Semi-trailers will be key to driving modal shift

CargoBeamer has developed technology to support the movement of non-craneable lorry semi-trailers by rail.

With semi-trailers accounting for a majority of Europe's road freight transport, policymakers must provide the right incentives to ensure that they can be used for intermodal applications if long-standing modal shift targets are to be achieved.

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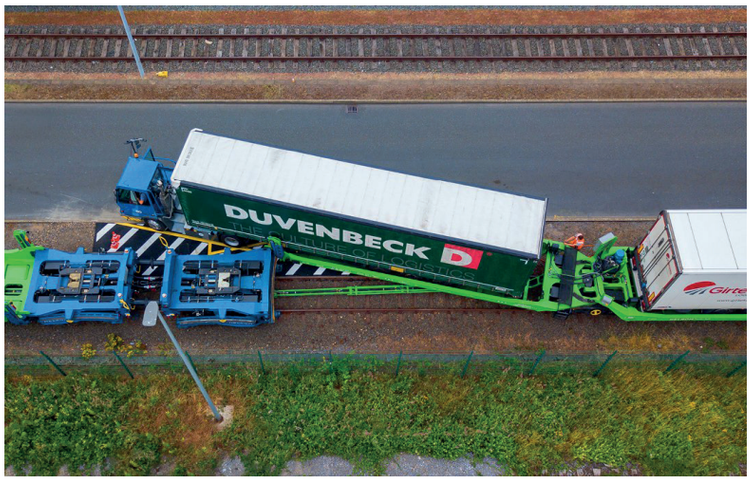
Modal shift from road to rail is a key objective of the European Union's drive to decarbonise the transport sector and improve its sustainability to mitigate the impacts of climate change. In 2011 the European Commission set a primary goal of shifting 30% of road freight in the EU travelling more than 300 km to other modes such as rail or waterway by 2030, and more than 50% by 2050[1].

Although recent figures have been complicated by the Covid-19 pandemic, it seems clear from available data that the much-desired modal shift has only been taking place at a relatively slow pace, if at all.

According to the International Union of Railways[2], 46·1% of total freight transport in the EU (excluding sea and air) in 2020 moved by road over less than 300 km. That represented 59·5% of all road transport for that year, but still left 40% that should be suitable for moving by rail.

One bright spot has been the growth of intermodal transport, which recorded a 51% increase in tonne-km between 2011 and 2021. We have opted to use the broader term 'intermodal' rather than the specific phrase 'combined transport',



Helrom's swing-platform wagon concept.

owing to its wider dissemination across the transport sector.

Looking at the business in terms of 'loading units', intermodal covers a range of technologies, including containers, swap bodies and semi-trailers, whether unaccompanied or accompanied, as in the rolling motorway concept.

The transport of unaccompanied semi-trailers has seen the most substantial increase over the past two decades. This has been particularly evident in Germany, where an average annual growth rate of 12% was recorded between 2005 and 2023. We envisage that there was a similar development in other countries, although we were unable to obtain detailed statistics.

Semi-trailers are the predominant loading unit for freight transport on the European continent today. According to Germany's Federal Motor Transport Authority, no less than 72% of all road transport activity in 2022 was handled in semi-trailers.

However, around 95% of the vehicles in use today are non-craneable, which means that they cannot be lifted on or off trains using conventional gantry cranes. So they cannot be used for intermodal applications without some form of special equipment. Earlier this year, a leading European manufacturer confirmed to the authors that although total production had been increasing, the ratio between craneable and non-craneable vehicles had remained constant.

Various companies are now offering technologies that enable non-craneable semi-trailers to be used for intermodal transport, using some form of horizontal transhipment, a lifting cradle or specialist wagons. These include CargoBeamer, Helrom and Modalohr, for example. These companies have been expanded their activities rapidly in recent years. Concurrently, there is notable demand for craneable semi-trailers for vertical transhipment using conventional gantry cranes.

Loading semi-trailers onto Modalohr wagons at a dedicated terminal.

This article aims to explore recent developments and consider future scenarios for intermodal semi-trailer transport across Western Europe, drawing data from Germany, France, Spain, Italy, Poland, and the Netherlands. Eurostat data show that in 2022 the first five of those countries accounted for almost two thirds of all freight transport within the EU. We have found that the theoretical potential for modal shift to rail is constrained by many factors, including macro trends, transport distance and prevailing business models.

Macro trends

In today's interconnected and rapidly evolving global landscape, intermodal transport is a pivotal component of the wider logistics supply chain. However, its dynamics are not solely shaped by industry-specific factors, but are deeply intertwined with broader macro trends. These reflect a combination of social, economic, technological and political (or regulatory) factors.

