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Modal shift or intermodality? Modal shift in Hungary and EU transportation and climate policy goals

Beatrix Béres
Department of Transport Technology and Economics,
Faculty of Transportation Engineering and Vehicle Engineering,
Budapest University of Technology and Economics,
Budapest, Hungary
beres.beatrix@edu.bme.hu

Botond Kővári
Department of Transport Technology and Economics,
Faculty of Transportation Engineering and Vehicle Engineering,
Budapest University of Technology and Economics
Budapest, Hungary
kovari.botond@kjk.bme.hu

Adrienn Boldizsár
Department of Computer Science,
GAMF Faculty of Engineering and Computer Science
John von Neumann University,
Kecskemét, Hungary
boldizsar.adrienn@nje.hu

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Abstract

This study aims to evaluate the role of modal shift and intermodality in achieving the European Union's transport and climate policy objectives, with a particular focus on the competitiveness and development of rail freight transport in Hungary. The research addresses the gap between policy ambitions for sustainable transport and the persistent dominance of road freight. The methodology is based on a structured literature review and secondary data analysis, drawing on European Union policy documents, Eurostat transport statistics, and national datasets. Comparative trend analysis is applied to assess changes in modal split at both the EU and Hungarian levels, while a qualitative assessment is used to identify the key structural, economic, and technological factors influencing the competitiveness of rail and intermodal transport. The results show that despite strong policy support, the share of rail freight transport has stagnated or slightly declined across the European Union, while road transport continues to dominate. In Hungary, similar patterns are observed, with rail maintaining a stable but limited market share. The findings identify infrastructure limitations, interoperability barriers, capacity constraints, and cost disadvantages as the primary factors hindering rail competitiveness. At the same time, intermodal transport has demonstrated significant growth, indicating its potential as a more feasible pathway toward sustainable freight systems than a pure modal shift. The study concludes that achieving climate objectives in the transport sector requires integrated policy measures, targeted infrastructure investments, and the accelerated development of intermodal solutions supported by digitalisation. Strengthening rail freight and intermodality is essential for reducing emissions and enhancing Hungary's role in European logistics networks.

Keywords
modal shift, intermodality, rail freight transport, sustainable transport, competitiveness

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1 Introduction

One of the most complex and defining challenges of 21st-century policy is balancing economic growth with the radical reduction of environmental impact. In the European Union, achieving climate policy goals and sustaining economic expansion go hand in hand with decoupling growth from greenhouse gas (GHG) emissions. Thanks to coordinated policy measures to date, total net greenhouse gas emissions in EU countries in 2022 were 32.5% lower than in 1990, while economic output grew by 67%. Transport is a key sector of the European Union's economy and plays a crucial role in today's mobile society. Transport and mobility are also central to sustainable development. Sustainable transport can foster economic growth and improve accessibility while respecting the environment and enhancing the resilience of cities, connections between urban and rural areas, and the productivity of rural regions. The goal of EU transport policy is to promote clean, safe, and efficient transport, underpinning the internal market for goods and citizens' right to free movement within the EU (European Commission, 2024).

In the member states of the European Union, the transportation sector is one of the most significant sources of pollution, and little progress has been made in reducing emissions over the past decades. This sector is responsible for nearly a quarter of greenhouse gas emissions (Filina-Dawidowicz et al., 2022). Despite efforts such as promoting the adoption of electric vehicles and encouraging the use of low-carbon fuels, transportation emissions have decreased only slightly since 2005, and the temporary decline in 2020 was due to the COVID-19 pandemic. At the same time, it is important to note that, based on current research, policy decisions, and measures, greenhouse gas emissions from transport are expected to reach 1990 levels by 2030. With additional measures, these emissions would be 13% lower than 1990 levels (EEA, 2025). Most of the policies and measures planned for the transportation sector focus on promoting low-carbon fuels or zero-emission technologies (Rodríguez and Delgado, 2019).

Within the transportation sector, road transport plays the most critical role, as the majority of emissions are generated by heavy-duty vehicles and passenger cars. Road traffic accounted for 71.1% of EU member states' transport GHG emissions in 2019, while the rail sector contributed a negligible 0.4%. Heavy-duty truck traffic accounts for 4–4.5% of CO_2 emissions in EU member states (Rodríguez and Delgado, 2019). Due to deepening globalisation, the internationalisation of supply chains, and the explosive growth of e-commerce, the volume of road traffic is expanding year by year. However, this process is unsustainable in the long term, as it creates increasingly severe economic and social tensions and environmental damage.

In addition to environmental issues, the physical saturation of road infrastructure is becoming an increasingly significant obstacle. Recurring traffic congestion on trans-European transport corridors directly impacts logistics efficiency: delivery times become unpredictable, and waiting times increase, resulting in high additional costs for manufacturing and service companies. Additional externalities include hidden costs in road transport systems that are not paid directly by the carrier or the client, but are borne by society as a whole. These include the costs of rescue and rehabilitation following traffic accidents, the decline in property values caused by noise pollution, the health effects of air pollution, and accelerated depreciation resulting from increased use of the road network. Together, these factors necessitate a fundamental restructuring of transportation systems (Vida et al., 2023).

