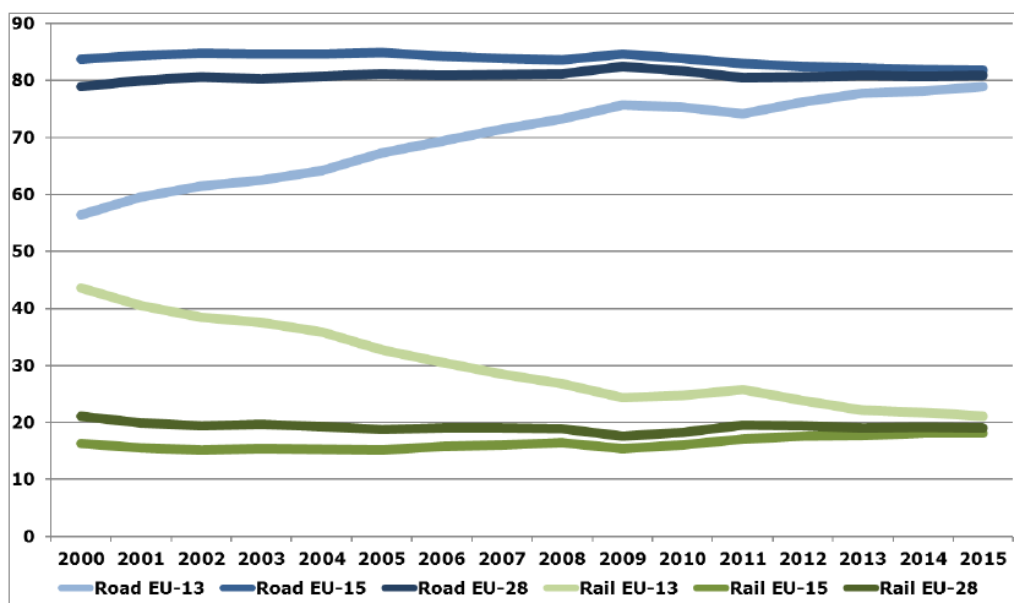


Figure 8: EU15 vs EU13, comparative evolution of modal share of freight transport

Rail freight was therefore subject to a kind of glass ceiling, the origin of which was to be found both on the supply side and on the demand side. Given that the average distance covered by goods is often less than 100 kilometres, only road transport could meet this demand. This is why the EU only sets a target modal share for rail for journeys of more than 300 kilometres (50% in 2050), i.e., flows that often cross borders. Figure 9 recalls the fact that international transport already represents more than 50% of the rail freight market in Europe.

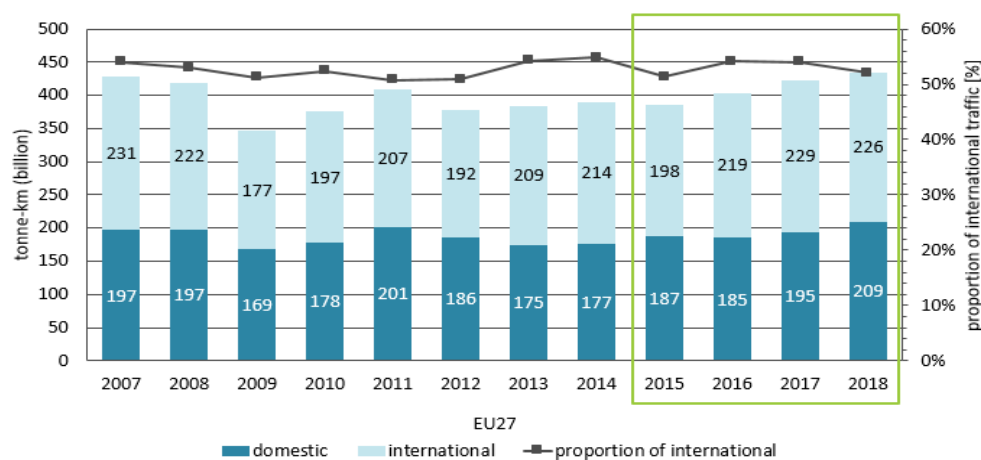


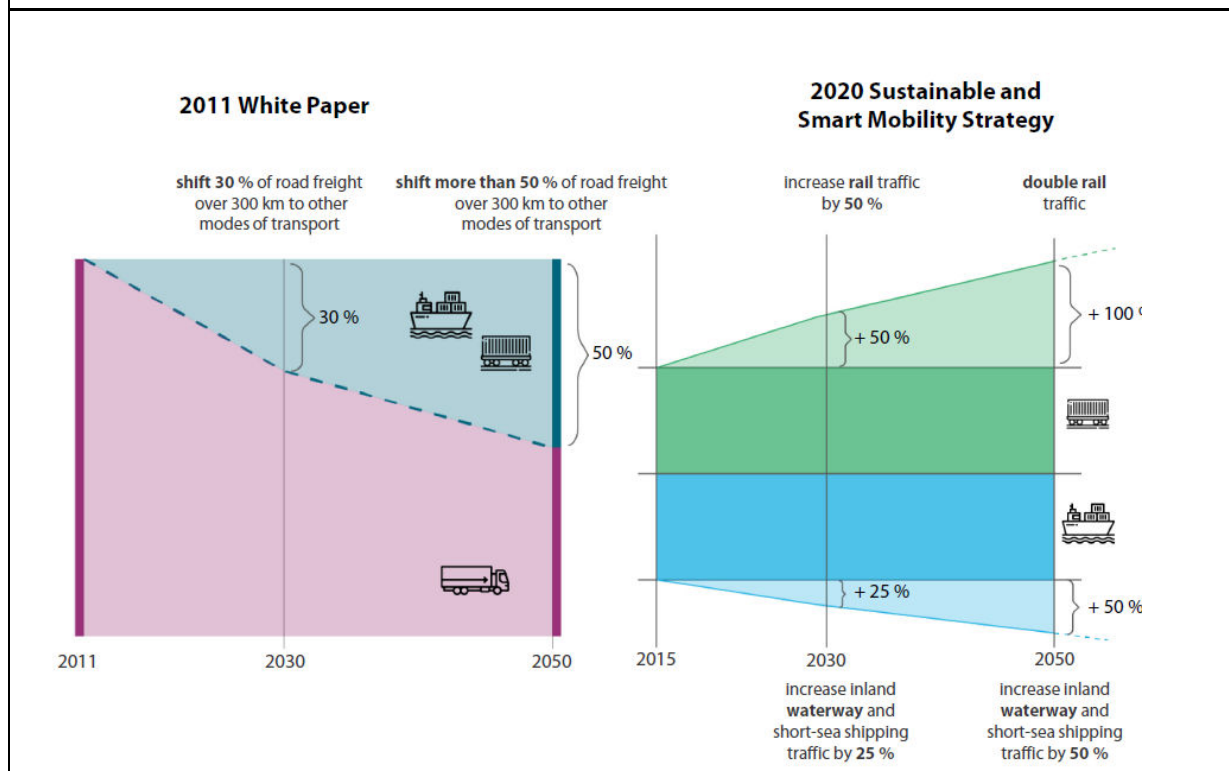
Figure 9: Rail freight: evolution of domestic and international traffic



However, increasing the volume transported by rail internationally faces various difficulties related to the crossing of borders: infrastructure capacity, inter-operability of equipment, heterogeneity of signalling systems, operators holding operating licences in several countries. Without forgetting, as is the case for domestic traffic, the difficulty in obtaining suitable rail paths when priority is given everywhere to passenger trains. For all these reasons the ambitions stated by the European Union and by numerous countries for 2030, need to be questioned as it has been done recently by the European Court of Auditors (box 3)

Box 3: The 2011 and 2020 EU sustainable freight targets

In a report entitled “Intermodal Freight Transport; EU still far from getting goods off the road”, the European Court of Auditors states that the 2011 Roadmap to a Single European Area and the 2020 Sustainable and Smart Mobility Strategy remained unrealistic as the underlying assumptions were not based on robust simulations of how much modal shift could be realistically achieved considering (i) existing long term infrastructure constraints for rail and inland waterways and (ii) regulatory barriers affecting the competitiveness of intermodal transports (P. 46, §89).





2.2 What perspectives for 2030?

How can we break through the glass ceiling that the modal share of rail transport faces in Europe for goods (figure 7) but also for passengers (figure 5)? The answer is not obvious to the extent that, as we have seen, this target was already set by rail policies 20 years ago without any real success. Has the nature of the problem changed recently? First, we shall note that this is indeed the case following the impact of the pandemic, but also as a result of climate engagements of States and of the European Union. Under what conditions can this new factor overcome the obstacles observed since the beginning of the century?

The pandemic and its repercussions

Transport of goods

Rail transport of goods was particularly resilient during the pandemic and lockdowns. Contrary to passengers, freight volume transported only diminished slightly in 2020, and then recovered to reach levels exceeding those of the previous decade (table 1).

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Germany	110	112	112	116	126	117	117	119	109	123
	065	613	629	632	686	382	931	470	219	067
France	32,539	32,230	32,596	36,328	34,761	35,655	34,061	33,671	31,559	35,751
Italy	20,244	19,037	20,157	20,781	22,712	22,335	22,070	21,309	20,750	24,262
Sweden	22,043	20,970	21,296	20,699	21,406	21,838	22,794	22,222	22,094	23,449
Austria	19,499	19,356	20,746	20,814	21,361	22,256	21,996	21,736	20,498	21,781
Poland	48,903	50,881	50,073	50,603	50,650	54,797	59,388	54,584	51,096	54,387
Switzerland	11,061	11,812	12,313	12,431	12,447	11,665	11,776	11,673	11,067	12,023

Table 1: Evolution of rail freight traffic (millions of tonnes-km)

Source: Eurostat

From 2012 to 2021, traffic increased by 11.8% in Germany, 10% in France, 19% in Italy, 6.4% in Sweden, 11.7% in Austria, 11.2% in Poland and 8.7% in Switzerland. Without this showing a radical change in the modal share of rail, this reveals a latent demand. Where rail solutions exist, shippers are ready to use them, all the more so since the cost of rail is low. Average revenue for freight operators is €35 for 1000 t.km, i.e., 3.5 cents per t.km (Figure 10). There are significant differences from one country to another, but if we exclude Luxembourg, the rates range from between 5.5 and less than two cents per t.km. This is a lot less than road transport. For a heavy goods vehicle such as a cab and trailer making long distance journeys, the cost of fuel alone today reaches €0.35 per kilometre, i.e., for an average load of 10 tonnes, 3.5 cents per km. If one adds personnel costs, equipment depreciation and the various structural costs, the cost of road transport exceeds 10 cents per tonne-km.

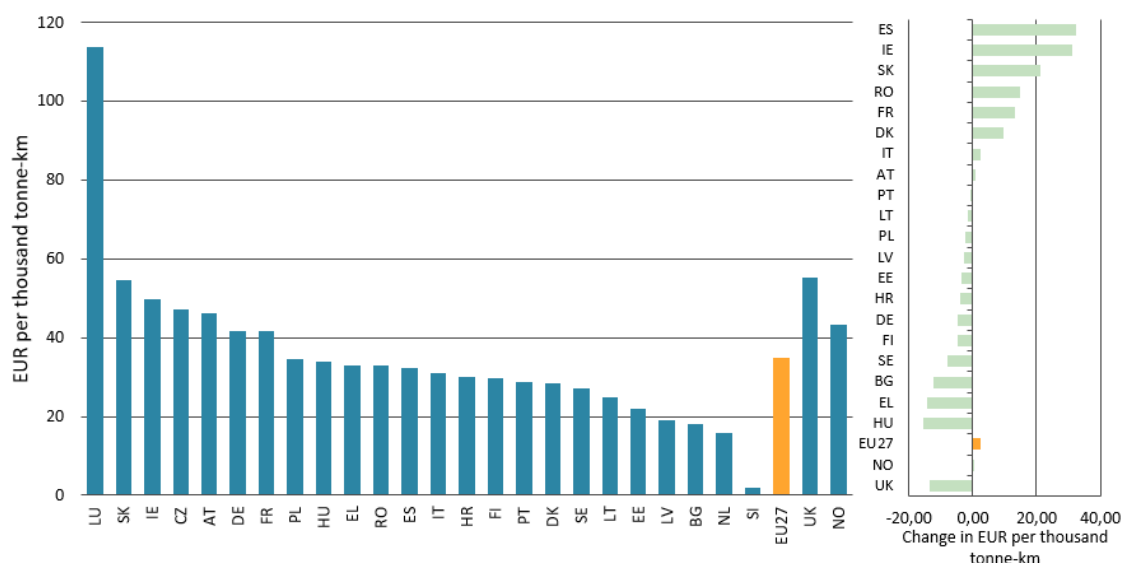


Figure 10: Revenue of freight train companies per thousand tonnes-km

Source: European Commission, 7th Rail Market Monitoring¹⁰

It would be naive to simply rejoice in the relative low cost of rail transport for shippers since this reveals three structural weaknesses of the sector:

- The first is that the role of relative costs is secondary in choices made by shippers. If rail freight only represents at best 1/5 of road freight, even though the latter is much more expensive, it is because it is capable of better and more widely responding to all types of traffic.
- The second is that this low price is only possible because track access charges paid by freight trains are, with the exception of the Baltic countries and Finland, very low and generally less than the marginal cost. The latter marginal cost being high as a result of the weight of freight trains.
- The third is that the low revenue per tonne.km places rail freight companies in a situation of structural financial fragility. Thus, in Germany and in France, as indicated by the European Commission, the freight subsidiaries of the DB and of the SNCF have only survived so long thanks to the increased subsidies coming from the profits of passenger activities which survive off public subsidies.

Passenger transport

2020 was a dark year for rail passenger transport. As a result of successive lockdowns, traffic was drastically reduced. In Great Britain, occupancy rates fell by 4/5 from one year to the next (figure 11). For several weeks, various international routes were closed. By the end of 2020 and the beginning of 2021, traffic volumes in Europe only represented one third of those observed in the same period in 2019.

¹⁰https://transport.ec.europa.eu/transport-modes/rail/market/rail-market-monitoring-rmms_en

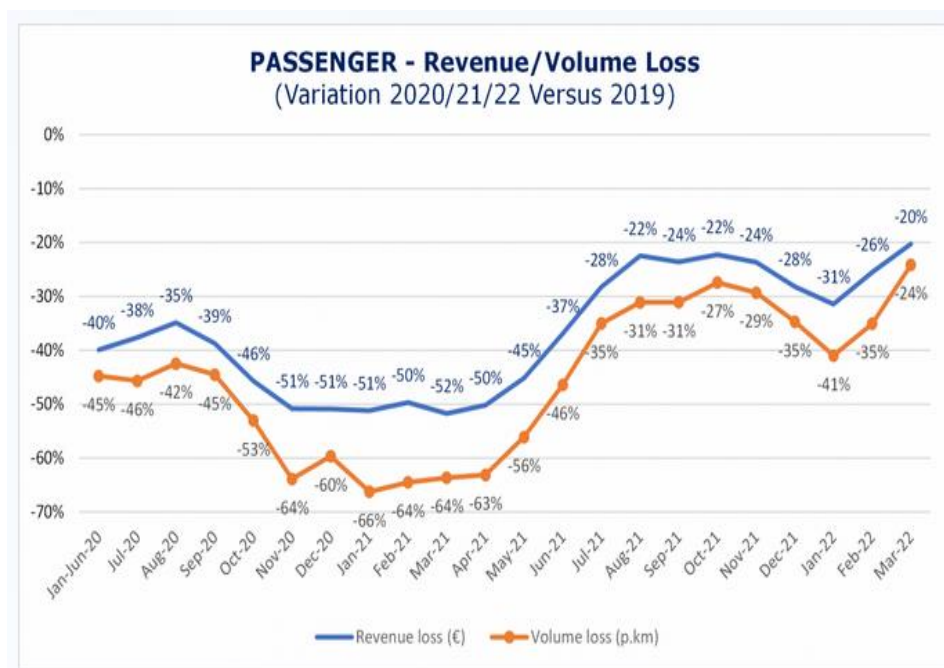


Figure 11: Variation in volumes and revenues of passenger rail traffic in Europe¹¹

Traffic recovery was slow. In March 2022, the volume of traffic was 24% lower than before the crisis, causing a 20% loss of revenue. Occupancy rates of trains fell everywhere, leading to completely new situations. It would be wrong to think that the pandemic was simply a parenthesis, structural changes are already visible.

- For example, in Switzerland, the occupancy rate of passenger trains fell from 28% in 2019 to 18% in 2021. Traffic has recovered since, but the federal railways (CCF) have observed a drop in the number of their subscribers since working from home has changed the travel habits and, to a certain degree locations, making the use of private cars more attractive. This is demonstrated in figure 12 following a survey of a panel of commuters by the Federal Polytechnic School of Zürich. Rail transport has suffered during the last three years from a reduction in traffic that is more significant than road, to the extent that in the third quarter of 2022, the number of journeys or the daily distances remained below that of the pre COVID period.

¹¹<http://www.cer.be/media/press-releases/european-rail-traffic-growing-effects-covid-downturn-still-evident>

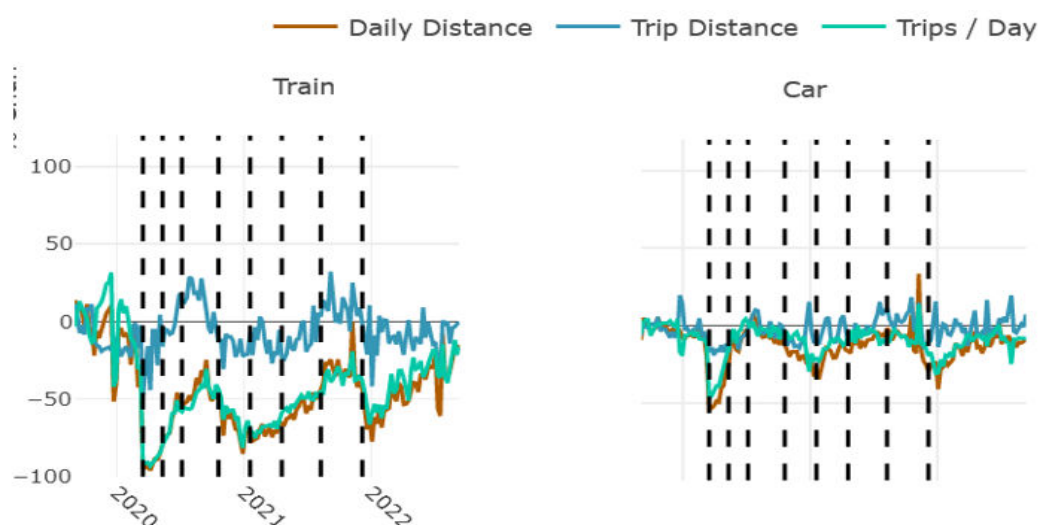


Figure 12: Switzerland: evolution of mobility behaviour by train and by car¹²

- In the United Kingdom, rail traffic collapsed, taking with it the franchising system (see box 4). At the beginning of the summer of 2022, before the large strikes that affected the English railways, traffic (in passengers-kilometres) was still more than 10% lower than it was three years before, whereas road transport had returned to its previous level. In London, the underground had only recovered 80% of its customers¹³.

Box 4: Renationalisation: a new railway Big Bang in the United Kingdom

The British transport secretary Grant Shapps published in May 2021 a White Paper setting out how the British railway system would be entirely rethought in the coming years. An indispensable reorganisation since the pandemic had made the franchising system obsolete. The drastic reduction in occupancy over many months - it still remains weak to this day - had decimated the operators. The British treasury spent £12 billion (€14 billion) in 2020 to save the railway system. Nationalisation also cements a promise of Boris Johnson, the fate of which is hard to discern after the recent changes in Prime Minister.

In principle, a new integrated public company will be created: Great British Railways (GBR). This name recalls the former historic operator that was dismantled in 1994. In this time of Brexit, it is clearly a nationalist and nostalgic nod of the head. But it is not only that. The White Paper in fact constitutes a balanced report on the 25 years of railway deregulation. This publication first highlights the many failings of the British railway system: lack of pricing transparency, high costs for rail users and public finances, delays and poor quality of service, as well as the increase in transaction costs due to the 'blame culture' and the rising number of disputes between different rail operators, including between

¹² Zürich Mobis survey, <https://ivtmobis.ethz.ch/mobis/covid19/reports/latest>

¹³ <https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic>



the latter and Network Rail, which acts as the Infrastructure Manager (IM). In light of these past mistakes, this White Paper is full of promises that rail users will see improvements made to the system. It then insists on the need to retain the benefits of the franchising system and the partnership with private operators. In practical terms, Great British Railways will be an integrated operator, managing tracks, signalling and train timetables, as well as organising services and ticket sales. This one-stop-shop for passengers, ticketing and information is a response to one of the major criticisms of the franchising system. However, that does not mean private operators will disappear; they will become transport operators only, in a similar way to how Transport for London (TfL) operates in the capital for buses and the underground.

Great British Railways will therefore be responsible for scheduling all passenger rail services (freight will remain open to competition between railway transport operators). After invitations to tender, Great British Railways will select the operators who will operate the trains and will doubtless maintain them in train depots, complying with specifications but without commercial contact with customers. This measure aims to reduce the transaction costs that emerged with the franchising system, but it is by no means a perfect solution. In fact, it is likely that Great British Railways will be on a fairly steep learning curve to develop the skills needed for the joint implementation of timetabling, control and pricing of the services. The main challenge of GBR, like any integrated operator, will therefore be to avoid internal inertia and mistrust regarding innovation. Given the governmental tensions that had prevailed in Great Britain in 2022, the project currently remains unfinished.

In all European countries, the railways, like urban public transport, have benefited from massive public subsidies to the point that the commercial revenues have become, for a time, marginal in the budgets of public transport, provoking a sort of cultural revolution in the sense that the support of rail transport has become a priority to be achieved whatever the cost.

- The best example of this revolution is in Germany. Its traditional budgetary rigour has been challenged by the energy crisis. Faced with the brutal increase in fuel costs, a temporary reduction in petrol taxes was enacted. Given the coalition currently in power in Berlin, this measure found its counterpart in public transport. As a result, for a period of three months (June to August) and for monthly flat rate payment of €9, Germans could benefit from free travel on regional trains and urban public transport. This operation was so successful that some trains were stormed. The Deutsche Bahn (DB), the main rail operator in Germany, had problems, due to a lack of rolling stock in particular, in meeting this spectacular increase in demand as summarised in figure 13.

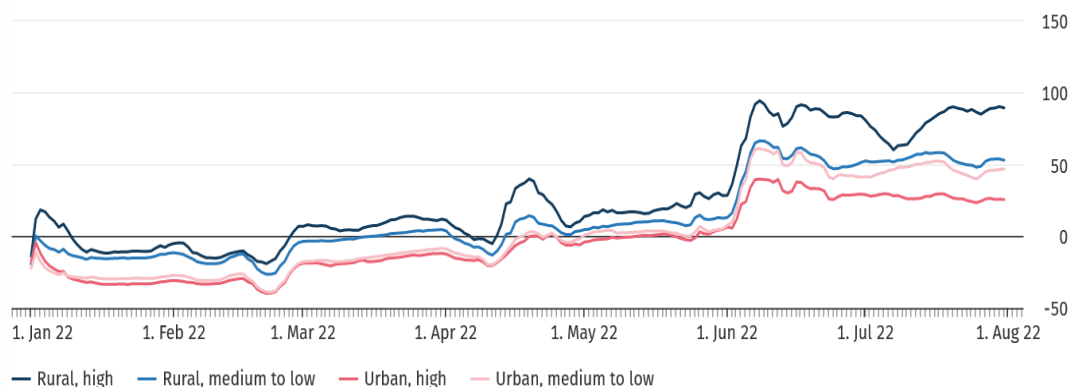


Figure 13: Germany: variation in the number of rail passengers over more than 30km in terms of zones and tourist volume (average over 7 days /2019)

Source: Statistisches Bundesamt: https://www.destatis.de/EN/Press/2022/08/PE22_339_12.html

At the beginning of 2022, the effects of the pandemic were still being felt, traffic being less than that in 2019. In springtime, traffic variation became positive, in particular during the Easter holidays in April. In June, the €9 ticket experiment began. It led to a real boom in rail to the detriment of coaches, in particular Flixbus, which did not fall within this framework. The effects of the reduction in prices were such that a return to the previous situation was no longer possible. In agreement with the Bundesländer, the federal government proposed a monthly flat rate for all local and regional journeys for an amount of €49. To offset loss of earnings, subsidies of €3 billion were required annually, half by the Federal State and the other half by the Bundesländer. To accompany the increase in demand, regional authorities wanted to develop the supply, hence additional investment spending reflecting the amounts that the Bund had planned to spend to modernise the network.

In Spain, unorthodox measures were also adopted to relaunch rail traffic. The pandemic had greatly reduced occupancy on public transport in Madrid. To remedy this, the authorities decided to make public transport free during rush hour in the morning. More recently, the government adopted an original type of incentive for regional trains. Since 1 September it is still necessary to buy a ticket or a pass to travel on these trains. But the pass may then be fully reimbursed if at least 16 journeys have been made within the month.

As in Germany, this support of the railways is connected to what is happening on the roads. Several motorway concessions in fact arrived at their terms in 2022 in Catalonia, the Basque country and in the region of Valencia. The toll booth barriers were then definitively removed to the great satisfaction of drivers. To some extent, the reduction in the cost of regional trains for commuters accompanied the reduction of the cost of car mobility. The results of this new programme are still unknown, but it is a good example of the political will to support the railways by new methods more centred on public funding than on opening up to competition.



Horizon 2030: a new factor and curbed ambitions

Opening up to competition has been a consistent European rail policy. It remains current, as demonstrated by the current stand-off between the Commission and the Dutch government. The latter refuses to change its method of contracting, on a private basis, with the historic operator NS, currently in charge of more than 95% of the domestic services in the Netherlands. But the recriminations of the Commission could just be a survival of the “world before” whereas “the world after” presents two novelties:

- The climate engagements of States and the wish to increase the modal share of rail will lead them to increase public subsidies. The European Commission has indeed understood this since, in March 2022, it launched a consultation on changes to the regulations concerning state aid.
- These subsidies will target infrastructure as a priority but will also concern the historic operator. This is how the Dutch position may be explained which, based on the Swiss model, considers that the protection of the historic operator is a guarantee of efficiency in the long term.

In the years to come, rail may steer itself towards the logic of “whatever the cost”. The limitation of the role of competition and the increase in subsidies would therefore be accepted as inevitable. The problem is that such a logic comes up against various limits and that its success depends on other evolutions in mobility policies.

Box 5: The elective affinities between rail and public spending

In rail, the new strategic factor resulting from the impacts of the pandemic reminds us of the recommendations of French economist Léon Walras (1834-1910). He taught in Lausanne, Switzerland and is considered one of the founders of the neoclassic economy. However, in 1875¹⁴ he pleaded in favour of the nationalisation of the railways. He was heard. In the decades that followed, all European States nationalised their railways and these historic operators remain active¹⁵. Walras based his analysis on two ideas that were new at the time: public service (the railway for everyone!) and the natural monopoly. The presence of a sole operator is necessary when the fixed costs are high. Once the infrastructure and the rolling stock have been purchased, the rate of return increases. Each additional service becomes cheaper and cheaper. Walras therefore recommended only to invoice the marginal cost.

The problem now is that rail is in competition with road and air, often preventing any increasing rates of return. If the occupancy rates of trains are low, it is impossible to reach the ‘break-even point’ or the profitability threshold of the service. The operation must therefore be subsidised. But since the public supervisory authority has little means of controlling costs, the public monopoly can generate an income that seems legitimate as long as there are “elective affinities” (Max Weber) between the

¹⁴ https://www.taieb.net/auteurs/Walras/etat_cdf.html

¹⁵ Great Britain is the only country to have dismantled its historic operator British Railways in 1994. But, in 2021, renationalisation and creation of Great British Railways.



rail sector and public spending, namely a convergence of interests and mutual support. A situation that employees' unions know how to exploit to promote their claims.

The limits of “whatever it takes”

Rail transport requires more public money. It may be necessary, but will this funding be sufficient? The answer is nuanced for various reasons. The main difficulty faced by rail to meet demand is the lack of capacity. In the current state of the network, it is often difficult to significantly increase the number of available paths, for freight and for passengers. This is particularly true for railway hubs that are more or less overwhelmed by daily mobility trains, but also on certain European corridors.

These problems are well known to the European Union, which is trying to remedy this by encouraging the improvement of signalling and control-command systems (ERTMS) and also by funding various major transborder projects (Rail Baltica, Tunnel under the Alps...). However, this takes time and only solves part of the problem, to the extent that it requires, at the same time, significant national funding of new and old segments of the national network. However, both of these factors face the decreasing rate of return of public spending in rail. How has this situation arisen?

The development of high-speed rail offers the first answer. At first sight, a HSL offers increased profits compared to a traditional line. The capacity of trains and their speed ensures a high potential flow rate. It is therefore sensible to invest in new lines. This statement is not universally true, as recalled by the European Court of Auditors (ECA) in 2019 ¹⁶ in a report entitled *“European high speed rail network: not a reality but an ineffective patchwork”*. In fact, the European HSL network tripled from 2000 to 2016, from 2,708 km to 8,200 km. At the same time however, traffic only doubled to reach 124 billion p.km. After a maximum of 21.9 million p.km per km of network reached in 2001, traffic intensity dropped in Europe by 50% in 2016¹⁷. This is the result of operating lines whose potential is less than the relevance threshold of a HSL, namely 9 million p.km per year. The report highlights three new lines (Eje Atlántico, Madrid-León and Rhin-Rhône) whose traffic was greatly inferior to this threshold, maybe because of a lack of competition. Since then, the new lines opened to traffic in Spain have further reduced the general intensity of traffic¹⁸.

Even in a country like France where high-speed train traffic remains high, figure 14 demonstrates a drop in the intensity of traffic over the last few years (millions of p.km per kilometre of network). This means that the network effect that was expected does not exist, i.e., an increase in traffic more significant than the extension of the HSL lines. The €15 billion invested in the four HSL opened in 2017, of which €8 billion of public subsidies, clearly illustrates what we call the decreasing rate of return of public spending.

¹⁶French version downloadable: https://www.eca.europa.eu/Lists/ECADocuments/SR18_19/SR_HIGH_SPEED_RAIL_FR.pdf

¹⁷According to the European Court of Auditors, the kilometric intensity in 2016 was 17.5 in Italy, 12.7 in Germany and 5 in Spain.

