

The CER Essay series

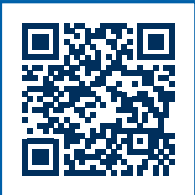
Where academic analysis
meets business insight

High speed rail as a strategic tool for achieving European Transport policy goals: smart, integrated and sustainable mobility

by Professor Oliviero Baccelli,
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CER Essays

The CER Essays initiative features a series of essays that show the rail sector as contributing not only to EU transport policy, but touching on different aspects of society at large. Topics covered by the initiative will range from modal shift, climate policy, infrastructure investment, high-speed rail, demography and more. Each essay will feature a different topic and be co-authored by a CER member CEO and a leading academic from the same country and will be used to spark debate among political stakeholders on the role of rail in the EU.



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He has over twenty-five-years' experience in the fields of research, consultancy, and

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In 2015, he was appointed by the Italian Presidency of the Council of Ministers as an independent member of the board of directors of TELT (Tunnel Euralpin Lyon Turin). In 2017 and 2020, he was appointed by the Mayor of Milan as an independent member of the board of directors of ATM, a Public Limited Company owned by the City of Milan in charge of managing the public transport system within the Milan metropolitan area, as well as the Copenhagen metro. He is also a Senior Advisor at PTS, a consultancy and advisory firm based in Milan, Rome, Verona and Trieste.



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Ferraris began his career in auditing at PriceWaterhouseCoopers; he later held several management positions in major Italian and international companies, such as Agusta, Piaggio VE, Sasib Beverage, Elsang Bailey Process Automation and Elsamcom (two subsidiaries of the Finmeccanica Group).

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Executive Summary

According to the 2022 UIC High Speed Rail Atlas, the European high-speed rail (HSR) network consisted of 11,990 km at the end of 2021, with 3,062 km under construction, 5,913 km planned, and 3,316 km foreseen over the long-term. From 2012 to 2021, European countries increased the total length of their HSR lines in operation by 36%, equal to 3,203 km, thanks to the inauguration of new lines in nine different countries. This value only amounts to 8.3% of the total new HSR lines inaugurated around the world during the same period. At the end of 2012, the European network constituted 43% of the total HSR length at the global level, while at the end of 2021 this value had declined to just 20%, thus highlighting the low average pace of Europe's HSR development compared to the rest of the world, mainly due to the fast expansion of HSR in China¹.

The European goals of doubling high-speed passenger traffic by 2030 and tripling it by 2050 compared to 2015² are ambitious targets. Doubling rail high-speed traffic by 2030 would require a 75% increase in high-speed infrastructure, with the clear ambition of connecting all the European capitals and major cities³. Therefore, the challenges posed by climate change, increasing urbanisation, and the ambition to achieve European technological leadership and strategic autonomy require a convergence of the efforts made in both the infrastructure and services sectors. Supporting high-speed rail development with a shared vision of mobility system transformation, will require more cross-border projects. Smooth interconnections for cross-border rail travel across Europe will be needed to integrate all Member States into the

European rail system of the future, while at the same time ensuring that the sustainability and inclusion goals are met.

While infrastructure is the main prerequisite for a successful HSR system, regulation also plays an important role, and, over the past decade, European Union interventions have been crucial for exploiting all the potential benefits offered by HSR services. In Italy the effects have been particularly positive in terms of increased traffic, reduced transport costs, flight substitution, and mitigation of the environmental impacts of transport, also thanks to the development of particularly efficient railway infrastructures, modern regulation systems, and competition between operators.

EU and national governments should actively facilitate and stimulate HSR market development, eliminating any technical and regulatory barriers that could reduce the potential benefits of competition, with price reduction, quality enhancement, and organisational and technological innovations underlining the importance of the open market.

An accelerated migration toward the ERTMS (European Rail Traffic Management System) is essential and strategic, considering the benefits that the system provides in terms of safety, improved interoperability, and increased performance, efficiency, and energy savings. The Connecting Europe Facility (CEF) budget should be rendered available for developing such implementation pilot studies, including the on-track and on-board ETCS (European Train Control System).

Doubling rail high-speed traffic by 2030 would require a 75% increase in high-speed infrastructure, with the clear ambition of connecting all the European capitals and major cities

¹ 2022 UIC High Speed Rail Atlas

² European Commission Communication "Sustainable and Smart Mobility Strategy – putting European transport on track for the future" COM (2020) 789 final

³ Community of European Railway and Infrastructure Companies (CER) - Need for high-speed: setting the scene for a European High-Speed Rail Network – 12 July 2022

In general, digitalisation is the way to make HSR mobility more attractive and easier to use, and to render the service more efficient overall. In addition to ERMTS, Digital Capacity Management, harmonisation of ticket sales, and Mobility as a Service (MaaS) are the technical tools that can generate positive spill overs for operators and customers, and will also encourage collaboration between air and rail operators. This collaboration is mainly based on joint infrastructure planning for efficient HSR stations at airports but is also favoured through integrated services that support automation and digitalisation (especially necessary for passengers with luggage).

The role that HSR services play in improving the accessibility of major cities in terms of time and cost savings compared to air transport is clear for journeys of up to 600-800 km at the EU level, while the improvement of the environmental performance levels of EU mobility due to HSR services as a replacement for air travel is always evident, regardless of the distances travelled. Integrated services should be supported, with general short-haul flight bans being introduced where an efficient HSR alternative is available, as has recently happened in France.

Italy has a specific investment plan in place to promote complementary air/rail services, to strengthen the intermodal system, and to improve the level of service offered to users. The most ambitious Italian projects concern the country's four largest international airports: Rome Fiumicino, Milan Malpensa, Bergamo, and Venice. These projects increase overall accessibility at the national and international levels, in part thanks to the expansion of the land catchment areas of the airports with low emission accessibility.

There is a considerable need for investments in order to meet the EU modal shift targets, and we are aware that the rail sector cannot rely on the budgets of the Member States alone. Increased rail capacity and enhanced connections at the Corridor level must be supported when meeting the Trans-European Transport Network (TEN-T) rail targets, providing European added value, with proper and sufficient funding, from both the public and private sectors, in order to ensure the timely completion of the rail network and the cross-border infrastructure projects. To this end, the next EU financial framework should still cover the TEN-T infrastructure beyond the current 2021-2027 budget, including the Connecting Europe Facility (CEF).



Alberto Mazzola

CER Executive Director

Rail has substantial potential to decarbonise the mobility sector, generate innovation, reduce congestion, and increase the quality of life of Europeans

Introduction

Rail is an essential part of the solution to some of Europe's most pressing mobility challenges. Moving forward with the completion of a modern European railway network will strongly support Europe's ambitious transport policies, as highlighted in the EU Council Conclusions (Rail at the forefront of smart and sustainable mobility) adopted by the EU transport ministers in June of 2021.

The European Green Deal aims to set European transport on a path towards full decarbonisation by 2050. It also specifically mentions the goal of supporting a modal shift of passengers and freight to rail, putting in place effective tools to implement the 'user pays' and 'polluter pays' principles, and ensuring proper funding for clean mobility and other supporting measures.