The European Union's response to this crisis is the concept of "modal shift", which is a central element of the European Union's medium- and long-term transport policy visions, the European Green Deal, the Sustainable and Smart Mobility Strategy, and the objectives of the TEN-T network policy (Zani et al., 2025). The *Green Deal* (Fetting, 2020). promotes a clean economic transition that serves environmental sustainability, economic stability, and social justice alike. In recent years, there have been significant shifts toward environmentally friendly modes of transport, primarily toward railway development. Rail freight transport has a strategic advantage in the modal shift, as its specific energy consumption and CO_2 emissions are much lower than those of road transport (European Commission, 2020a). By electrifying its network infrastructure, rail can achieve the fastest decarbonisation, thereby playing a key role in helping the EU achieve climate neutrality by 2050. A tangible result of this recognition is that the Sustainable and Smart Mobility Strategy also clearly states that a significant portion of road freight transport over distances longer than 300 kilometres must be shifted to more environmentally friendly modes, primarily rail and inland waterway transport. On this end, the directive has set as a key objective a 50% increase in rail freight transport capacity by 2030, followed by a doubling of that capacity by 2050 in order to achieve climate neutrality, as well as the integration of key seaports into rail and inland waterway networks (European Commission, 2020b).

https://doi.org/10.55343/CogSust.23485

This is why the *Drive to 55%!* package of measures adopted in the transport sector is of particular significance; it imposes a legal obligation on Member States and is expected to reduce EU emissions by 55% by 2030 (European Council, 2023). This legal framework encompasses various technological solutions to create efficient, interconnected multimodal transport systems in both passenger and freight transport sectors, enabling reductions in emissions of nearly 80% by 2040 compared to 2015 (European Commission, 2024). The EU's shorter-term climate policy goal, set in 2024 and to be achieved by 2040, brings the realisation of decarbonisation in the EU into clearer focus, proposing a 90% net reduction in GHG emissions relative to 1990 levels. As an important step toward this, it identifies, among other things, the increased utilisation of rail infrastructure capacity, the greater expansion of rail transport, and the development of an efficient and integrated multimodal passenger and freight transport system supported by the trans-European multimodal transport network, which could thereby contribute significantly to reducing total emissions. Decarbonising transportation requires significant investments across all transport sectors – in zero- and low-emission vehicles, rail equipment, and electrified infrastructure –, which also necessitates innovative EU financing instruments. As a result of these investments, the reduction in CO_2 emissions from road transport is expected to accelerate over time, in parallel with the growth of rail transport. Additionally, the share of battery-electric and other zero-emission vehicles in the road sector is projected to exceed 40% for light commercial vehicles and approach 40% for heavy-duty vehicles (European Commission, 2024).

Given that external costs of road freight transport will need to be internalised in the future (e.g., through tolls and carbon taxes), this is likely to provide a natural competitive advantage for more environmentally friendly transport solutions. Based on the above, while road freight transport can be made greener in the long term through consistent measures, a more achievable near-term goal is a modal shift through the development of rail and intermodal infrastructure. This study aims to evaluate the role of modal shift and intermodality in achieving the European Union's transport and climate policy objectives, with a particular focus on the competitiveness and development of rail freight transport in Hungary. The research addresses the gap between policy ambitions for sustainable transport and the persistent dominance of road freight. The methodology is based on a structured literature review and secondary data analysis, drawing on European Union policy documents, Eurostat transport statistics, and national datasets. Comparative trend analysis is applied to assess changes in modal split at both the EU and Hungarian levels, while a qualitative assessment is used to identify the key structural, economic, and technological factors influencing the competitiveness of rail and intermodal transport.

2 The role, limitations and development trends of rail freight transport

This study applies a mixed qualitative–quantitative research design to analyse the role of modal shift and intermodality in the context of European Union transport and climate policy objectives, with a specific focus on Hungary. The methodological approach combines secondary data analysis, comparative trend evaluation, and qualitative policy assessment.

The empirical basis of the study relies on secondary data obtained from international and national statistical and institutional sources. The primary datasets include Eurostat freight transport statistics, particularly modal split indicators expressed in tonne-kilometres, as well as publications from the European Union Agency for Railways (ERA) and the European Environment Agency (EEA). These datasets provide consistent time series for analysing changes in the distribution of freight transport modes across the European Union over the period 2010–2024. At the national level, Hungarian freight transport data were incorporated to examine domestic trends and to position Hungary within the broader European context. Additional sector-specific data were drawn from professional organisations and industry reports, including publications related to intermodal transport development and logistics performance in Hungary.

The analytical methodology is based on comparative trend analysis. First, temporal changes in modal shares of road, rail, inland waterway, maritime, and air transport were examined at both EU and national levels. This allowed the identification of long-term structural patterns and deviations from policy targets. Second, a comparative assessment was conducted between rail and road freight transport to evaluate their relative competitiveness. This assessment considered key dimensions such as infrastructure availability, operational flexibility, cost structures, capacity constraints, and service reliability.

In addition to the quantitative analysis, a qualitative evaluation framework was applied to interpret the underlying drivers of observed trends. This includes the examination of policy documents such as the European Green Deal, the Sustainable and Smart Mobility Strategy, and the TEN-T framework, as well as regulatory initiatives related to digitalisation (e.g. eFTI and ERTMS systems). The qualitative analysis focuses on identifying structural barriers to rail freight development,

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including interoperability limitations, fragmented infrastructure systems, and regulatory inconsistencies across Member States.

Finally, the study integrates a case-oriented perspective on Hungary by analysing national logistics strategies, infrastructure conditions, and intermodal development trends. This approach enables the identification of country-specific challenges and opportunities, particularly in relation to Hungary's role as a transit and logistics hub within European transport networks.