Transport is highly sensitive to economic changes and external shocks. Economic downturns and unforeseen events like the global pandemic can significantly impact the transport sector, altering demand patterns and highlighting vulnerabilities. Economic downturns typically lead to lower freight demand, increased competition, and reduced rates. Despite this, EU road transport showed resilience during Covid-19, with Eurostat only reporting a 1% decline in tonne-km in 2020 compared to 2019. Conversely, rail transport saw a 6·1% reduction. One factor that might be relevant is the nature of the goods being transported. Rail is heavily used for bulk and raw materials, but can suffer when industrial production declines, whereas road transport enjoys a relatively stable market for perishables and fast moving consumer goods. People tend to prioritise non-discretionary spending on essentials like food and medical supplies during crises, or when GDP declines.

The cost of fuel is another important external factor, but here rail is less dependent on fossil fuels, as well as consuming significantly less energy per tonne-km than heavy goods vehicles. This implies a higher sensitivity of road transport to fluctuations in fuel prices, whereas rail has been benefiting from a transition to electric and hybrid locomotives.

Currently, 96·9% of all trucks run on diesel or petrol, with only 0·1% being electric. Current trends suggest that road transport will gradually catch up to rail in terms of transitioning to electric power in the medium to long term. The EU's commitment to achieving carbon-neutrality by 2050 is driving significant investment in 'green' transport, and major truck manufacturers

12%

average annual growth rate in transport of unaccompanied semi-trailers in Germany between 2005 and 2023

Photo: DB E&C / Iuliia Kozina

A craneable semi-trailer on a rail wagon at the DUSS Hamburg Billwerder terminal.

are developing hydrogen and electric models. In 2020, Scania, Daimler, Volvo, MAN, DAF and Ford jointly committed to achieving full decarbonisation by 2050.

Another critical factor is labour supply. The European road haulage industry faces a significant driver shortage, with more than 380 000 unfilled positions (10%) in 2021. The shortfall is projected to reach 745 000 by 2028. According to a 2021 survey, 45% of fleet operators reported a lack of skilled personnel, and 46% cited difficulties in attracting young people. This shortage affects first and last mile deliveries to a lesser extent than long-haul trucking.

In the longer term, the truck driver shortage may be partially alleviated through the introduction of autonomous driving technology or recruiting more foreign drivers. Although much less significant than the truck driver shortage, the locomotive driver shortage is also being compensated for by training foreign workers.

45%

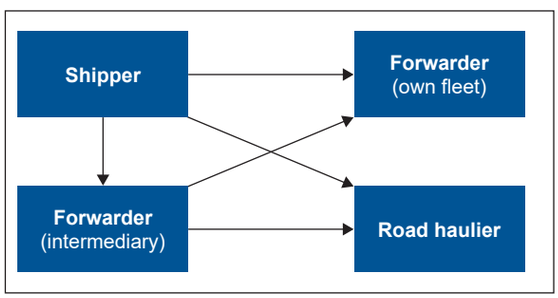
of European road haulage fleet operators reported a lack of skilled staff in 2021

Adoption of digital technologies and telematics is improving operational efficiency, tracking and route optimisation. Digitalisation and automation are especially important for intermodal, due to the number of interfaces between the components of the logistics chain. Key areas for further development include capacity management, wagon tracking, autonomous train operation, cybersecurity, predictive maintenance and electronic document exchange.

Infrastructure condition and capacity are crucial factors for the entire supply chain. Congestion in rail networks and at intermodal terminals can lead to delays and reduced efficiency. Various European initiatives are addressing this issue, including TEN-T projects. Such capacity constraints generally have less impact on road transport due to the greater availability of alternative routes compared to rail.

Finally, technological developments are gradually transforming the landscape for intermodal freight transport, particularly the emergence and increasing maturity of horizontal transhipment technologies, which use specialised equipment for seamless transfer of semi-trailers between road and rail. Developments in rolling stock are also helping to bolster the competitiveness and sustainability of rail.

Fig 1. Contractual relationships in road freight transport.



Business models and modal shift

Apart from 'hard' factors such as performance, cost and time, the business model of a freight forwarder can be an important factor that impacts the choice of transport mode. Fig 1 shows typical contractual arrangements in the road freight market. A shipper can either contract directly with a road haulier or outsource the transport task to a freight forwarder.

Over time, many forwarders have moved from acting as an intermediary to becoming transport companies in their own right, often with their own assets. Most have contracts with other operators to achieve competitive rates, which makes them less neutral in their decision-making.

A forwarder can either provide transport using its own fleet, or contract the work to another haulier. We therefore need to make a distinction between forwarders with their own fleet and those who subcontract the transport operations.