From a well-to-wheel perspective, rail has a much lower carbon footprint than other modes of transport, and has the potential to be powered entirely by renewables. For instance, NS Dutch railways already relies 100% on renewables, thanks to a power purchase agreement for wind energy and Eurostar aims to achieve the use 100% renewables by 2030. FS Group has the goal of producing 40% of the electricity needed for the Italian railway system by 2031 thanks to renewable power plants.

Rail has substantial potential to decarbonise the mobility sector, generate innovation, reduce congestion, and increase the quality of life of Europeans, thanks to the possibility of increasing accessibility in a safe and inexpensive manner. This potential is underlined by Connecting Europe Facility (CEF) Programme⁴. The European goals

of doubling high-speed passenger traffic by 2030 and tripling it by 2050 are ambitious but future transport demand and other industry trends, from the infrastructural, technological, organisational and commercial points of view, must also be considered. Since aviation activity is also projected to double by 2050, a thorough assessment of short-haul flights is also needed, considering a regulatory framework on carbon pricing and energy taxation. With the existing high-speed rail lines, it is not feasible to achieve such targets and doubling rail high-speed traffic by 2030 would require a 75% increase in high-speed infrastructure⁵. Therefore, the challenges posed by climate change, increasing urbanisation, and the ambition to achieve European technological leadership and strategic autonomy require a convergence of the efforts made in both the infrastructure and services sectors, in order to support high-speed rail development.

The proposed revision of the Regulation on the Trans-European Transport Network (TEN-T) sets new ambitious infrastructure targets. We at CER believe the Commission proposal represents a considerable improvement and support several elements, such as connectivity and development of regions, including last mile-connections, multimodality, and enhanced urban nodes and connections with third countries. However, the proposal is not ambitious enough regarding high-speed rail, as the plans are limited, and with no clear European dimension. Most high-speed connections are national, and there is no clear plan to link up all the national high-speed "islands" to form a continental network, and we therefore call for a high-speed rail network connecting all the European capitals and major cities.

⁴ The Connecting Europe Facility (CEF) is a key EU funding instrument for promoting growth, jobs, and competitiveness through targeted infrastructure investments at the European level. It supports the development of high performance, sustainable, and efficiently interconnected trans-European networks in the fields of transport, energy, and digital services. CEF investments fill the gaps in Europe's energy, transport, and digital backbone.

⁵ Community of European Railway and Infrastructure Companies (CER) - Need for high-speed: setting the scene for a European High-Speed Rail Network - 12 July 2022



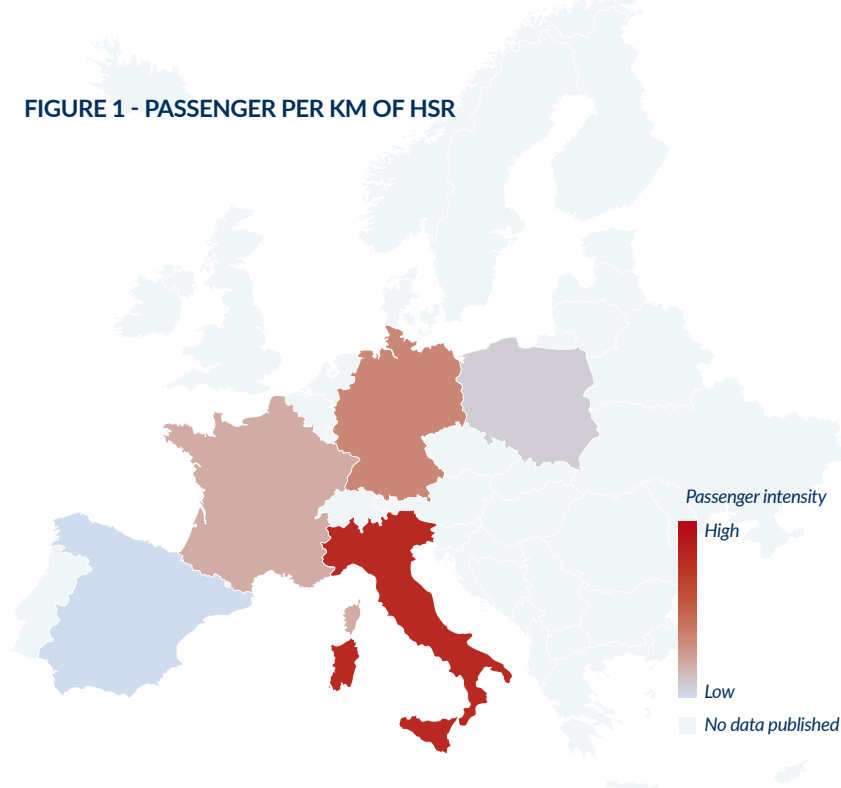
The development of European HSR

During the past decade, the speed of European HSR extension has been limited and concentrated in the South Western part of the EU. According to the 2022 UIC High Speed Rail Atlas, the HSR network in Europe consisted of 11,990 km at the end of 2021, with 3,062 km under construction, 5,913 km planned, and 3,316 km foreseen over the long-term. The HSR experience in Europe began in Italy in late 1970s, with the first Pendolino (tilting) train for public service, and with the first section of the Rome-Florence line being inaugurated in February 1977. Immediately afterward, France, Germany, and later Spain (in the late 1980s) launched their own HSR projects. From 2012 to 2021, European countries increased the total length of their HSR lines in operation by 36%, equal to 3,203 km, thanks to the inauguration of new lines in nine different countries. This value only amounts to 8.3% of the total new HSR lines

inaugurated around the world during the same period. At the end of 2012, the European network constituted 43% of the total HSR length at the global level, while at the end of 2021 this value declined to 20%, thus highlighting the faster pace at which HSR is spreading in other parts of the world, above all China (with over 40,000 km at the end of 2021).

Among the countries listed above, Spain has reached a total length of 3,661 km, by far the longest HSR network at the European level. During the same decade, France increased the length of its HSR network by 681 km, for a total length of 2,724 km, with Germany having 1,571 km, and Italy having 921 km. In 2022, these countries jointly accounted for 74% of the HSR lines at the European level.

FIGURE 1 - PASSENGER PER KM OF HSR



Source UIC Atlas, High-Speed Rail 2022

Despite having a shorter HSR network, Italy by far has the greatest passenger intensity, with over 64,000 passengers per kilometre of HSR line, thanks to the high frequency Frecciarossa, and a considerable high load factor (Figure 1).

Currently, Eastern European countries have a limited expanse of HSR lines, but major international projects will be in operation by 2032, such as the 360 km Brno-Prague-Dresden line between Germany and Czech Republic, and the 1,218 km Rail Baltica line between Estonia, Latvia, Lithuania and Poland. The 870 km Rail Baltica line traversing the Baltic countries will also include four new stations at the region's main airports, thus underlining the importance of air-rail planning.