Overall, the methodological framework allows for a comprehensive assessment of both statistical trends and structural determinants, thereby linking empirical observations with policy-relevant conclusions on modal shift and intermodality.The role of rail freight transport is undeniable from both sustainable transport and economic growth perspectives, particularly in the light of carbon-neutrality goals. Rail is the most energy-efficient mode of transport, thanks to the low rolling resistance and its ability to meet the transportation needs of the most significant sectors of the national economy in large volumes with a low environmental impact. However, the downside of this efficiency is that, due to fixed-track transportation, trains can only operate in geographic locations where railway tracks have already been built. Track capacity can also be reduced by other trains operating on the same track, especially if there is no double-track infrastructure. Another structural constraint of rail is the relatively high fixed costs of equipment and operations, which require a high level of utilisation to be covered (Ficzere, 2023).

The rail freight market has shrunk significantly in recent decades in Europe, partly due to a lack of interoperability – that is, the lack of ensuring mutual compatibility, which requires removing existing technical, administrative, and legal barriers across member states and enhancing railway safety. This deficiency has prevented rail freight services from offering reliable service and led to issues such as service quality, congestion on certain networks, and local bottlenecks. The rail sector, which is subject to global trends in freight transport, offers high-volume, secure transport solutions to market participants; however, its reliability, punctuality, and flexibility lag behind those of freight market operators offering road transport services. Rail transport services still face a significant disadvantage compared to the road transport market in terms of competitiveness and cost-effectiveness. Overcoming this competitive disadvantage is particularly important because freight transport trends across Europe – and thus in Hungary as well – increasingly call for the development of combined transport services and integration into intermodal transport chains as green, sustainable logistics systems. This requires an appropriate support system that encourages a modal shift – specifically in the rail transport sector and through intermodal solutions – along with the conceptual development of infrastructure, terminals, and rolling stock, and the expansion of track capacity (Bucsky, 2021).

In response to growing economic demands on rail services and the need for door-to-door mobility, the EU has identified the creation of a Single European Railway Area as a key objective. One of the fundamental prerequisites for this is interoperability. From both competitiveness and sustainability perspectives, new information technologies will play a key role in future railway development. The digitisation of rail freight transport helps reduce administrative costs for economic operators, improves the enforcement capacity of competent authorities, and enhances the efficiency and sustainability of transport. Both economic operators and authorities must take measures to facilitate the electronic exchange of freight transport information (eFTI) via information and communication technology (ICT)- based platforms (eFTI platforms). The introduction of electronic transport documentation and digital traffic management systems (ERTMS) is now a key factor in competitiveness. Given the importance of a rapid, real-time flow of information for the electronic planning of conventional and intermodal rail routes, the tracking of rail shipments, the preparation of accurate transport documentation, and the reduction of administrative burdens, the mandatory implementation of such a system within the TEN-T infrastructure (e-freight) is being encouraged (Official Journal of the European Union, 2020).

2.1 Freight transport trends in Europe

In terms of the rail transport sector's share of the freight transport market, there has been no significant change over the past decade, either in the European Union or in Hungary, despite targeted policy interventions. The sector's share in EU member states averaged 18.22% between 2010 and 2022 (ERA, 2024). The policy goal of a 30% modal share for rail freight transport – and the expectation that, to achieve this, rail freight must double, and rail traffic must triple by 2050 compared to 2015 levels – is also not realistically on the verge of being achieved.

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An analysis of freight transport distribution by mode reveals that, over the past decade, maritime transport accounted for the largest share of freight transport performance in the European Union member states – as measured by tonne-kilometres travelled – among the five modes. Figure 1 shows that the share of maritime freight transport reached its lowest point of the decade in 2024, at 67% (4,753 billion ton-km), after five consecutive years of decline. Over the past decade, maritime freight transport reached its highest share in 2014 and 2015, at 69.5%. Compared to 2014, the share of maritime transport was 2.5 percentage points lower in 2024 (Eurostat, 2026b).

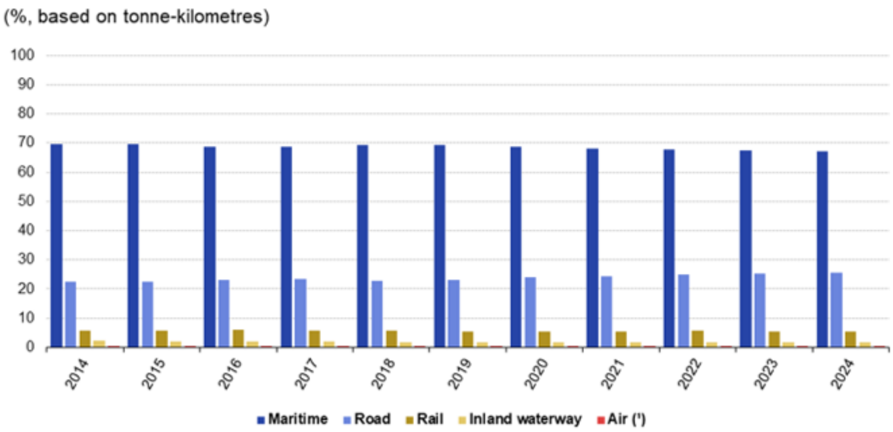

Figure 1. Breakdown of freight transport by mode in the EU, 2014–2024 (Eurostat, 2026b)

The share of road freight transport in the EU's total freight transport volume peaked at 25.7% in 2024, reaching 1,821 billion ton-kilometres, up 0.4 percentage points from 2023. During the 2014–2024 period, the share of road freight transport reached its lowest level in 2014, at 22.4%. The share of rail freight transport remained stable during the same period, with minimal volatility. The highest value was recorded in 2016, at 6.0%, while the lowest was in 2020, at 5.3%. In 2024, the share decreased by 1.1 percentage points compared to 2023 (5.4% or 385 billion ton-km). The share of inland waterway transport in total freight transport performance also remained relatively stable during the period under review. It peaked at 2.2% in 2014. By 2018, the share had fallen to 1.7%. The share of air freight transport remained at 0.2% during the period in question (Eurostat, 2026a).