¹⁸ In Spain, in 2022, the intensity of traffic has grown on the segment opened to competition (Madrid Barcelona)

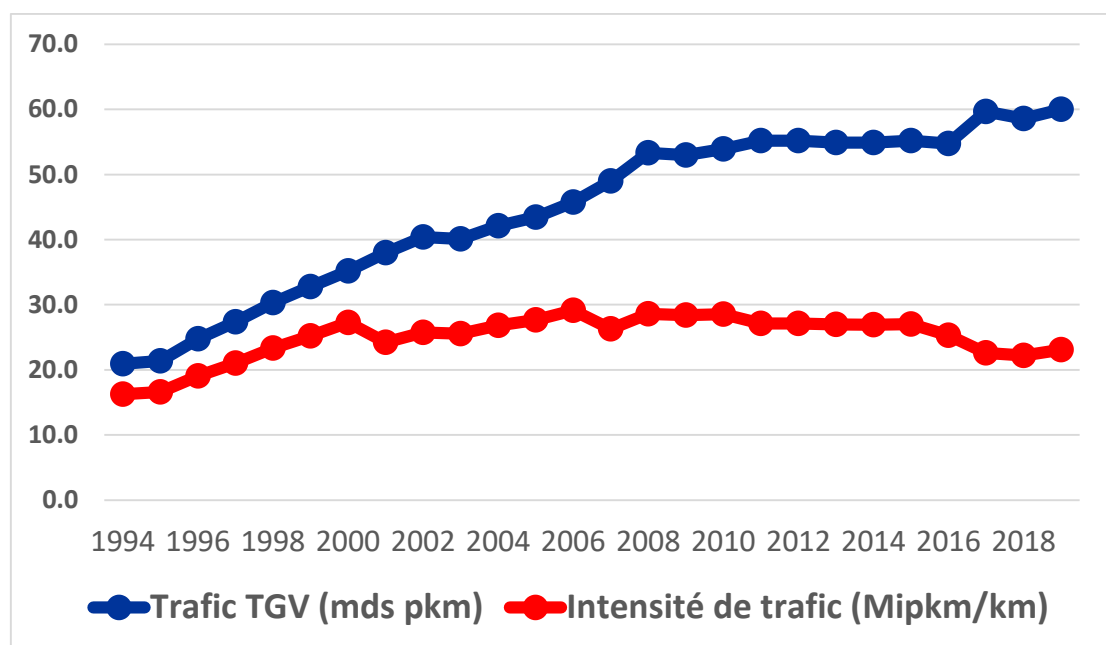


Figure 14: Traffic and high-speed rail traffic intensity in France

The ECA also highlights a surprising reality, the under use of gains in speed. The ratio ‘speed of the fastest service’ to ‘maximum operational speed’ cannot reach 100% as a result of accelerations and decelerations. But it is often less than 70%: 209 km/h instead of 300 km/h for Madrid-Barcelona, 186 km/h instead of 300 km/h for Turin-Salerno. The difference arises from stops in intermediary stations, some of which host reduced traffic.

The ECA also reviewed trans-border lines, those benefiting from European funding. However, they are not the most promising because of the ‘border effect’. The main reasons for travel concern the national character of activities: meeting in the capital or at company headquarters, family visit or visit to friends. Only a part of tourist travel, including business travel, is covered by trans-border HSL. This is the reason why Eurostar took so long to become profitable. In 2017, this company transported a little more than 10 million passengers between London and France. It is less than 1/4 of the total: 14.9 million used ferries, 8.4 million used car shuttles and 8.7 million travelled by plane.

Investments in the traditional network are also affected by the risk of decreasing rates of return of public spending. Regeneration and modernisation of the existing network are necessary to improve punctuality and safety but the impacts on capacity are sometimes limited. The spending made is indispensable, but it does not result in significant increase in traffic for a simple reason: the low rates of occupancy of trains. In Switzerland, a model of rail efficiency, the occupancy rate of trains before the pandemic was 28%. The same kind of numbers prevail for regional trains in France or in Germany. It is therefore often necessary to offer almost three empty seats per passenger since users require frequency which is costly during off-peak hours. The funding requirements of the traditional network are therefore enormous but their impact on traffic is limited. Would it not therefore be possible to



attract more passengers by reducing prices? The German experiment of the €9 ticket during the summer of 2022 offers an ambiguous reply to this question.

As we have seen (figure 13), the €9 ticket was a real commercial success but it was costly for the public finances. The Federal State had to compensate the loss in revenue of the DB but also of various authorities organising transport. Public transfers reached €2.5 billion, whereas the impact on the modal shift was limited.

- A majority of journeys made corresponds to a dead weight effect. The €9 ticket, valid for one month in all of Germany on regional trains, generated a new demand. At the price of several connections, people could travel from one end of the country to the other. At the same time, average distance journeys increased, for shopping, recreation, visits to family or friends.
- Substitution mechanisms were also observed (Figure 15).

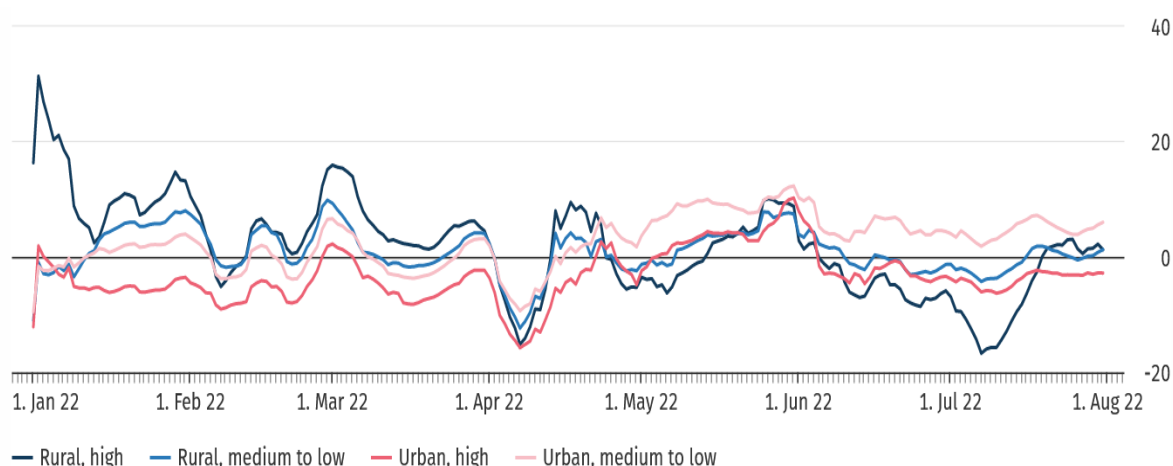


Figure 15: Germany: variation in the number of road journeys of more than 30 kilometres (average over seven days /2019, different scale of figure 13) in function of zones and their volume of tourists

Source: Statistisches Bundesamt: https://www.destatis.de/EN/Press/2022/08/PE22_339_12.html

This was on the one hand at the expense of intercity coach services (Flixbus) that did not benefit from any subsidy. Even if their kilometric rate is low, approximately 4 cents per passenger km, it was difficult to resist a ticket at €9, i.e., 1 cent/km for four return journeys of 225 kilometres for example. On the other hand, at the expense of the private car, even if, for Germany, traffic during the summer of 2022 was close to that of 2019. Interviews conducted by the DB and the VDV, a users' association, nevertheless led them to confirm that 10% of the journeys made with the €9 ticket replaced travel by car. This would have resulted in a saving of 1.8 million tonnes of CO₂, as much as the creation of a speed limit on German motorways.



The figure of 1.8 million tonnes is impressive, but in relation to €2.5 billion of costs for public finances, this corresponds to a cost of reduction of €1,388 per tonne of saved CO₂. This would seem to cost a lot in a country where there is still no carbon tax. This high amount arises from the fact that public transport in general, and rail in particular, are only imperfect replacements for the car. In other words, support of public transport is something that is necessary, but it is naive to believe that the reduction in rail costs could, with the wave of a magic wand, significantly reduce road use for passengers and for goods.

The €9 ticket experiment reminds us of two things:

- The first concerns the modal share and substitution between rail transport and road transport. Since this phenomenon is limited to a few segments of the travel market, it is pointless to believe that reducing the price of rail would significantly change the game.
- The second is that if one wishes to develop rail supply, massive public transfers of funds are necessary. The risk being that the increase of operating subsidies would replace the necessary spending on equipment (maintenance, renewal, extensions). Sustainable funding must be found for both, it is one of the conditions of an effective modal shift from road to rail.

Towards new regulations of mobility?

Because they are necessary, public subsidies in rail transport will increase greatly in the coming years. But this necessary condition is not sufficient if the politics of mobility do not change in tone, as we indicated in the CERRE White Paper¹⁹ by questioning the opportunity of curbing mobility. In fact, with the Green Deal of the European Union (EU) and the ambitious targets of the “Fit for 55” programme, public policies are engaging in a delicate change of paradigm. The change of discourse started at the beginning of the century, but concrete results are difficult since it questions numerous mobility practices and more widely certain gains of economic growth. In its three aspects, locations, activities and travel, mobility in fact remains governed for passengers and for goods by a logic of ‘always more’ associated with the upward trend of purchase power. As a result, mobility value is deeply anchored in attitudes, even though it is in conflict with climate engagements²⁰ which require a certain energy sobriety. It will not be reached without changing prices of energy and carbon mobility modes.

Box 6: Energy sobriety is not degrowth but...

“Anyone who believes that growth can go on forever in a finite world is either a madman or an economist”. In this quip, economist Kenneth Boulding (1910-1993) was not saying that economists are madmen. He was rather inviting one to mistrust the sophistry of the finite world. To believe that decline is inevitable in a finite world is an error that consists in assimilating growth with an infinite

¹⁹https://cerre.eu/wp-content/uploads/2020/05/cerre_whitepaper2024_mobility.pdf

²⁰Crozet Y., 2019, Reconciling transport and the environment - a dilemma that is here to stay, European Court of Auditors Journal, N° 1, 2019, pp. 6-14
https://www.eca.europa.eu/lists/ecadocuments/journal19_01/journal19_01.pdf



increase in the consumption of natural resources. However, growth is not that, but it is the increase in productivity resulting from technical progress and changes in structure resulting therefrom. Technical progress is necessary for the well-being of future generations because, mechanically, since the world is effectively finite, they will have fewer natural resources. We must therefore ensure that gains in productivity continue by increasing the ratio between wealth produced and unit of fossil resource consumed, but in a logic of energy sobriety, namely **reducing the denominator without always trying to further increase the numerator**. We therefore need economic growth but curbed by a modification of prices related to energy in general and to fossil fuels in particular to drastically reduce the consumption thereof.

Energy sobriety means that, in order to reduce our carbon and environmental imprint, innovations are necessary, but they are going to increase prices relating to numerous products: housing, energy, insurance, water, household waste, transport... The tightness of the household budget is only going to get worse even though it is already very tight for the most modest households. Therefore, in order to decarbonise growth, something that we imperatively require, **purchasing power will decrease** in certain sectors as a result of actions on quantities and/or prices. In a certain fashion it is what the sociologist Harmut Rosa²¹ envisaged with his idea of 'reducing access to the world'. Are we ready for that?

A change of course in public policies is therefore necessary. It requires the definition of new targets, together with a road map that clearly identifies the means intended to achieve them in the short, medium and long term. To bet everything on the development of rail traffic and the modal shift is an error. Even if rail passenger traffic increases by 50% from now until 2040 (as in France from 1990 to 2019), that would only represent 7% of the 2019 traffic in private cars. The relative weight of the masses at stake means that, as surprising as it may seem, **the modal shift is not the main lever for the necessary regulation of mobility modes** when the road remains the vector of more than 85% of land travel.

For the promises of rail to be kept, two issues must be resolved. We know the first: where is the necessary funding going to be found? The second is largely ignored: how will the other modes of transport, in particular road and air, be regulated?

For modes other than rail, public policies are gambling on technical changes: electrification of cars and in the long-term trucks, agro-fuel and in the long-term hydrogen for aircraft. However, if these perspectives are confirmed, they will not play in favour of rail, on the contrary. **Why seek a modal shift towards rail if road vehicles and aircraft no longer consume fossil fuels?**

Promoting the railway therefore supposes an interest in the concurrent modes by underlining, on the one hand, the limits of technical progress and, on the other hand, the necessary introduction of a price signal in the regulation of all mobility modes.

- The limits of technical progress are known but they should be recalled. The first is that technical progress comes together with rebound effects. Thus, the reduction in unit

²¹ H. Rosa, *Rendre le monde Indisponible*, La Découverte, 2019



consumption of aircraft or cars encourages usage. The second is that technology is not a magic wand. Electric cars do not emit CO₂ when they are driven, i.e., tank to wheel. But they do emit them, sometimes substantially, in their manufacturing and recycling. For aircraft, kerosene substitutes are only coming online very slowly. It is therefore necessary, as the Kaya identity²² teaches, to take an interest in demand and its control.

- The price signal must be used more systematically to regulate demand for travel which are sources of collective costs to be internalised. Just as drinking water, collective sanitation or the processing of household waste are increasingly managed by industrial and commercial public services, likewise **motorised travel must become part of the pricing logic**²³. Motorised travel (individual and collective modes) must be associated with a monetary cost used both to make the user responsible and to create resources for the collectivity, while at the same time giving it the means to act on the demand.

To make the price signal acceptable, it is necessary to plan for a clear allocation of collected resources, both for road infrastructure and for public transport. The financing of transport must be explicitly organised between the different transport modes in function of the nuisance emitted and therefore in favour of public transport. The second part of this report gives examples of solutions for France.

²²To control transport greenhouse gas emissions, public policies have five levers categorised in the Kaya identity (1993): The first two correspond to technical variants: the unitary emissions of vehicles on the one hand and the source of energy used on the other hand. The following three depend on behaviour: global demand for transport, modal share and the occupancy rates of vehicles.

²³Crozet Y., 2019, Car and Space Consumption: Rethinking the Regulation of Urban Mobility, paper prepared for the Roundtable on Zero car Growth? Paris 17-18 December 2019, ITF-OECD, 28 pages. www.itf-oecd.org/car-and-space-consumption-rethinking-regulation-urban-mobility



3. FRANCE CASE STUDY²⁴

France is a key actor in rail transport in Europe for various reasons. Its demographic and economic weight means that traffic there is significant in volume, in particular in the high-speed rail sector. The SNCF plays a key role therein; it has been protected for a long time by a monopoly of fact if not of law. But given its geographic position, and the amount of traffic, competitors are ready to enter the market. It is a reality that has existed for a dozen years for freight and for several months for passengers. This could contribute to changing the game, as could public policies. But in this sector, results have not met the ambitions over the last 30 years. Hence the changes of course which are without doubt unfinished. This is what we shall recall initially before turning towards the horizon of 2030 and 2040.

3.1 1990-2019, between success and disappointment

During the presidential and legislative elections of 2022, rail was highlighted in all the electoral programmes. The train is presented both as an efficient solution for passengers and a way in which France can respect its climate engagements. The president of the SNCF, Jean-Pierre Farandou, proposed to play “iron against carbon”²⁵. This effective slogan was accompanied with concrete proposals aimed at doubling rail traffic for passengers by 2040. For freight traffic, the government itself set a target of doubling the modal share from 9% to 18% by 2030. These two promises should be reviewed in light of the decades that preceded the pandemic.

Passengers: traffic and modal shares

As an initial analysis, doubling rail traffic for passengers within the next 20 years is no easy task, since from 1990 to 2019 progress only reached 50%. More specifically, and not taking into account the traffic in Île-de-France, from 1995 to 2018 the distance per inhabitant covered each year by train increased from 790 to 1,200 km. Since the population has increased, we are close to an increase of 50% (figure 16).

During the same period, a car-peak²⁶ was noted, followed by a levelling off. In France, since the beginning of the century, each inhabitant covers between 9,000 and 10,000 kilometres by year by car (left scale). That might explain the success of rail and lead one to believe in a massive modal shift. But this is not the case for reasons of comparative masses. Rail traffic (right scale) is 8 times lower than car traffic. If there has been any modal transfer, it has remained modest, all the more so since 2008 a rail-peak has appeared. Distances covered by train have stabilised.

²⁴ Yves Crozet

²⁵ As a reference to the famous “iron-carbon diagram” that is taught in metallurgy courses in engineering college.

²⁶ In 2012, the International Transport Forum (OECD) organised a round table that demonstrated that since the beginning of the 2000s, a car-peak had been observed in the majority of developed countries. https://www.oecd-ilibrary.org/fr/long-run-trends-in-car-use_5k44whvc0l7b.pdf?itemId=%2Fcontent%2Fpublication%2F9789282105931-en&mimeType=pdf

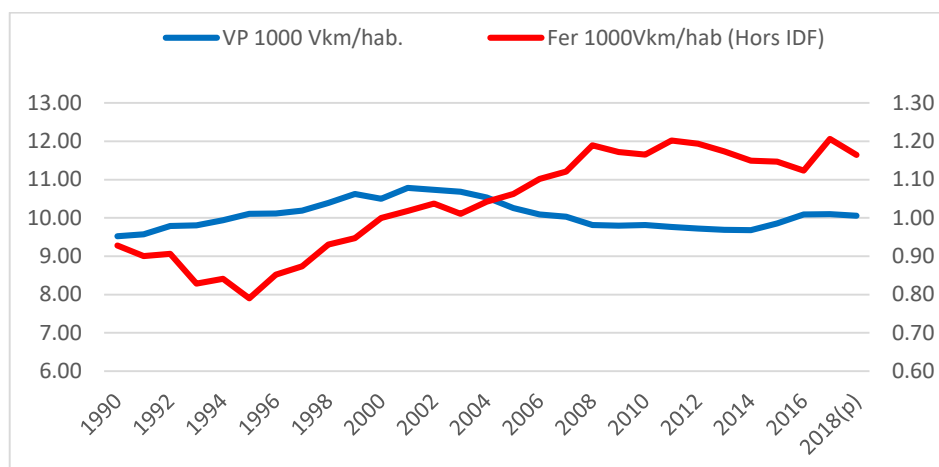


Figure 16: Car and train passenger traffic in France (1000 passengers-km/hab.)

Source: National transport accounts 2018

The new HSL and the development of regional trains (TER) supported demand after 1995, but this is no longer true since 2008. What has happened?

Economic growth slowed significantly after the financial crisis, then lengthy strikes within the SNCF damaged the railways in 2014, 2016, 2018 and 2019, but that does not explain everything (figure 16).

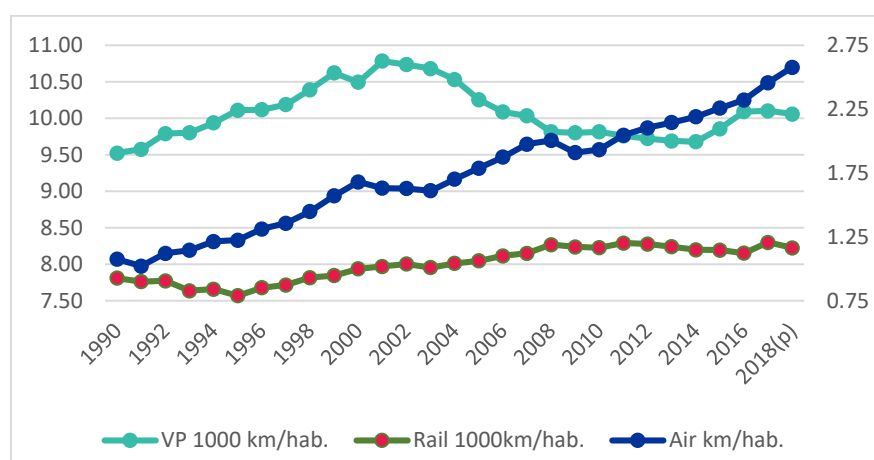


Figure 17: Annual distances per inhabitant (private vehicles (VP) left scale, rail and air right scale)

Peak-car and peak-rail do not correspond to peak-travel. If the distances covered by air transport are integrated (domestic and international), people residing in France covered 11,500 kilometres per year in 1990 but 13,500 in 2018, i.e., growth of 0.6% per year. But air transport on its own has grown by more than 3% per year. Here we have an illustration of what we have presented as the logic of “always more” which accompanies the promotion of “mobility value”. In this perspective, air transport is indeed very attractive not only because of the diminishing relative price (see figure 17) but also for the great diversity of destinations that are accessible in a short time thanks to greater speed. A critical eye maybe cast on what economists call the “preference for variety”. Thus, according to H. Rosa *“an extremely powerful idea has infiltrated into the smallest pores of our psychic and emotional life: the*



idea according to which the key to a good life, to a better life, resides in the extension of our access to the world”.

But public policy has not yet indicated that it wishes to reduce access to the world. The logical result is that greenhouse gas emissions from transport are not in line with the climate engagements of France. In 2019, it exceeded the target set in the Kyoto Protocol for the year 2020 by 36%. However, 15 years ago the “Grenelle de l’Environnement” project had already gambled on the modal shift towards rail to reduce CO₂ emissions. €15 billion were invested in the HSL. TER and tramways have greatly increased their supply. However, the modal share of public transport has only increased from 10 to 11% whilst funding has been generous (figure 18).

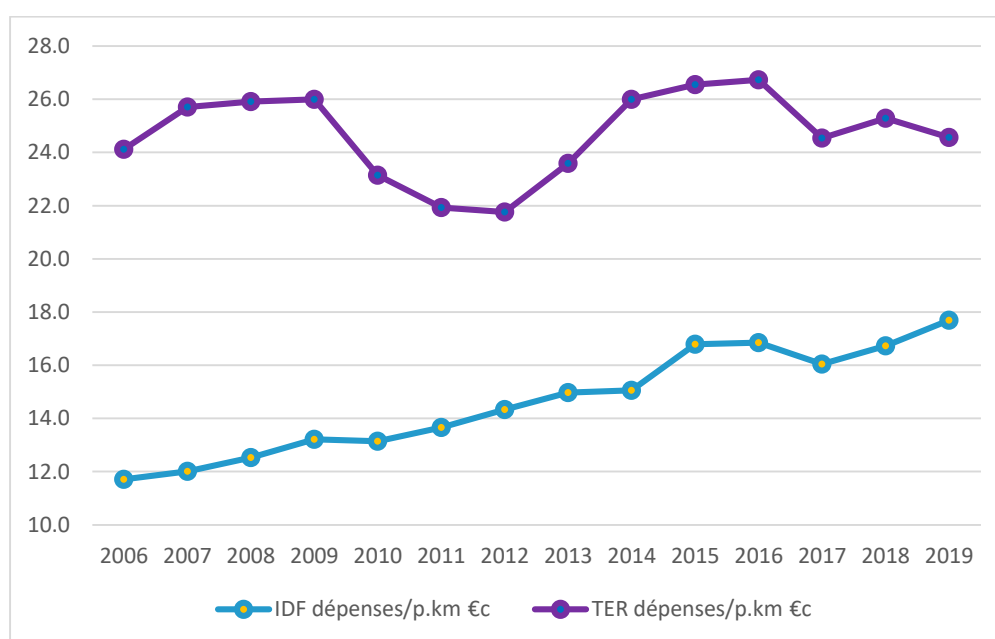


Figure 18: Public subsidies to regional rail transport in €c per passenger km

Source: National transport accounts

One discovers a high and growing public cost for each passenger-km without even taking into account the cost of infrastructure. In Île-de-France, public subsidies per passenger-km increased from 11.7 to 17.7 cents, a good illustration of the decreasing rate of return of public spending. For the TER, the situation is less worrying, subsidies per passenger-km are stable or slowly increasing. But this nevertheless means that any voluntarism for the development of rail transport presumes a strong increase in public spending.

Rail freight from decline to rebound

For the last two years, the freight rail transport sector has been rallying in France. The launch of the “Alliance 4F” reveals a strong collective will to redress an increasingly worrying situation. The government is also on the case, and has set an ambitious target: 18% of the modal share for rail by 2030, namely twice as much as in 2019. Is this possible? To reply to the question, it is necessary to



revert to the profound changes that have taken place over the last 20 years in the transport of goods in general and rail freight in particular.

The data presented in figure 19 are quarterly and corrected for seasonal variations, erratic variations of rail traffic (transported tonnes-km index, left scale) appear clearly therein. The national strikes (2001, 2003, 2010, 2014, 2016, 2018, 2019) cause indentations on the curve. But the most obvious impact appears during the recession following the financial crisis of 2008. A fairly modest reduction in levels of GDP and manufacturing production (in thousands of current euros, right scale) is reflected in a sharp fall in traffic of goods which is more significant for rail than for road (index of t.km transported for others in France).

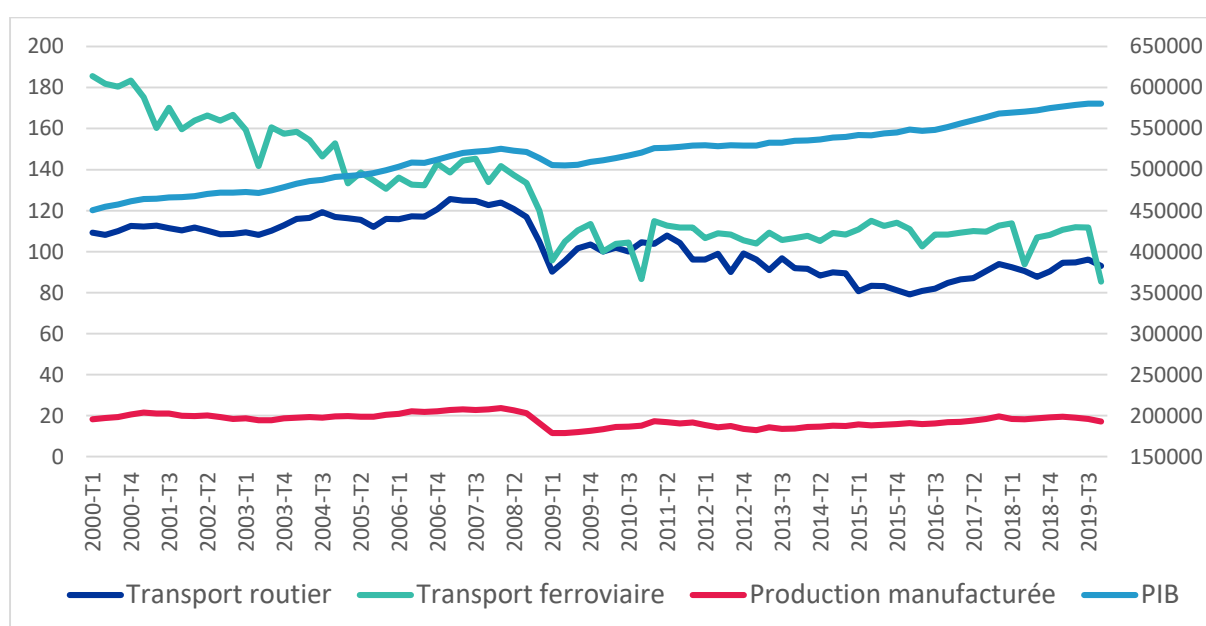


Figure 19: Flow of goods and economic activity

Source: <https://www.statistiques.developpement-durable.gouv.fr/conjoncture-des-transports-0>

Beyond this conjunctural impact, the traffic curves reveal a structural transformation. Goods, like passengers, (see the peak-car) have undergone a certain “demobility”. Over the last 10 years, a decoupling has occurred. Whereas GDP started rising again, even though at a slower rate, rail transport flattened out, as did moreover in current money the production of manufactured goods. Deindustrialisation is one of the causes of the decoupling between GDP and the flow of goods. An economy based on services and the digital economy limits the number of tonnes transported. For rail, it has been reducing as a trend for more than 40 years. It is therefore an illusion to count on a strong increase of total volume transported as the basis of a rebound in rail freight. All the more so since the latter is increasingly disconnected from modern logistics chains. Warehouses without railway connection and served only by road are increasing along the main axes and around large towns. Goods transiting therein are more generally packed on pallets, the origins and destinations of which are very varied. Rail transport cannot reply to this demand. Modern logistics is characterised by the reduction in size of the batches and the transport by successive short hops. Goods rarely make a direct journey



from the place of production to the place of use as witnessed by the fact that the average journey of a truck on concession motorways in France is less than 100 kilometres.

Rail is therefore limited to certain types of freight travelling over significant distances and in the form of full trains (cereals, chemical products, vehicles, various equipment). There is little overlap between demand addressing itself to rail and demand turning to the road. Thus, in Germany, since the beginning of the century the strong increase in rail freight traffic (+40% since 2000) has not changed the market share of the road. The gains made by rail have been made at the sole expense of the waterways. To avoid this relegation of rail, operators are seeking to attract new traffic such as containers. But the margins of progress are limited because a container unloaded in a large maritime port is rarely transported over hundreds of kilometres. It is more often warehoused near the port to optimise the distribution of the batches that it contains.

The land transport of containers represented in France in 2018 11.7 billion tonnes-km, only 3% of the total of the t.km of domestic transport. In this sector rail matches the road (5.5 billion t.km each). Even if rail took over all of the container transport, its modal share would only increase by 1.5 points. However, since 2014 it is the opposite that has happened, the share of containers in rail traffic has reduced from 25 to 15%. This is the reason why the hopes placed in combined transport have not been realised. Such an evolution, contrary to the hopes placed in rail freight, highlights the decline that rail freight has suffered in France. In 20 years, the index of tonnes-km transported has almost halved. The decline started at the beginning of the century well before the opening up to competition. The latter, which has been in place for 10 years, has simply stabilised traffic slightly above 30 billion tonnes-km against 55 in 2001. The general result is the exact opposite of the announcements made by the ministers Gayssot (1999) or Borloo (2008). The modal share of road has increased and reached 86% in 2018, 10 points higher than in 2000.

3.2 What perspectives for 2030?

Rail transport in France has undergone a critical success since the beginning of the 2020s. The reduction of traffic during lockdowns taken together with climate engagements has convinced the public decision makers of the necessity to sustainably support rail. These new directions are caused both by climate engagements and the impacts of the pandemic. But what are the best options to support the rail development? And what will the medium-term impacts of the new priorities announced by the government be?

The pandemic and changes in political course

During his first mandate as President of the Republic, on 1 July 2017 Emmanuel Macron made an emblematic speech at the inauguration of the new HSL Bretagne-Pays-de-Loire, one of four new HSLs launched by President Sarkozy ten years earlier. Without fear of disappointing the expectations of the local governments, the president announced that now was not the time for such new projects and that priority must henceforth be given to daily mobility.



However, four years later at the 40th anniversary of the opening of the Paris-Lyon line, a relaunch of the HSL was announced. The Prime Minister Jean Castex played a key role in promoting the GPSO (Great Southwest HSL rail project) to the top of the political agenda, but also the Montpellier-Béziers line and in part the connexion between Marseille and Nice. This change of course is not the last one. The government also relaunched night trains and reduced track access charges paid by freight trains. Recently, at the end of February 2023, the French Prime Minister, Elisabeth Borne, announced that the rail network would benefit from increased public aid. More than 5 billion euros per year are expected. Coming from the State, these sums will be earmarked for the regeneration and modernisation of the classical network. But some doubts exist about the credibility of this commitment as well as the origin of the billions of euros promised for the improvement of regional rail services in 12 metropolitan areas.

A lot of questions remain on the capacity of public finances to keep both the previous promises on new high-speed lines and the new promises giving priority to the maintenance and renewal of the classical network. The future of rail remains uncertain in France.

Passenger transport

At the end of 2019, following the great debates organised to diffuse the crisis of the yellow jackets, a “citizens climate convention” was launched. Its recommendations in the transport sector published in June 2020 were clearly in favour of a relaunch of rail transport: relaunch of night trains, ban on domestic flights when there is a high-speed train link, speed reduction on motorways and all sorts of measures aimed at reinforcing the modal shift towards rail. At the same time, passenger rail traffic was collapsing due to lockdowns (figure 20).



Figure 20: Evolution of passenger traffic in France from 2014 to 2021

Source: annual transport report <https://www.statistiques.developpement-durable.gouv.fr/bilan-annuel-des-transports-en-2021>

In France, as well as everywhere else in Europe, passenger rail traffic shrunk by about 50% in 2020. For regional trains, the financial impact was limited since commercial revenues barely represented



20% of the total cost. The consequences were more direct for high-speed rail that lost more than 50% of its passengers and revenues. This is why the government had to pay a subsidy of €4.5 billion to the SNCF. Announced as a subsidy to the SNCF network for the renewal of infrastructure, this exceptional subsidy corresponds more exactly to the losses in activity of the main lines, and it was paid to the SNCF Holding and not to SNCF Network. A recovery in traffic was observed in 2021 but the recovery is less clear for rail to the point than in terms of market share, road share in 2021 was at 84%, three points above that of 2019. This conjunctural evolution and the structural recommendations of the citizens convention convinced the government that it had to officialise a change of course. This occurred as we have seen by the relaunch of night trains, HSL projects and various traditional services called territorial levelling-up trains (TET) subsidised by the State and not the regions as is the case for the regional trains. Traffic data for the year 2022 is not known in detail but indicates a return of passengers for all types of service. The end of lockdowns and the increase in fuel prices were catalysts in this movement. The high-speed services of SNCF have been profitable in 2022.