The development of the HSR network in the EU has improved the competitiveness of railways and has contributed to transnational connectivity. It is a crucial part of the EU transport policy, and has achieved positive results, such as the following:

- Increased environmental and operational efficiency on medium- and long-haul journeys, generating new opportunities for travellers;
- Significant diversion of air and road traffic to rail and to corridors served by HSR, as has been well noted in Italy between Rome and Milan (other examples include Paris-Lyon-Marseille; Madrid-Barcelona; Munich-Berlin, and Paris-Brussels-Amsterdam);
- Development of the regional economy within the context of the HSR stations (as is the case of the Reggio Emilia Mediopadana station in Italy along the Milan - Bologna HS line);
- Standardisation of the tracks, vehicles, and control systems;
- Internationalisation of high-speed rail services, as demonstrated by Trenitalia's Frecciarossa operating between Italy and France (as well as the TGV and ICE for cross-border connections between France and Germany, Eurostar for connections between France, Belgium, the Netherlands and Germany, and Renfe-SNCF between Spain and France), and the emergence of pan-European "domestic" players, once again including the Trenitalia Frecciarossa, which is now active on the domestic markets in both France and Spain.

While infrastructure is the main prerequisite for a successful HSR system, regulation also plays an important role, and, over the past decade, European Union interventions have been crucial for exploiting the potential benefits offered by HSR services.

EU and national governments should actively facilitate and stimulate HSR market development, eliminating any technical and regulatory barriers that could reduce the potential benefits of competition, with price reduction, quality enhancement, and organisational and technological innovations underlining the importance of the open market.

New and upgraded HSR lines: the playground of liberalisation and innovative strategies

The recent main pillar of EU strategies has been the Fourth Railway Package (4th RP), which is divided into a Political pillar and a Technical pillar – each consisting of three legislative texts. These directives and regulations entail rules on the opening of domestic passenger transport, common rules for the normalisation of the accounts of Railway Undertakings (RUs), and additional rules on safety (Directive 2016/798) and interoperability (Directive 2016/797), as well as the reform of the European Railway Agency (Regulation 2016/796), which has been renamed the European Union Agency for Railways (ERA).

These new directives and regulations have mainly concerned four specific aspects: standardisation of the authorisations, further expansion of the market with incentives for new entrants, enhanced role and financial and operational independence of infrastructure management, and a series of measures to improve the competence and motivation of human resources thanks to an adequate level of social protection and certifications of on-board rail staff. With the implementation of the Fourth Package, the liberalisation of the EU railway network is considered complete. Italy, Austria, Germany, Czech Republic, Sweden, and the United Kingdom are among the countries where the opening of the market was pursued even prior to 2020, and they offer several examples of the important role that competition plays in market growth.

The potential offered by modern long-haul railway services has been highlighted by the Italian market, where, after the completion of the high-speed line and the introduction of a new railway

operator, traffic on the high-speed line between Turin and Salerno increased from approximately 15 million passengers per year in 2009 to 59.7 million in 2019. In Italy⁶, HSR services have been integrated with a number of “customers care” features, ranging from a yield management system for tickets, proposing a variety of offerings for the same journey, dedicated on-board personnel, dedicated waiting rooms, and more. Attention has been focused on the terminals as well. In fact, since 2000, many new stations have been built, and existing ones have been substantially renovated, in keeping with the principle that, in addition to being functional and useful, a railway station should also be appealing and comfortable. The distinguished architects who have designed the railway stations in Italy include Santiago Calatrava for the “Reggio Emilia” station, and Zaha Hadid for the “Napoli Afragola” station. The Porta Susa station in Turin and the “Roma Tiburtina” station in Rome reveal how rail stations can also be opportunities for urban regeneration.

On the Milan-Rome corridor, where the railways and airlines respectively hold a 70% and 30% market share, much more polluting passenger flights decreased by 66% between 2007-2019.

Moreover, thanks to the greater load factors, due to increased demand and more efficient commercial business models, based on the choice of thirty different ticket types, between 2009 and 2017 competition has produced an average ticket price reduction of about 40% with respect to 2008. Travellers are able to find competitively priced rail tickets. This is exactly what happened also in the airline industry: a competitive market can drive down prices, decrease journey times, and improve the rail customer experience.

Scientific studies (Cascetta et al, 2020) have shown that the Italian HSR project has been a “game changer” for medium-long range intercity mobility and has greatly affected the economy of the entire country. Significant changes in travel

6 UIC Atlas, High-Speed Rail 2022

The Italian example is interesting in two aspects: first, it shows that HSR services can be profitable on backbone corridors and, second, it shows that competition on HSR networks is possible, beneficial to customers, and useful for improving the quality and efficiency of the services

demand (+200% in ten years, well beyond earlier forecasts) and measurable effects on the overall Italian per capita GDP have been achieved thanks to a combination of the geographical distribution of the major cities (150–200 km distant from one another) along the north-south axis, a 1–2.5 h reduction in travel times between most origin–destination pairs, and a highly competitive market, resulting in a reduction in average ticket prices, with a variety of commercial offerings, as well as an increase in daily frequencies.

Ferrovie dello Stato Italiane has played a central role in this development in Italy, and it considers Europe as the new overall domestic market, thanks to the increasing liberalisation and the push for modal shift. The Group's European vocation is well represented by its presence in six major countries beyond Italy, and in various business segments, including high-speed rail, where, as mentioned above, Trenitalia is exporting its services across borders and to countries like France and Spain, as well as Local Public Transport (LPT) in the Netherlands, regional transport and logistics in Germany, and passenger transport in Greece and the UK. The expansion of the international rail service will continue to be a priority for the FS Group.

The Italian example is interesting in two aspects: first, it shows that HSR services can be profitable on backbone corridors and, second, it shows that competition on HSR networks is possible, beneficial to customers, and useful for improving the quality and efficiency of the services. The European Court of Auditors (ECA, 2018) therefore argued in favour of increasing competition and promoting liberalisation to help bolster the incumbent former national public railway companies at the European level.

Moving on to France, the LGV SEA (Sud Europe Atlantique) project, the largest French HSR project launched in the past decade, has been a success with the number of travellers exceeding the initial estimates prepared by the project's stakeholders during the first year of service (July 2017–June 2018)⁷. According to an SNCF Mobilités analysis, these traffic gains are 45% due to induction, 16% due to a modal shift from air travel, and 39% due to private mobility. It is worth noting that unlike the first traffic scenario studies carried out in 2005–2010, this modelling includes the new modes that emerged during the design and construction of the LGV SEA project (carpooling and long-haul coach).