The share of road transport was highest in Luxembourg in 2024 (84.4%), followed by the Czech Republic (78.0%) and Hungary (68.8%). The share of rail transport was highest in Austria (30%), followed by Slovakia (29.8%), Hungary (25.8%), and the Czech Republic (21.1%). In 2024, the share of road freight transport in the EU increased by 3.3 percentage points compared to 2014. When comparing the data from 2024 and 2014, the share of road freight transport in total freight transport performance decreased slightly in 4 EU member states. In contrast, it increased significantly in the Baltic countries, Romania, and Slovakia (Fig. 2). Looking at the last two reference years, the decline in the share of road freight transport was most pronounced in Hungary, where it fell by 1.9 percentage points from 2023 to 2024 (Eurostat, 2026a).

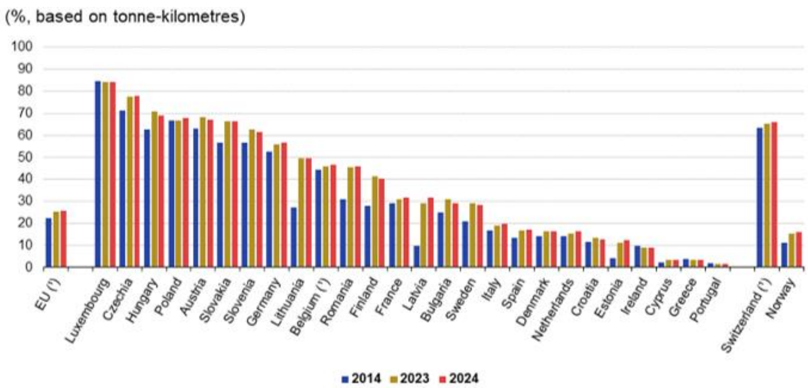

Figure 2. Share of road freight transport in total freight transport (Eurostat, 2026a)

https://doi.org/10.55343/CogSust.23485

An analysis of trends in rail transport shares shows that, in 2024, the share of rail freight transport in EU member states decreased by 0.3 percentage points compared to 2014. Comparing the beginning and end of the period under review, the share of rail transport in total freight transport performance decreased in 17 countries, including EFTA member Switzerland (Fig. 3) (Eurostat, 2026a).

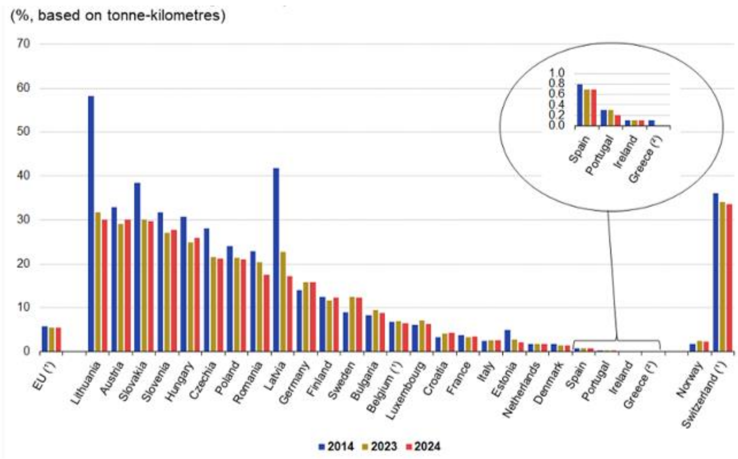

Figure 3. Share of rail freight transport in total freight transport (Eurostat, 2026a)

The largest decline was recorded in Lithuania, where the share fell from 58.2% in 2014 to 30.1% in 2024, and in Latvia, where it dropped by 24.6 percentage points from 2014. A decline in rail transport's share was also noticeable in Slovakia, the Czech Republic, and Romania. In contrast, the share of rail transport increased the most in Sweden, by +3.3 percentage points, followed by Germany, by +2.0 percentage points. In the other countries, an increase of less than 1.1 percentage points was recorded, or the share remained unchanged. Compared to 2023, the largest decline in 2024 was in Latvia (-5.6 percentage points), followed by Romania (-2.9 percentage points) and Lithuania (-1.6 percentage points). In the other countries, the decline in rail freight transport's share was less than 1 percentage point. In contrast, the largest increase was observed in Hungary and Austria, with +0.9 percentage points in both countries. The remaining 7 EU countries recorded an increase of 0.6 percentage points or less (Eurostat, 2026b).