Transport of goods

The transport of goods was also affected by the pandemic but much less clearly. In 2021 rail freight made a strong recovery which led it to a level higher than the average of the 2010s and to a small gain of market share.

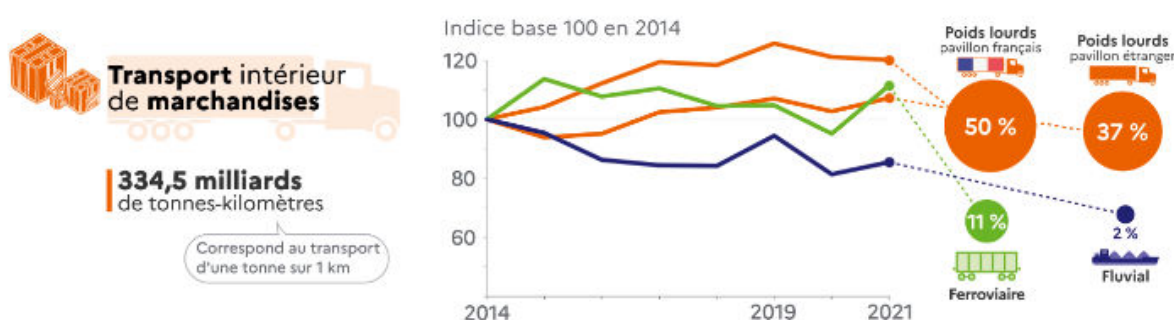


Figure 21: Evolution of goods traffic in France from 2014 to 2021

This recovery was accompanied by the measures decided by the government in the 2020 relaunch plan. The main measure, the reduction in track access charges, was required to avoid the collapse of the rail undertakings (RU). But that will not be enough to form the basis of a structural change leading to tendency growth of the modal share of rail freight. The efforts made by the public powers are real but public subsidies do not guarantee an increase in traffic. Low access charges improve the margins for undertakings, but they do not solve the other problems faced by the activity. Rail freight cannot seize upon this reduction in access charges because it has little capacity to increase its supply. The key problems of rail freight are not first and foremost financial problems but organisational problems.

One of the recurrent difficulties faced by the RU is the unsuitability between the paths offered by the infrastructure managers (IM) and the requirements of shippers, clients of the RU. Add to that the fact that the speed associated with a given path is weak. It does not allow for good profitability of the



equipment. For the RU, the average speed is a key factor of productivity thanks to better rotation of equipment. Scheduled works, numerous in the current phase of catching up in terms of renovation of the network, are a further cause of degradation of the quality of service. However, none of that can change to the extent that national, regional and metropolitan priorities concern passenger transport. Announcements on the relaunching of rail freight have followed one after the other for the last 20 years. Each time they are polarised on local emblematic performances (infrastructure, a new piggyback service, a “first ever” train...) but what is sometimes a local success only has weak global impact. Thus in 2021 the market share for the road transport of goods remained very high, 87% against 13% for the group rail and waterways. The latter, despite a small recovery, is losing ground, notably against rail, as in Germany.

Perspectives for 2030 and 2040

2021 was the “European year of rail”. But as we have seen, this was only the year of a partial recovery after the pandemic. The strategy of the European Commission²⁷ published on 9 December 2020 places a major role on rail in the transition towards carbon neutrality, in particular high-speed rail. In France also, the government is increasing its announcements in favour of rail in the name of climate goals, but a key question remains about the abatement cost of the potential CO₂ reduction.

The question of emission reduction costs

The president of the SNCF wants to double the market share of rail freight in 10 years and, from now until 2040, also double the market share of passenger transport²⁷. To do so he is requesting from the State massive subsidies to develop infrastructure: €100 billion in the coming 15 years, more than a half of which is for new HSL. He indicates that these investments would save 8 to 10 million tonnes of CO₂ per year overall. If we add to the investment subsidies the operating subsidies, which will have to adapt to the increase in traffic, the public cost of the railway would rise from €13 to 20 billion per year. If that would save 10 million tonnes of CO₂, the cost of reducing emissions would be €2,000 per tonne! A very poor return on public spending.

Such a figure raises a question, knowing that it is found in numerous sectors. Concerning housing insulation, the ADEME recently recalled²⁸ that the necessary investments often correspond to a reduction cost of €1,000 per tonne of CO₂. However, it is necessary to act. Even though we are recalling the high level of the reduction costs, it is not in favour of inaction or the *status quo*. What is at stake is the inability of public policies to impose upon companies and households a carbon cost that would lead them to drastically reduce their consumption of fossil fuels. It is the reason why at the European Union scale, from 2010 to 2022, greenhouse gas emissions have only dropped by 1% per year²⁹. They have not reduced in the transport sector. In France, in 2022 the CO₂ emissions of transport were 2% higher than in 2021, close to their 2019 level.

²⁷<https://medias.sncf.com/sncfcom/pdf/strategie/fer-carbone.pdf>

²⁸<https://presse.ademe.fr/2022/07/pour-un-contrat-social-de-transition-lademe-devoile-ses-propositions-pour-une-reforme-equitable-de-la-valeur-du-carbone.html>

²⁹https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quarterly_greenhouse_gas_emissions_in_the_EU&stable=1



We must therefore do more, and being unable to rapidly affect the behaviour of households and companies, public authorities are going to have to spend significant amounts since it is they who must, via various subsidies, support the high costs of emission reductions that we have just mentioned. All this brings us back to a world of decreasing rates of return and to the famous “Ricardo effect” defined by F. Hayek: increasing the burden on the manufacturing process since in fact a price must be paid to sectors of activity such as rail which will help in decarbonisation. This supposes that funding will be found and for that it will be necessary to review pricing and regulations not only for rail but for all mobilities.

Another regulation of mobility in the service of rail?

As we explained at the end of the first section, paradoxically, the funding of rail must be tackled by evoking the changes necessary for all mobilities and in particular use of the road. The alternative scenario that we propose below seems unrealistic. It is however only the alignment of climate engagements with the development of various forms of energy sobriety, in particular in road usage. Our ambition is to return credibility to public policies by recalling the saying “he who wills the end wills the means”.

In the scenario that we are proposing the following evolutions must be envisaged in stages by explicitly integrating therein the issue of acceptability and thus the issue of the use of funds collected in the framework of a dual and then triple road pricing system.

- The first component of road pricing, fuel tax, constitutes the first change of course. It can be done quickly. The fuel taxes are in fact intended to internalise the costs related to the use of fossil fuels which is not going to disappear for several decades. The minister of the economy Bruno Le Maire proposed at the end of 2021 that revenue from the fuel taxes be allocated to policies in the fight against climate change. It is a way of explaining that today they have no link with public spending for mobility whereas they could be in part allocated to the funding of public transport. That would not represent an additional expense for the collectivity but the earmarking of a resource. The carbon component of the fuel taxes, approximately 10 cents per litre, today brings in approximately €5 billion per year. The allocation of this amount to public transport and rail transport would be a strong signal, a way of improving acceptability of the tax.
- A second component of the pricing concerns urban and peri-urban zones that could be the sphere of a second phase of change of course of public policy. In the large agglomerations, a logic of supply of services is already developing, services that are multimodal and integrated, already possible in the logic of mobility as a service (MaaS)³⁰. The organising authorities for

³⁰ See the 2 reports of CERRE on Maas in 2019 and 2021

<https://cerre.eu/publications/shared-mobility-and-maas-regulatory-challenges-urban-mobility/>

<https://cerre.eu/publications/mobility-as-a-service-maas-digital-roadmap-public-transport-authorities/>



mobility could be encouraged financially to offer at the same time a multimodal regulation via a “mobility pass” that would include for users of the road a variable toll (time, space, type of vehicle) contributing to the funding of public transport. This is the case in Oslo where revenue from tolls represents 40% of the revenue of public transport.

- The third component of road pricing concerns the end of motorway concessions that do not have to be renewed under identical conditions. The toll should be replaced by the eurovignette, adopted by the EU at the beginning of 2022 for Heavy Goods, Light Utility Vehicles and Private Vehicles. This idea of a modulated payment in terms of the distance covered must be materialised, integrating the costs of infrastructure and the taking into account of certain external costs specific to the zones crossed. Electrification of the fleet, and the announced reduction in revenue of the fuel taxes, require the implementation of such a tool. One must be prepared for the next decade that will see the end of the motorway concessions. Such a system must be tested well before the end of the concessions.

The implementation of the new mixture of fuel taxes + mobility pass + eurovignette must be made without trying to immediately find new resources. The interest in road is that the monetary cost already supported by users is quite high. Annual expenditure of households for individual transport amounts to more than €150 billion of which almost 20 billion accounts to fuel taxes and 3.5 billion to motorway tolls. Without increasing these amounts, the structure needs to be changed in order to have, in the long term, a regulation tool that will be all the better accepted since the allocation of resources will be clearly established in favour of modes of transport that have the lowest emissions of CO₂.



4. BELGIUM CASE STUDY³¹

4.1 General positioning of rail in Belgium and forecasts

In order to be able to make meaningful projections on the future of rail, it is important to take a wider look at transportation in general and related patterns of evolution. The modelling and forecasting come from the Belgian Federal Planning Office (2022). The evolution of the transport demand is a projection under unchanged policy. It is based on the macroeconomic and socio-demographic outlook of the Federal Planning Bureau and takes into account the evolution of the transport costs (monetary and time costs). The projection assumes an average annual growth rate of 1.3% of GDP (in volume) and 0.3% of the Belgian population. It assumes a continuation of the current fiscal and pricing policy (with the greening of the car tax and the two-phase ban on combustion vehicles in the Brussels Region, but not with the more recent project of the ban on the sale of combustion vehicles in Flanders) and of the implementation of the existing European directives that provide for new euro standards and an improvement of the energy efficiency for vehicles. The evolution of energy prices is based on a projection made in March 2022.

At the infrastructure level, the projection is based on the preservation of the current road infrastructure. An increase of road transport thus generates more congestion and thus reduces the speed on the road network. Transport speed by rail or by barge is assumed to be constant over the entire period. So, we assume implicitly that the growth in demand for these modes of transport can be accommodated by the existing rail and inland waterway infrastructure or that it is adapted if necessary. What is observed for Belgium in general transportation, is that passenger transport is and remains a far larger user of the transport network than freight transport (183.2 bn passenger-km vs. 76.4 bn ton-km in 2040, see Tables 2 and 3). Passenger transportation gets saturated as of 2030 (Figure 20). That implies that total volumes of passenger-km start to go down slowly after 2030 (-1% by 2040, Figure 22), whereby the population increase gets compensated for by the lower transport consumption per inhabitant. The main reason for that is the higher level of teleworking that got installed more structurally since COVID, causing a break with the past (Dutch Knowledge Institute for Mobility, 2022). Other reasons are the ageing population and the higher generalised cost of transport, mainly due to congestion (Figure 24). Home-work trips remain the most important contributor to passenger-km, be it that in number of trips, leisure and shopping score higher (Table 2)

³¹ Thierry Vanelander, University of Antwerp.

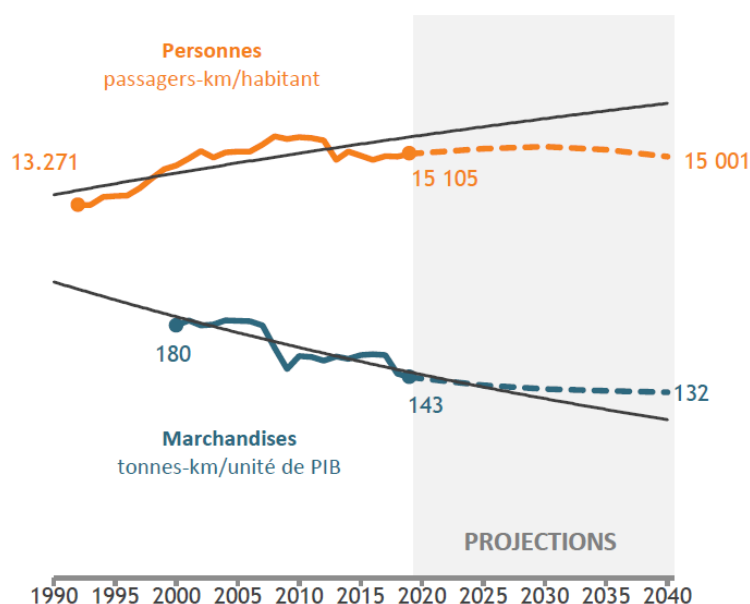


Figure 22: Evolution of transport intensity measures

Source: Belgian Federal Planning Office, 2022

Black lines represent tendencies calculated based on past observations only

For freight transport, transport intensity goes down by about 7% in the considered period (Figure 22), with a weakening of this trend after 2030. In total absolute volumes (ton-kilometers), freight transport volumes keep on increasing (Figure 23), mainly due to imports and exports (Table 3). A clear structure change in the nature of flows is observed, with only slightly growing domestic traffic, but the strong volume increase in imports and exports leads to a net increase in overall flows (Figure 25).

Looking deeper into the individual modes of transport, it can be seen that for passenger as well as freight transport, road remains the dominant mode by far, with rail only having a fairly small share (10.6 respectively 11% in 2040, see Table 2)³². For passenger transport, which share means a decrease from the current (2019) 12.8%. The decrease in overall volumes is even bigger: -20% by 2040. Rail is the only mode that is projected to lose volume substantially: road and bus/metro/tram lose by very small percentages, while walking/biking gain volume compared to 2019.

For freight transport, the rail share increases marginally from the current 10.3% (Table 3), with rail being the only mode that registers a share increase³³. Over the period to 2040, the absolute volume thereby increases by 28.5%, which is the strongest absolute growth of all freight modes.

³² Note that the Belgian Federal Planning Office (2022) calculations do not take into account the Belgian Rail Vision 2040, published in May 2020, which aims at a 15% mode share for passenger rail by 2040.

³³ The Belgian Rail Vision 2040 aims at a 20% mode share for freight rail by 2040.

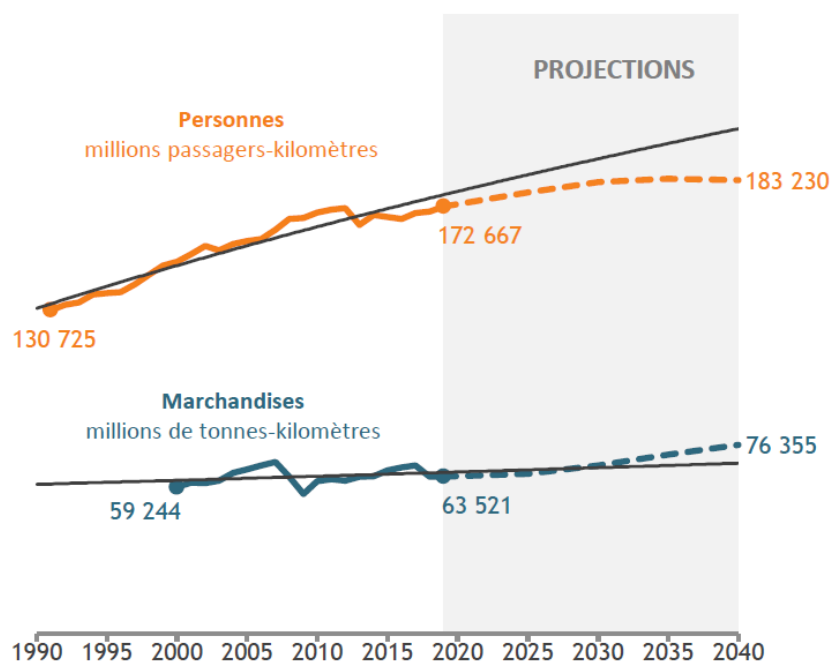


Figure 23: Evolution of domestic transport demand

Source: Belgian Federal Planning Office, 2022

Black lines represent tendencies calculated based on past observations only

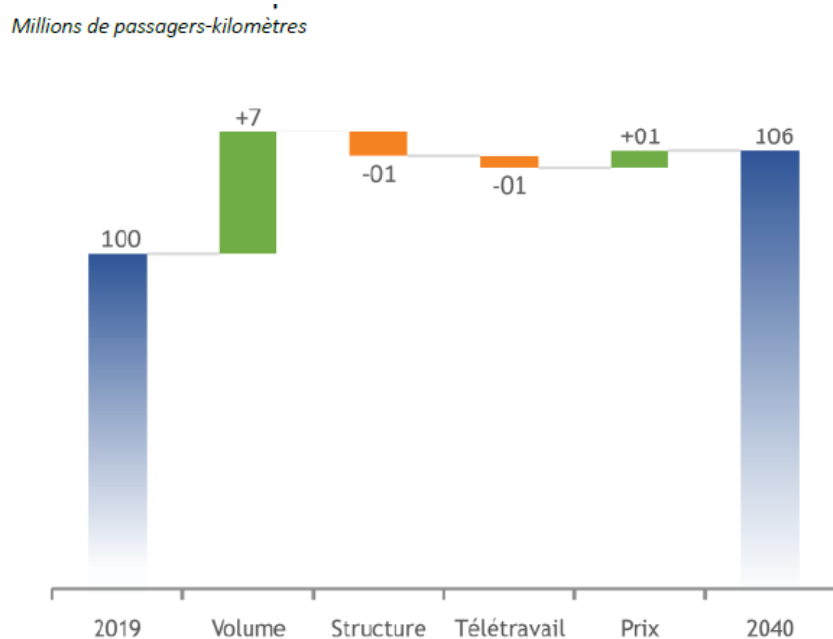


Figure 24: Main sources of total passenger transport demand evolution

Source: Belgian Federal Planning Office, 2022



	2019	Niveau 2030	2040	2019	Parts (%) 2030	2040	2030/2019	Croissance 2040/2030	2040/2019
<i>Millions de déplacements par an</i>									
Total	5435	5784	5847				6,4%	1,1%	7,6%
Domicile-travail	1003	1019	972	18,5%	17,6%	16,6%	1,6%	-4,6%	-3,1%
Domicile-école	396	390	390	7,3%	6,8%	6,7%	-1,4%	0,0%	-1,4%
Domicile-études	38	43	41	0,7%	0,7%	0,7%	12,9%	-5,6%	6,5%
Business	273	288	282	5,0%	5,0%	4,8%	5,7%	-2,2%	3,4%
Accompagner qq.	438	471	484	8,1%	8,1%	8,3%	7,5%	2,6%	10,4%
Achats	1575	1726	1793	29,0%	29,8%	30,7%	9,6%	3,9%	13,8%
Loisirs	1712	1846	1886	31,5%	31,9%	32,3%	7,9%	2,1%	10,2%
<i>Milliards de passagers-kilomètres par an</i>									
Total	172,7	182,4	183,2				5,6%	0,4%	6,1%
Voiture	142,8	151,0	150,8	82,7%	82,8%	82,3%	5,8%	-0,2%	5,6%
Train	15,0	15,0	14,5	8,7%	8,2%	7,9%	-0,1%	-2,8%	-2,8%
Bus/Tram/Métro	6,9	7,2	7,5	4,0%	3,9%	4,1%	4,4%	4,1%	8,8%
Marche/Vélo	5,7	6,7	7,7	3,3%	3,7%	4,2%	17,5%	15,0%	35,2%
Domicile Travail	49,3	49,7	47,6				0,7%	-4,2%	-3,6%
Voiture	40,5	41,5	40,0	82,2%	83,5%	83,9%	2,2%	-3,7%	-1,5%
Train	6,3	5,6	5,0	12,8%	11,3%	10,6%	-11,0%	-10,3%	-20,1%
Bus/Tram/Métro	1,3	1,3	1,2	2,5%	2,6%	2,6%	1,9%	-2,1%	-0,3%
Marche/Vélo	0,6	0,7	0,7	1,2%	1,3%	1,4%	8,4%	3,6%	12,3%

Table 2: Long-term perspectives for passenger transport under unchanged policy

Source: Belgian Federal Planning Office, 2022

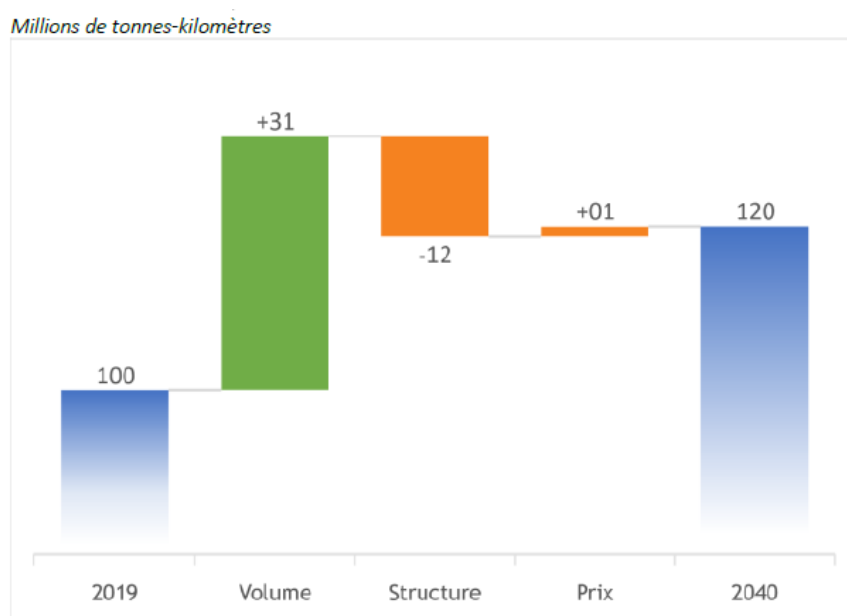


Figure 25: Main sources of total freight transport demand evolution

Source: Belgian Federal Planning Office, 2022



	2019	Niveau 2030	2040	2019	Parts 2030	2040	2030/2019	Croissance 2040/2030	2040/2019
<i>Millions de tonnes par an</i>									
Total	1820	1986	2220				9,1%	11,8%	22,0%
National	606	583	623	33,3%	29,3%	28,0%	-3,9%	6,9%	2,7%
Entrées	632	723	821	34,7%	36,4%	37,0%	14,5%	13,6%	30,0%
Sorties	582	680	776	32,0%	34,2%	34,9%	16,8%	14,1%	33,3%
<i>Milliards de tonnes-km par an</i>									
Total	63,5	68,0	76,4				7,1%	12,2%	20,2%
Route	49,1	52,2	58,7	77,4%	76,7%	76,9%	6,2%	12,4%	19,4%
Rail	6,5	7,5	8,4	10,3%	11,0%	11,0%	14,3%	12,4%	28,5%
Voie d'eau intérieure	7,9	8,1	8,6	12,5%	12,0%	11,3%	2,8%	6,0%	9,0%

Table 3: Long-term perspectives for freight transport under unchanged policy

Source: Belgian Federal Planning Office, 2022

The above figures and forecasts do not take into account more recent policy developments. In what follows, we will look more in detail into rail-related policies that have been decided, and that should impact on rail's performance, leading to higher rail figures than the ones from the Belgian Federal Planning Office (2022) as described above.

Road transport is the most energy-consuming mode of transport in Belgium. Demand for fossil fuels in this sector is expected to continue to rise. Figure 26 shows the share of the main sectors in the Belgian greenhouse gas emissions in 2017. With nearly a quarter of the total emissions, transport clearly is the biggest contributing sector.

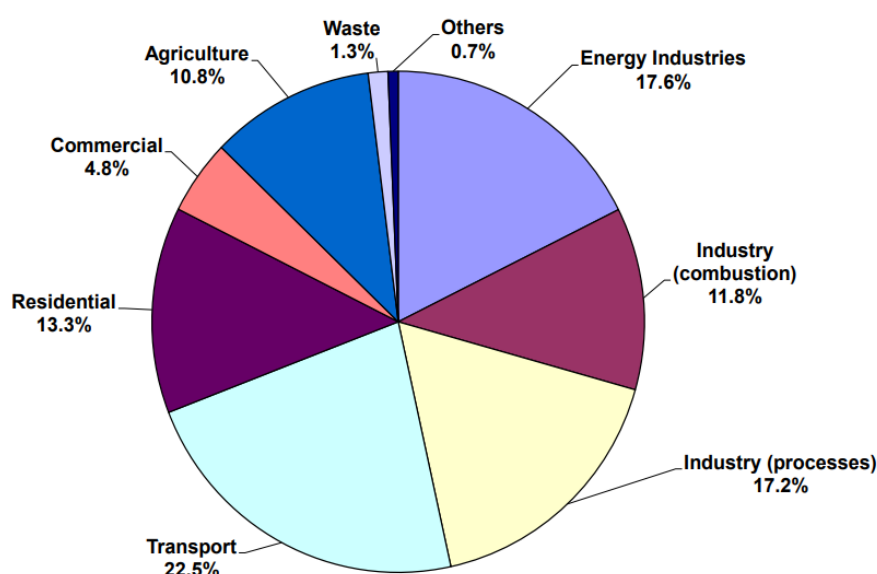




Figure 26: Share of main sectors in Belgian greenhouse gas emissions (2017)

Source: Belgian Federal Government (2020)

Figure 27 provides a summary of the impact of the main sectors on the changes in the national trend. It clearly shows the large increase in road transport emissions, both in % and even more in absolute values.

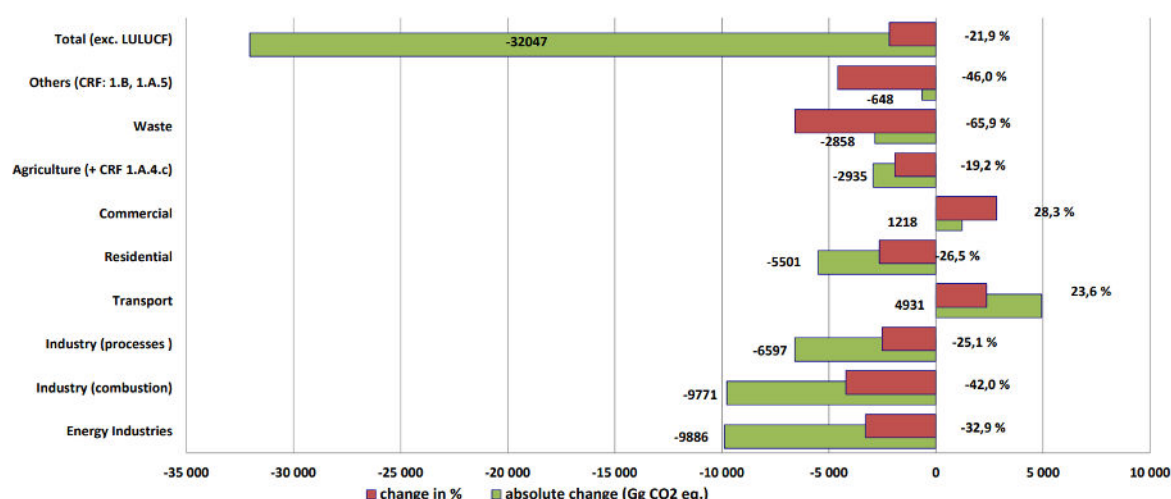


Figure 27: Changes in greenhouse gas emissions from main sectors between 1990 and 2017

Source: Belgian Federal Government (2020)

For the future, based on the registered policy intentions in Belgium by 2020, the Belgian Federal Government (2020) indicates that the trend in the transport sector can be reversed to a 23% decline in 2030 compared to 2005. This does not include many of the rail policies mentioned in the next sections, as part of more recently proposed vision documents, plans and management contracts.

4.2 Passenger transport policy and evaluation

Policy

With respect to passenger transport, an important step put forward by the Belgian Federal Government is the signing of new management contracts between that Government and SNCB, Belgium's only and national passenger rail operator, respectively Infrabel, Belgium's infrastructure manager. Such management contract was long due, as the previous contract was running for the period 2008-2012, and in 2012 got prolonged for indeterminate length of time, until the signing of a new contract. That finally happened end of 2022, with a contract for 10 years, including a mid-term review.



The goal of the new contracts is boosting passenger rail traffic. By 2032, SNCB must transport 30% more passengers and reach 50% more passenger-kms³⁴, thanks mainly to more trains, variable fares and lively stations. An additional 8.2 million kilometres should be driven annually, up from the current 83.4 million. The number of daily services on weekdays should increase to 4,200, up from the current 3,800. That will amongst others happen through earlier and later trains. Two trains per hour in each direction at just about every station will be the minimum offer. Around the major cities four trains per hour will run at least.

In addition to a sharp increase in the offer, SNCB will also have to entice new travellers by improving the 'passenger experience'. It starts in the stations, which should grow into "lively and safe places for exchanges and encounters", says the contract. "In this way, they play a central role in local life and form an essential link in the chain of sustainable mobility". Together with the local authorities, SNCB will set up the 'Life in the station' project. This is intended to turn 'unused and available spaces' into cafes, halls for events, shops or bicycle repair shops. Also, from now on, SNCB is no longer allowed to decide on its own to close stations but must first request permission from the transport minister.

Between now and 2032, half of all rolling stock must be renewed. Just under 100% of the trains will then have air conditioning. SNCB is studying how mobile phone connectivity on board can be improved. There can be no question of the disappearance of the train conductors – a step that has already been taken in several countries.

In order to encourage the combination of train and bicycle, each new train must have room for at least eight bicycles. The storage space for storing folding bicycles, for example under the seats, is also increasing. The number of bicycle parking spaces at the stations will increase by 40%.

Finally, the new contract gives SNCB the freedom to determine a number of rates itself – something the company has been requesting for ten years. For example, it will be allowed to introduce lower fares during off-peak hours, in order to better spread the crowds on the trains over the day. However, with regard to the majority of the rates, the contract keeps SNCB on a leash. The prices of most tickets and subscriptions will still have a regulated - read: low - price for the next ten years, whereby SNCB has no freedom to play with the rates. Those regulated tickets include all standard second-class tickets, commuter, student, senior and other specific groups. The contract leaves some room for manoeuvring though: if the railway company meets the interim annual targets for improving punctuality, customer satisfaction and the number of kilometres travelled by the trains, it may increase the rates of the regulated subscriptions by a maximum of 1% on top of the index.

In ten years' time, travellers will generally have to rate the NMBS with a 7.44 out of 10, compared to 7.25 now. This is partly achieved by limiting delays, but it involves a wide range of twelve criteria: from the price of the ticket to the information provided on the train, its cleanliness to the friendliness of the staff. In 2019, 63% of train users were OK with cleanliness.

³⁴ Passenger and passenger-km objectives concern national transport only, not international.



To achieve all these objectives, SNCB will receive a total size of the investment plan for the next ten years amounting to 8.1 billion euros.

Infrastructure manager Infrabel in turns needs an increase in its investment budget from 800 million a year now to more than 1 billion from 2023. Infrabel also aims for an extra 100 million on an annual basis for operating costs. Over the entire term of the new management agreement, this involves an additional budget of approximately 3 billion euros. This money must be used, among other things, to eliminate overdue track maintenance, to invest in extra rail capacity and to increase the accessibility of the stations.

Evaluation

The above-mentioned government plans are ambitious, which is good and needed in view of the challenges ahead, but the question is whether that ambition is feasible given the many limitations surrounding its implementation. The additional supply in train trips has been cross-checked with infrastructure manager Infrabel, and therefore should be technically feasible. However, other questions can be asked on other items and characteristics of the government's Rail Freight Action Plan. That is structured along a number of passenger rail disruptions, as identified by Voes et al. (2021), and classified in five categories (Figure 28).