As noted by the French Autorité de Régulation des Transports (ART) in its studies carried out in 2022⁸, the entry of new players into the commercial services market is a major stimulus for the development and revitalisation of passenger rail transport and, consequently, for the decarbonisation of the transport sector. However, in some countries like France, this entry has been slowed by the lack of network interoperability and the consequent difficulties in designing safety architectures on board trains that have been adapted to the national rail system (especially for new operators wanting to operate high-speed services), and in ensuring their implementation under the right conditions, with the aim of obtaining the authorisations required to operate on the network. By way of example, ART issued 18 recommendations in order to lift the barriers to entry posed by the lack of measures taken by France to ensure interoperability for the control-command and signalling systems, in order to improve the railways' attractiveness and to facilitate opening up the domestic rail passenger transport market to competition. The importance of opening up the main lines to competition was highlighted by the success of Trenitalia's

7 Bilan LOTI (Loi d'Orientation des Transports Intérieurs) intermédiaire de la LGV Sud Europe Atlantique (SEA) (20160085/44-20160085/49)

8 « Etude sur l'ouverture à la concurrence des services de transport ferroviaire de voyageurs. Edition 2022 » and « On-board safety equipment at a time when high-speed rail services are being opened up to competition », July 2022

Frecciarossa services between Milan and Paris and between Lyon and Paris, introduced in December 2021 and April 2022 respectively, which, in the first case, introduced a new direct service with two departures per day and, in the second case, increased the frequencies between the two cities with three pairs of trains each day, in both cases differentiating the offering and increasing the opportunities for passengers.

Anticipating regulatory requirements, and providing objective, data-based and experience-based analyses informing robust and effective regulation, are challenges faced by regulatory bodies, who need to deal with them in order to ensure non-distorted competition.

Within this broader context, the European rail sector⁹ sees the deployment of ERTMS as a centrepiece for the completion of the market's liberalisation. However, over the past twenty years, less than 10% of the TEN-T core network has been equipped with ERTMS. The rate of deployments needs to be accelerated. The immense financial efforts that railways are ready to make must go hand-in-hand with a clear commitment on the part of the public authorities, both in terms of secure and adequate funding, as well as in terms of improved governance of its deployment. The ECA estimated that the capital investment for track-side ERTMS deployment on the entire TEN-T core network amounts to 80 billion euros, including digital interlocking plus 11 billion euros for onboard retrofitting of the entire fleet. The importance of ERTMS is highlighted by CER analyses, which, by way of example, note that the estimated network capacity increase associated with full ERTMS deployment would be up to 20% in Germany¹⁰.

Having implemented the ERTMS system on the high-speed network as early as 2005, FS Group, through its infrastructure manager subsidiary RFI, has extensive experience in this area, and, in this regard, has laid out a specific strategy with its "Accelerated ERTMS Plan", which envisages the system's implementation by 2036 throughout the entire RFI national network. This plan will make it possible to anticipate the functional benefits, thanks to an increase in safety and lower operating costs, which, thanks also to energy efficiency improvements, will facilitate the modal shift. The total investment on the infrastructure side, over 15 years (2022-2036), is approximately 13 billion euros for 16,000 km, and will provide for a digital, technological, and cultural revolution¹¹. Italy will be one of the front-runner countries in terms of railway system potential and performance, also acting as a driving force for the European railway industrial system on a global scale.

An accelerated migration to ERTMS is essential and strategic, considering the benefits that the system provides in terms of safety, improved interoperability, and increased performance, efficiency, and energy savings. The Connecting Europe Facility (CEF) budget should be rendered available for developing such implementation pilot studies, including the on-track and on-board ETCS¹².

The deployment of first mover ETCS on-board units (OBUs) as well as retrofitting existing OBUs in order to account for charging specifications (e.g. GSMR to FRMCS) poses a huge financial challenge.

While ERTMS is an important technical component for supporting HSR services at the national and international levels, the use of state-of-the-art

⁹ "CER Position - Boosting ERTMS deployment", CER The Voice of European Railways, 27 September 2021

¹⁰ *Ibidem*

¹¹ FS Group "Accelerated ERTMS Plan", 2021.

¹² *The European Train Control System (ETCS) is the signalling and control component of the European Rail Traffic Management System (ERTMS). It is a replacement for legacy train protection systems and is designed to replace the many incompatible safety systems currently used by European railways*

In order to achieve seamless ticketing, sector-based solutions should be supported and considered as the starting point when improving multimodal ticketing, in line with the example of the CER Ticketing Roadmap

digitalisation technology in all areas of capacity and path management is also extremely important. Digital Capacity Management (DCM) is an integral IT-part of the European programme entitled “TimeTable Redesign (TTR) for Smart Capacity Management”, as highlighted by RailNetEurope, Forum Train Europe, the Rail Freight Forward initiative, the Community of European Railway and Infrastructure Companies (CER), European Rail Infrastructure Managers, and the European Rail Freight Association in a Joint Vision for the Sector on DCM published in October of 2021. The European TTR programme is already up and running, but funding and resources, both national and international, are essential for its implementation. Implementing DCM will cost a total of 675 million euros, and this needs to be financed by European and national funds. The regulatory framework at the European and national levels should be adapted to allow for the fully harmonised implementation of TTR.

Digitalisation is also a major component of the booking experience for HSR passengers. The possibility of e-ticketing, e-booking, integrated and/or multimodal ticketing, and new offerings from new or existing digital platforms is all owed to increased digitalisation. In order to achieve seamless ticketing, sector-based solutions should be supported and considered as the starting point when improving multimodal ticketing, in line with the example of the CER Ticketing Roadmap¹³. In the context of the revision of the Multimodal Digital Mobility Service (MDMS) regulation, the European Commission should strive to adopt a balanced approach based on both sound economic principles and experience derived from other sectors where digital platforms have arisen based on investments and consumer choices, rather than as a consequence of regulatory intervention. The presumed insufficiency of cross-border rail travel is mainly derived from the lack of investment in infrastructure and interoperability, and not the distribution of rail tickets.

¹³ CER Ticketing Roadmap, 2021



Digital solutions and distribution agreements make it easier for international passengers travelling to or from Europe to book an air-rail combination ticket, or to book on rail services via an air booking platform. The purpose of air-rail cooperation is to enhance the passengers' travel experience with easier check-in and greener forms of international travel. Digitalisation will increase the quantity and the quality of the data, thus enabling operators to address individual requirements and create door-to-door solutions together with added value for the customer, before, during and after travel. In this context, Mobility as a Service (MaaS) describes a shift away from personally owned modes of transport, towards solutions that are consumed as a service. MaaS regards the entire low emission transport system as a single entity.

Digitalisation is the way to make HSR mobility more attractive and easier to use, and to render the service more efficient overall. ERMTS, Digital Capacity Management, harmonisation of ticket sales, and Mobility as a Service (MaaS) are the technical tools that can generate positive spill overs for operators and customers.



HSR vs air travel: evidence of efficient collaboration at EU level

Examples of genuine cooperation between airlines and short-haul rail services – typically an “Airport Express” line connecting airports and cities – are not particularly common even now. Less common still is cooperation between airlines and high-speed railways, which are often seen as natural competitors.

Specific examples reveal how mutual benefits can be generated through synergies between high-speed railway services and medium-long-haul air transport services, given a mutual willingness to cooperate. However, an essential prerequisite is an efficient high-speed rail station at major airports, in order to increase overall accessibility, especially for inhabitants and tourists of islands and outlying areas.