2.2 Trends in Hungarian domestic rail freight transport

From the perspective of rail freight transport in Hungary, the first decade of the 21st century saw a dynamic growth, which came to an end with the financial and economic crisis that peaked in 2009. The volume of freight transported declined until 2013, then began to grow again starting in 2014. Over the past decade and a half, domestic freight transport volume peaked in 2017, exceeding the 2010 level by one-fifth. The next crisis was caused by the pandemic, which resulted in a significant decline in domestic freight volumes and the weight of goods transported. In Hungary, there has been no significant shift in the distribution of freight modes; over the past decade and a half, the proportions have remained stable with minimal volatility. In 2024, rail freight transport, with a 20% share, remained second behind road transport's 77.4% share (Fig. 4).

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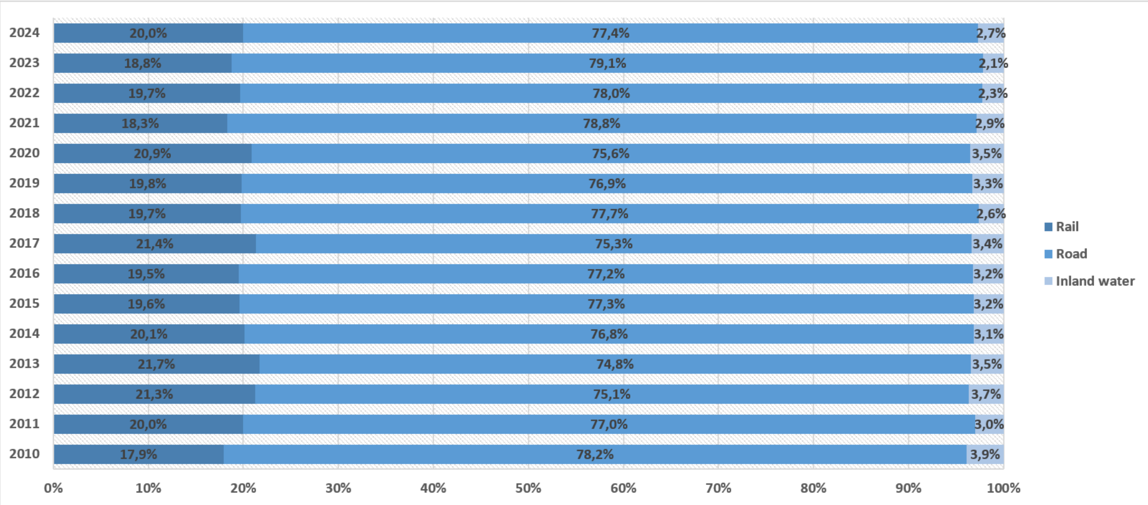

Figure 4. Breakdown of domestic freight transport by mode of transport (in tons, %)

According to rail freight data, transport volumes remained relatively stable throughout 2022, totalling around 50 million tons annually. However, a significant decline was observed starting in 2023: the total volume of goods transported fell to 45.7 million tons. Domestic transport was hit particularly hard, accounting for only about 9 million tons by 2024, whereas in 2014, 15 million tons of goods were still being moved via domestic rail. In 2024, international rail freight transport accounted for 88% of the sector's total volume. From the end of 2021, the drastic rise in energy prices eroded rail's cost advantage over road freight transport. In terms of traffic composition, export and transit traffic remained of decisive importance. At the same time, import volumes declined, primarily due to a moderation in demand for raw materials and energy. Transit traffic remained significant at nearly 4 billion tonne-kilometres, accounting for nearly 43% of total international traffic in 2024 (Fig. 5).

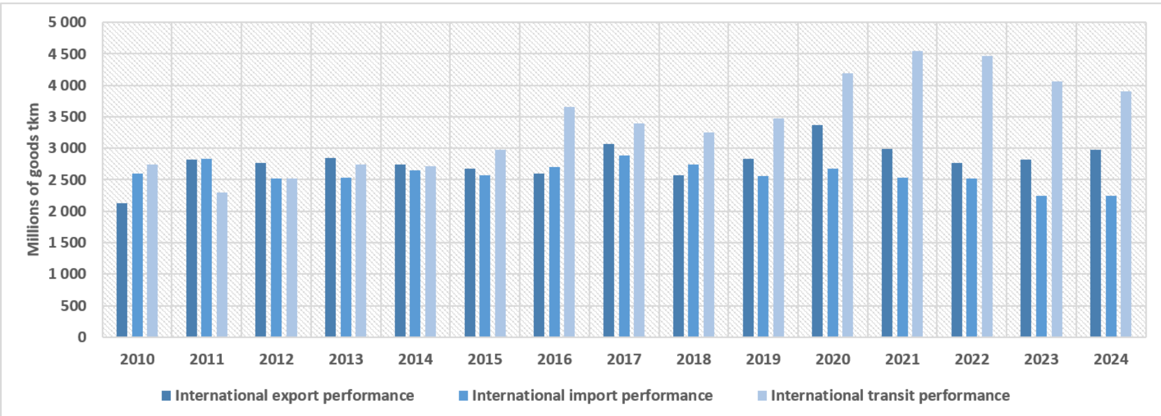

Figure 5. Volume of international rail freight traffic by direction in Hungary

Due to Hungary's strategic geographical location, transit traffic plays a particularly significant role in international rail traffic. Thanks to Hungary's location at the intersection of the NW–SE and SW–NE trans-European corridors, nearly one-third of the total weight of goods transported in international transit traffic passed through the country in 2024. Freight transport volume in transit traffic in Hungary rose by a further 4.2% in 2024 compared to 2023. In 2023, Hungary ranked third among EU member states in terms of rail transit traffic, behind Denmark and Slovakia.