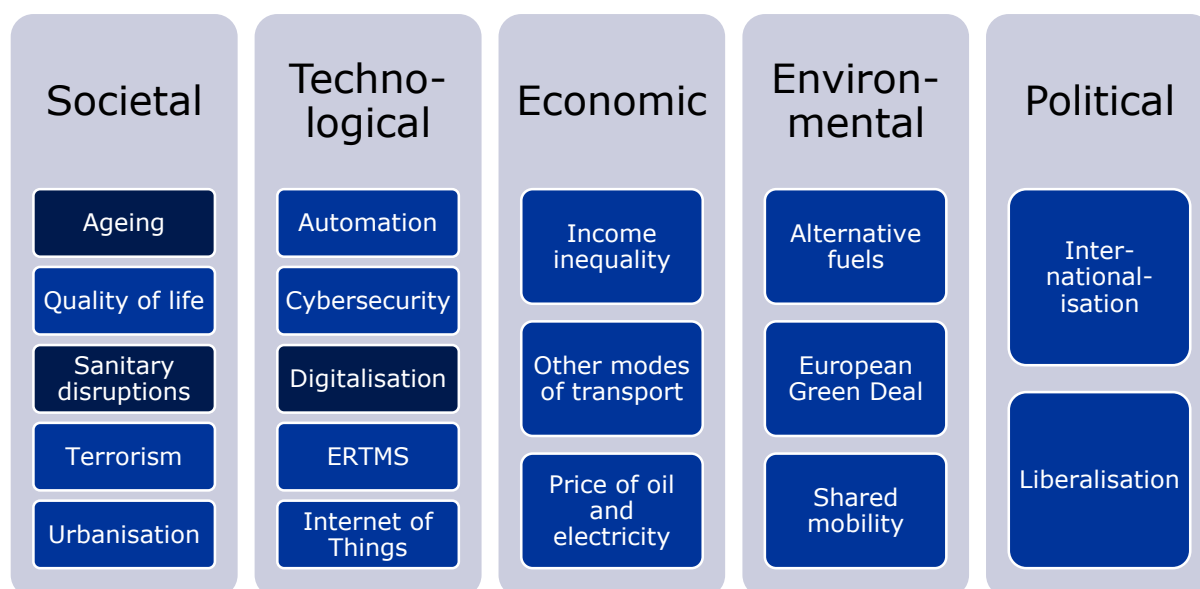


Figure 28: Disrupting factors in passenger rail

Source: Voes et al., 2020

The first societal disruption that needs to be considered is the ageing of the worldwide population. The first ageing challenge is accommodating the physical mobility of the elderly, since many elderly people do not have the same physical mobility as people from a younger cohort, and people with limited mobility. The second ageing challenge is providing a solution for the digital understanding of



the elderly (Niehaves & Plattfaut, 2014). None of both topics is explicitly mentioned in the draft management contract of SNCB, so that is for sure a point that will require further attention, given the Belgian population evolution, and given that Belgian stations do not score well on reduced mobility solutions, and Belgian aged digital literacy needs improvement. In 2021, only 91 Belgian train stations still featured a ticket booth, while only 25.8% SNCB stations had all platforms elevated in 2018 and 78 stations were accessible by lifts or slope in 2021.

The second societal challenge follows on the ageing of society and relates to the orientation towards Quality of Life (QoL) (European Commission, 2019b). The health-adjusted life expectancy of Europeans (68.4 years) and Belgium (71.1 years) is higher than that of the global average. There is an increase in the importance of living a longer and healthier life. This could create an increase in demand for transport that contributes to increased physical activity; this includes active transport (walking and cycling) and public transport to a certain amount (Crane et al., 2016; Larouche, 2018; Michalos, 2014). With its expansion of capacity, also in non-peak hours, the management contract seems to play into this relatively well. Relevant further in respect of the ageing population is the factors that older people take into account when deciding on selecting the train as their mode of transport, as taken from research by Voes et al. (2021, see Figure 29).

Train punctuality seems to stand out. In 2019, 90.4% of the trains were considered on time (i.e., less than 6 minutes late). Punctuality is mentioned also in the management contract for allowing price increases to happen for regular tickets. Second in importance comes the number of direct trains. No public figures are available on how SNCB scores these days on this characteristic. Third in importance comes availability of car parking around stations. 56 stations in Belgium have a B-parking, most have free parking. Fourth comes trip duration. Remarkable thereby is that 57% of respondents think travel times are too long.

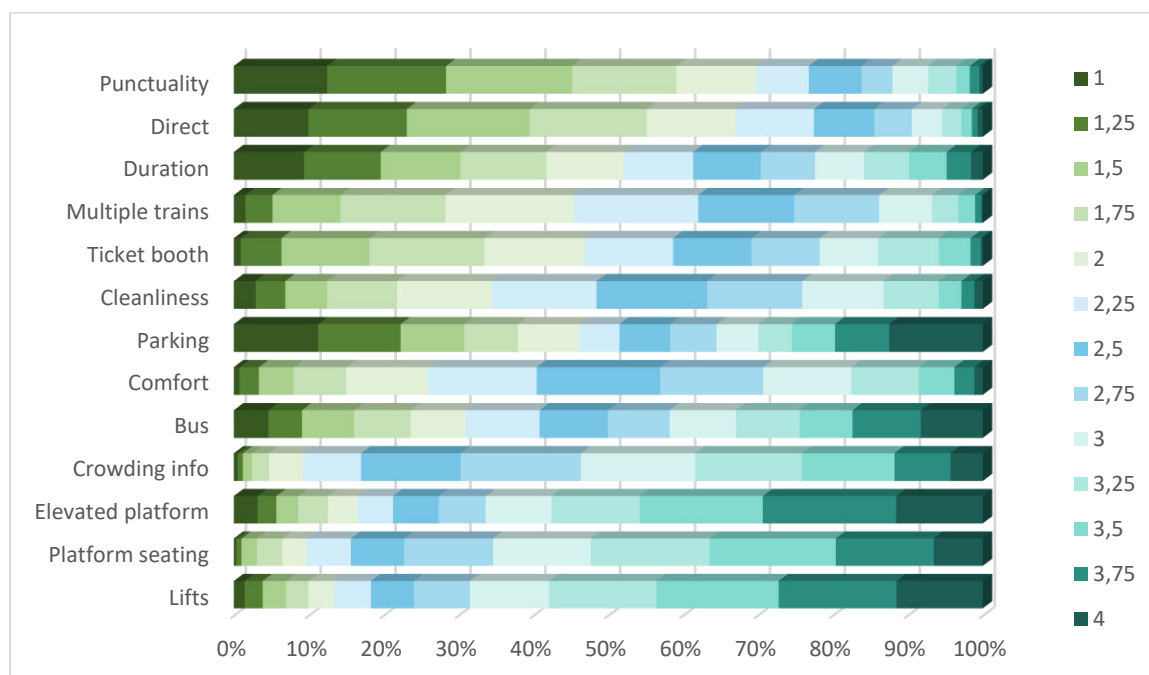


Figure 29: Average ranking of the presented features in the survey ranked by average importance

Source: Voes et al., 2021

Note: sequence on vertical axis is by average importance, not number of most important mentioning

The third societal trend is the increased urbanisation in most countries. By 2050, it is expected that 98.9% of the Belgian population will live in an urban area (cities or towns and suburbs), an increase of 0.8 percentage point from 2020 (United Nations, 2018). Passenger rail can be an important mode of transport in the development of Europe's urban areas. The capacity increase around cities envisaged in the management contract in that sense is a good move.

Infectious disease and pandemics as a fourth disruption can lead to sanitary disruptions, most notably by the COVID-19 pandemic caused by the coronavirus. It is clear that the COVID crisis has had a long-lasting impact on passenger rail transport. Still mid-2022, SNCB is 15% below pre-COVID traveller figures.

Fifth and final, terrorism is another major disruption and is a threat that can change the use of transport immediately. Not only air but also rail bound traffic have been frequently affected by terrorist attacks with attacks in Brussels (Belgium), Saint Petersburg and Moscow (Russia), and London (United Kingdom) amongst others. Belgium, like most other countries, has after the Islamism extremist events and threats in the middle of the previous decade, returned to relative quietness in this respect.

The first technological disruption that needs to be considered is automation. With increased automation, train operators could improve safety, punctuality, comfort and fast convenience (Chiusolo, Dicembre, Ricci, & Sorace, 2011). Automation is not mentioned in the new management contract of SNCB. However, a current problem that SNCB faces, is the need to cancel a lot of train rides (22,000 by July 2022 already), amongst others due to illness among staff. For such problem,



automation may provide a solution. It is to be expected however that such replacement of labour by capital will not be accepted easily by unions, as already now we see in the management contract that removing the train driver from the train is explicitly out of discussion. Furthermore, comfort is judged positive by 72% of the customers.

Second under technology, cybersecurity is the organisation to protect cyberspace systems from malicious and unauthorised use of data and information (Craigén, Diakun-Thibault, & Purse, 2014; Mueller, 2017). Data breaches can be a critical danger and railway operators are no exception from cyber threats (The Local, 2017). The more rail transport will digitalise, the higher the risks of cyber-attacks. Digitalisation and its securitisation are only briefly mentioned in the management contract of SNCB, through projects and experiments that will be tested.

Third, digitalisation has become more present and more emphasised due to technological advancements and the current COVID-19 crisis. First of all, increased digitalisation can foster working from home, or teleworking. Teleworking leads to a reduction of commuting trips (Hamer, Kroes, & van Ooststroom, 1992), which lowers the need of transport. The latter is certainly happening, witness the fact that rail passenger figures in Belgium have not yet recovered from COVID. Figure 30 visualises the share of employed people working from home in 2019 in each of the European nations. For Belgium, this share amounted to 6.9% of the employed population. Voes et al. (2020) show that passengers travelling by train have a higher ability to work from home than other employees using other modes of transport. This impacts on the traffic potential that SNCB can expect. In order to increase the number of journeys for commuting by barely 3%, SNCB must therefore sell no less than 45% more season tickets than currently. Further, increased digitalisation affects the digital illiterate and therefore might also result in a change in the demand for public transport.

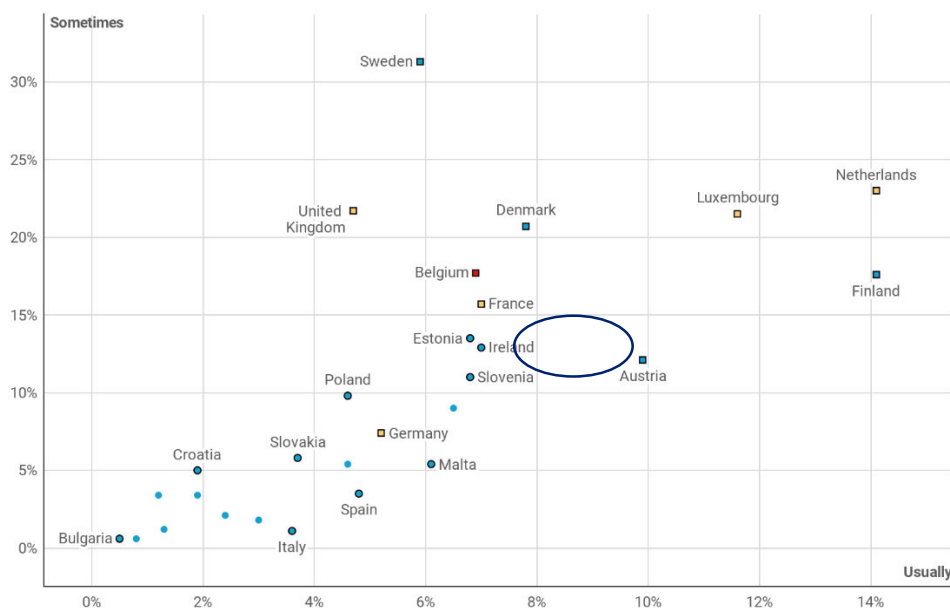


Figure 30: Share of people working from home in the European Union

Source: Voes et al., 2020

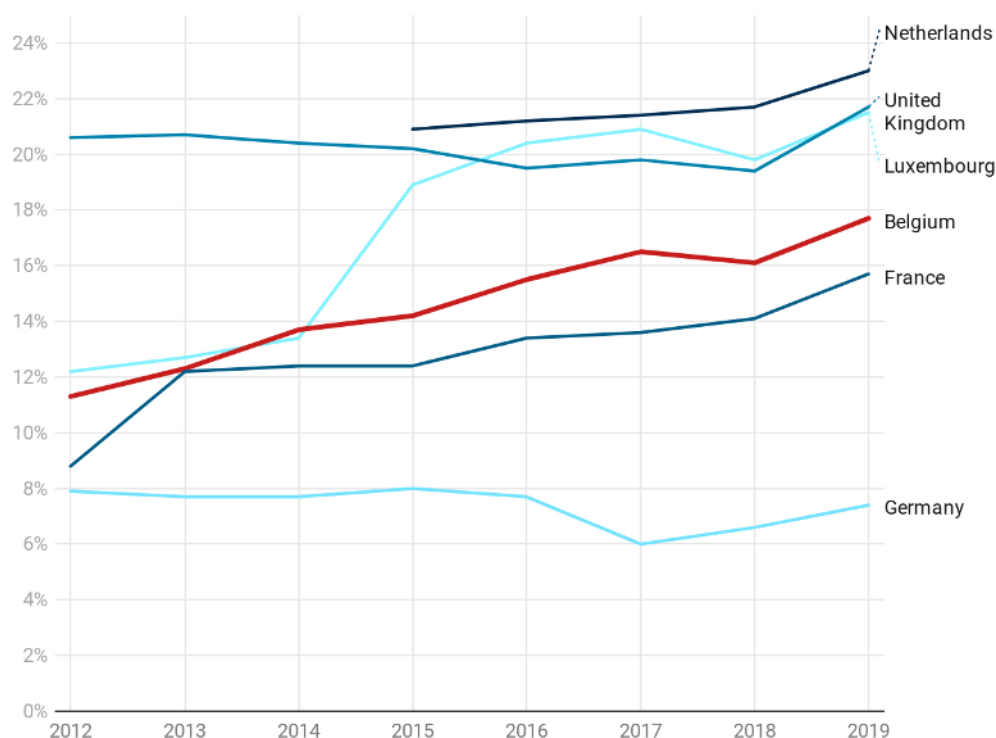


Figure 31: Share of population sometimes working from home

Source: Voes et al., 2020

The European Rail Traffic Management System (ERTMS) is a technological system developed to promote interoperability of trains in the European Union. ERTMS is already significantly implemented in Belgium, but it can lead to an increase in average speed, and an increase in the capacity of the network. Internet of Things finally relates to the interconnectivity of different digital devices, allowing them to transfer data and information. Internet of Things can allow railway companies to improve communication and monitor the railway infrastructure (Infrabel; ProRail). Internet of Things is not explicitly mentioned in the main text of the management contract of SNCB nor Infrabel³⁵, but will be needed to achieve other objectives mentioned there.

Among the economic disruptions, global income inequality is a first issue that is present and people with a lower income tend to have fewer transport options and lower quality transport services available. Railways can improve the accessible range of employment opportunities for lower-income people (Lewis, 2011). That of course implies that room for price variation is small, as was requested by SNCB for the new management contract. That also is clear from the price-elasticity of passenger rail transportation, which is usually very high (Augusto Olarte Bacares et al., 2022)

³⁵ It could be implicitly understood in the core document of the contract in sections referring to asset management/maintenance/digitalization, and it is explicitly mentioned in the main annex IV with the investment plan.



Second under economic disruptions, it is important to consider competing modes, such as buses, trams, cars and shared mobility alternatives when establishing a future for SNCB. Here too, price elasticity will play a role, next to all other mode choice factors, as shown in Figure 29 for elderly. The management contract of SNCB refers to the complementarity with bikes but says little about other modes of transport – only that connection times to other modes should be optimised, and that these protocols should be formalised.

Third, over the last decades, the global economy became more interconnected and with that a more volatile economy has arisen. This has led to sharp changes in the price of oil and electricity, more than 95% of the motorised locomotives of the Belgian national passenger railway operator (SNCB) are powered by electricity. The sector should therefore take disruptions and fluctuations in the energy market, with a focus on electricity, into account when making decisions on possible future developments. The management contract explicitly refers to further electrification. In that case, it will be important for SNCB to have certainty about its energy prices. SNCB buys its traction-electricity from Infrabel. EU regulation foresees that every Railway undertaking can choose its electricity supplier, but until now all Belgian network clients voluntarily buy their electricity from Infrabel. Infrabel does participate in the windmill farm park Greensky and Infrabel also invests in solar panels.

The fourth category of disruptions are environmental. Alternative fuels and energy sources can lead to a disruption in the way passenger trains operate. In Belgium, the majority of the rail routes are electrified and therefore, passenger rail can already use renewable sources. The Belgian federal government aims at further electrifying the railway network and researching the use of hydrogen or battery trains.

Second, the European Green Deal provides a strategy that aims at transforming the European Union into an economy without net emissions of greenhouse gases in 2050. It stimulates healthier, affordable and accessible transport alternatives. Especially if that will be supported by internalisation of external costs, or with the pricing of carbon emissions, which should lead to an increase in passenger rail traffic.

The increasing popularity of shared mobility is the third environmental disruption. The rise in technological development has led to an increasing popularity of shared mobility, which can disrupt the modal split of passenger transport.

The last megatrend is politically oriented and consists of governmental disruptions. First, businesses are increasingly involved in international markets, with no exception for the transport sector. One Single European Transport Area aims at integrating the European Union's Member States' national transport infrastructure to create a connected network (European Commission, 2011). In 2020, there are differences in the railway networks of each Member State which leads to a comparative disadvantage for railway operators (Islam, Ricci, & Nelldal, 2016). The management contract of SNCB does not refer to cross-border agreements.



The second disruption in this category derives from the liberalisation of the European railway market. The Belgian federal government has granted SNCB a direct renewal of ten years as operator of the main railway network. However, the government initiated a pilot project to seek a new operator for two transport regions (one in Flanders and one in Wallonia) (Magnetite & De Croo, 2020). When the domestic rail market is liberalised, other rail operators can enter the market.

4.3 Freight transport policy and evaluation

Policy

For rail freight, the Federal Government presented late 2022 its Rail Freight Action Plan. The overall objective of that plan is doubling rail freight by 2030. To achieve this, the Action Plan proposes a series of 13 wider actions, grouped under four axes³⁶.

The first axis deals with infrastructure planning, maintenance and development to needs. A first action here deals with developing a 'Vision 2040'. Since accurate capacity projections are currently absent, a 'catalogue of train paths' is meant to support the rail development, combining passenger and rail freight. This should allow getting a view on investment needs, and guarantee sufficient capacity, both for passengers and freight.

A second action under the infrastructure axis deals with preventive maintenance. A significant part of the infrastructure is approaching the end of its economic life. This applies to 22% of the switches in the main track, 12% of the rails in the main track, 20% of the overhead lines (= more than 1,000 km), and 3,000 km of optical fiber cable. Preventive maintenance should prevent costs for operators from increasing, and transport quality from deteriorating. It should also allow planning investment decisions for local rail freight infrastructure (rail bundles, industrial lines, etc.). This will guarantee that sufficient means are scheduled in the Multi-Annual Investment Plan. It should also ensure that the infrastructure manager will transparently and timely communicate its investment plan to all concerned logistics actors. In case of need, it should also allow providing alternative routes.

A third infrastructure action deals with optimising available capacity. That involves first of all finishing up the transition of the freight lanes of the core TEN-T network to the European 740m / P400 standard. It also involves avoiding traffic conflicts at critical nodes. Finally, this action involves matching the Belgian rail network development with the technological developments on other networks abroad, and those of rail operators.

The second axis deals with 'Building on proximity'. A first action here, is the neutral management of the sorting hill in the port of Antwerp, and the investigation of the first/last mile principle. The sorting hill involves both a physical (open to combining all cargo types) and an organisational (open to all users, under transparent conditions) component.

³⁶ Note that not all proposed policy actions are also fully covered in the management contract between the Government and Infrabel.



A second ‘proximity’ action is setting up a parking service. Its current lack implies congestion and network disturbances. Infrabel will be instructed to develop such parking policy in all industrial sites, with a long-term parking fee. Supplementary services should also be provided there.

Third under proximity, a clear frame for access to the network is to be developed. This involves clarifying and promoting access to the network. Together with the regions, options for support of new connections should be investigated. Finally, a frame is also to be developed for unused infrastructure.

Fourth and final, specific frames for proximity need to be developed.

The third axis involves optimising traffic. That first of all involves the supply of train-paths. Path management should be fully digitalised, which should allow for pro-active capacity management. Currently, network slot bookings for a specific year are due before the 2nd Monday of April of the year before³⁷. This is highly inefficient, as on the one hand it may lead to missed opportunities due to underestimated market forecasts, while at the same time it also leads to overbookings of different slots and products, of which in practice only one gets taken up. The EU project TTR should allow for middle-run capacity visibility and short-run flexibility for last-minute supply. It also implies maximum valorisation of the mass/length dimensions and avoiding overbookings.

A second traffic optimising action is ‘optimising traffic management’. This involves increasing the speed and punctuality of trains. Digital Capacity Management and creating a Green Wave should stimulate eco-driving. Digital Capacity Management is one of the five core technologies identified by the European coalition of railway companies, Rail Freight Forward (RFF), as being necessary to double the modal share target by 2030. This is perfectly in line with the objectives defined in the European Green Deal and the Strategy for Smart and Sustainable Mobility.

Second under capacity optimisation come ‘customer care during works’. Network works should be stable and predictable, with quality alternatives provided. Overall, this should lead to increased reliability.

The fourth and final axis involves ‘caring for equity and coherence’. A first action is creating a green and sustainable level playing field. That implies supporting European initiatives towards internalisation of external costs and road traffic legislation enforcement (dumping, etc.). In case full internalisation is not possible, rail should be compensated for the missing parts. Coherence of the various Federal and regional support mechanisms will be watched. Also, this involves a data sharing component.

Second under ‘equity and coherence’ comes stimulating alternatives to road. Rail freight currently lacks a good image, and its attention is spread over multiple government layers. Concrete actions are

³⁷ According to what happens also in other European countries.



a promotion organism by the sector, an eco-label by users, and government-sector concertation on overall policy.

Last comes investigating the feasibility of an independent training program for train drivers and ground personnel. Currently, such training is not publicly offered, and comes at the full expense of operators. An option could be a 'training credit', as exists abroad. Partnerships with wider training for logistics professionals should also be promoted.

Evaluation

Overall, the Federal Belgian Rail Freight Action plan, and its translation in the management contract with Infrabel, is praised by the sector as a leap forward compared to the absence of such plan in the preceding decades. However, it contains a mix of visionary and concrete elements. Also, it is often not clear why one or another concrete measure were selected or not. The question thereby is also whether it is holistic enough. Equally, budgets and timings are often not provided, and when mentioned, they often refer to the longer run, which increases the 'wishful thinking' character of the Action Plan. The long-term vision study that is planned, is relevant to determine overall needs and priorities, but a lot of concrete infrastructure projects do not need further necessity study and have been known for quite long now as bottlenecks. The second access to the port of Antwerp is a central one in those, but is not mentioned in the plan, unless covered implicitly under the broad articles covering the relationships with port service providers.

More specifically, following comments are voiced by the sector:

- The Vision 2040 is important but seems to be framed in a too simplistic way, with a risk of oversimplification and generalization.
- The sorting hill issue at port of Antwerp is important, but the Action Plan seems to over-rely on solving this as a 'holy grail'. Its scheduled budget is also too limited. The port environment is a separate multimodal ecosystem with the presence and activity of many industries, terminals and transport and port companies. It is a rapidly changing environment that is highly subject to the economic situation, world trade, etc. The specific position of ports is referred to within the management contract between the Government and Infrabel, but does not get a concrete elaboration, and is kept in very broad terms. Rail within the port is also different from that on the main network: speeds are lower, no interaction with passenger transport, greater need for flexibility instead of regularity, a lot of first and last mile traffic. In addition, the operational and commercial rules and the conditions for use of port rail infrastructure are the same as on the rest of the network (not adapted to specific port needs), making a separate rail policy for the port difficult. Moreover, the existing rules cannot be flexibly adapted (procedures from 1.5 to 2 years). It could be investigated whether the recognition of the port as 1 major service facility in line with European Regulation 2017/2177 could make it possible to introduce an adapted rail policy in the port.
- It is unclear what parking services involve: which kind of 'other services' are expected from the infrastructure manager?



- Network access is unclearly defined: does it refer to the bundle, the terminal, or something else?
- It is unsure how last-mile inclusion will not conflict with existing commercial contracts.
- Preventive maintenance is crucial, but the proposed timing, cost, impact and capacity are left very vague. Nevertheless, the issue is urgent, as over a distance of 77 kilometers, trains now have to run at a lower speed, because the track is in too bad a condition. The elaboration of a modernisation plan by end of 2023 will hopefully shed more concrete light on this.
- The level playing field is maybe the most crucial one, but also worst defined and left totally open in terms of timing and workplan.
- The planned concertation committee is a good idea, but presidency by a government administration risk diluting the dynamics, even though it provides a strong neutrality factor.

When looking into the Rail Freight Roadmap 2030 (Belgian Rail Freight Forum, 2022), co-designed by rail operators, users and academia in 2021 with consultation of the infrastructure manager and the government, a number of other pain points emerge that are not tackled in the government's Rail Freight Action Plan:

- No budget is foreseen for technological investment in digitalisation: camera's, platforms, etc. Digitalisation is mentioned in the management contract between the Government and Infrabel, mainly concerning data collection and exchange.
- Electrification is only mentioned for work trains and with bi-mode solutions, while this would be crucial for rail freight to keep its competitive environmental advantage and avoid charges in case of internalisation of external costs. This will require substantial budget.
- In line with the latter, no indication is given of the way in which increase in frequency of services and capacity occupancy rates will be achieved. Logically, that is largely in the hands of private operators, even though available capacity on the network is a prime condition.
- One of the key elements mentioned to achieve higher capacity and related utilisation is digitalisation. However, that again largely depends on operators to show willingness to share crucial information, and logically the government action plan cannot impose much here.
- Standardisation of contracts might be a way to achieve more transparency towards users, but again, this largely depends on operators' will to do so.
- Paying attention to proximity would also imply avoiding over dimensioning of end service and containing costs, with clear reference frames.
- For traffic management optimisation, lacking priority rules and communication between signposts and locomotive drivers are thereby to be avoided.

Furthermore, TTR is mentioned in Infrabel's investment plan (under SCM, Smart Capacity Management), as a project of prime attention. In reality, it is far from that. It requires following elements to be present:

- 1) Capacity strategy
- 2) Capacity model, distribution
- 3) Capacity planning and supply
- 4) Capacity request annual plan
- 5) Rolling capacity request planning



6) Adjustment of capacity allocation by rail operator or infrastructure manager

Item 1 should be tackled through the Vision 2040. Item 2 will require sufficient modeling, planning and a policy choice. Item 3 again will need planning, also in terms of budgets and procedures. Item 4 will again need policy choices to be made, on the selected sequence of projects. For item 5, a methodology of rolling the requests will need to be found and agreed. For the last item, interaction will be needed to make sure that any updates on available and needed capacity are captured. All this will need a strategy, a working plan, and follow-up. Setting up and especially sustaining this effort will require time and perseverance. Moreover, following side conditions will need to be fulfilled:

- Equalised or compatible commercial conditions of the infrastructure managers
- Customised IT landscape
- Legal anchoring of the processes

Each of them will in turn take time and willingness to materialise.

On TTR, Belgium obviously is not an island. The implementation in Europe will happen in several waves. In this first wave, the infrastructure managers who feel ready to introduce certain elements of the new processes and thereby give a boost to the entire implementation are taking part. Infrabel is one of those infrastructure managers, just like the infrastructure managers in neighbouring countries. Being part of the first wave is a logical consequence of Belgium's central location and gives the advantage that it can still be steered where necessary. However, it is also an economic necessity if our country is to safeguard its competitive position as a logistics hub. Several international Rail Freight Corridors also run through Belgium.

This participation to TTR also requires commitments from the government and the infrastructure manager to implement the processes in a timely manner and in coordination with the other countries. The government must support the necessary legal framework and provide the necessary priorities and resources so that Infrabel can play a pioneering role, adapt the necessary processes and develop supporting tools. These processes are therefore to be supported with the necessary IT applications. In concrete terms, the countries from this group should work out the implementation according to the method of Minimum Workable Product (MVP – Minimal Viable Product). Solution concepts are to work out (process and ICT) as prototypes to be tested, and then deployed in a pilot environment to be subsequently rolled out. In this way, the solutions are further developed in a learning process.

Two specific automation needs require co-ordination and support:

- Digital Automatic Coupling (DAC): Coupling and decoupling are two of the most important manual procedures in train operation. Automation can thus lead to large productivity gains. Europe is lagging behind in this regard as it is the last continent to use manual clutches as standard. The DAC technology should be fully deployed by 2030.
- Automatic Train Operation (ATO): The automation of train control is equally important. The rail operators propose to fully retain driver-supervised driving on long routes, and to reserve fully autonomous, driverless trains for shunting yards, on the first and last kilometers and for closed infrastructure of the main lines. The freight transport sector aims to be the first user of a coherent application of this technology in Europe.



Next, there is an issue with auxiliary companies that seems not tackled by new Rail Freight Action Plan: the process of becoming an auxiliary company is unclear and complex. For example, an auxiliary company must have a fully up-to-date competence file available with the railway undertaking for all personnel that can be deployed, and an auxiliary company certificate must be requested for each railway operator for which it wishes to offer its services. The current process is laborious, highly reactive and puts a brake on the modal shift. There is therefore need for a clear framework in which affiliates only have to go through the process of becoming an auxiliary company once (e.g., via an application).

Also non tackled is the locomotive legislation. Each type of locomotive must comply with a certain set of regulations. A locomotive that is used locally (shunting, intraportuary movement) is put on the same level as a locomotive that is used on main lines. However, certain regulations are not relevant locally and should be adapted to the current situation that requires greater flexibility to be more productive. There is therefore a need to apply different traffic regulations within the local (port) area so that different rules apply, and other rail vehicles can be used. This proposal is part of, among other things, greater deployability of track rail vehicles and the abolition of the mandatory presence of ETCS on local traction when main lines are crossed.

Communication with train drivers is another point of attention. Infrabel must enable direct communication with the train driver (whether or not via an application) so that a driver can adapt his driving behaviour and anticipate incidents on his journey. This will not only increase efficiency and productivity, but also safety and capacity on the grid.

Finally, there are a number of remaining issues to make rail fit in the Logistics as a Service philosophy: there are innovative initiatives in this area that conflict with current regulations. We are thinking here, for example, of the installation of a scan gate at the entrance of a port area where there is a conflict at the level of liability, of the required multilingualism on the Belgian network, which often makes it impossible for drivers to drive directly to the final destination, or of the old-fashioned communication between operators in local rail bundles, whereby Infrabel still uses a paper timetable. Infrabel must be open to innovative projects that require an adjustment to the current regulations. For example, possible solutions to the problem of multilingualism on the Belgian rail network can be found in translation technologies (existing UIC project) or digital standard forms for a number of important commands. With regard to local bundle management, there are already applications that allow communication between operators to control fully automatically (currently only applied in private rail bundles).

Equally, a number of pragmatic customer-oriented solutions could be proposed: we are thinking here of the operation of interlocking locks within the port where lock boxes are too often in illogical places, so that ground personnel have to travel great distances to open or apply the locks, to the application of IOB (Installation Transferred Control) whereby Infrabel leaves the bundle management to the railway operators, but involves a lot of administration, simultaneous movements of different operators within the same bundle are limited and waiting times can increase. Another example is the



too tight restrictions on the use of the brake coupling during pushing movements, which can lead to dangerous situations since a ground operator must guarantee three support points and simultaneously hold the brake coupling. This entails the necessary risks and is therefore less suitable for freight trains. Infrabel needs to think in a more customer-oriented way. For example, the problem of coupling locks can be tackled by providing electrical derailer tongues or butt clamps when modernising connections or by using standalone installations (Internet of things). With regard to the problem of IOB, solutions can be found in splitting the local bundle infrastructure, in the use of communication applications or the provision of installations in which Infrabel's signal boxes can operate rail devices and signals from a distance (EBP = Electronic Service Post).