Air-high-speed rail synergies could generate benefits for all stakeholders: passengers, airlines, railway operators, airports, and society as a whole. These synergies will be strengthened by the European policy framework, and by the

technological, organisational, and infrastructural strategies indicated in the Long-Term Industrial Plan recently presented by the major railway operators, including Ferrovie dello Stato Italiane, SNCF, NS and Renfe, and could result in:

- an increase of the levels of sustainable access to airports, thanks to the modal shift away from private cars to rail;
- a broader choice of combined destinations, and a reduction of travel time for passengers;
- economic gains for airlines thanks to the possibility of reducing or withdrawing from short-haul flights and code-sharing with rail;
- increased revenues for railway operators from former airline passengers;
- more efficient use of limited slots at congested airports, thanks to the possibility of setting aside slots for larger long-haul planes rather than smaller short-haul planes;
- shifting of short-haul flight passengers to railways generates significant environmental benefits: the pollution along the route generated by an electrically-powered high-speed train is significantly less than that generated by an aircraft, and much less noise pollution as well.

The role that high-speed rail services play in improving the accessibility of major cities in terms of time and cost savings compared to air transport is clear for journeys of up to 600-800 km at the EU level, while the improvement of the environmental performance levels of EU mobility due to HSR services as a replacement for air travel is always evident, regardless of the distances travelled.

Moreover, HSR enables passengers to reach all the major business and tourist destinations in metropolitan areas through either the central rail stations or through suburban gateway stations that offer direct connections to the metropolitan public transport and regional networks (e.g. Milano Rogoredo as a southern gateway to the Milan metropolitan area, or Roma Tiburtina as a northern

gateway to the Rome metropolitan area). Both of these opportunities are more efficient than airports, and allow for better door-to-door service thanks to the better access to public transport services that railway stations offer with respect to airports.

While competition between these two transport modes is increasing thanks to the technical, organisational, and commercial development of HSR services in the majority of EU countries, new forms of collaboration between high-speed railway companies and air transport operators (airlines and airport management companies) are also emerging.

The main goals of the air-HSR link are to reduce the environmental impacts of airport activities (greenhouse gasses, local pollution and congestion), to improve airport accessibility in order to increase the relevant catchment areas, and to reduce the cost of building alternative infrastructure (new terminals, new airports, new airport access roads and new car parks).

An analysis of the most relevant instances of air-rail organisational and commercial collaboration at the EU level (France, Germany Netherlands, Switzerland and Italy) reveals opportunities and challenges, and highlights the potential policy implications of fostering collaboration between the two transport modes in order to increase the transport network performance in terms of accessibility, operating costs, and environmental indicators.

Substitution of inefficient short haul air services is among the potential benefits of collaboration, as revealed by the combined service between Air France and SNCF on the link between Paris Charles de Gaulle and Paris Orly (via the Massy TGV station), which serves eighteen national destinations. The strategic partnership between SWISS and SBB is also an interesting benchmark thanks to the recent extension of the Swiss Air-Rail network service, serving eleven tourist and business destinations, to include the 3 hour and 20-minute international route between Munich and the Zurich Airport. In both cases, the strategy

is part of a commitment on the part of the airlines to reduce their CO₂ emissions through the promotion of intermodal means that offer efficient, low-carbon alternatives to the longer and more tedious road journeys or short haul flights to reach major airports.

Encouraging collaboration between airlines and railways should mainly be based on joint infrastructure planning and promoting integrated services in support of automation and digitalisation (especially necessary for passengers with luggage), with short-haul flight bans being introduced where efficient HSR alternatives are available. In terms of commercial partnerships between airlines and railways, the recent agreement of Ferrovie dello Stato with two international air carriers (Lufthansa and ITA) should be framed within this broader context of collaborations with other collective and shared mobility operators, consistently with the goals of the 2022-2031 Business Plan; on the side of joint infrastructure planning, Ferrovie dello Stato Italiane, signed an agreement with Aeroporti di Roma for greater integration of schedules, starting with connections to and from the Rome Fiumicino airport.

NextGenerationEU funds are supporting these joint infrastructure projects, which are also perfectly in line with an EU Sustainable & Smart Mobility Strategy that requires all scheduled collective travel under 500 km within the EU to be carbon neutral by 2030.

Among these projects, in 2022 Spain's Adif AV promoted a new connection for high-speed traffic to the Adolfo Suárez Madrid-Barajas airport from the Madrid-Chamartín-Clara Campoamor rail station, with the launch of the contracting process for the work activities, with an initial budget of 26 million euros, backed by NextGenerationEU funds. The project contemplates a high-speed network

connection - in European standard gauge - with Terminal 4 of Spain's Barajas International Airport.

Adif AV promotes intermodality between rail and air transport in the capital and is committed to the creation of synergies between the two modes, enabling further decarbonisation of transport by encouraging the use of rail for short-haul journeys. This is possible thanks to a high-speed network that will cover almost 4,000 km by the end of 2023, with high levels of reliability, and the context of liberalisation, which is bringing high-speed services within reach of a greater number of people, in very competitive times and conditions. At present, Renfe is offering a combined rail and airline ticket that allows for travel between fourteen Spanish cities and Iberia's international destinations via Madrid Atocha or Madrid Chamartín - Clara Campoamor with a single ticket, which can be purchased through Iberia sales channels and at travel agencies. While the journey to/from Madrid is made on high-speed Renfe trains, and the international route is operated by Iberia, the transfer between the airport and the railway station is carried out using the Renfe Cercanías service.

Integration effects: better accessibility and more efficient mobility are the goals of the FS Group's infrastructure investment for new air-rail connections

The main goals of one of the most ambitious components of the NextGenerationEU Italian Plan are to transfer passenger traffic from road and air to rail, to increase rail speed/capacity/connectivity and improve service quality along key national and regional links, and to improve cross-border connections and EU railway interoperability. FS Group is the beneficiary of 25.86 billion euros in

funds from the NEXTGenerationEU Italian Plan, which, among other things, will be dedicated to high speed lines (Genoa-Tortona, Brescia-Padua, Naples-Bari, and Palermo-Catania), the ERTMS programme, urban airport nodes and links, and railway station upgrades in Southern Italy.

Rail-air integration is a key issue and each strategic sectoral document, concerning rail or airways, should be based on intermodal integration, with the fundamental objective of proposing a systemic mobility analysis that will promote synergic relationships between the most efficient transport modes, in accordance with the passengers' needs and demands.

The Italian case of the National Airport Plan (PNA) presented in the autumn of 2022 by ENAC – the Italian Civil Aviation Authority - represents a policy document supporting an ecological air transport transition towards a new form of mobility, whose main objectives for 2035 also include identifying minimum percentages of sustainable access to airports. The strategy is to enhance the various possible forms of intermodality, which, in addition to rail transport, also include electric and hydrogen-powered vehicles or their equivalents. These cumulative percentages of sustainable access to airports have been established as follows:

1. 40% by 2030 and 55% by 2035 for airports of intercontinental importance;
2. 30% by 2030 and 45% by 2035 for airports of international importance;
3. 20% by 2030 and 35% by 2035 for the remaining airports of national importance.