2.3 A comparative analysis of competitiveness factors in rail and road transport

https://doi.org/10.55343/CogSust.23485

It is worth examining trends in rail freight transport performance compared with the road transport sector, as the latter is a competitor to rail freight. If we review how road and rail networks have developed over time, we arrive at a startling realisation. Between 1960 and 2020, approximately 53,000 km of highways were built in Europe, while 55,500 km of railway lines were dismantled. These figures clearly reflect European investment priorities (Fig. 6). Although the total length of the railway network exceeds that of highways in every region of Europe, it is significantly shorter than the total road network, which includes more than just expressways (ERA, 2024).

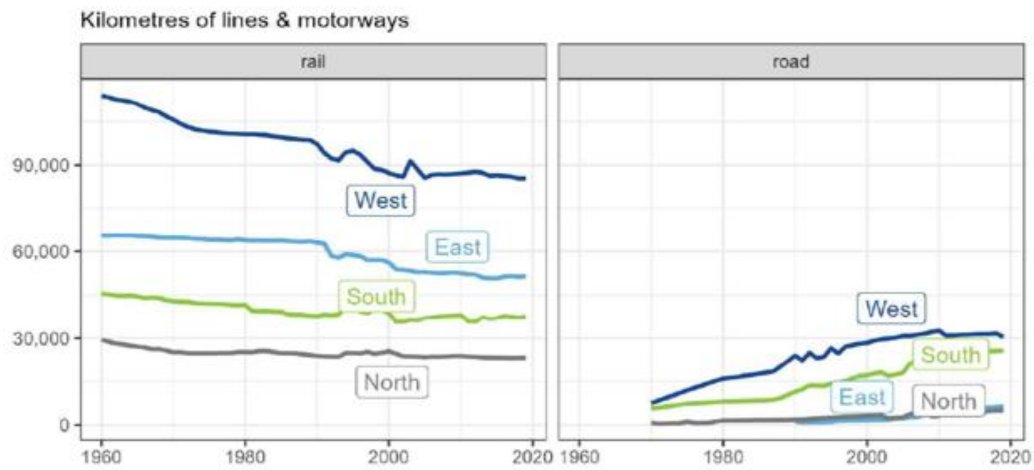

Figure 6. Changes in network length across four regions of Europe, 1960–2020 (ERA, 2024)

In the ERA analysis covering 20 countries, the Northern Europe region – Denmark, Norway, Sweden, and Finland – experienced the smallest decline in the length of its rail networks and also saw a slight increase in the extent of its road networks. Large-scale railway line closures have occurred in the countries of the Eastern Europe region (Bulgaria, Poland, Hungary, Romania, and the Czech Republic), where the expansion of the road network was negligible compared to the number of railway lines discontinued. In the four Mediterranean countries of Southern Europe, as well as in Western Europe (the Benelux countries, Germany, France, Austria, and EFTA member Switzerland), the development of road networks was a priority for investment; as a result, the majority of road construction took place in these regions, while the majority of railway line closures also occurred in Western Europe.

The condition of the rail network, the extent of electrification, the signalling systems in place, and the level of maintenance and modernisation significantly impact the quality and speed of rail transport services. There are also significant differences among European countries regarding these characteristics and the level of investment. In 2020, the top 5 countries (the Benelux countries, France, and Austria) invested seven times more in track modernisation than the bottom 5 countries, including Hungary (ERA, 2024). Moreover, underfunding creates additional disadvantages, leading to temporary capacity restrictions (TCR) and unavoidable disruptions in rail transport that cannot be adequately planned. This can lead to freight traffic being diverted from rail to road, as happened in Hungary in 2025, when 17,000 TEU – approximately 10,000 truckloads of goods – were diverted to road transport – offering more flexible service – due to unpredictable operations, track closures, and traffic restrictions (MLSZKSZ, 2026).

The disadvantages arising from a lack of interoperability pose a major problem. A total of 149 cross-border rail connections in Europe are no longer operational, 119 of which have been identified as promising candidates for reactivation. At the same time, even if a border crossing is actively in operation, technical barriers impose additional costs on railway operators for actual crossings, and thus on the users of their services as well. The lack of interoperability poses a serious obstacle to economic development and hinders growth in the regional gross value added of 4.5% or more in certain border regions (ERA, 2024).

From a technical standpoint, the European railway infrastructure is fragmented and complex, primarily due to four different main track gauges, varying platform heights, four main electrification systems, numerous train safety systems, and

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more than 170 different train control systems that do not comply with the Technical Specification for Interoperability (TSI). In the future, this should be managed in a coordinated manner to reduce procurement and maintenance costs, as in certain cases, investments in and maintenance of railway infrastructure can cost up to ten times more than those for road infrastructure (ERA, 2024). The capacity allocation process further limits the network's performance. Track allocation has traditionally been organised under national jurisdiction, with countries determining priorities based on principles. Furthermore, the standard track application and allocation process is lengthy, making rail freight services inflexible and effectively creating an additional competitive disadvantage. When examining the cost of rail and road freight transport, it should also be noted that the energy crisis led to a significant rise in electricity prices, putting rail freight at a cost disadvantage. The 2004 EU enlargement had a significant impact on road freight transport services in the new member states. The resulting competition – particularly in terms of costs – contributed to road transport becoming relatively cheaper even over longer distances.