The implementation of the 4th Railway Package also leaves a number of challenges. EU policy aims to create a single European railway area. This was worked out in various Railway Packages, which in turn were translated into national regulations by the various Member States. Each Member State however gives its own interpretation to the European directives. For example, certain responsibilities are transferred from the infrastructure manager to the railway undertakings. However, a problem arises with the transfer of knowledge and expertise to take on these responsibilities. After all, this is not present at the railway undertakings. Examples of this are the determination of braking percentages, maximum loads, etc. Infrabel must guarantee the transfer of knowledge and the availability of tools so that railway undertakings can build up expertise and thus take on responsibilities that were previously not theirs.

Totally unmentioned concerning safeguarding abuse of competitive power in the market in the government's Action Plan is the regulator. By analogy with other countries and other sectors, an efficient and proactive regulator that is ambitious in its action and which has been given an important task can play a key role in improving the functioning of the market. Examples of the Swiss or Austrian regulator, but also of the Belgian gas and electricity regulator, are sources of inspiration. In the light of these examples, the tasks, assignments and resources of the Rail Transport Regulation Service and the Operation of Brussels National Airport should be tightened up. The Safety and Interoperability Service of the Railways (DRSI) also plays a decisive role in the safety of the railway sector. He must act in consultation with the rail regulator, but at the same time remain strict on the safety aspects, which is his *raison d'être*. Therefore, a review of the assignments, tasks and resources allocated to the rail regulator, after comparison with foreign regulators or other sectors, is highly needed.

Not all can be left to the government and the infrastructure manager of course. The sector will also need to do its part of the job, with among others new types of rail products, targeting new market segments, automated loading systems, increased service frequency, sharing of information, etc.

Overall, it can be added that more competition usually helps to make a specific transport mode more competitive. In that sense, the high market share of the Belgian incumbent (Lineas) could be challenged. However, competition then needs to be looked at European rather than national level: bringing in a European oligopoly will not help, since at European level, this will result in more market power for that / those players, and given the minimum distances needed to make rail competitive, the European cross-border dimension is the one counting.



In all, the question is whether the Rail Freight Action Plan and the management contract with Infrabel as drafted will be sufficient to generate the desired modal shift. To judge on that, it is important to be aware about the choice factors as taken into account by supply chain decision makers when choosing a mode of transport, and the performance of individual modes on that combination. Table 4 shows the importance attached to those factors (5 = very important, 1 = hardly important). Green marks the five most important criteria, with reliability standing out above all. Table 5 shows the score given by a large sample of European supply chain decision makers on the performance on mode choice criteria for road as compared to the rail intermodal solution. Two criteria in blue clearly play in favour of rail: it features lower risk of loss and damage, and it has a lower cost. However, two other choice criteria explain why mainly rail's uptake in the freight market is relatively low: its performance on customer service is significantly weaker, and its flexibility for coping with changes, last-minute or not, strongly underperforms. Obviously, these are elements that in the first-place operators will need to ensure. However, having a smooth flow of information with all chain actors, including the network manager, and having transparency and predictability in changes and disruptions on the network are preconditions for being able to provide an appreciated rail product. In that sense, the management contract proposes relevant actions, although as mentioned earlier, their concrete layout and roll-out will be crucial for the actual shift potential to materialise.

	Reliability	Flexibility	Loss/Damage	Frequency	Cost	Transport time	Customer service	Environment
Importance	4,8	3,95	4,6	3,85	4,1	3,6	4,35	2,5

Table 4: Importance of mode choice criteria

Source: Grosso (2011)

Performance road	reliability	flexibility	loss/damage	frequency	cost	transport time	customer service	environment
	3,85	4,35	3,75	4,40	3,45	4,10	4,00	2,30
Performance intermodal	reliability	flexibility	loss/damage	frequency	cost	transport time	customer service	environment
	3,80	3,25	4,10	3,40	3,95	3,20	3,65	3,95

Table 5: Score of road vs. rail intermodal on choice criteria

Source: Grosso (2011)



4.4 Overall evaluation

Looking deeper into the individual modes of transport, it can be seen that for passenger as well as freight transport, road is and remains the dominant mode by far, with rail only having a fairly small share. That evolution of the transport demand is a projection under unchanged policy. With respect to passenger transport, an important step put forward by the Belgian Federal Government is the signing of a new management contract between that Government, SNCB and Infrabel. For rail freight, the Federal Government presented early 2022 its Rail Freight Action Plan. Both are badly needed initiatives, after years of policy standstill. In broad lines, it is crucial initiatives to make rail more future-proof and attract more customers. However, the question remains whether they will be sufficient to achieve a doubling of rail freight volumes, and 30% more passenger rail volumes. Such increases are unprecedented, and the past measures taken mainly at European level seem not to have led to any meaningful mode share increases. So, the question is whether these additional measures will be sufficient to achieve such a giant leap. Also, quite some of the measures still need concretisation, into sub-measures and steps to be taken. It is to be expected that broad lines as the current ones are easier to digest than concrete measures that will impact on and hurt certain stakeholders. Budgets, and more in particular sticking to what is agreed in the new management contracts, will also be crucial. It also remains to be seen how customer's choice criteria evolve, which also depends on how competing modes will behave, as well as on macro-economic developments.

A striking observation is that on many items, no or very limited data is publicly available. It appears that over time, the availability of indicator data has even diminished (e.g. operator volumes, market shares, etc.). Individual operators have available more and more data, through the use of sensors and Internet of Things applications, but those remain in their private hands, and most often cannot be used for public purposes, so also not for policy and planning activities. That is a pity, as good policymaking requires good data. Now, it seems that policymaking is sailing rather blindly, which leads to measures which may be over- or undershooting, both of which come with extra costs.

Linked to the previous issue with data, scientific foundation of policy decisions seems also lacking too much still. At various levels, scientific support could be of use: demand forecasting, supply matching, customer choice analysis, pricing impacts, regulation needs, etc. Without scientifically founded decision-making, again, the costs of wrong or over- or undershooting policy measures risk being high.

A last overall point of attention is the division of competences and responsibilities between the Belgian federal level and the regions, and within the regions also between departments. Rail in Belgium is a federal matter, but building permits and environmental approvals depend on different regional departments. Road and inland waterway transport are under regional competence, but again belonging to two different agencies. Needless to say, that such dispersion risks leading to sub-optimal policies, with departments aiming at promoting their own mode, rather than viewing things from societally optimal point of view.

The dispersion of policy competences leads in Belgium to the absence of an overall integrated transport policy. There is for instance no overall policy of internalisation of external costs and



subsidisation over the various modes of transport. Subsidies are granted more as a result of strong lobbying and/or as a reaction to other departments granting subsidies. Road transport security is a federal matter, but with a general 70km/h policy decided by the Flemish region (only) on all secondary roads since 2016. That speed however does seem to conform to the real speeds achievable on most roads during business hours, given existing congestion levels. Parking policy is another domain with large dispersion: this is fully left to cities and municipalities, with as a result highly diverging policies and tariffs, and in general tariffs which are far from prohibitive and much lower than in other countries. All three Belgian regions, in charge of road infrastructure, seem to have committed since about 15 years to a reduction of the number of road lanes on an average road, so as to avoid speeding, passing-by in dangerous circumstances, etc. This has impacts on road security but is not assumed to lead to a mode shift. Just as of 1 October 2022, the Belgian Road Code allows reducing to one bi-directional lane roads which are too small to have one lane in each direction. Overtaking is possible when no bikes are around. Again, and given that this particular measure applies only to smaller roads, it is not expected that a mode shift will result, at least not towards rail – rather biking if any.

Integrating mobility modes is again left to the regions and cities / municipalities in Belgium. Various cities (Brussels, Antwerp, Leuven, etc.) feature (e)-mobility hubs, but often this remains at pilot level and/or with limited geographical scope. Flanders has taken the initiative in 2019 to split up its territory into 15 ‘transport regions’, which are in charge of organising public and private transport in their respective region. The focus for now is on passenger transport, although also freight might become part of its competencies over time. Each region is supposed to draft a mobility plan, indicating which and how modes will be integrated, and what new infrastructure is needed to do so. The rail network is taken as a backbone, and the role of the incumbent Flemish bus operator De Lijn is to be defined for each region. The idea is to open up to other operators and modes. This is meant to optimise the mobility offer, not necessarily leading to increased train usage.

Two federal Belgian policies clearly do not favour a shift towards rail: the stimulus to salary cars, and the fiscal deductibility of car commuting. Salary cars are widely implemented as a way of tax-exempted remuneration, complemented often with fuel cards, and allowing most often use of the car not only for work but also leisure purposes. This is clearly indirect, socially undesired use of transport for other purposes, leading to excess road mobility consumption. It definitely keeps away travellers that otherwise would have taken another mode of transport, for instance the train. Furthermore, also without salary cars, commuters get stimulated to use the car, by the fiscal deductibility at a fixed rate per km of the trips made. Each Belgian citizen is allowed to either opt for a forfeitary deduction amount or declaring real expenses – the latter of which becomes interesting when people live further away from work – thereby further increasing p.km volumes.

The recent energy crisis also led to dispersed answers as far as the different modes are concerned. For road transport, the Belgian federal government for example decided to reduce excise duties on car fuel by 0.175 euro per liter. The measure got introduced on 19 March 2022, and ended 30 September 2022. For rail, since 2020, the Belgian Federal Government has spent about €1.4 bn on crisis support: against COVID, floodings and energy. An additional amount of about €600 million was spent on restart and transition, as part of the European and Belgian recovery plans. However, rail operator SNCB



announced that the additional energy expenses of €100 million euro in 2022 would need to be somehow passed on to the users, unless the government would take them up.

Also, one can ask whether all crisis measures have proven as effective. After the first COVID wave, in summer 2020, the Belgian federal government entitled each Belgian citizen with 10 free train trips, in an effort to trigger people to use the train again. Those tickets had to be actively requested and were not automatically distributed. In total, 2.3 million such 10-trip tickets were delivered. It is unclear how many of those were actually (all) used, since COVID hit in next waves, and given school and work occupations, remaining time to actually use them was rather limited. However, the measure most likely did not achieve its goal to re-attract users that had abandoned rail due to COVID conditions: rather, if any, it attracted one-shot users that created rail traffic that otherwise would not have occurred.

In all, it seems like the management contracts between the Belgian Federal Government on the one hand, and SNCB and Infrabel on the other hand, give good and well-quantified incentives to the operator resp. the network manager to do its best and acquire a maximum variable financial compensation share, next to the fixed compensations guaranteed. The annual performance dialogues and the mid-term review after five years also should lead to timely monitoring of the development path and allow avoiding surprises.

The question whether, assuming *ceteris paribus* market developments, the foreseen budgets and action domains will be sufficient to meet the criteria and generate an uptake in rail market share, both for passenger and freight, can only be answered when concrete operational plans will be developed and rolled out, so as to make the many action domains more concrete. The Government will need to be aware that the concrete plans may warrant the need for the budget increases, apart from market conditions changing. The annual performance dialogue therefore will not only bring obligations for Infrabel and SNCB, but also for the government.

Impacting on budgets, but also on choices made by users, will be the creation of a level playing field between the modes. As mentioned in the freight section, it is important that the Government has mentioned this in its Action Plan. However, this impacts all domains of infrastructure and operational funding, pricing and regulation.



5. ITALY CASE STUDY³⁸

This section is aimed at describing and discussing the state of the art and perspectives of the Italian rail market. Section 5.1 includes some statistical figures, among the few that are continuously available in Italian statistical documents, divided in the three main segments of long-distance, regional and freight. Section 5.2 outlines the Italian governance, trying to clarify who plans what and through which documents. Final section 5.3 is dedicated to future perspectives, in particular collecting the targets of the rail system. The section is also a commentary on the limits of the Italian approach.

5.1 Italian rail market: (few) figures

Size of the markets

Due to the scarce transparency of companies in disclosing traffic figures, the only statistical source available is the CNIT (*Conto Nazionale Infrastrutture e Trasporti*, a statistical book published yearly by the Minister of Transport). The main limit of such publication is that, excluding the general mobility chapter (see Figure 32 for example) every detail available on the rail system is actually related to Ferrovie dello Stato and Trenitalia. This means that we have no details at all about other rail companies operating in the country, in particular Italo (long-distance), Trenord (regional transport in Lombardia region) and all freight operators different from Mercitalia Rail.

In a 10-years perspective (Figure 32), Italian transport series do not present difficulties in the interpretation. The 2008 economic crisis has hit the country's economy quite hardly, as can be seen from the decline in road transport occurred between 2009 and 2012. Only starting from 2013 there was a recover, suddenly stopped by COVID19 crisis.

The share of rail in Italy in terms of p.km is low, constantly below 6%. The downward trend of 2009-2012 saw a relative rise of rail, which can be explained with the reduction of wealth of households. The trend was reversed during the following recover and in 2017 rail was 5.5%. Interestingly (figure 33) rail has steadily increased numbers since 2013 until COVID, but this rise is not changing substantially the global modal share firmly unbalanced towards car and was partially offset by a much more consistent rise of air transport.

³⁸ Paolo Beria, Politecnico di Milano

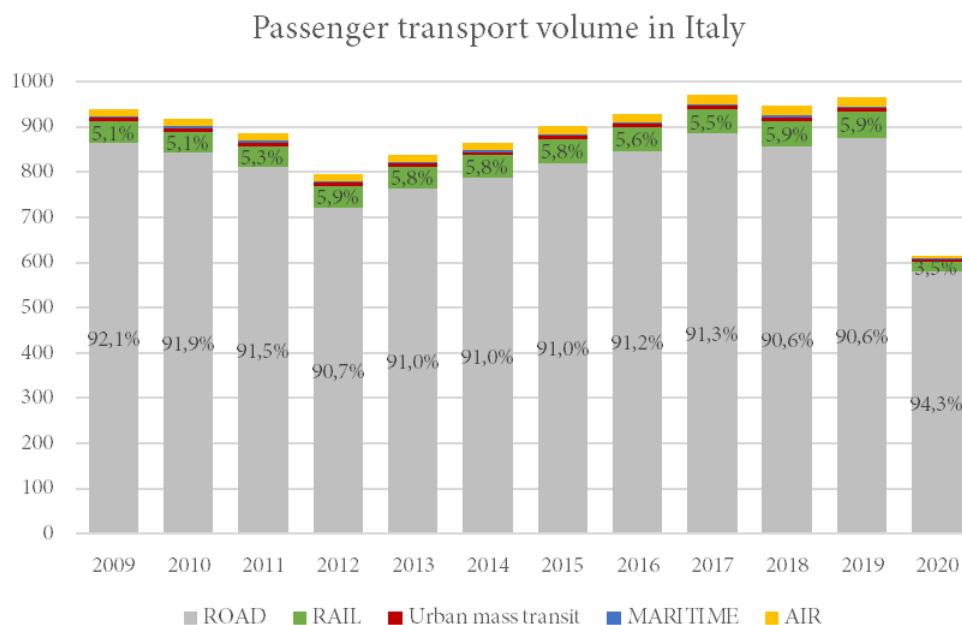


Figure 32. Passenger transport volume in Italy [Bp.km/year].

Source: our elaborations on DEF, 2022, pag. 56.

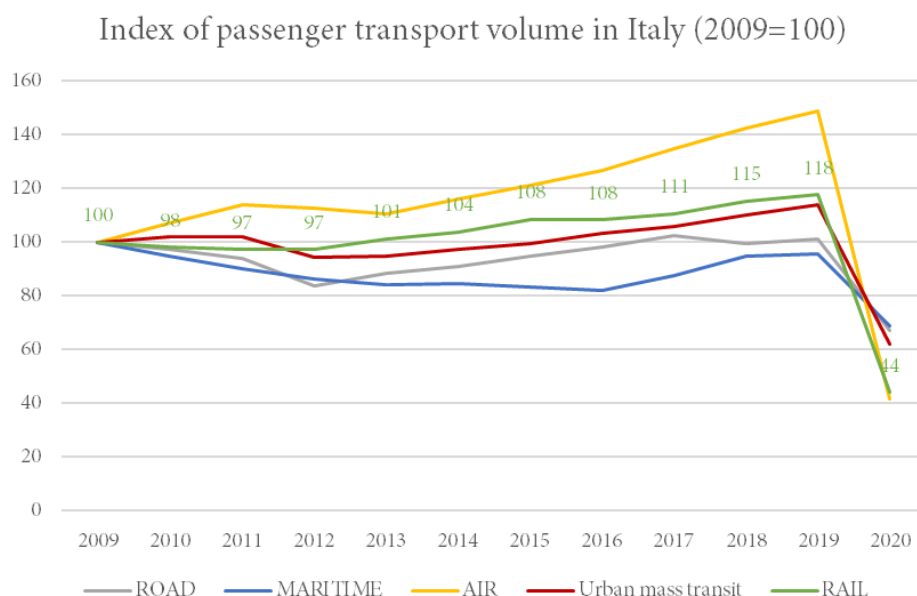


Figure 33. Indexed passenger transport volume in Italy [2009=100].

Source: our elaborations on DEF, 2022, p. 57.

Passenger demand can be split into five segments, which will be described further in the following sections (Figure 34). Regional segment counts for 50% of total Italian passengers.km, slightly



increasing in volumes until 2019. International long-haul demand is absolutely residual, around 2%, telling of a basically rail-isolated country.³⁹

The two segments of long-haul conventional traffic, both market and PSO one, are small and slightly declining. In 2019 they count for 7% of total demand each. The segment that saw a “boom” is the one defined “premium”, which means services operated with fast rolling stock and using totally or partially, the HS network. Fully HS and mixed services, together, passed from 15 to 19.5 Mi. p.km, or from 30% to 35% of the entire Italian rail market.

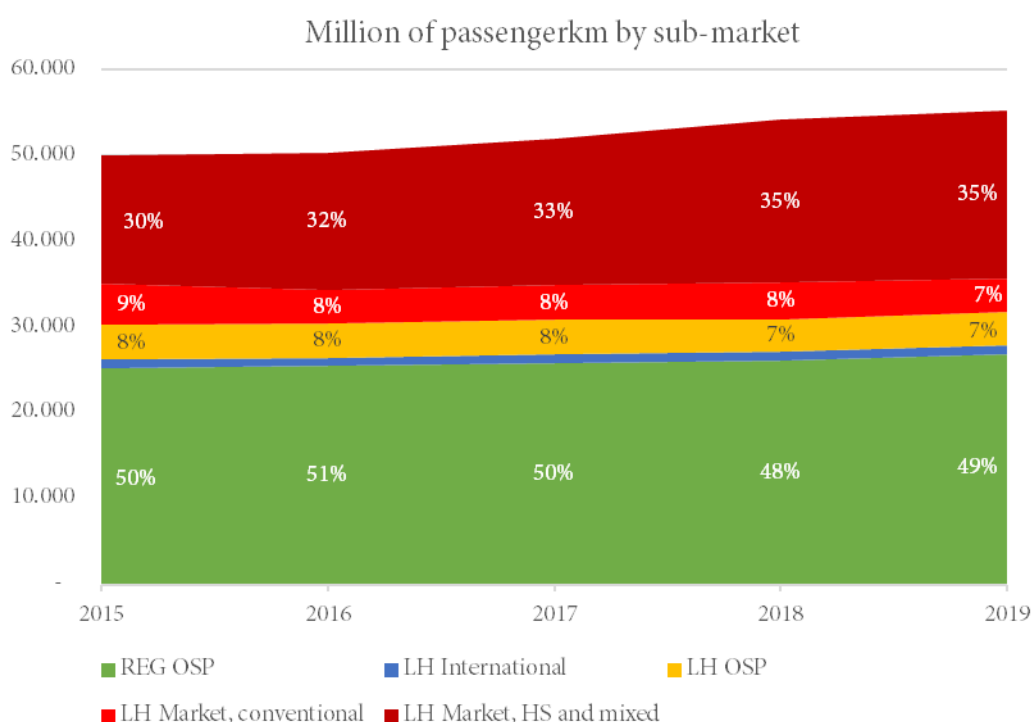


Figure 34. Passenger traffic [Mp.km] by market segment. Source: our elaborations on ART, 2022

Demand data on a company-base are basically unavailable. The following table uses the circulations in train.km on RFI network (the national network), integrating Trenord which is operating also on Ferrovienord network. Other regional operators operating on separate networks are not included.

The trends are very different from transported traffic, since during pandemic train companies kept the supply over dimensioned with respect to demand to keep crowding low. Italo is the company growing more. The regional segment instead is the one suffering more, due to low demand and long-term shy financial support from most regions (see below).

³⁹ The only significant connections are with Switzerland.



[Mtrkm/year]	2018	2019	2020	2021	2022	2022 vs 2019
Trenitalia (LH, market)	65,25	66,42	68,24	63,34	68,56	+3%
Trenitalia (LH, PSO)	25,26	25,31	25,46	25,88	25,72	+2%
Italo (LH, market)	19,65	22,50	27,23	29,96	29,80	+32%
other national incumbents (LH, market)	2,26	2,15	2,32	2,34	2,39	+11%
other domestic (LH, market)	-	-	-	0,06	-	/
Trenitalia (REG, PSO)	162,98	165,85	154,04	152,07	153,11	-8%
Trenord (REG, PSO)	(48,89)	44,90	34,64	38,80	(40,44)	-10%
Trenitalia-TPER (REG, PSO) *before: Trenitalia	-	-	15,34	15,53	15,48	/
other regional (REG, PSO) *on RFI network only	7,52	7,68	5,03	5,35	5,31	-31%
Mercitalia Rail (FRE, market)	29,74	29,08	29,96	29,68	31,27	+8%
other national incumbents (FRE, market)	11,29	13,32	13,97	13,66	14,54	+9%
other domestic (FRE, market)	17,92	20,17	23,09	25,58	31,54	+56%
total	390,77	397,38	399,32	402,26	418,16	+5%

Table 6. Production in trainskm per Rail Company. Our elaborations on RFI data, integrated with Trenord estimates.

Not surprisingly, Trenitalia is by far the dominant operator having almost the entirety of PSO traffic. Only in the HS and mixed segment it is challenged by Italo, now near to 1/3 of all market services. Other companies are marginal, either SBB, SNCF or OEBC for international traffic. To date, no other open access operator is present in Italy except Italo, even if in 2020 it was expected the entry of a local rail company on the Naples-Bari LH connection. It did not happen due to COVID.

CO₂ emissions

The estimation of CO₂ emissions benefits of a recent source, the National Greenhouse Gas Inventory (ISPRA, 2022), that includes also historical homogeneous estimations.

Figure 35 depicts the size of the emission reduction effort that took place since the 2000s, when emissions started to go progressively down. We can recognise two phases: from before 2010 to 2014 emissions went down considerably, due to the economic crisis and the stagnation of production. Since 2013 until COVID19, economy restarted but emissions did not grow.

Transport related emissions are instead much steadier. 2005 still represents a maximum, but the actual emissions reduction observed since 2012 is negligible. This makes the relative size of transport-emissions increasing, from 26% to 31-32%.

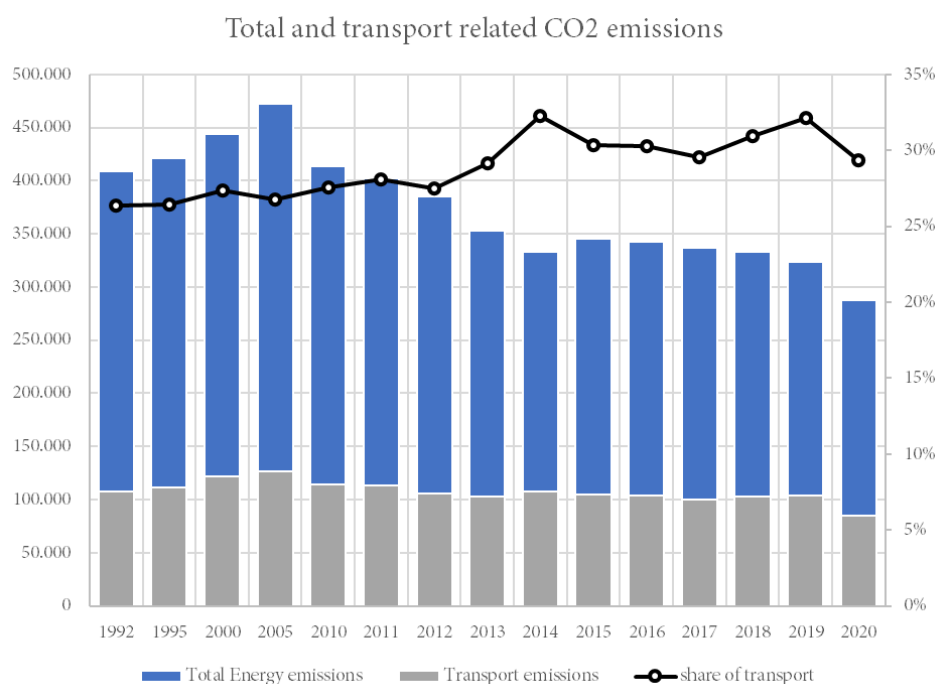


Figure 35. Total Italian CO2 emissions and share of transport.

Source: our elaborations on ISPRA, 2022.

The same source details emissions by mode, obtaining a rather predictable outcome (Figure 36): road transport is responsible for 92-94% of yearly CO2 emissions from transport-related activities. Rail and urban transport count nearly zero and the remaining is due to domestic navigation and domestic aviation, the latter counting for about one half of the first.

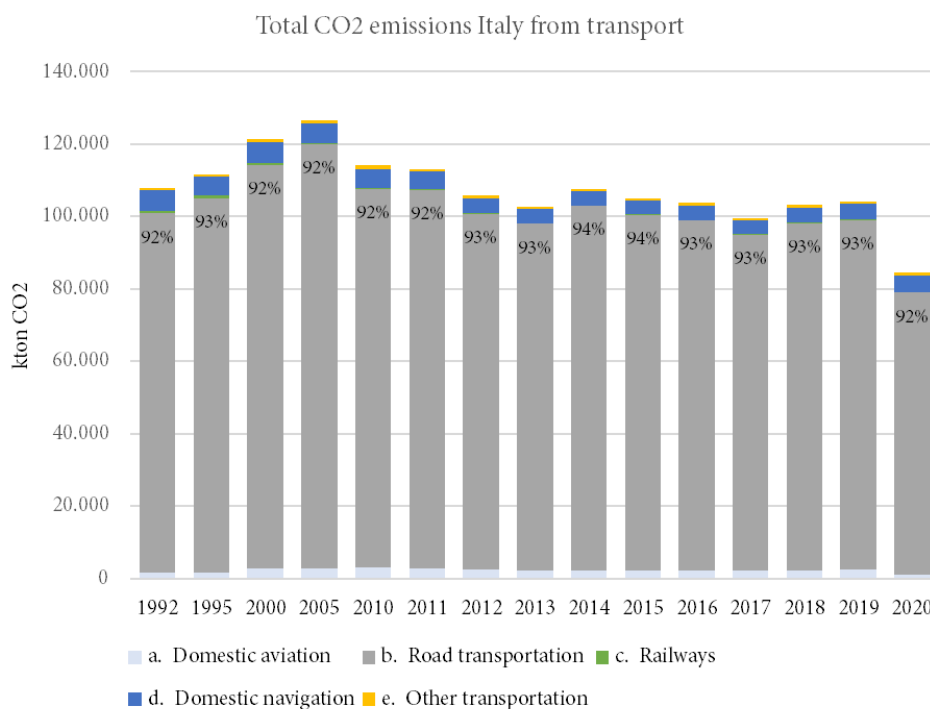


Figure 36. Italian CO2 emissions from transport, by mode and share of road transport on total.

Source: our elaborations on ISPRA, 2022.

Governance

The Italian rail market is the evolution of an asset, common with many other European countries, based on a vertically integrated national monopoly (originally *Ferrovie dello Stato*), plus some local vertically integrated monopolies (formerly *Ferrovie in concessione*, now passed to the ownership of regional governments).

The situation today is profoundly different, with the legacy company still dominating the market, but not as part of a vertically integrated monopoly. National network access is guaranteed to the entry of any authorised company since 2003 and other local networks are going in the same direction.

First of all, the national incumbent is divided into different companies under a holding. The three main ones are:

- RFI: the network manager
- Trenitalia: the passenger company
- Mercitalia: the freight company



In addition to Trenitalia and Mercitalia, other companies operate in Italy:

- 1 national LH company, Italo, operating HS and mixed services nationwide.
- 3 international LH companies⁴⁰, all belonging to neighbouring countries and operating in Italy independently (SNCF), or through Trenitalia (SBB) or through other Italian traction companies (OEBB).
- 20 regional companies, often but not exclusively operating on their own network. Among them, 2 are partnerships between Trenitalia and a regionally owned company (Trenord and Trenitalia-TPER).
- 24 freight companies (2022), the bigger of which counts for ¼ of Mercitalia traffic.

The level of liberalisation of the Italian rail market is very different according to traffic segment. Very synthetically, long-distance is fully liberalised with Italo seriously challenging Trenitalia on premium segments. Before COVID other companies (Flixbus and Ferrovie dello Stato) were expected to enter on some market niches and this trend is expected to restart soon. Also, national neighbouring incumbents seem to have plans, OEBB in the night train niche, and SNCF in the HS in response to Trenitalia entry in France.

Freight market is fully liberalised, too. The number of companies is significant, the market is dynamic and Mercitalia is the least dynamic company in terms of traffic growth.

Regional and LH PSO markets, instead, are basically not liberalised or not contestable. Trenitalia had, without any tender, the exclusivity for 10 years on IC market (subsidised, see below). This segment accounts for 7% of Italian passenger market (Figure 34) and is similar to Italo in terms of train.km (Table 6). This direct award is ending, but there is no mention of how the Ministry of Transport is willing to reorganise it. For sure, another 10 years of unchallenged monopoly can be hardly justified, also because at risk of preventing the entry of newcomers on intercity market.

Regional market is in a similar situation: the market is completely in the hands of incumbents and no region is realistically doing open tenders until 2023, when it will not be allowed anymore an in-house award. Just a handful of tenders have been done so far by regions to award their regional PSO to a competitively selected company. Among the few contestable tenders, one must mention the suburban trains of Turin, won by Trenitalia (and lost by the local company, GTT). In Emilia-Romagna a tender was done and a joint venture between Trenitalia and the local company TPER has won it. In Lombardia a similar joint venture, Trenord, holds the largest and richest Italian regional market. Despite the poor performances of the company, the new Regional Government is not willing to make a proper tender and will likely renew the monopoly for another 10 years.

⁴⁰ Charter companies excluded.



Subsidies

The subsidy structure is quite clear in Italy. Market long-distance trains get no subsidies and rely only on ticket revenues. They account for 86.6% of long-distance services (derived from 31 data). The remaining 13% includes any “Intercity” train, subsidised yearly with more than 316M€ in 2019 and with a cost coverage from fares of approx. 55% (ART, 2022). These trains are operated with conventional rolling stock (but increasingly with old HS rolling stock), run on conventional tracks and cover some subnational markets, in particular the long connections with Southern Italy, some trains from Eastern Italy to Rome and most of trains operating on the Tyrrhenian coast from the Po Valley. Why these trains are subsidised and not others have never been clarified: they are simply the subsidy-needing trains coming from past timetables.

Regional train’s financial support is of an order of magnitude higher. The bulk of resources comes from a national fund transferred to the regions for both trains and local public transport. The fund changed in the years and is relatively stable since 2017 around nearly 5 billion €/year. Of this, the part going to regional rail is difficult to be estimated and represented in Figure 37. On top of that, some regions add own funds to support their regional transport. The panorama is extremely varied, with regions adding nothing and others adding significant extra amounts. The ones investing more on a per capita basis are Emilia-Romagna, Puglia, Liguria, Toscana. The one investing more – absolutely and relatively – is Lombardia, which is the one that saw services and passengers increasing substantially.