Particular attention must therefore be paid to interventions aimed at fully realising intermodal integration, first and foremost by rail, starting with high-speed rail, guaranteeing better accessibility for citizens to the airport network, and thus providing a concrete response to the demand for mobility throughout the country, including Sicily

Particular attention must therefore be paid to interventions aimed at fully realising intermodal integration, first and foremost by rail, starting with high-speed rail

Rail connections to Italian airports

2022

2030



- Airport in the Core network
- Airport in the Comprehensive network
- Airport out of the TEN-T network
- Airport connected to the National Rail Infrastructure
- Airport connected to other regional rail network or to other transport system (e.g. people mover)
- Existing connection
- New connection
- Enhanced connection

Source: Reg. EU 1315/2013

and Sardinia, the two most populous islands in the Mediterranean Sea.

In order to promote complementary air-rail services, strengthen the intermodal system, and improve the level of service offered to users, the Programme Contract in force between RFI (Italy's rail infrastructure manager) and the Ministry of Infrastructure and Transport (MIT) envisages numerous rail connection projects with the main Italian airports, for a total investment of more than one billion euros.

By 2031, seventeen new connections and upgrades will be completed (Alghero, Bari, Bergamo, Bolzano, Brindisi, Catania Fontanarossa, Fiumicino, Genoa, Lamezia Terme, Malpensa, Olbia, Perugia, Pescara, Salerno, Trapani, Venice, Verona), in addition to the seven existing connections managed by RFI (Trieste, Rome Fiumicino, Cagliari Elmas, Palermo Punta Raisi, Ancona Falconara,

Reggio Calabria and Catania Fontanarossa) and the six others managed by the regional and local operators (Turin, Malpensa, Linate, Bologna, Pisa, Florence and Bari).

The most ambitious Italian projects involve Italy's four largest international airports: Rome Fiumicino, Milan Malpensa, Bergamo, and Venice.

In the first case, the objective is to strengthen direct HSR connection services with Southern Italy and to accelerate the current services provided with the north of the country (Florence/Bologna/Pisa). In particular, the aim is to develop integrated products, through the implementation of commercial agreements with air carriers at Fiumicino, in order to integrate reciprocal sales and distribution systems, with the possibility of carrying out passenger and baggage check-in procedures directly in the main railway stations connected to the airport. The end result will be to allow passengers to board their trains at stations like Florence, Bologna or Naples, and to disembark directly at their destinations, even overseas, in a quick, easy, safe, and convenient manner, as well as the other way around, with the goal of ensuring better accessibility and more efficient integration. In addition to increasing the number of connections and improving an already efficient organisational and commercial model, the project also includes the infrastructural development of the Fiumicino airport rail station, expanding the number of tracks available from three to five. With regard to urban-air mobility, the agreement between RFI and Aeroporti di Roma also includes the design and construction of a vertiport on the parking deck at Rome's Termini station, which could be used by air – electric shuttle services to and from the airport, but also as a new feeder system for the national HSR network.

At Malpensa, the railway infrastructure developments include a new connection to the RFI Simplon international line, with an investment of 210 million euros, which will include the airport within the network of high-speed services to both Milan and the rest of Italy, as well as Switzerland.

The work will be completed before the 2026 Winter Olympic games and is being funded by the Connecting Europe Facility programme, as well as ministerial and regional funds.

While the investments at the Malpensa and Fiumicino intercontinental airports will generate new benefits for passengers by making it possible for them to reach the airport more efficiently, they will also have positive effects on environmental sustainability by reducing the market share of short-haul flights and private road mobility. There will also be further economic benefits in the areas around the main rail stations, which will benefit from an enhanced proximity and productivity effect due to the increased long-distance accessibility and will also be more appealing to a new international clientele, thus helping to maintain a high-quality level of commercial services within the rail stations themselves.

Moreover, the new 5.3 km connection between Bergamo's central station and the airport, with an investment of 121 million euros, will also be completed before the opening of the Olympic games, and will again provide a more efficient connection to Milan, and from there to the national HSR network.

Lastly, the Venice airport's 8 km link to the main line between Venice and Trieste was initiated in 2022 thanks to 428 million euros in public funds granted to RFI, and, once completed in 2025, will provide high-speed rail services to the main urban areas of north-eastern Italy. In fact the new link will allow HSR and local trains to directly connect the airport terminal to the city of Venice (Mestre, Venezia St Lucia), to Trieste, and to the main urban areas in the Veneto region, as well as to other major European transportation corridors (Mediterranean, Baltic-Adriatic and Scandinavian-Mediterranean TEN-T core corridors), thanks to the completion of the high-speed line between Brescia and Padua foreseen by 2026. Within this framework, in order to facilitate the integration between rail-air services (code share, single ticketing, one-stop baggage check agreements)

and promote new cooperation agreements between different operators, the airport management company will promote innovative organisational and commercial initiatives to fully exploit the complementary aspects of intermodal HSR and air transportation at the Venice Marco Polo airport, with positive effects for the territories involved as well.

The high-speed rail and air transport integration projects complement and complete the High-Speed Network programme launched by the Italian government in 2017. This programme aims to further extend the benefits of the high-performance core network by seeking to develop a networked service system, in part using new dedicated lines, and in part using other sections of the comprehensive network, in some cases subject to targeted upgrades to increase commercial speed.

Upon the completion of the new air-rail connections, the availability of new same-day return travel will increase rapidly. At present, HSR same-day return travel is possible between major national cities, while new links will also make single day return travel feasible between certain isolated areas all year round. Accessibility to outlying regions or islands is mainly characterised by seasonal short and medium haul flights, except to and from major capital cities. In an era of remote work, new destinations might also be appealing to the knowledge economy, with HSR-air links helping to overcome their isolation and improve their high quality of life, with advantages in terms of low office rent and helping de-seasonalise their tourism appeal. Examples might include connections between Padua and Bari via the Venice airport, Trapani-Florence via the Rome - Fiumicino airport, or Alghero-Brescia via the Bergamo airport. The completion of these new projects will offer the potential for multimodal trips, whereby a trip combines air travel on one leg and railway travel on another, rather than travelling the entire distance by air, thus potentially increasing the tourism appeal of secondary destinations.

Substitution effects: decreased airport congestion and environmental impacts

Multimodal solutions that combine air and rail are also highly appealing in terms of reducing runaways, slots, airport lay-bys and parking area congestion at airports, and optimising sustainability, as they directly contribute to increasing the efficiency of airports and generate benefits for society whenever short-haul flights are substituted with rail services.

London - Gatwick provides a valuable example of the development of the relationship between rail services and the airport, having increased its rail passenger numbers from 11.9 million in 2007 to 21.2 million in 2019, making it the sixth largest rail station in Great Britain outside of London, and by far the largest within an airport. Rail traffic growth between 2007 and 2019 was 78%, as opposed to 32% for airport passengers. In 2022, Gatwick airport had the best rail connections of any airport in Britain, linking passengers to one hundred and twenty train stations directly, and to over seven hundred within just one change.