ail and road freight transport compete under very different labour conditions. Rail relies on highly specialised staff. Train drivers and operational personnel must complete long training and strict certification. They also need regular requalification. In international traffic, language requirements are demanding. Drivers often must use the official language of each national network. This increases costs and reduces flexibility. In some cases, multiple drivers are needed for one trip. Road transport is much more flexible. Entry barriers are lower. Drivers mainly need a licence and a professional certificate. Training is shorter and simpler. Language requirements are also less strict. Basic communication is usually sufficient. This allows companies to hire from a wider international workforce. As a result, road transport can adjust faster to demand. Labour is cheaper and easier to organise. Rail, despite its environmental benefits, remains less competitive due to stricter labour constraints.Consequently, the stagnation in rail transport's share can be partly attributed to its deteriorating cost position relative to road transport. Legislators need to consider how to improve the cost competitiveness of rail and road freight transport. This involves several areas, such as rail and road regulations (including the allocation of rail capacity and rules governing driving and rest periods for truck drivers).

Rail freight transport is typically associated with the transport of high-volume bulk goods, such as coal; however, due to sustainability requirements and deindustrialisation, demand for raw materials and energy sources has generally declined. The decline of industry goes hand in hand with the disappearance of demand for rail transport from economic actors operating in heavy industry, the energy-intensive chemical industry, or the manufacturing sector. In contrast, the liberalisation of the European road freight market has, on the one hand, led to greater competition, reducing costs. On the other hand, offered much more flexible and reliable services to supply chain members striving to maintain ever-smaller inventories in just-in-time systems. These facts paint an unfavourable picture of the rail sector, making it difficult to achieve a modal shift. Due to changes in demand for transport services, rail must adapt more flexibly to changing needs, and the success of modal shift can be supported if the rail sector monitors the needs of economic sectors. This will require further investment and policy intervention to ensure that rail freight transport doubles by 2050 compared to the baseline (ERA, 2024).

Given current trends in freight transport, the demand for containerised shipping is growing. Industry organisations believe that intermodal transport can increase freight transport efficiency and that this segment will see the fastest growth in the future. This requires investments across Europe in traction vehicles that meet the interoperability requirements set out in the technical specifications. Regarding the fleet of towed vehicles, it is necessary to procure wagon types capable of hauling semi-trailers, containers, and other intermodal loading units. At the same time, there is a need to expand intermodal terminal capacity, as current capacity is insufficient to handle expected traffic. The rail transport sector, which has traditionally specialised in the transport of bulk goods, is becoming an integral part of intermodal transport, a role it can fulfil only if the infrastructure operates predictably and reliably.

3. Medium- and long-term development proposals in Hungary to promote modal shift and intermodality

Recognising the above processes and trends, professional organisations in Hungary have also set the objective of developing sustainable rail freight transport into a reliable and efficient mode of transport that contributes significantly to the growth of the national economy while simultaneously reducing the environmental impact of freight transport (Csavajda and Böröcz, 2019). A specific goal set out in the concept is to increase rail freight transport performance by 50% between 2024 and 2030 by enhancing the sector's competitiveness (Gelei and Kovács, 2026). Furthermore, increasing the competitiveness of the railway sector will significantly contribute to ensuring that in the future, Hungary is not merely

https://doi.org/10.55343/CogSust.23485

viewed as a gateway to Eurasian supply chains or simply as a transit country, but rather becomes a key logistics hub in Central and Eastern Europe. The shift to green, sustainable modes of transport, including rail freight, cannot be achieved in Hungary as long as unfavourable conditions are present. These include the fact that the sector receives less support relative to road transport in terms of freight volume, infrastructure operations are not adequately funded, the rolling stock is outdated, track capacity constraints are difficult to plan for in advance, and the transition through the capital city constitutes a bottleneck. In the medium term (2024–2030), comprehensive, integrated expansion of rail and intermodal infrastructure is necessary to meet the transport needs of manufacturing companies operating in strategic sectors of the national economy. In the long term, through stakeholder cooperation, the share of intermodal transport in Hungary must be increased from the current 7% to 21% (Gelei and Kovács, 2026).

In recent years, while the volume and performance of rail freight transport have declined, intermodal traffic has grown rapidly in Hungary. From 2023 to 2024, it grew by a spectacular 122%, and the total volume exceeded 850,000 TEU. Semi-trailer traffic accounts for a significant share of intermodal growth, reaching 56,000 TEU in 2024. In 2025, total intermodal traffic grew by another 14%, with 502,037 TEU of loaded containers transported, a 6.51% increase compared to the previous year. An exceptionally high increase (+81.22%) was also recorded in semi-trailer transport, with 101,164 TEU transported via this mode (MLSZKSZ, 2026).