Referring to 2019, the last year for which we have complete data, State contributed with 1817 M€, regions with 520 for services (of which 191 only from Lombardia) and 424 for new rolling stock. Subsidies per capita are quite varied. Figure 38 shows that regions with the highest subsidy per passenger are also those with the lowest rail use and in the South (Basilicata, Calabria, Molise, Sardegna, etc.)⁴¹. To the contrary, among low-subsidy regions (below 10€/pax), the situation is more varied, with travels per capita ranging from 5 to 20 or more. The three regions with the highest per capita use are also those with very low unit subsidy (Lazio, Lombardia and Liguria). All three are very adapt to rail transport because of large urban areas (Rome and Milan, respectively) or because of orography (Liguria: one single line serving almost the entire regional population).

⁴¹ This might be limitedly also the effect of the disproportionate cost of Contracts of Service for regional rail networks that include also track maintenance (which is excluded for those running on RFI network).

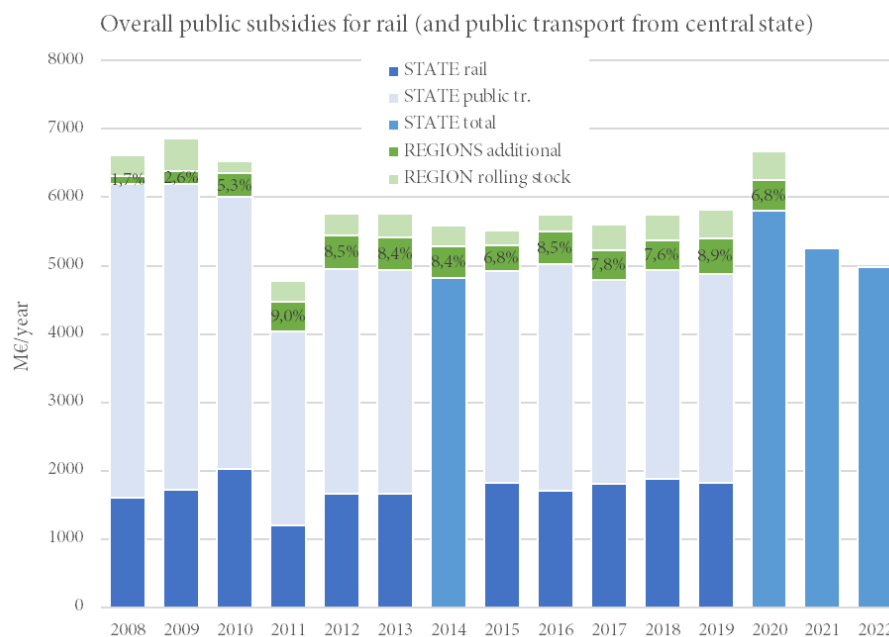


Figure 37. Estimation of subsidies for regional rail PSOs.
Source: our elaborations on Pendolaria (various years).

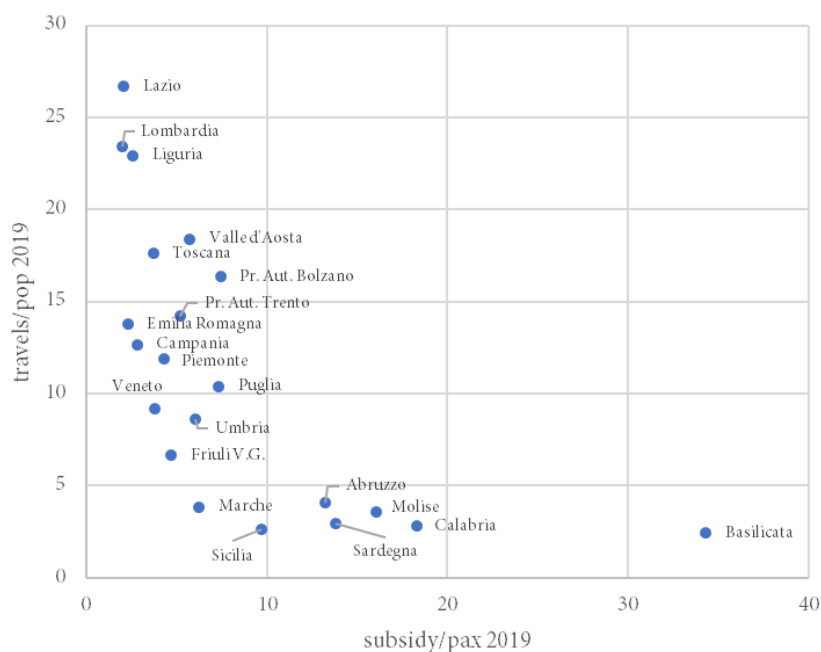
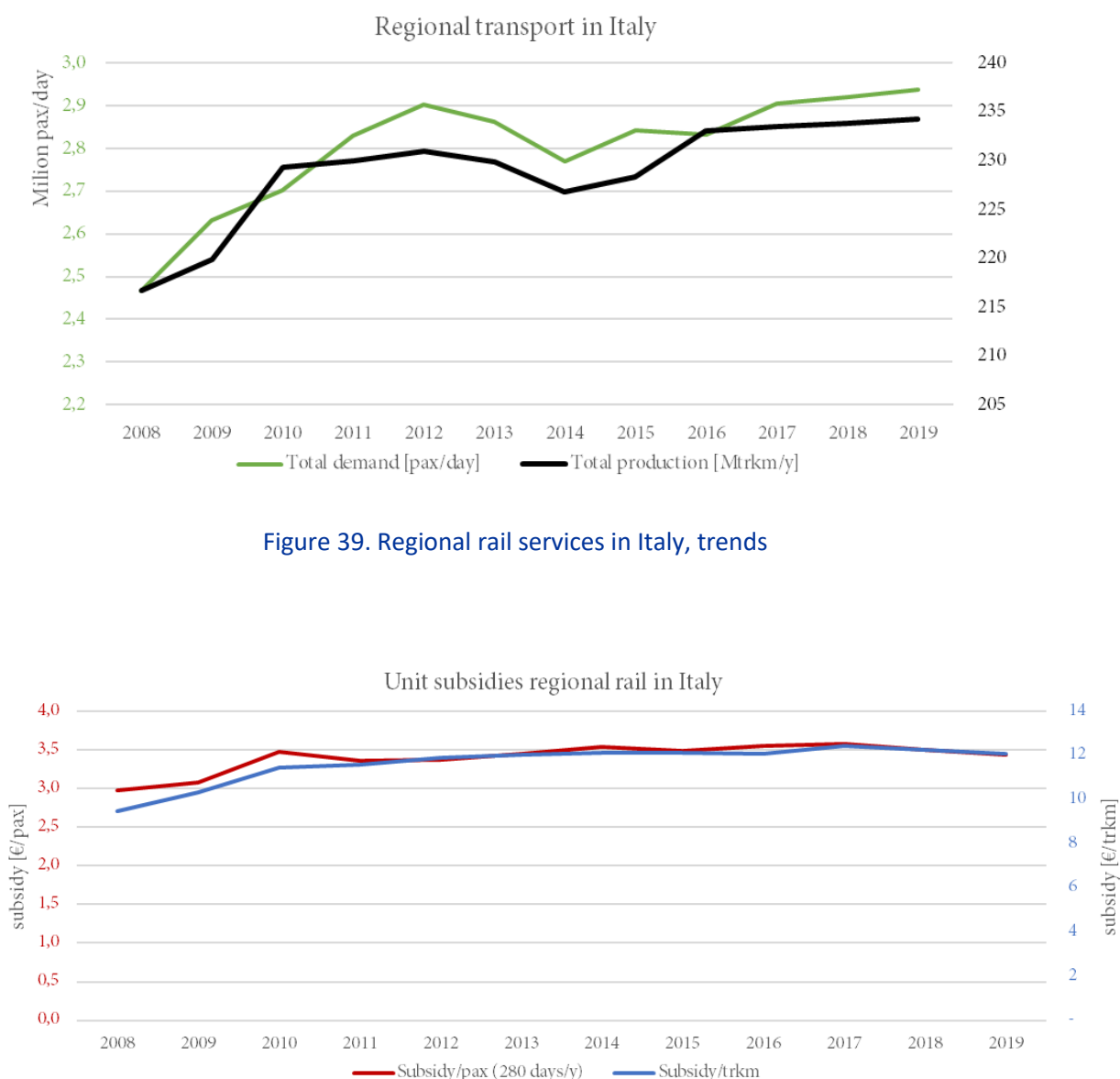


Figure 38. Regional indicators of regional transport contracts of service: travels/population and € per passenger/year (HP: 280 days/year). Our elaborations on Pendolaria (various years).



Looking at trends, Figure 39 tells of a steady increase of supply and demand between 2008 and 2012, followed by a clearly stationary phase stopping at less than 3 million/travels per day: about 0,025 return trips per day per inhabitant.

Given the slow but steady rise of costs, unitary subsidies rose until 2014, and then stopped at about 3.5€/passenger and 12€/train.km.





5.2 Rail transport planning in Italy

Is there any national rail transport planning in Italy?

If for “planning” we mean a process in which a public body takes strategical decisions necessary to reach a shared vision of a system, the answer is: no. Both because decisions are not fully taken by a public body (rather by rail company) and because it is hard to see a future “vision” to tend to.

Italian rail planning consisted, after the last and unapplied “General Plan for Transport and Logistics” of 2001, in a *laundry list* of new lines and upgrades. The approach has been firmly “infrastructure-centered,” i.e., planning means foreseeing new infrastructure, without any general vision on rail services, network relations and performances. In simple terms, it is the exact opposite of well-known and seminal Swiss Bahn 2000 approach, where a target national timetable is the starting point, from which needed infrastructural developments are derived. In Italy, also for the parts of the network used by PSO services only such as regional trains, the “plan” is rather a collection of single line projects, each one vaguely assuming how many additional trains can be hosted.

More formally, until 2022 the decision track for rail transport can be summarised as follows:

- i. In absence of a General Plan of Transport and Logistics (not existing anymore after 2001), the strategic vision has been driven by the so-called “objective law”, a law of 2001 aimed at speeding up the decision process of a list of infrastructure classified as “strategic” yearly by the...
- ii. ...“Allegato al DEF” (literally: *attachment to the document of economics and finance*), a document providing a very general framework to a long list of projects labelled as strategic without any evaluation and often also in absence of a proper design phase.
- iii. The Allegato al DEF is the basis for the definition of the *Contratto di Programma* with RFI, the infrastructure manager. This document was – and to a certain extent still is – the real “shadow planning document” for Italian rail policies, despite it is not a plan but a *contract* defining which infrastructure must be built and for which amount of public money. Once an infrastructure is in the CdP, RFI has resources and motivation to design it.
- iv. The Programme Contract is yearly translated in a more operational plan, the RFI Commercial Plan, this one entirely managed “in house” by the infrastructure manager.

This approach, not particularly wise, has been put into discussion only twice in the last 20 years:

1. By the DEF of 2017 (and of 2020), whose content is, for the first time, a strategic vision of the rail system and not a mere list of infrastructure. The DEF 2017 introduced a new concept, called AVR (“Network-shaped high-speed rail”), which will be discussed in the next paragraph 0.3, but unfortunately abandoned soon.
2. By the very recent revision (DEF, 2022) of the entire planning process, introducing Cost Benefit Analysis, relaunching the National Transport Plan for 2023 and publishing the first “Documento Strategico della mobilità ferroviaria di passeggeri e merci” (*Strategic Document of passenger and freight rail mobility*) (MIMS, 2021). Theoretically, the complex of these three



elements: a national vision, a modal strategy, a sound assessment system, looks like there are finally the premises for a good approach to rail planning. However, apart the declarations, the contents of such documents are still far from international standards.

In this sense it is very revealing what the introduction of MIMS (2021) says about the document contents:

The current document is articulated in three parts. In the first one are introduced the strategic goals of mobility and infrastructural policy [...]; in the second one are described current Contract Programme [with the infrastructure manager RFI] 2017-2021 and the 2020-2021 update, the available resources for the Contract, and the strategic programmes on rail mobility including the indication of priorities; finally, it is described the assessment procedure (ex-ante, ongoing and ex-post) for rail investments [...].

While the first part will be described later in Section 5.3, one must notice that the core of the document is the *usual* list of single investments, with a detailed record of costs, cost overruns and timing, but without any reference to the significance of such projects in terms of travel needs, network development or economic benefits. In other words, the “strategic document” is largely a procedural and tactical document, not differently from the DEFs of the past.

DEF 2017 and the AVR concept

As anticipated, Italy enjoyed a very short season of properly said “strategic rail planning”, starting with DEF 2017 and fading with DEF 2020. The core of such season was the new “Alta Velocità di Rete” concept, AVR in the following. It consists in a definition of target performances of the long-distance rail services to be obtained by a mix of new services using the existing HS lines, upgrades of conventional lines, new HS sections and, in limited cases, new fast lines. Starting from the in deep analysis of the current network status and market behaviour of firms, the document foresaw an infrastructural development that was strongly linked to the expected performances of the network, avoiding unnecessary overinvestment.

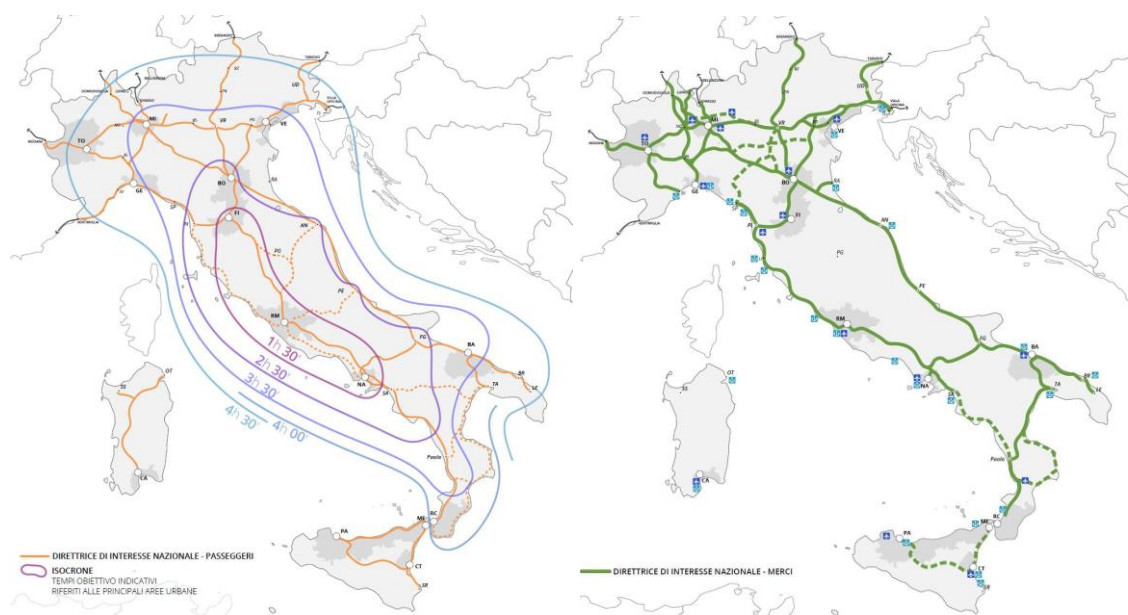


Figure 41. Lines interested by the AVR network of fast connections and travel time targets (left). National freight corridors (right). Dashed lines are corridors for which feasibility studies must be prepared.

Source: DEF (2017).

More precisely, the following targets have been set:

1. Progressive extension of high-speed services *out of the high-speed network*, to create a network of fast services covering the entire country in a short time and without the need to build new tracks except for specific situations or insufficient capacity.
2. Integration of fast services with regional services, today working as a separate system and thus limiting the effects of HS lines to main cities only.
3. Strengthening of the rail connections with ports and inland terminals and extension of high-performance services to all industrial areas of the Peninsula.

The vision of the AVR entails two important elements, before (and also after, see 5.3) absent from Italian rail planning: the focus is on the timetable performance of the system and not on the top-speed of a line, and new infrastructure must be “lean”, namely avoiding unnecessary technical characteristics and saving money. All of this has disappeared already just four years later, as a consequence of an extraordinary injection of money into Italian economy: the NextGenerationEU fund.

PNRR

A recent important episode is the national implementation of NextGenerationEU funding, called PNRR. Activated by the EU as a response to the expected economic crisis due to COVID19 pandemics, Italy became for the first time, a net beneficiary of EU funds, due to its evident economic weakness. Funds made available to Italy are 68.9 billion of euros as grants and 122.6 as loans, for a total of 191.5 billion. Italy is not only the largest beneficiary, but also the only country that is planning to spend *the entirety* of the loans (Beria and Pucci, 2022).



While the aim of the Commission is not only to stimulate economy through spending, but also efficiency through reforms, Italy has interpreted the European plan *as an investment plan*. The combination of large amount and short delivery time (by 2026 money must be spent), generated the following choices:

- a. Almost every “ready” project is included in the plan, without particular care in the coherence of such projects;
- b. Rail is the main recipient of funds because the infrastructure manager RFI is one of the few that is *able* to spend billions in few years;
- c. The shift of funding from national to NGEU of many ready projects has “freed” funds already allocated. This allowed to add another 30 billion € of national funds to the 191 from Europe, to further extend the list of new infrastructure, in this case beyond the 2026 deadline.

In conclusion, NGEU and PNRR will be an important step for rail spending in infrastructure, allowing to complete almost any mature project (including some not particularly transformative). But the mentioned weaknesses remain and are even amplified: no reasoning on network performance, risk of having new tracks but not the money to run the services, overdesign, overinvestment, extraordinary procedures made ordinary, etc. And new debt to be repaid.

5.3 Goals and actions of Italian rail transport policy

Transport policy goals

The *Strategic Document of passenger and freight rail mobility* (MIMS, 2021) outlines the principles of Italian rail transport planning, but also the rhetoric narrative behind it. Bold and translation are of the authors.

*“The country's recovery and resilience **decisively depend from the infrastructural stock and from the efficiency of the network systems** that supports economic and social activities. **Quick and significant investments** in this field, therefore, may not only have a relevant **positive employment effect** in the current situation, but also contributing to the improvement of economic competitiveness, in quality of people's lives and in the environment in which they live. **Transforming infrastructures and transport system in the sense of sustainability is indispensable also to achieve the planned greenhouse gas reduction targets** by the European Union in the new Fit-for-55 climate package (reduction of greenhouse gas emissions by 55% compared to 1990 levels, with the aim of reaching to carbon neutrality by 2050), as the transport and construction sectors contribute to more than half to greenhouse gas emissions and the their impact on soil quality and biodiversity is very significant.*

*On the other hand, the country's infrastructure must be adapted to needs of businesses and citizens, also to **overcome serious social inequalities and territorial conditions** that afflict Italy, with an **unacceptable distance between North and South, centres and peripheries, cities and internal and rural areas**. Last but not least, also considering the average age of Italian transport infrastructures, it is **needed an extraordinary [maintenance] investment** to ensure its efficiency and increase the safety of citizens.” (MIMS, 2021, page 12)*



The main messages can be summarised as:

- a. Development of Italy passes also from the increase of the infrastructural stock. Investments are so crucial that must be quick and significant in size. An external reader may assume that Italian infrastructure network is underdeveloped.
- b. Among the positive effects of investment, the first to be mentioned is employment: Italy needs public spending – in transport networks – to reduce unemployment. Other positive effects are mentioned after: economic competitiveness, quality of life, and environment.
- c. To meet *Fit-for-55* emission targets transport contribute in two ways: infrastructure must be built “more sustainably” (probably intending that construction must emit less) and transport system must go towards more sustainable modes. Again, infrastructure is central.
- d. Infrastructures (not services, again) are needed to fill an accessibility gap between parts of the country.
- e. The obsolescence of infrastructure may become an issue for the operation and safety of the networks and therefore an extraordinary maintenance effort is needed.

These are the main assumptions of national rail planning. It is evident the focus on the physical dimension (the tracks, the infrastructure) rather than on the performance of the services using it. Competitiveness and geographical mending pass primarily from new tracks, not from better connections.

These assumptions are not exactly “transport related goals”, in the opinion of the author. It is a goal to aim at reducing territorial inequalities as well as reducing emissions or maintaining the stock. However, it is not a transport goal properly said to invest quickly, nor creating jobs.

Apart mentions of European emission reduction targets, there is no trace of any quantitative indicator nor performance target in transport-related documents. The *Fit-for-55* target is assumed to be the target for Italy, too. No verification of the realism of mentioned EU modal shift assumptions (e.g., doubling rail passengers by 2030) is provided. The approach is naively axiomatic: given that EU targets require to shift from road, we must invest in rail infrastructure. According to DEF (2022), the additional investments needed to cut emissions by -55% in 2030 (with respect to 1990) and net-zero in 2050, account for 8 billion €/year for the transport and energy networks.

Out of transport planning documents, we can find a forecast and a strategy in the so-called “PNIEC” (MISE, MinAmbiente and MIT, 2019). The plan for energy and environment sets own goals for emissions reduction and compare it with a business-as-usual scenario that is already reducing emissions. Figure 42 depicts transport-related goals: from a level of 100 Mton/year in 2020 in the BAU scenario, 2030 sees a 7% reduction without additional policies and -21% reduction in case of additional policies. Additional policies focus mainly on:

- a. vehicles electrification
- b. biofuels
- c. increase of public transport through electrification, track doubling of secondary railways, investment in urban mass transit.

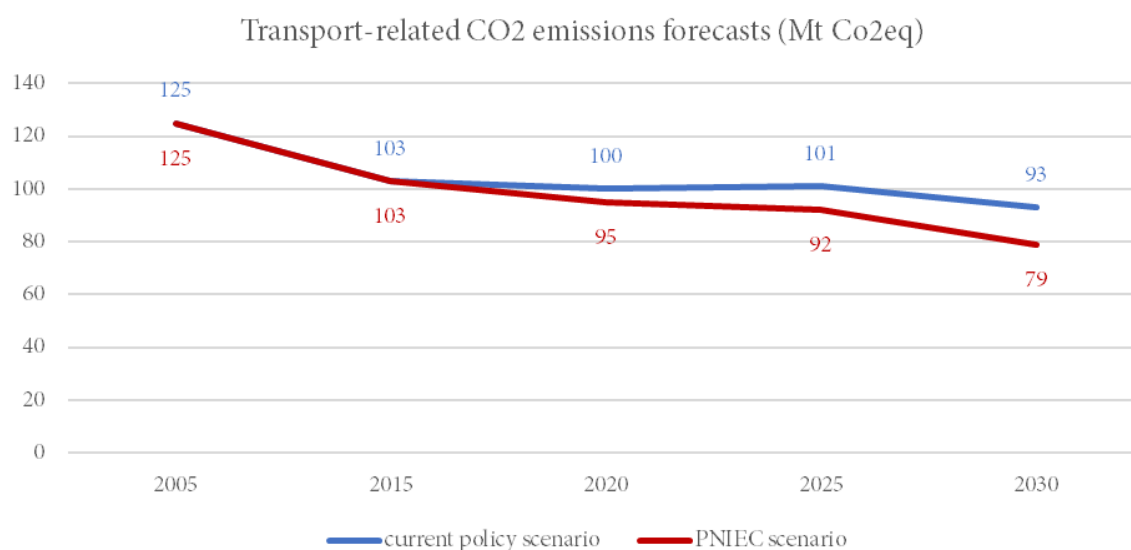


Figure 42. Transport related CO₂ emissions in current and PNIEC scenario.

Source: our elaborations on MISE, MinAmbiente and MIT (2019).

Interestingly, in transport-related documents, rail transport is considered intrinsically “green”. This assumption is reflexed also in the PNRR/NextGenEU plan: zero road investments, any rail investment. However, in the planning documents it is never mentioned the expected CO₂ reduction impact of *those* investments listed. They will surely shift someone from road to rail and then they will surely reduce emissions, is the bet. Whether that panel of investment is the best combination (more effective? more efficient?) is never discussed. In single project documentation the modal shift expectation is usually mentioned (at least in recent projects), but without any comparative perspective (what can one obtain from the same expenditure on other lines or sectors?) and forgetting emissions during construction.

The actions aimed at obtaining the goals are:

1. Full realisation of TEN-T corridors by upgrading existing rail lines to EU standards and new Alpine crosses.
2. Extension of ERTMS system to the entire national network by 2035.
3. Increase of the resilience of infrastructure to climate emergency.
4. Extension of HS network, in particular towards south and east-west connections.⁴²
5. Upgrade of metropolitan, regional, and interregional rail networks, including touristic lines.
6. Strengthening of logistic network through the upgrade of last-mile connections with ports, airports and freight terminals.
7. Increase of quality of stations.
8. Technological innovation (e.g., hydrogen trains).

⁴² But the AVR concept is not mentioned.



It is clear that this list of actions includes *any* possible project or investment on the rail network. Unfortunately, between these ample “boxes” of actions and single investments of the list there is no structured rationale. One could see this strategy from another perspective: given a long list of (infrastructural) investments decided, they can be grouped into these eight categories to provide an illusion of strategy.

Infrastructural expectations

As described above, with the parenthesis of AVR in 2017, Italian rail policy is mostly an infrastructural policy. Therefore, planning documents are full of operational details about the investment effort, the extension of the infrastructure built or upgraded, the timing of construction phases (not very different from what is included in tactical and operational documents such as the RFI Contratto di Programma or RFI Piano Commerciale, Figure 43).

<p>Potenziamento infrastrutturale e raddoppio Orte-Falconara</p> <p>Il costo di 4.028 mln indicato nell’Allegato Infrastrutture al DEF 2021 è stato ridefinito per affinamenti progettuali e consolidamento del perimetro di riferimento, dapprima in 3.759 mln (nell’aggiornamento 2020-2021 del CdP 2017-2021), successivamente in 4.348 mln, derivati dal Progetto di Fattibilità Tecnico Economica dei lotti afferenti a PM228-Castelplanio con by pass di Albacina e PM228-Albacina.</p>
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Figure 43. Example of description of Orte-Falconara project status contained in MIMS, 2021.

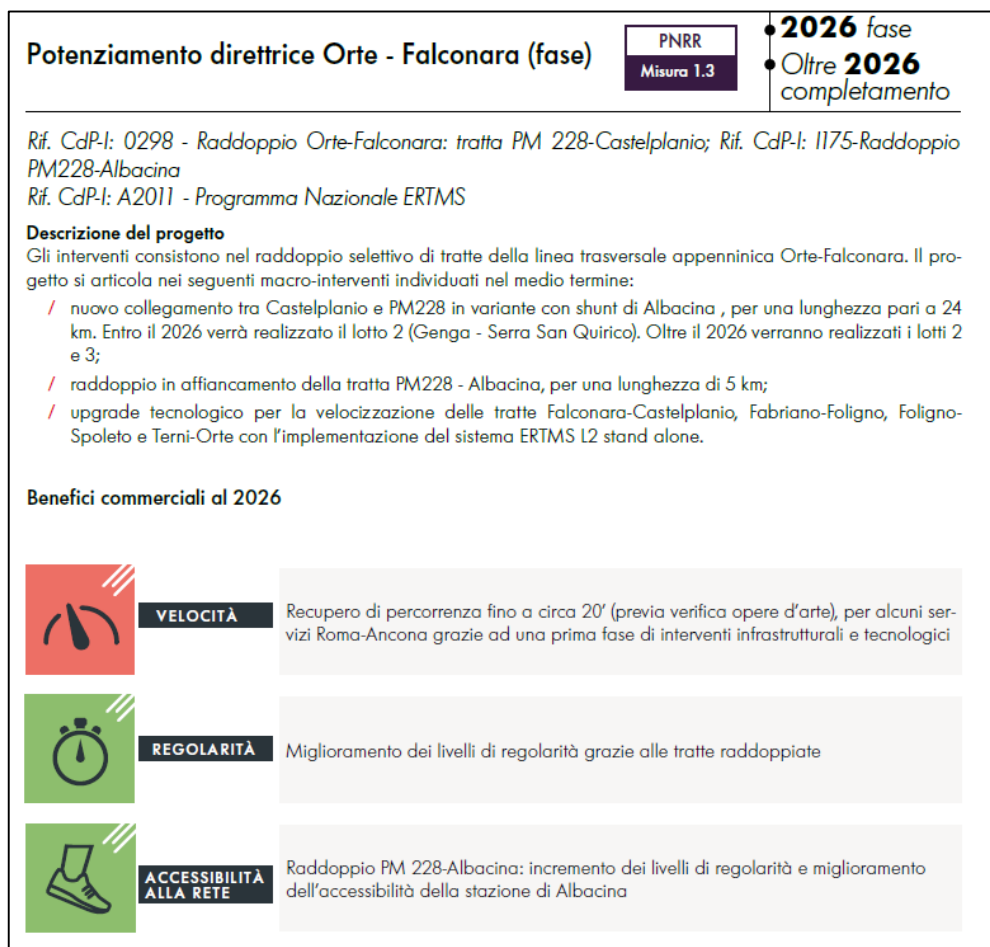


Figure 44. Example of description of Orte-Falconara project status contained according to RFI Commercial Plan 2022.

Figure 45 details the yearly amounts and sources of funding for the next 15 years. It is clearly visible the extraordinary injection of the PNRR (that is the NextGenEU funding), plus the additional national funding derived from it (PNC) and going beyond 2026. After that, the investment levels will return to normality of the Balance Laws (LB) and structural and investment funds. The mid-term expected travel time (referred to the speed of fast services) are represented in Figure 46.