This was achieved through specific organisational, commercial, and new direct line development initiatives, thanks also to its geographical location along the axis between central London (Victoria and London Bridge) and Brighton, which constitutes the main rail route in Great Britain in terms of passenger numbers.

Not being able to count on the possibility of building a second runway as planned up until the end of 2018, the airport's long-term development plans are based on maximising the capacity of the only runway available, continuing to intervene

through technological and organisational investments, as well as through the use of increasingly larger aircraft by carriers, aiming to overcome the long-standing hypotheses of capping the airport's capacity. This strategy led to the approval of the airport Master Plan in 2019, in which the clear objective is to have a 45% market share of land accessibility by rail by 2024, by reducing the airport's number of short and medium-haul flights, and replacing them with rail connections that will increase its catchment area.

The European Aviation Safety Agency's 2022 European Aviation Environmental Report indicates that the aviation sector causes substantial environmental problems in terms of climate impacts and local environmental problems. Moreover, although environmental efficiency is expected to improve further in the future, air travel is also forecast to grow, leading to an expected increase in the local and global environmental impacts of air travel. According to the average parameters indicated in the 2019 version of the European Commission's 'Handbook on the external costs of transport', the environmental costs of a passenger per km by air is 3.59 Euro cents¹⁴, while for an HSR passenger it is just 0.405 euro cents¹⁵ (-88.7%). Although actions can be undertaken by the aviation sector itself to reduce its environmental impacts, a shift to less polluting modes is central to reducing the environmental footprint of travel. Scenarios calculated by the International Energy Agency (IEA) indicate that limiting the global average temperature increase to below 2 °C also requires the substitution of intra-continental flights over medium distances of up to 1,000 km with high-speed rail (IEA, 2017). The IEA (2019) identifies cases where a new HSR line can almost immediately lead to net reductions in greenhouse gas (GHG) emissions. These are cases with low GHG emission intensity in the construction of the line, low well- to-wheel (WTV)

14 The value is the sum of 0.11 (cost of Air pollution), 2.18 (cost of climate change), 0.5 (cost of noise) and 0.8 (Well to tank). All the values are in Euro cents.

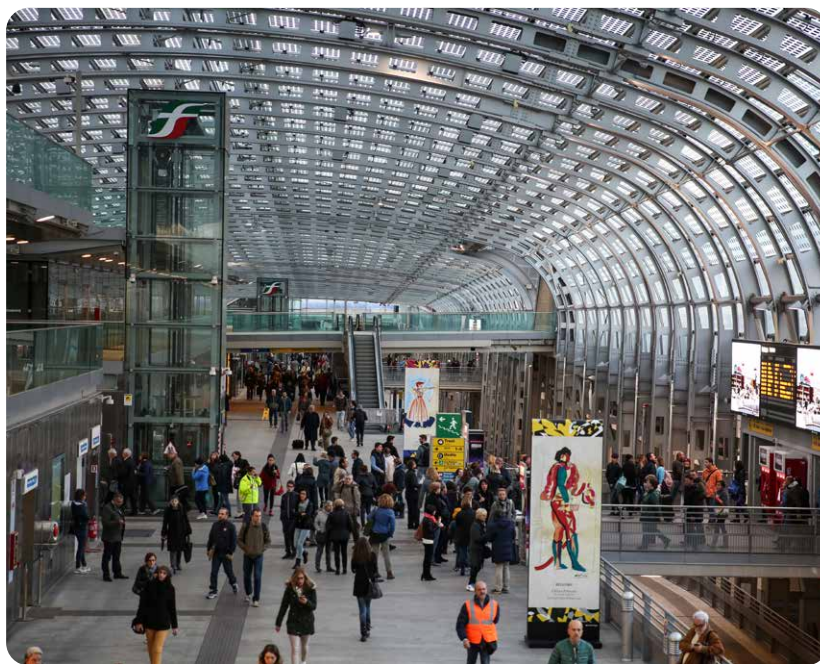
15 The value is the sum of 0.002 (cost of Air pollution), 0.0 (cost of climate change), 0.13 (cost of noise) and 0.39 (Well to tank). All the values are in Euro cents.

GHG emissions of rail, a high diversion of traffic away from GHG-intensive modes, and a high occupancy rate for rail.

In addition to CO₂, aviation also emits short-lived climate forcers, including sulphur dioxide (SO₂), nitrogen oxides (NO_x) and black carbon, leading to changes in the radiative forcing in the atmosphere. Such pollutants can have both global warming and cooling effects, with the net effect being warming. In addition, sulphate aerosols and water vapour can lead to contrails and cirrus cloud formation, thereby contributing to net climate warming. Unlike CO₂ emissions, the non-CO₂ effects differ as a function of flight altitude, time of day, weather, and location. As a result of this, in 2019 the European Commission estimated the total climate change costs of aviation to be twice the costs of the CO₂ emissions alone¹⁶. That is especially true for short-haul flights, which can generate twice as many emissions per seat-kilometre than long-haul flights (Grimme and Jung, 2018).

In this wider context, in order to contribute to the reduction of greenhouse gas emissions in the air transport sector, France has chosen to temporarily limit the exercise of traffic rights. More precisely, in August of 2021, the French government adopted the 'Loi Climat et Résilience' to flight climate change. This law introduced a temporary limitation on flight traffic due to serious environmental concerns and, according to Article 20(2) of Regulation (EC) No 1008/2008, it was approved by the European Commission in December of 2022.

The ban applies to domestic scheduled public passenger air transport services for which there are several direct daily rail connections of less than two and a half hours, with the following conditions:



- the journey should be between train stations serving the same cities as the airports concerned;
- without change of train between the two train stations;
- several times a day and bidirectional, with sufficient frequencies and satisfactory timetables;
- and allowing more than eight hours of presence at the destination during the day.

Where the most important airport in terms of traffic is served directly by a high-speed rail service, the train station used to calculate the alternative rail service shall be the one serving this airport¹⁷; in all other cases, the station used to calculate the alternative rail service shall be the one serving the same city as the airport concerned.

¹⁶ European Commission (2019), 'Handbook on the external costs of transport'.

¹⁷ In practice, of the eight routes identified, only two airports are directly served by a high-speed rail service: Paris- Charles de Gaulle and Lyon-Saint Exupéry

HSR has brought impacts which have been widely studied in different countries in relation to their different socio-economic, territorial, environmental, and transport characteristics

In France, the measure has affected three routes between Paris-Orly¹⁸ and Bordeaux, Nantes and Lyon, which will be prohibited for any carrier. The French authorities estimate that the prohibition on these three additional routes could lead to potential emission reductions of 54,900 tonnes of CO₂.