It is well recognised that road freight transport has serious social and environmental impacts: high GHG emissions, overburdened infrastructure, and labour shortages. Intermodal rail transport along green freight corridors effectively supports climate protection goals by reducing road congestion and noise pollution, improving traffic safety, and mitigating greenhouse gas emissions (Janić, 2020). Furthermore, it helps alleviate the labour shortage in road transport. In complex transport chains, the efficiency of intermodal transport lies in the fact that goods are transported in unitised cargo carriers across multiple modes of transport, without the need for direct or indirect transshipment. This method can optimise the strengths of each mode of transport in terms of flexibility, speed, cost, and environmental impact. While road transport is the most flexible and often the fastest mode, other modes, such as rail or inland waterway transport, offer greater safety and environmental performance and can reduce congestion on busy roads. In combined transport, unit loads travel most of the route via a green freight corridor, with short-distance road transport to and from terminals. This combines the advantages of different transport modes: it merges the efficiency of road collection and distribution with the long-distance, high-capacity freight transport capabilities of rail and waterway transport. It relieves traffic on public roads, thereby improving road network safety and reducing congestion. It is an environmentally friendly, sustainable logistics solution that also creates a well-regulated, continuous, and traceable flow of materials. In this mode, loading and other wait times can be planned, and the number of transshipments and cargo-handling operations is minimal. The goal set by professional organisations is for the share of goods transported by semi-trailer (or equivalent 45-foot containers/swap bodies) to increase from 7% to 21% of total road freight transport by 2030 (Gelei and Kovács, 2026). However, in addition to infrastructure development, the widespread adoption of combined freight transport also requires the creation of a transparent and predictable support system that directly responds to the needs of market participants. For carriers and logistics service providers, economic rationality is the primary decision-making criterion; thus, intermodal and multimodal solutions can only become competitive if they are environmentally friendly, cost-effective, and reliable.

For intermodal traffic to continue growing in Hungary, infrastructure development must prioritise expanding rail line capacity and increasing the capacity of existing intermodal terminals to meet increased traffic demands. The fleet must also be upgraded; in addition to procuring craneable semi-trailers and 45-foot containers, it is essential to increase investment in specialised rolling stock and efficient, innovative loading equipment. To improve supply chain efficiency, it is worth encouraging the launch of new direct trains connecting industrial zones and seaports. From a policy perspective, consideration should be given to increasing direct subsidies for combined transport and to reducing fees at domestic terminals. In the future, digital solutions, such as eFTI platforms and services, will also play an important role in increasing the efficiency of intermodal transport.

There are currently 11 intermodal terminals in Hungary, with 94% of the country's total intermodal traffic concentrated in three hubs in Budapest. As for regional terminals, significant growth is expected, particularly in Debrecen and Szeged, thanks to ongoing investments in the automotive industry. The objective of professional organisations is to triple semi-trailer intermodal rail traffic by 2030, expand the intermodal network with new, strategically located terminals that meet the needs of economic operators, and integrate them effectively into the national rail and waterway network (Gelei and Kovács, 2026).

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To achieve the above objectives, three of the thematic development project packages developed by professional organisations are designed to encourage a shift in transport modes and strengthen intermodality. Among these, the *Green Logistics Program* aims to achieve targeted CO_2 reductions and reform the toll system. *Strengthening Transport Competitiveness*" prioritises a support system for domestic carriers, favourable tax policies, and driver training. At the same time, the specific *Intermodal Development Package* sets out clear requirements for infrastructure development, a fleet of vehicles capable of handling unitised cargo, new rail services, and terminal capacity expansion. In the medium term, between 2027 and 2030, the priority is the expansion of rail and terminal infrastructure, as well as the development of trimodal logistics connections, while in the long term, the focus should be on strengthening strategic positions (European Court of Auditors, 2023).

Conclusion

This study provides a comprehensive overview of the sustainability challenges facing the transport sector, with a particular focus on the structure of freight transport and the role of modal shift and intermodality in achieving the European Union's climate and transport policy objectives. The study is based on the premise that striking a balance between economic growth and reducing environmental impact is one of the most important challenges of the 21st century, in which the transport sector plays a key role. Road transport continues to dominate EU transport emissions, while rail – despite its favourable environmental characteristics – has a low market share. A study has shown that rail freight transport, thanks to its outstanding energy efficiency and low emissions, can be a key tool for decarbonisation. At the same time, its structural limitations – such as fixed-track infrastructure, limited flexibility, high fixed costs, and interoperability shortcomings – significantly undermine its competitiveness compared to road transport. Road transport, on the other hand, remains a dominant player due to its high flexibility, speed, and cost-effectiveness, particularly with the rise of just-in-time supply chains. Based on European trends, we have observed that the share of rail freight transport has stagnated or declined slightly over recent decades, while the share of road transport has increased. A similar trend can be observed in Hungary. Although rail freight transport holds a stable second place, its share is not growing significantly. Alongside the competition between the two sectors, however, intermodal transport has also developed dynamically in Hungary, following European trends; thus, this mode offers a tangible solution for the future development of sustainable logistics systems rather than a modal shift.

The competitiveness analysis highlighted that the railway sector's lag can be attributed to the combined effect of several factors. These include insufficient infrastructure development, limited track capacity, technical barriers at border crossings, and low investment levels. In addition, the fragmentation of the railway system and regulatory differences also hinder the creation of a single European railway area. At the same time, digitalisation offers new opportunities: eFTI platforms, electronic transport documentation, and ERTMS systems can significantly improve the sector's efficiency, transparency, and competitiveness. It is important to emphasise that a modal shift can only be achieved through complex, coordinated policy interventions. To this end, significant development of rail and intermodal infrastructure, expansion of terminal capacities, and modernisation of the rolling stock are essential. In addition, there is a need to establish a predictable and effective support system that encourages market participants to adopt environmentally friendly modes of transport. The internalisation of the external costs of road transport can also help level the playing field.

Overall, the development of rail freight transport and intermodality is essential to achieving the EU's climate policy goals. Hungary's favourable geographic location creates an opportunity to become a regional logistics hub in the future; however, this requires targeted investments, a strategic mindset shift, and effective cooperation across transport modes. Accordingly, the transport system of the future will be based on an integrated, digitised, and sustainable multimodal network in which rail plays a key role.

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