FIGURA I.2.2: RISORSE PER LE INFRASTRUTTURE E LA MOBILITÀ SOSTENIBILI IN CONTO CAPITALE DI COMPETENZA DEL MIMS PERIODO 2021-2036 (MLN EURO)

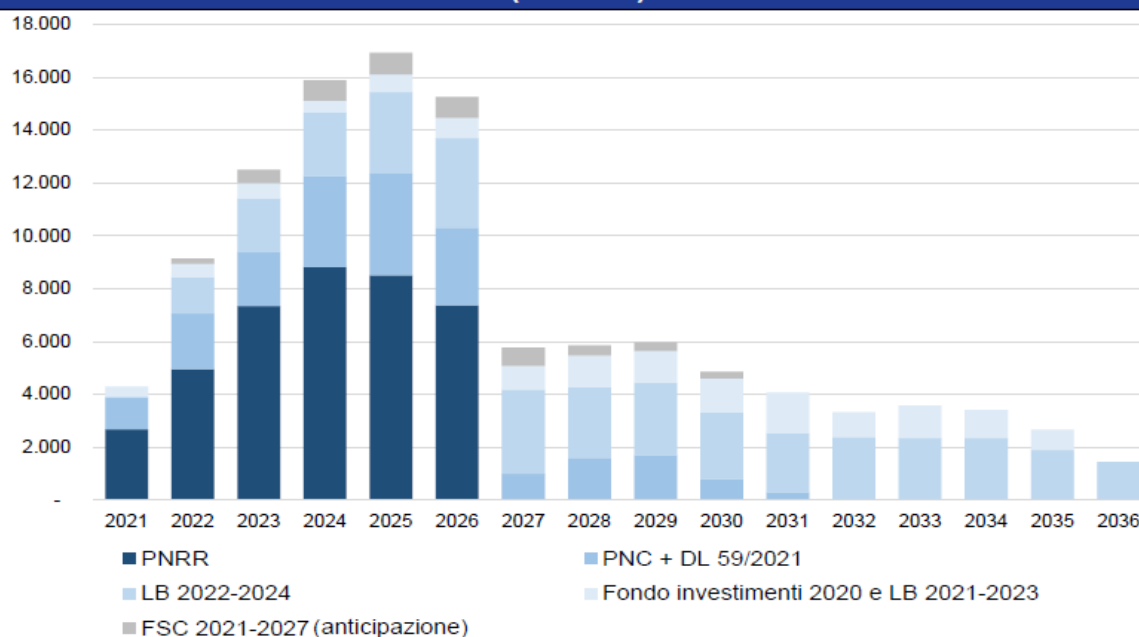


Figure 45: Planned investments in rail infrastructure 2021-2036. Source: DEF, 2022

FIGURA III.3.1: TEMPI MEDI DI PERCORRENZA SCENARIO TENDENZIALE (ORIZZONTE 2031)

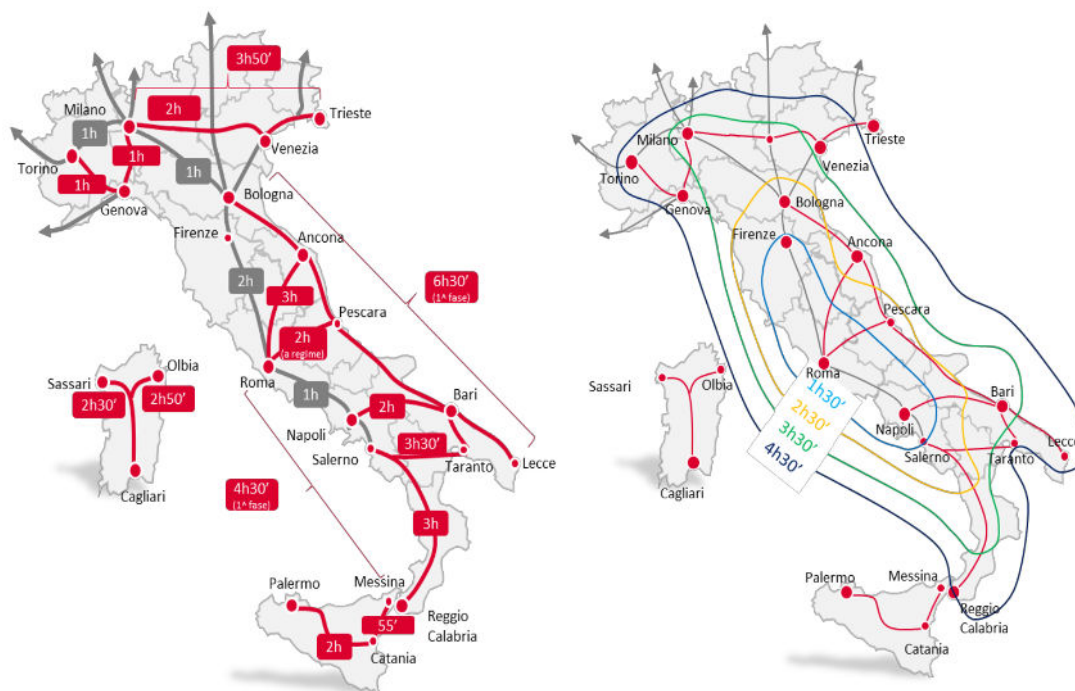


Figure 46. Future travel time 2031. Source: MIMS, 2021



In addition to network improvement, some space is dedicated also to the accessibility of stations, to make them central elements of the city mobility through:

- a. Improvement of accessibility (public transport, shared mobility, active mobility)
- b. Reduction of internal barriers
- c. Infomobility and wayfinding
- d. Charging stations.

Unfortunately, the role of stations as urban centralities, through the concentration of urban functions and land redevelopments, is however less central than their role as mobility hubs.

5.4 Conclusions

Italy has put much emphasis on rail transport and rail investments at least since 2001, when a season of megaprojects has started. While the full realisation of those plans is still to come, the combination of the opening HS line Turin – Naples, the successes of competition in long-distance rail and the political focus, has made rail transport one of the core policy discourses. Figures, however, do not fully justify such enthusiasm. Apart the two-digit boom of high-speed rail (mostly competition driven), the remaining of services is steady or declining and the modal share remains stuck at less than 6%. On the environmental side, while transport emissions stopped to grow, the contribution of rail to this is negligible.

The Italian rail market is liberalised since 2003, but we see competition (in the market) only in long-distance and freight. Regional and national PSOs are firmly in the hands of Trenitalia and there is no sign of a future change of that. Subsidies have been irregular in the past years in terms of sources and often decided late, but the amount has been rather fixed at 5 billion/year including local public transport and excluding possible regional integrations. The performance of each regional contract in terms of passengers per subsidies is extremely varied. National average of subsidies is 3.5 €/passenger or 12€/train.km.

Reasons of such “steadiness” can be found in the governance of the rail system. While the rail company (FSI and its controlled RFI and Trenitalia) are quite dynamic and succeeded to evolve significantly, the governmental side is the weak part of the game. At the national level, there is not properly said “planning”, as a) much is left to the national company and b) efforts are spent only on the infrastructure side and nothing on the planning of services. This failure explains why market segments grow, while PSO just survives. Recently, a new planning phase was inaugurated in 2017, but the European money landed with the NGEU fund has brought Italy back to the past, focusing on new tracks without a vision of services.

As said, politics love to focus on rail spending. The common narrative is that rail investment will bring employment and then development and competitiveness, together with environmental benefits. None of these, however, are documented in policy documents. Emissions reduction, in particular, is assumed axiomatically.



6. GERMANY CASE STUDY⁴³

Since the rail reform in 1994, German rail policy has been based on five pillars: 1) vertical separation between transport and infrastructure, however with all DB companies operating together under the roof of the DB Holding, 2) open access to rail infrastructure, 3) full cost recovery of access charges, 4) governmental financing of investments, 5) franchising and subsidising of regional rail passenger services (RRPS). While the German model for railway reform was considered as successful both in terms of transport performance and regarding the financial outcome and taxpayers' costs (Link and Merkert, 2011; Nash et al., 2013), in particular capacity and quality problems of the sector became evident over the last years and require governmental action. Already the former government, a coalition of Christian Democrats and Social Democrats, which was in force from 2018 to 2021 initiated various measures to tackle the increasing problems of the rail sector in Germany. To these measures belonged a series of financial measures such as the reduction of track access charges for rail cargo and the increase of governmental financial contributions both for DB's network and for RRPS. Since November 2021, a coalition of Social Democrats, the Green Party and the Liberal Party has been in power. Their coalition agreement sets ambitious goals for rail based on the EU's Green Deal: an increase of rail cargo's modal share to 25% and a doubling of transport performance in rail passenger transport. To achieve these goals, the German government has announced a drastic increase of governmental financing to rail investments. In addition, there is an ongoing preparatory work for a new rail very reform with the aim to establish a not-for-profit infrastructure provider, consisting of the former DB Netz, DB Station & Service, and DB Energy.

These ambitious goals raise foremost an issue of financial feasibility, but in addition also concerns on the availability of construction capacity as well as staff needed for construction, maintenance and finally also for operating trains. Against this background, this paper reviews the development of transport performance and modal shares, the quality of service and the subsidisation policy⁴⁴.

6.1 Brief overview on the German rail sector

The German rail market is still dominated by the state-owned incumbent Deutsche Bahn AG (DB), but traditionally a considerable number of rail companies, such as private rail cargo companies, subsidiaries of internationally operating private companies, foreign national rail companies and smaller regional rail passenger companies compete with the incumbent mainly at the regional rail passenger market and at the freight market. As of 2021, around 630 companies have an official permission to operate rail services in Germany, out of these 346 companies are currently active at the

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⁴⁴ The German court of auditors (Bundesrechnungshof) published in March 2023 a report on the situation of the Deutsche Bahn. At the end of this subpart, the content of the report is summarised in Box 6.
https://www.bundesrechnungshof.de/SharedDocs/Downloads/DE/Berichte/2023/db-dauerkrise-volltext.pdf?__blob=publicationFile&v=5



market (BNetzA, 2023). With a number of 163 companies, the majority operate rail freight services. 107 companies provide regional rail passenger transport while 26 operators are active in long-distance passenger transport, with Flixtrain, ÖBB and SNCF as the most prominent examples.

Germany was one of the first European countries in opening up the rail network for third parties against payment of infrastructure charges. Since 1994, both passenger and freight companies have open access to DB tracks and track access charges have been raised, based on different principles since then⁴⁵. All of them have been based on average costs aimed at full cost recovery and belong to the highest in Europe. In addition, DB Station & Service, the provider of rail stations, levies charges for the use of stations. Since 2006, the Bundesnetzagentur (BNetzA, the until then regulatory body for the utility sectors such as electricity, gas, telecommunications and postal services) has been responsible for supervising the rail market, in particular in order to safeguard non-discriminatory access to rail infrastructure, to approve track access charges and also to provide information on the market development to the public.

Subsidies to rail are mainly granted to fund infrastructure investment and to support regional rail passenger services (PSOs). Apart from these two areas, the state took over all liabilities of the former DB and the East German DR as part of the reform measures in 1994 (debts, difference between former DB's civil servant's salaries and market-usual salaries, backlog investment demand in East Germany, pension liabilities as well as environmental burden).

Germany has introduced a franchising system for unprofitable and subsidised regional rail passenger services (PSOs). The share of public service obligations (PSO) contracts for regional rail passenger services awarded by public transport authorities (PTAs) to non-DB companies has continuously increased from around 4% in 1998 to 40% in 2021 in terms of train-km. It should be noted that this translates to a lower share in passenger-km.

6.2 The performance of rail in Germany

Transport performance and modal shares

Annual growth of transport performance during the period between 1996 (chosen as base year due to start of the franchise approach in regional rail passenger services) and the pre-pandemic year 2019 was 2 % in regional passenger transport and 1 % in long-distance passenger transport compared with 0.4 % in car transport (figure 47). While regional rail passenger transport shows a more or less steady increase during that period, long-distance rail has particularly increased from 2015 onwards. As in all countries around the world, there was a drastic decline in all rail passenger service performance in 2020 and 2021 as a result of lockdown policies. In freight transport, rail had with around 2.7% an annual growth rate of the same magnitude as road freight (2.5%) and was able to keep its market share.

⁴⁵ In fact, since 1994 four fundamentally different track access charging schemes have been applied by *DB Netz*, ranging from one-part pricing schemes over a two-part scheme (1998-2000) up to a Ramsey-based charging scheme introduced in 2018 (see Nash et al, app. On the German case, 2018 for details).

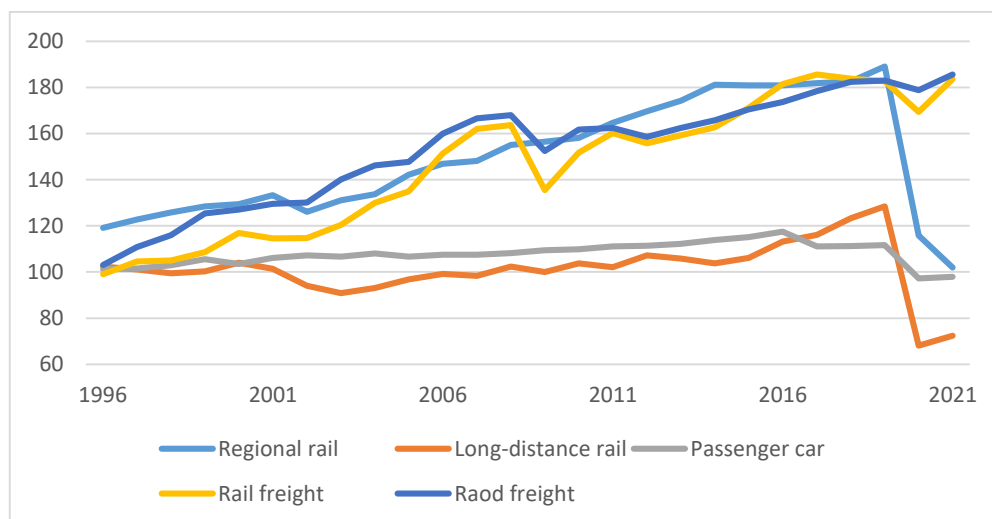


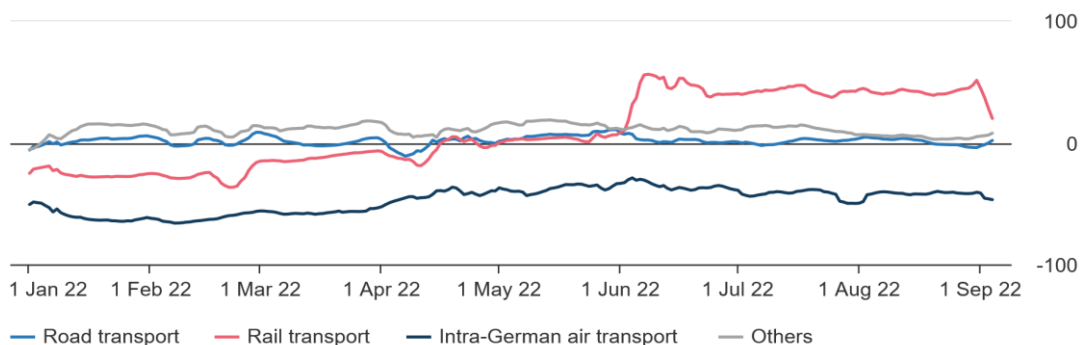
Figure 47: Growth of rail and road transport in Germany (1996=100) (source: Transport in Figures, BMVI)

In terms of modal shares, figure 49 shows that the share of rail in passenger transport increased from 7.2% in 2000 to 8.7% in 2019 with a drastic decline to 6.1% in 2022 as a consequence of the COVID measures. In the same period, car's modal share declined from 81.2% to 78.4%, with an increase to 86.8% in 2022. Although the 9€ ticket as a temporal measure to foster rail passenger transport was successful in shifting passengers to rail, this was mainly for leisure day-travel and use of rail fell back on the level before the 9€ Ticket in September (Figure 48).



Change in mobility, by means of transport, on 2019

Distances of 30 kilometres or more, percent, 7-day average



Note: Regarding the 7-day average only the data available for the 7-day period are used to calculate the average. Data gaps usually occur because of technical problems on the part of the mobile network operators. Sources: own calculation | © Teralytics

© Statistisches Bundesamt (Destatis), 2023

Figure 48: Effects of the 9€ tickets on the number of trips above 30 km

In freight, rail's mode share has increased from 16.2% (2000) to 18.5% (2019) and is – as of 2021 - back in the range of the pre-COVID years. The modal share of road freight has increased from 67.9% to 71.4% (2019) and has reached 72.1% in 2021, its share was only slightly affected by the COVID period. The overall pre-pandemic tendency of increased modal shares both for road and rail at the expense of inland waterway transport has continued.

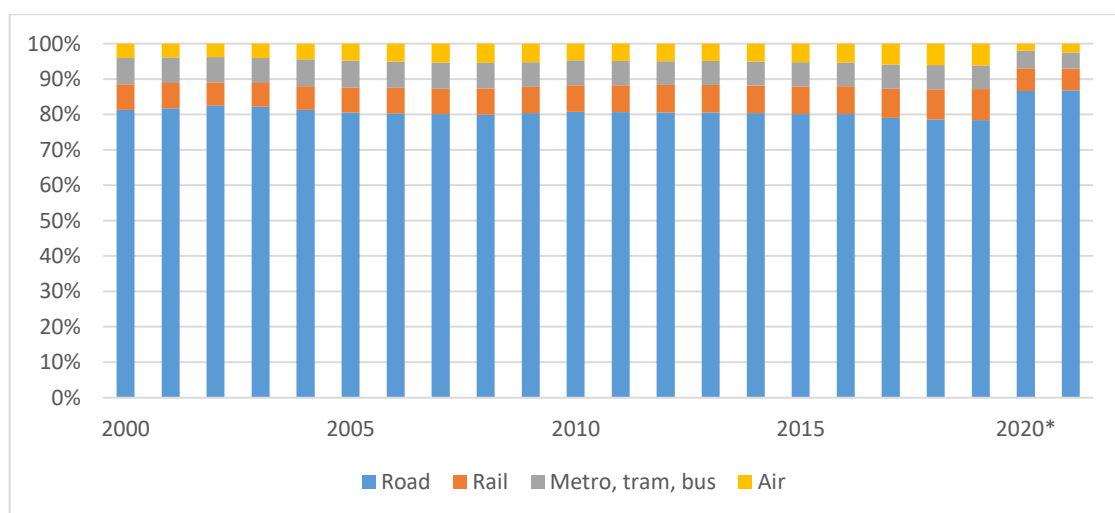


Figure 49: Modal split passenger transport (Pass-km) Germany (%) (Source: Transport in figures, BMVI)

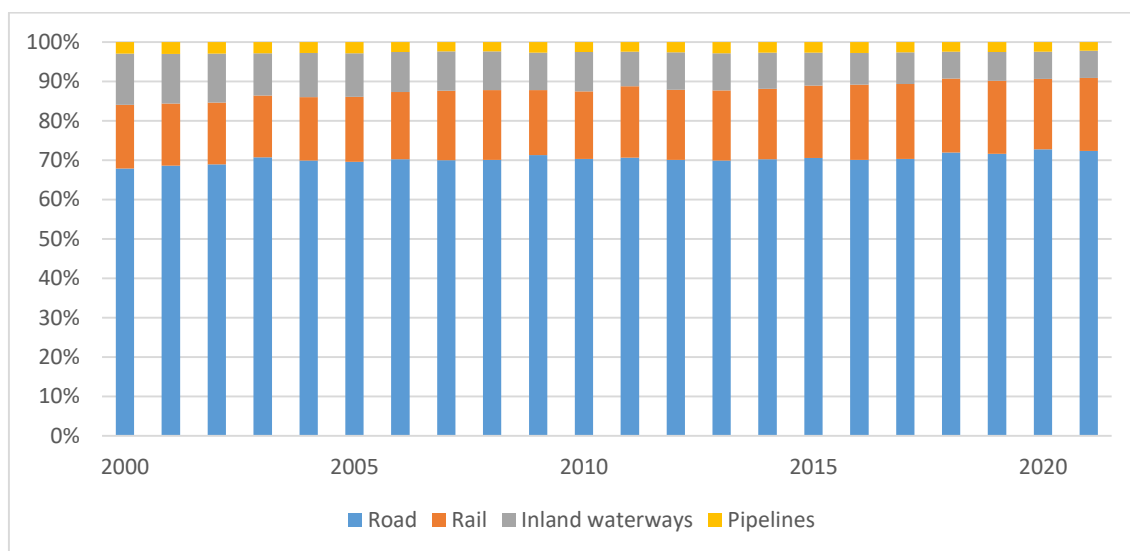


Figure 50: Modal split freight transport (Tonne-km) Germany (%) (Source: Transport in figures, BMVI)

Quality of service

When discussing the past development of rail's modal shares as well as the future potential of rail, quality of service plays probably the most important role for travellers and freight customers. In Germany, punctuality and reliability of rail passenger services have declined over time, constituting a major problem for traveller's satisfaction with the quality of service (figure 51): In long-distance passenger rail, one quarter of trains were not on time in single years, with single months showing even a worse performance than average figures (figure 52, which shows aggregated figures for all passenger trains).

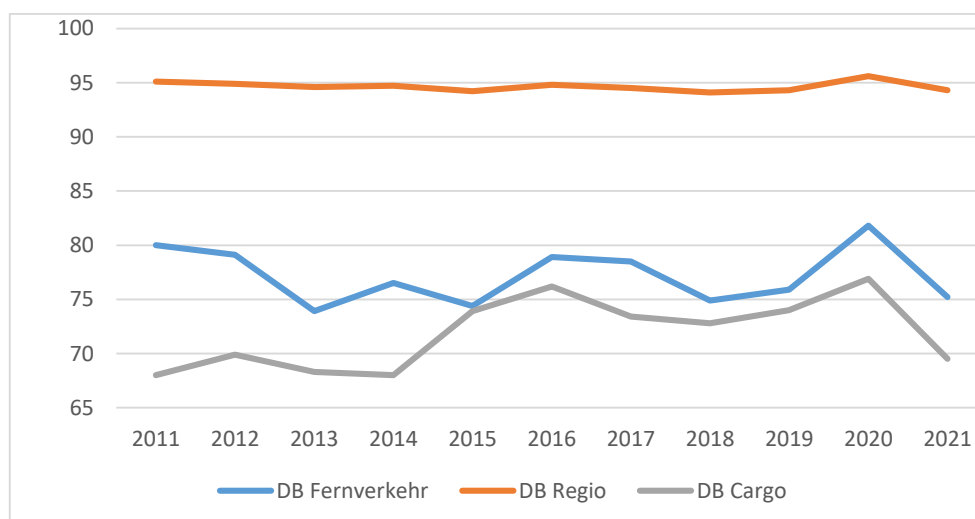


Figure 51: Punctuality of DB companies (%) (Business reports DB)



In regional rail passenger services, average figures indicate a higher punctuality, however, it has to be noted that performance differs considerably by regions. Figure 53 shows the example of the Berlin S-Bahn which has been coping with a serious crisis due to shortage in rolling stock, drivers and infrastructure failures since 2007/2008. Most striking is that although punctuality and reliability have improved since then and less trains have been cancelled, the share of train cancellations due to infrastructure-related problems has increased. This indicates problems with aging rail assets and insufficient maintenance and renewals.

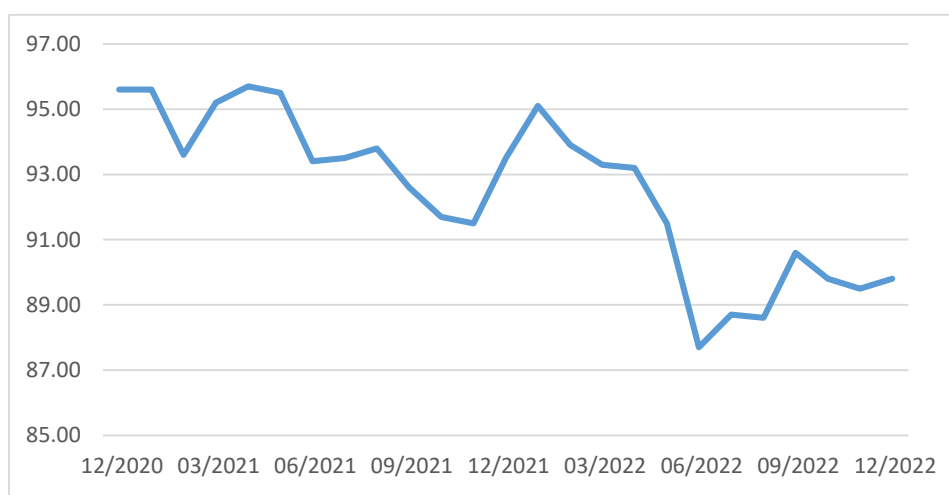


Figure 52: Punctuality of total DB passenger trains per month (%)
(Source: DB)

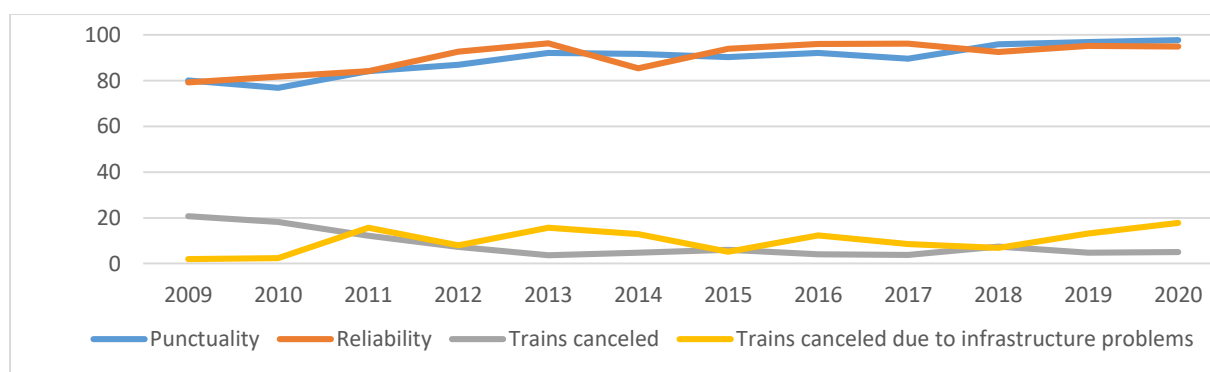


Figure 53: Quality of service: Punctuality, reliability and train cancellation at S-Bahn Berlin (%)
(Source: Quality reports VBB)



Rail capacity

A major problem of the German rail sector is shortage of capacity. The length of DB's network has declined continuously from 44 600 km in 1994, the year of the rail reform, to 33 400 km in 2021⁴⁶. There are several regional initiatives to re-activate routes, but this refers only to small increases in track capacity. While network length and thus capacity has been declining, transport demand both in passenger and freight has increased as shown in figure 47, implying both the aforementioned problems in the quality of service and crowding out effect of transport demand. Figure 54 shows as an aggregate indicator the ratio between train-km and available network-km. Capacity problems refer to various parts of the network. Out of these, DB Netz has declared 19 routes and 2 stations as over-utilised, based on the official procedure of the German Regulation Law (§55 ERegG). These over-utilised sections make up 731 track-km, which implies the second place of over-utilised rail tracks in the EU (see EU Commission, 2021).

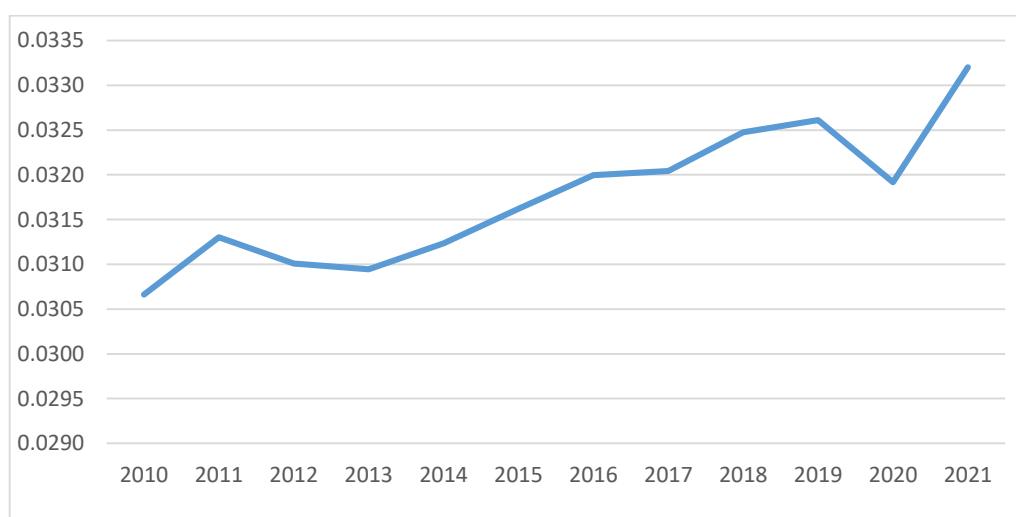


Figure 54: Overall Capacity utilization DB infrastructure – Train-km per Network-km (Source: Transport in Figures, BMVI)

The Railway Regulation Law (ERegG) requests infrastructure managers to take a series of measures to tackle capacity problems. First, congestion (or capacity) charges for over-utilised tracks have to be raised. If such surcharges cannot be raised, the infrastructure manager has to define prioritisation rules which adequately consider the welfare benefits of prioritised services compared to those services excluded from track use. For 2020, 17 prioritisation procedures were reported with an increase to 96 procedures in 2021, indicating a worsening capacity situation. Apart from prioritisation rules, the Railway Regulation Law obliges the infrastructure manager to perform a detailed analysis of capacity and to submit an action plan for capacity increase to the regulator. However, the decision on

⁴⁶ See BMVI/DIW/DLR: Transport in Figures, various issues.



measures to increase capacity is subject to the Railway Construction Law (Bundesschienenwegeausbaugesetz BSchwaG), and even more important, it crucially depends on the availability of funds in the federal budget plan. Apparently, the instrument of an action plan for capacity increase, as foreseen in the Regulation Law, does not meet at adequate financing, given that the list of over-utilised network sections has remained unchanged since 2008.

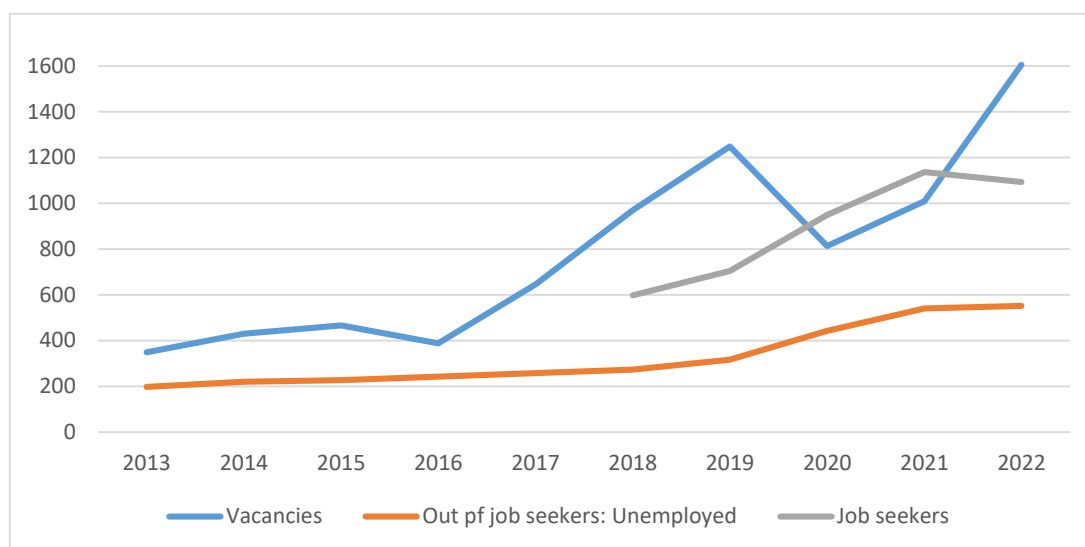


Figure 55: Staff situation in the rail sector – drivers of rolling stock
(source: Bundesagentur für Arbeit)

For rail cargo, there is the additional problem of a decline in siding tracks from more than 10,000 in 1994 to 2340 in 2021, even though since 2004 the federal government has been subsidising 50% of the construction costs for siding tracks, provided that a modal shift from road to rail can be expected. The financial volume of the subsidies amounts to €131 million for the period from 2004 to 2018 (BtDrSa, 2019). A second measure to cope with capacity problems of rail cargo is the so-called “740 m network”. It contains construction measures at around 70 stations to increase the length of passing tracks on the main rail freight routes in order to enable freight trains of 740 m to be passed by faster passenger trains. This program with a financial volume of around €680 million is part of the federal masterplan on infrastructure development⁴⁷.

Capacity is not only limited due to shortage of track slots but also due to lack of staff. Figure 55 shows as an example the development of vacancies and unemployment for drivers of rail vehicles. With the exception of the pandemic years 2020/2021, the gap between vacancies and unemployed drivers has been increasing, indicating one of the most serious problems in the sector (and in fact in many other

⁴⁷ Project-no 2-050-V01. For a detailed description see: https://www.bvwp-projekte.de/schiene_2018/2-050-V01/2-050-V01.html#h1_ergaenzung.



branches). This is reinforced by the age structure of drivers where staff aged above 50 years has meanwhile a share of 39% in 2021 (BNetzA, 2023).