The adopted measure is in place for three years, and France shall provide a review after twenty-four months. After that period, the effectiveness of the measure will be assessed, also considering the improved level of railway services, and the level of CO₂ emissions in air transport. The measure is therefore temporary, in order to consider the changes in the regulatory context, such as the adoption of the 'Fit for 55' package presented by the European Commission to achieve a 55 % reduction in net greenhouse gas (GHG) emissions by 2030, and with the aim of making the different modes of transport, such air transport, more green. Once in place, the legislative proposals should effectively contribute to the decarbonisation of the air transport sector, and will be duly considered when assessing the measure.

One of the objectives of the Commission's Sustainable and Smart Mobility Strategy (the 'Mobility Strategy') is to create the conditions for transport operators to offer carbon neutral options to their customers by 2030 for scheduled collective journeys of less than 500 km within the EU, and the legislative measure introduced by France is a step in the right direction. High-speed rail has the potential to replace collective journeys of 600-800 km and, according to the IEA, can help effectively reduce CO₂ emissions from the transport sector on journey of up to 1,000 km.

Conclusions

The deployment of HSR services has arguably been the most significant innovation for intercity travel in Western Europe in recent decades. HSR has brought impacts which have been widely studied in different countries in relation to their different socio-economic, territorial, environmental, and transport characteristics.

In the case of Italy, the effects have been particularly positive in terms of increased traffic, reduced transport costs, substitution of flights, and mitigation of the environmental impacts of transport, also thanks to the development of particularly efficient railway infrastructures, modern regulation systems, and competition between operators.

Within a polycentric context such as Italy's, the strategic choices identified in the NextGenerationEU programme to extend the benefits of HSR to broader territorial areas, including the most outlying regions and, above all, the two most populous Mediterranean islands, have further enhanced the development of two ambitious and strategic programmes: the High Speed Network Programme, begun in 2017, and the Air+Rail Programme, which envisages a strong integration between air transport and high speed rail at the main airports, which has been promoted in a systemic manner since 2021.

In order to achieve a 'multimodal network effect' in the long-distance rail offering, FS Group has laid out strategic programmes that in part use new dedicated lines, consisting of a series of short links to the airports, as well as other portions of the core network, with targeted technical and technological upgrades to reach higher commercial speeds. The Air+Rail Programme was developed with the aim of ensuring complete integration

¹⁸ The measure applies only to Paris-Orly. Paris-Charles de Gaulle should be understood as a destination to be assessed in its own right. In the same vein, Lyon-Saint Exupéry airport is equipped with a high-speed train station which must be regarded as a destination in its own right when analysing various relevant routes, in particular the Marseille-Lyon link.

with the TEN-T Core corridors, in order to provide accessibility to a large number of international, peninsular, and island destinations.

In order to extend the benefits of high-speed rail to as many territories and populations as possible, it is necessary to have a systemic and intermodal outlook, which also considers aspects relating to technological innovations for safety and the integrated marketing of services. There is a considerable need for investments in order to meet the EU modal shift targets, and we are aware that the rail sector cannot rely on the budgets of the Member States alone. Increased rail capacity and enhanced connections at the Corridor level must be supported when meeting the TEN-T rail targets, providing European added value, with proper and sufficient funding, from both the public and private sectors, in order to ensure the timely completion of the rail network and the cross-border infrastructure projects. To this end, the next EU financial framework should still cover TEN-T infrastructure beyond the current 2021-2027 budget, including the Connecting Europe Facility.

Lastly, the vision presented by the European Commission within the *European Strategy on Sustainable and Smart Mobility* (the 'Mobility Strategy') and its ambition of promoting sustainable transport choices, such as high-speed rail, should be supported with appropriate policy measures wherever possible and appropriate. One of the objectives of the Commission's 'Mobility Strategy' is to create the conditions for transport operators to offer their customers carbon neutral options by 2030 on scheduled collective journeys of less than 500 km within the EU. Promoting sustainable transport choices, such as high-speed rail, is necessary to achieve that goal. As highlighted in the Mobility Strategy, this requires suitable rail services to be in place at competitive prices, frequencies, and comfort levels.



To summarise, rail and air transport are both complementary and in competition on different travel routes and, from a policy making perspective, the end goal should be to establish the right conditions and modal combination to reduce overall transport emissions and to achieve the EU climate targets. Despite the conditions imposed to achieve the effective restriction of air traffic in France, and the temporary duration of the resulting bans on air traffic, where applicable, the French law, and the subsequent compliance Decision by the European Commission, have succeeded in explicitly highlighting the greater sustainability of rail transport over air transport. The decision to ban flights when a more sustainable mode of transportation offering an adequate level of service is available, such as rail, is certainly an important precedent that can be adapted within other contexts as well.

Key facts

The European high-speed rail (HSR) network consisted of **11,990 km** at the end of 2021, with 3,062 km under construction, 5,913 km planned, and 3,316 km foreseen over the long-term.



From 2012 to 2021, European countries increased the **total length of their HSR lines in operation by 36%** equal to 3,203 km



On the Milan-Rome corridor, where the railways and airlines respectively hold a 70% and 30% market share, much more **polluting passenger flights decreased by 66%** between 2007-2019



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FS Italiane Group

The FS Italiane Group is one of the largest Italian companies, at the heart of the country's sustainable mobility system. It counts around 86,000 employees, over 10,000 trains a day, more than 17,000 km of railway lines and 32,000 km of roads. FS Group governance is composed of four different Business Units - Infrastructure, Passenger, Logistics, and Urban - each one made up of different subsidiaries controlled by the holding company.

Bocconi University

Bocconi University was established as a private, independent, non-profit university in 1902, through a philanthropic gift from Ferdinando Bocconi in memory of his son Luigi. Bocconi was the first Italian institution of higher education to grant a degree in economics and management and has played an important role in Italy's social and economic modernization. Today it is considered one of the leading European universities in economics, management, finance, data science, law and political science. Bocconi University appears in the most prominent rankings which cover its areas of expertise, steadily positioned among top European institutions.

Among its eight permanent research centres, GREEN (Centre for Geography, Resources, Environment, Energy and Networks) was born in 2018 from the merger of two historical research centres of Università Bocconi, IEFE (Center for Research on Energy and Environmental Economics and Policy, founded in 1957) and CERTET (Center for Regional Economics, Transport and Tourism, founded in 1995).

GREEN has thus absorbed and further expanded its networks and wide range of expertise at national, European and international levels. Building on its deep multidisciplinary footprint, the centre's objective is to conduct and promote research at the intersection of socio-economic phenomena and climate change, transport, environmental policy and energy markets.

CER

The Community of European Railway and Infrastructure Companies (CER) brings together railway undertakings, their national associations as well as infrastructure managers and vehicle leasing companies. The membership is made up of long-established bodies, new entrants and both private and public enterprises, representing 71% of the rail network length, 76% of the rail freight business and about 92% of rail passenger operations in EU, EFTA and EU accession countries. CER represents the interests of its members towards EU policy makers and transport stakeholders, advocating rail as the backbone of a competitive and sustainable transport system in Europe.



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