	2011	2012	2013	2014
DB				
Investment subsidies	4 001	4 278	4 474	4 172
Out of these:				
Funding of infrastructure renewals (LuFV)	2 500	2 500	2 751	2 751
Other investment subsidies ¹⁾	1 024	1 237	1 019	934
Subsidies for rail crossings ²⁾	80	82	73	74
EFRE- funds ³⁾	111	168	160	70
EU funds for TEN ⁴⁾	57	61	143	32
Non-investment subsidies	4 275	4 327	4 274	4 346
Out of these:				
Subsidies for regional rail passenger services (PSOs) ⁵⁾	3 883	3 875	3 732	3 729
Bundeseisenbahnvermögen ⁶⁾	16	83	128	193
Total	8 276	8 605	8 748	8518
Non-DB companies				
Investment subsidies			55	n.a.
Non-investment subsidies	n.a.	n.a.	2 526	n.a.
Out of these:				
Subsidies for regional rail passenger services (PSOs)	1 744	1 870	2 120	2 128
Total⁷⁾	n.a.	n.a.	2 581	n.a.
¹⁾ Title 89 101 chapter Kapitel 1222. ²⁾ Title 74 501, 86 101, 88 201, 88 301, 88 303 chapter 1222. ³⁾ Title 89 104 chapter 1222. ⁴⁾ Title 89 103 chapter 1222. ⁵⁾ Figure is taken from business reports of DB Regio. ⁶⁾ Financial plan Appendix to chapter 1216. Balance of expenditures and revenues for active DB staff, borne by the Federal government. ⁷⁾ Figures refer to companies with reporting obligation to official statistics (Destatis). Sources: Federal Household (Reported expenditure), Business Reports DB Regio, Destatis, Calculations of DIW Berlin.				

Table 7: Governmental subsidies for DB and Non-DB companies 2011-2014

Financial performance and subsidisation

Public funding for rail transport in Germany is granted for two main areas, namely infrastructure investment funding and subsidies for regional rail passenger services⁴⁸. Within a study for the Federal

⁴⁸ In addition, in 1994 the state took over historic debts, it pays for difference between former DB's civil servant's salaries and market-usual salaries, backlog investment demand in East Germany, pension liabilities as well as environmental burden compensations. Furthermore, the state subsidises price reductions for disabled travellers and for school buses.



Environmental Agency, Link et al. (2017) have extensively analysed the household expenditures of the Federal government and the 16 Federal states with the aim to quantify all governmental expenditures for both DB and non-DB companies. There is no update of this comprehensive study available, but even though the figures refer to the period from 2011 to 2014, one can assume that the general structure of expenditures has remained stable over time. As table 7 shows, the subsidies for DB are at equal shares distributed between infrastructure investments and other expenditure, with a slightly increasing share of infrastructure investment subsidies. Out of the non-investment expenditure, the by far largest part falls on subsidies for PSOs. For non-DB companies the picture is different: In 2013, the only year with figures available, only 2% were granted as subsidies for infrastructure investments and the by far largest share refers to subsidies for PSO contracts.

Subsidies for infrastructure

To start with infrastructure funding, the general rule is that the Federal government finances investments for construction and replacement of tracks in form of investment subsidies while DB has to cover the cost of operation and ongoing maintenance, as well as all investment costs for new rolling stock. New investments are based on the Federal Masterplan for Government Infrastructure (BVWP) and are subject to project appraisal such as CBA, analysis of regional impacts, environmental compatibility analysis etc. For renewals of the existing infrastructure, the level of spending is subject of long-term contracts between the Federal government and DB (so-called Leistungs- und Finanzierungsvereinbarung – LuFV), with meanwhile the third contract since 2009. Within these multi-annual contracts, the government finances an annual amount for renewals while DB Netz has to contribute with an own (by far smaller amount to renewals) and to spend an agreed annual amount for ongoing maintenance, based on an obligation to guarantee a defined quality level of infrastructure. The requested quality level is operationalised through quality indicators referring to the status of tracks, of stations and the security in providing electric traction.

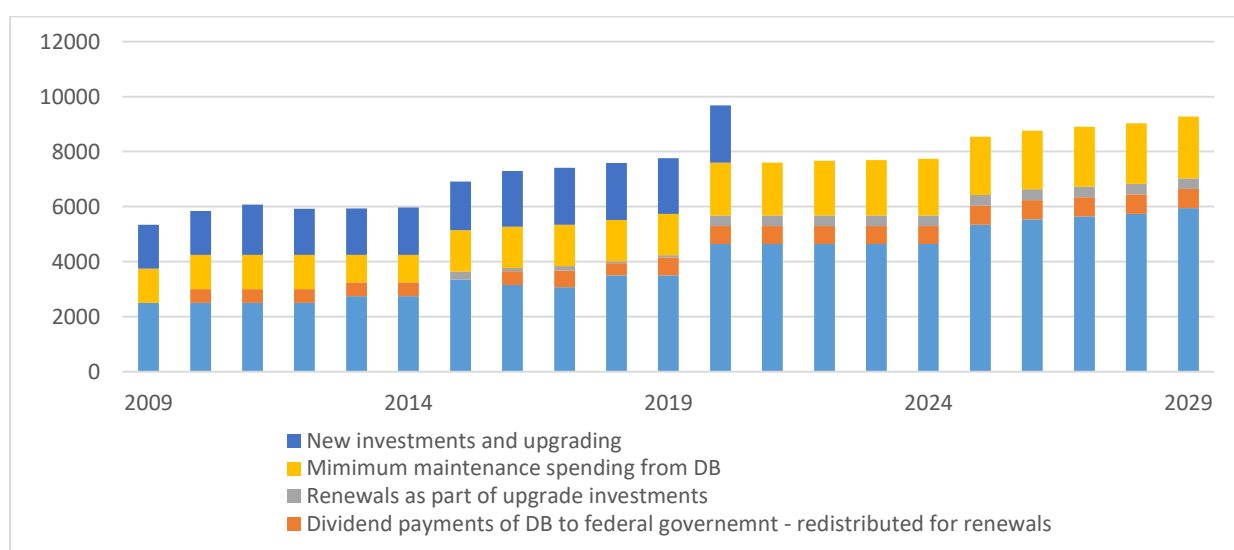


Figure 57: Infrastructure financing DB – governmental subsidies and DB's maintenance spending (Million €) (source: LuFV, Verkehrsinvestitionsbericht BMVI)



Figure 57 details the subsidies for infrastructure financing of DB. With a mature rail network, the major task is to fund renewals and maintenance of the existing network. The current financing agreement LuFV III foresees an impressive governmental spending volume of €86 billion for the period from 2009 to 2029. However, two issues need to be considered: First, DB has to spend a minimum annual amount of €1.9 billion for ongoing maintenance out of own resources with an increase to up to €2.2 billion in later years. Second, the nominal figures in this financing agreement are not adjusted to the rather drastic increase of construction prices and imply in fact a decline of governmental spending in real terms. Table 7 also shows the investment subsidies for new construction and upgrading until 2020; figures from 2021 onwards are not yet available and the peak in figure 8 should therefore not lead to misinterpretation. In 2020, governmental expenditure for new investments and upgrading totalled at around €2 billion underlining the fact that by far more funds have to be spent for maintenance and renewals of existing infrastructure.

Subsidies for regional rail passenger services

As indicated above, the second-largest block of governmental subsidies is granted for PSOs in regional rail passenger services (RRPS). The franchising approach for these subsidised RRPS, introduced in 1996, has widely been considered as successful in terms of cost savings, service provision and patronage (see Link and Merkert, 2011; Nash et al., 2013; Link, 2016, 2019). There was a decline in operating subsidies per train-km demonstrating a more efficient use of funds to provide services which can be attributed to the provision of services by non-incumbent companies at lower costs on the one hand, and to an increased productivity of the incumbent Deutsche Bahn (DB) due to competitive pressure. Subsidies per passenger-km have even more fallen suggesting an increased use of services by travellers. Until the COVID pandemic, passenger-km in RRPS have increased more than train-km, however, this has also led to overcrowding in particular in the conurbations. As everywhere in the world, in 2020/21 the fall in passenger-km was drastic (about 40%). In 2022 a recovery took place, not least due to the 9Eurpo ticket, but without reaching the pre-pandemic level.

The total governmental subsidy for RRPS has been increased several times in order to account for increases in track access charges and staff costs, and lately for compensating losses of operators due to the pandemic during 2020-2022 (so-called COVID Rescue Fund) as well as for compensating the increase of energy prices. In 2022, about €8.9 billion and in 2023 about 9.1 billion € are spent for subsidising RRPS.

Subsidies related to losses during the pandemics

As a response to the pandemic-related financial problems, a number of single subsidisation measures were decided. A systematic review is out of scope of this paper, and it should also be noted that some measures were already in force as part of the climate protection package. To start with, in January 2020 the VAT on long-distance rail tickets was reduced by 50%, a measure that was part of the so-called “Climate Protection Package”. Within this package, also starting in 2020, the regionalisation funds were increased by €150 million. In order to support the rail sector which suffered from March 2020 onwards from the drastic fall in patronage, the aforementioned “COVID Rescue Fund” was introduced. It contained a set of financial measures such as a further increase of the regionalisation funds, financed at equal shares by the Federal government and the Federal states. This financial



support for the period 2020-2022 made additional funds of around €9 billion available. An additional €1 billion for 2022 has been agreed upon in the Eighth Revision of the Regionalisation Law, with an annual increase by 3% from 2023 until 2031. Furthermore, the €9 ticket which required a subsidy of €2.5 billion was financed under the revised Regionalisation Law.

A heavily debated subsidisation measure was the originally planned state aid of €5 billion to increase DB's own capital. After refusal of this state aid by the Competition Directorate of the European Commission, the Federal government decided to permit an increase of DB's debt limit from originally €25 billion to 32 billion.

Further subsidies were granted to reduce track access charges. Already since 2018, rail freight has benefited from a reduction of access charges by around 47% with an annual state subsidy of €350 million to DB Netz for compensating the loss of income. Within the COVID package, the Federal government compensated DB Netz for a reduction of track access charges both for freight and long-distance passenger trains by even 98% (!) in 2020 and 2021. Track access charges for regional rail passenger services were not reduced since they are passed through to the PTAs as part of the service contracts and are paid from the (increased) regionalisation subsidies.



6.3 Ongoing debates and conclusions

Already before the outbreak of COVID, the envisaged strong role of the rail sector for achieving the climate protection was contradicted by the problems of the sector such as the increase of DB's debts, the decrease of quality and shortage of capacity and staff and the insufficient public funds to finance the necessary renewals as well as capacity expansion. The COVID pandemic has intensified both these problems and the related policy debate.

One of the most important policy measures currently under discussion is the merger of DB's infrastructure companies DB Netz, DB Station & Service and DB Energy into a new company called InfraGo. This new company, which is planned to be founded at already in 2024, shall have a welfare-oriented, not-for-profit approach in contrast to the current DB infrastructure companies. Amongst the proposals which are under discussion is a revision of track access charges which shall be based on marginal costs (proposal of Mofair, see Mofair, 2022).

Against this background and summarising up the problems discussed in the previous sections, it can be concluded that solving three main problems will be crucial:

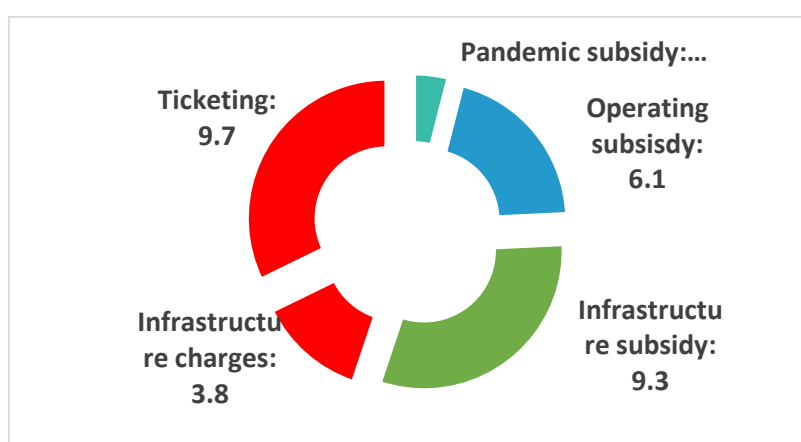
1. Insufficient funding of existing capacity and capacity increase despite of a considerable volume of governmental subsidies. It goes beyond this paper to discuss how this funding can be guaranteed. What comes clear from the 2020/2021 rather erratic subsidisation policy is that a more systematic approach to subsidisation policy is needed, with clear goals and justifications for governmental spending, as well as appropriate monitoring.
2. Limitations to increase capacity by the construction of new routes due to citizens' resistance against new infrastructure projects in a densely populated country like Germany. This indicates foremost the need to use the existing capacity more efficiently, and to improve planning and realisation of already decided expansion projects.
3. Lack of staff in most of the relevant areas such as drivers of rail vehicle and staff for maintenance and construction. Given that this appears to be a general problem in a society with an increasing share of academic education and the respective employee structure, a concept is needed to for attracting young people also for non-academic occupations.



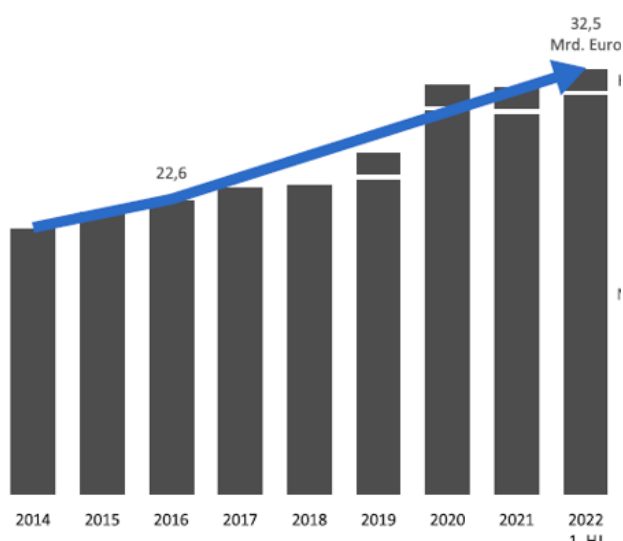
Box 7: Key figures of the German Court of auditors

The report of the German Court of Auditors paints a bleak picture of the railway situation in Germany and in particular of Deutsche Bahn, the incumbent operator. The main findings can be summarised in 4 figures.

The first figure compares, for the DB and the years 2019-2021, resources from commercial revenues (ticketing and infrastructure charging) and those resulting from public subsidies. The latter amounted to an average of €16.6 billion per year compared to 13.5 for the former. This signals a growing dependence on public funding.

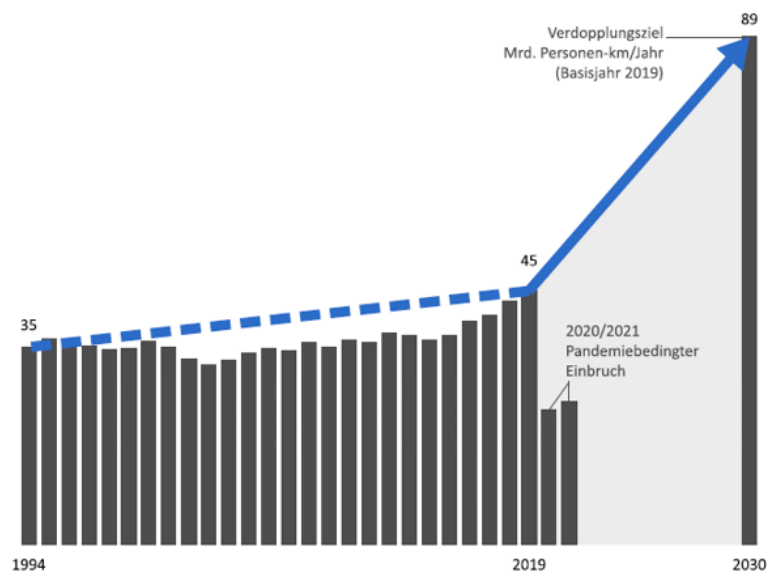


The second figure shows the growth of DB's debt, which increased by €10 billion between 2016 and the first half of 2022. To reduce this debt, the report recommends selling subsidiaries such as Arriva and even DB Schenker, which yet represents half of DB's profits.

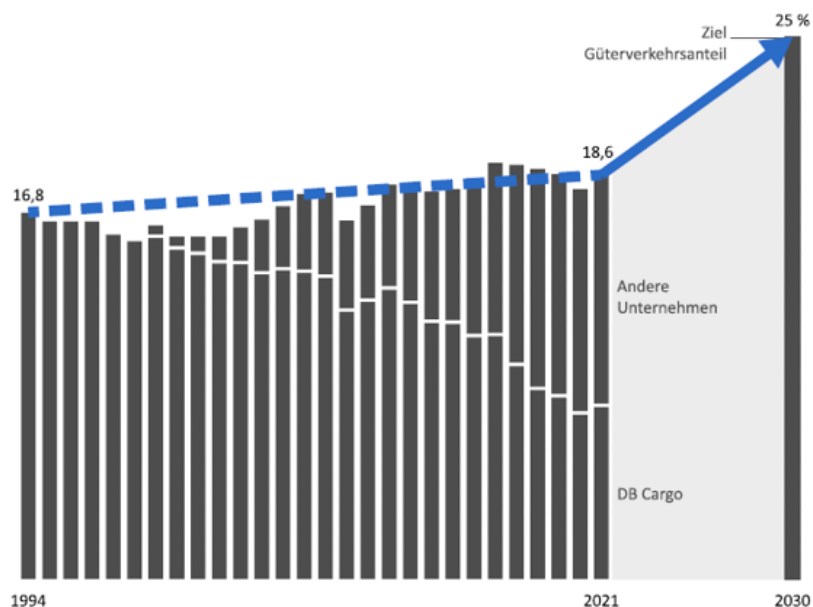




The third figure focuses on forecasts of long-distance rail passenger traffic, all operators combined. The increase from 45 to 89 billion passenger-km in 11 years is described as unrealistic.



The fourth figure does the same for freight traffic. Increasing the rail market share from 18.6 to 25% in ten years seems very optimistic.





7.OVERALL CONCLUSION

In the rail sector, Belgium, France, Germany and Italy have many points in common. Although the geography of the countries differs, leading to different roles respectively for freight and passenger traffic (regional or long distance), the problems faced by rail are similar. Thus, in the four countries, a consensus exists on the need to develop rail, passenger and freight traffic. For this, the public operator, sometimes in a monopoly position, is part of a great national ambition: to accelerate the decarbonisation of transport.

For this, large sums are required, both to modernise the network and increase its capacity and to support the operating expenses of daily mobility trains. But everywhere, the public decision-makers are facing a huge financial challenge.

Thus, in France, the performance contract signed between the State and SNCF-Réseau provides for significant sums for the regeneration of the network, nearly €3 billion per year. But many, and in particular the Transport Regulatory Authority (ART), underline the de facto inadequacy of the resources allocated. Even with the new programme announced at the end of February 2023 (1.5 billion more per year for the regeneration and the modernization), some uncertainties remain, as there is no earmarked revenue for recurrent railway expenditure, a budgetary sword of Damocles hangs over railway projects. In other words, it is likely that the announcement effects will not all materialise or that they will be at a distant time horizon.

The situation is similar in Belgium. The government's ambitions are great, but the infrastructure manager Infrabel and operator SNCB had to wait years before a multi-year contract was offered allowing them to define their strategy. In addition, the funds promised to remain limited, and part of the new resources will have to be funded by passengers, via uncertain tariff modulations.

Things look different in Italy and Germany. In these two countries, significant public funds have been targeting rail, and more specifically the financing of infrastructure. But the results in terms of modal shares and reduction of CO2 emissions remain uncertain.

In Italy, thanks to funds received from the European Union, the network of high-speed lines will be extended to destinations on the peninsula that are not currently served, as well as for the Alpine crossings to Austria and France. However, as high-speed rail represents only a small part of passenger traffic, its development will only play a marginal role in the decarbonisation of transport.

In Germany, given the difficulties encountered in recent years (delays, aging rolling stock and infrastructure, lack of network capacity, etc.), significant funds will be invested to upgrade the network. It is a reasonable choice as it seeks to address the most pressing issues. But its main effect will be to preserve the modal share of rail, not to make it progress significantly.



There is therefore a great risk that the rail promises that accompany the climate commitments will only partially materialise, just like those made at the turn of the century. This situation stems from an insufficient analysis of what the Green Deal means in terms of mobility regulation. On a European scale, as in most countries, GHG emissions from transport are expected to decrease rapidly via technical measures (electrification of vehicles) and thanks to a modal shift facilitated by public aid for infrastructure and public transport. These measures are necessary, but they do not take into account the diminishing returns to public spending and therefore their modest impact on the modal shift.

As a result, it is not surprising to observe that the European Environment agency is not very optimistic in its projections about CO₂ emissions of transport in Europe⁴⁹. With existing measures (upper curve) the level in 2040 will be hardly below the level of 1990. With the additional measures (second curve) 2030 emissions would reach a level of 6% below 1990 levels.

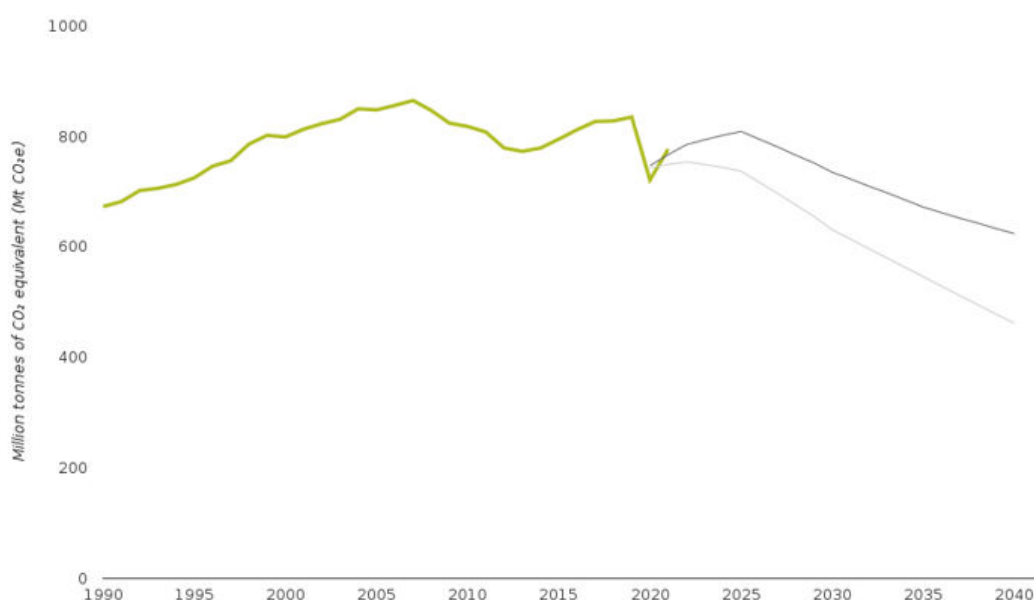


Figure 58: Greenhouse Gas Emissions from Transport in Europe

<https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport>

This result, far from the “Fit for 55” objectives, can be explained by the fact that CO₂ emissions will remain at a high level, not only for domestic and international aviation, but also for domestic navigation and international maritime transport, and even for rail transport. Road transport is the only mode where a reduction is expected, about – 40% with additional measures. But even this objective will be difficult to reach.

⁴⁹ The CO₂ emissions of transport are calculated from Tank to Wheel (TTW) and not from Well to Wheel (WTW). The emissions from Well to Tank (WTT) are integrated to other activity (energy, industry...). As a consequence, the CO₂ emissions of an electric vehicle (train, car...) are zero even if it is not true from a scope 3 perspective.



For instance, in Germany, in 2022 the emissions of transport were 148 million tons of CO₂ equivalents, 1.1 million tons (0.7%) above the 2021 figure, and around nine million tons above the annual emission quantity of 138.8 million tons of CO₂ equivalents allowable in the Federal Climate Change Act for 2022⁵⁰.

In France, according to the most recent data from CITEPA⁵¹, transport emissions in 2022 were 129 million tons of CO₂, compared to 126 in 2021 (+2.3%). Compared to the level reached in 2018 (137 million tons), before the pandemic, this represents a downward trend of -1.5% per year, twice less than the objective set by the national low-carbon strategy. The situation is the same in Belgium and Italy. After the lockdowns and the pandemic, CO₂ emissions from transport started to rise again in 2021 and 2022 as in all European countries.

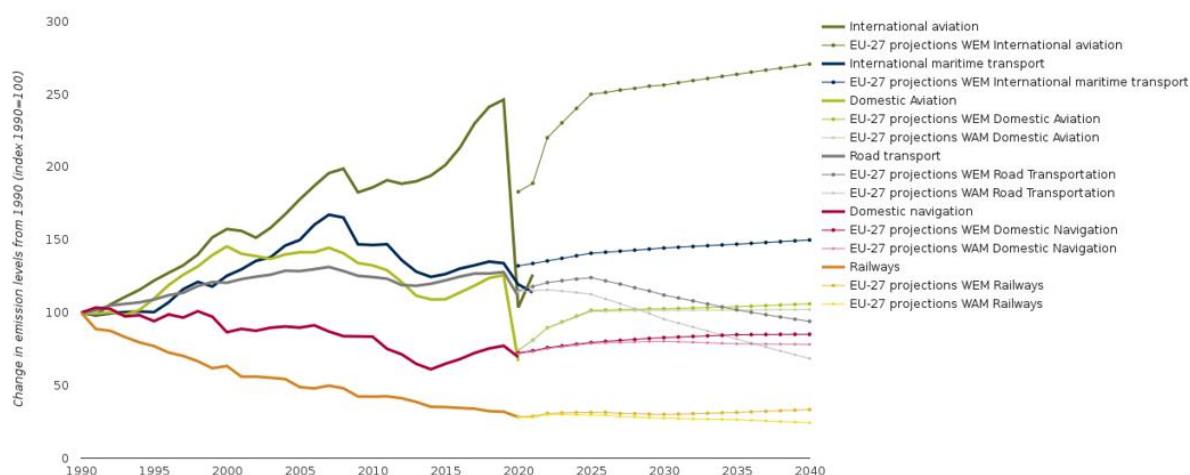


Figure 59: Greenhouse Gas Emissions from the main modes of transport in Europe
<https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport>

This means that to achieve their GHG emission reduction targets, other measures will be necessary. A particular effort will have to be made for the mode responsible for more than 80% of CO₂ emissions from transport, namely road. It is for this reason that, paradoxically, at the end of this report on the future of rail, our **findings and our main recommendations**, ten in number, do not concern rail transport alone. They can be synthesized as follows:

- 1) Rail transport being the lowest emitter of greenhouse gases, in absolute value (million tons) as well as in relative value (gram per passenger.km), it must be developed,

⁵⁰ <https://www.umweltbundesamt.de/en/press/pressinformation/uba-forecast-2022-greenhouse-gas-emissions-down-19>

⁵¹ <https://www.citepa.org/fr/barometre/>



especially since it is also virtuous in terms of safety and pollution. But the modal shift to rail is not self-evident.

- 2) In terms of modal sharing, we must be wary of the principle of substitution, which suggests that each additional passenger or ton on the rail would be a passenger or ton less on the road. Transport is not a closed world where the gains of some are the losses of others. What has been observed for decades is the progression, more or less rapid, of all traffic.
- 3) Climate commitments could therefore lead us to curb the development of certain types of traffic, in particular those that emit the most CO₂.
- 4) Rail transport could escape this logic of rationing, but it comes up against another scarcity, that of public funds. Rail is in fact increasingly dependent on public funding, both for infrastructure and for operations. Productivity gains are needed to avoid increasing diminishing returns to public spending on rail. Opening up certain services to competition can in some cases be a solution to this problem, but it is not a magic wand.
- 5) To develop, rail transport therefore needs new financial resources, which can only come marginally from customers (passengers or goods). To guarantee sustainable revenue, public resources must be permanently allocated to it.
- 6) As a consequence of the polluter-payer principle, these revenues can come from environmental taxes (see figure 60 below). The external costs of transports are growing more rapidly than the traffic. Therefore, especially in dense areas, there is an opportunity to collect a high level of taxes. It is also the case for the taxation of greenhouse gas emissions. In several European countries, there is a carbon tax. When this is not already the case, it could be allocated, in whole or in part, to rail transport. The same could happen in the future with the carbon quotas of the European ETS market since in the long-term they will no longer be free.
- 7) There are fuel taxes in all European countries. On the scale of the European Union, they represent more than 200 billion euros. The earmarking of this tax resource varies from one country to another, but part of it could benefit rail transport. But this approach must be part of a broader reflection on road taxation and pricing and direct earmarking of these resources.
- 8) In the decades to come, the road will remain, for passengers as well as for goods, the main vector of transport. As it will also remain a major CO₂ emitter, its use must be regulated more strictly. Beyond the regulatory measures already in force (maximum speed, environmental and social standards, etc.), price regulation is necessary. On the



one hand to reduce the pressure of demand on a sometimes saturated road network. On the other hand, pricing releases resources, part of which could be used for rail.

- 9) Three forms of road pricing already exist, they could be more widely mobilised both to control demand and to free up resources: taxes on fuel and on CO₂ emissions; user fees which should be extended with the implementation of the new Eurovignette directive; rights of access to urban areas which could be coupled with “mobility passes” integrating the various urban mobility services in a logic of Mobility as a Service (MaaS).
- 10) Rail financing and its ability to attract new customers will depend on the public funds that will be allocated to it, but also on changes in the regulation and pricing of road use.

These recommendations are part of a perspective based on the idea that the regulation of mobility will gradually enter a new era illustrated, by simplifying things, by the figure below, which can be read clockwise. For decades, transport policies have mainly been governed by the **administered economy**, through regulations, standards and subsidies. For the latter, the price to pay is sometimes high, as we have pointed out for the railway.

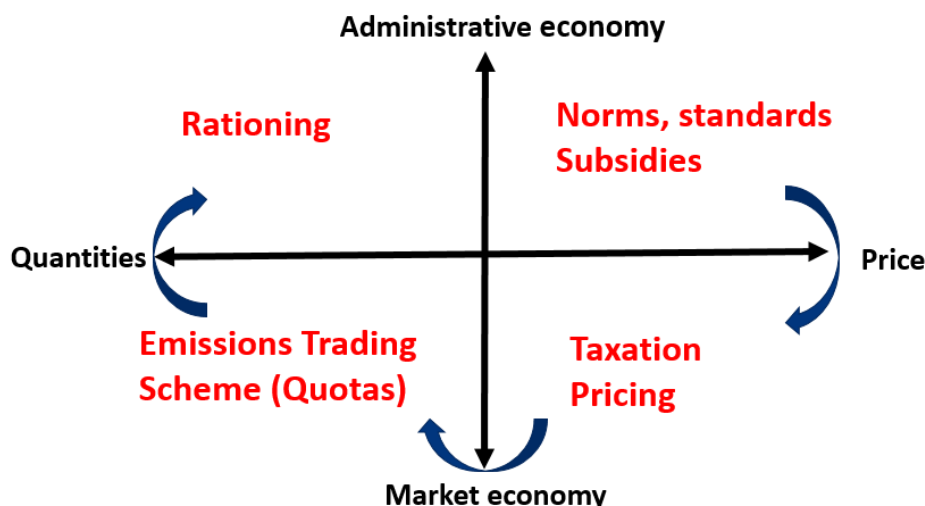


Figure 60: CO₂ emissions and the regulation of mobilities

There are also **taxes**, particularly on fuel, and sometimes a tariff that the user must pay. Part of our recommendations aim to strengthen this mode of regulation by bringing mobility into market logic. The problem is that in the face of climate commitments, the only action through prices is limited. This is the reason why the EU has set up regulation by quantities via a system of **tradable allowances (ETS)**. It already works for industry and will gradually be extended to air, sea and road transport. Like fuel



taxes, this system will ultimately provide resources. We therefore propose that some of them be directed towards rail.

The last quadrant of Figure 60 is not explicitly on the public policy agenda, but it has appeared in some cases as an ultimate solution. For example, to drastically reduce automobile access to the densest urban areas. If climate commitments cannot be kept in the years to come, it may be necessary to consider certain forms of **rationing**, in particular for the modes that emit the most greenhouse gases. This is a very sensitive issue politically, but it is necessary to mention it.



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