In 2014, Truschkin et al[3] suggested that subcontracting could be a barrier to modal shift from road to intermodal transport. Empirical data indicated that the current form of dispatch influenced the willingness to shift to intermodal transport. Specifically, forwarders that hired road hauliers were less likely to switch modes, even when there was a competitive advantage to doing so. This tendency was less pronounced in cases where companies had their own fleet. The research also found a correlation between company size and willingness to shift, with larger companies finding intermodal more attractive.

Transport policy measures

It is important to understand how country-specific policies and initiatives in different European countries have been addressing the use of semi-trailers for intermodal transport.

Of the six countries we examined, Germany, Spain and Poland had recognised the importance of semi-trailers and implemented dedicated measures. For example, Germany's *Flottenerneuerungsprogramm für schwere Nutzfahrzeuge* (Fleet Renewal Programme for Heavy Commercial Vehicles) promotes trailer use by subsidising intelligent trailer

Table I: Growth of semi-trailer numbers in Europe by permitted load capacity

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
20-30 tonnes	118652	109887	136297	125744	131639	155244	155712	157342	158525	162376
30-40 tonnes	748165	1035069	1175095	1250696	1378779	1865591	1894097	1941365	2035947	2139957
EU total*	**866817**	**1144956**	**1311392**	**1376440**	**1510418**	**2020835**	**2049809**	**2098707**	**2194472**	**2302333**

* For those countries where data is available. Note: Some countries began reporting in different years. Source: Eurostat

technologies and CO_2 reduction measures. It also provides funding for upgrading non-craneable semi-trailers to craneable. The programme offers up to 60% of the cost for each measure, capped at €5 000, and has a budget of €257m for 2022-25.

In 2023, the Federal Ministry for Digital & Transport allocated €15m for Helrom Trailer Rail to address the market segment of non-craneable semi-trailers. Helrom provides a one-stop-shop, offering traction, Megaswing wagons and terminal operations from a single source. Updated funding guidelines for transhipment facilities that came into effect on December 1 2022 aim to encourage investment in intermodal terminals. For projects with a budget of €100 000, the ministry will cover up to 80% of the cost.

Similarly, in Spain, the government has implemented measures to support the use of semi-trailers, including encouraging the purchase of craneable vehicles. This is being co-financed by the European Commission's Recovery & Resilience Fund, with an allocation of €2·5m. Furthermore, the government gave €17·3m to Ermewa Ibéricato to fund 150 Shimmns coil transport wagons and 50 pocket wagons for carrying semi-trailers, which are due to be delivered in 2024.

Intermodal transport is less developed in Poland, primarily due to the irregular distribution of terminals and transhipment hubs. The European Council has allocated €130m to address this, mainly for investment in road, rail and intermodal terminals. The European Commission has also allocated €180m to support intermodal transport within Poland until the end of June 2026, covering up to 50% of eligible costs through direct grants. As part of efforts to reduce CO_2 emissions, a project spearheaded by Ceutp will see the procurement of 92 pocket wagons or platforms to carry intermodal trailers.

We could not identify any dedicated policy measures in France, Italy, and the Netherlands specifically for semi-trailer transport, although these countries remain committed to developing intermodal transport and increasing rail's market share.

In France, there are plans to invest €100bn by 2040 to upgrade and expand the rail network, although precisely how this will be delivered is less clear. The government has set an objective of increasing rail freight from 32 billion tonne-km to 64 billion by 2030. It is providing subsidies for wagonload freight and general infrastructure improvements that would support intermodal transport, totalling €450m by the end of 2025. These subsidies are expected to cover 30% of first and last mile service costs.

Italy has initiated several measures to promote a shift towards rail, such as the FerroBonus incentive, which was endorsed by the European Council in 2016. This has now been extended until the end of 2027, with a minimum of €22m per year being made available for 2023-27.

The Dutch government is supporting the installation of Ertms to support interoperable cross-border operation; this is important as around 80% of rail freight in the Netherlands originates from other European countries. It has also funded the construction of new lines and additional tracks to relieve key bottlenecks.

Semi-trailer market development

The theoretical potential for semi-trailers in the EU's intermodal transport market can be determined from Eurostat statistics (Table I). The reported number of semi-trailers in the EU had reached more than 2·3 million vehicles by 2022, although some countries failed to provide data for earlier years. Assuming a 95% share, that means there are at least 2 187 216 non-craneable semi-trailers.

It seems clear that the market potential for intermodal is significantly constrained by the high number of semi-trailers being used for short distance transport, although no EU-wide data could be obtained.

180 €m

allocated by the European Commission to support intermodal transport within Poland until the end of June 2026

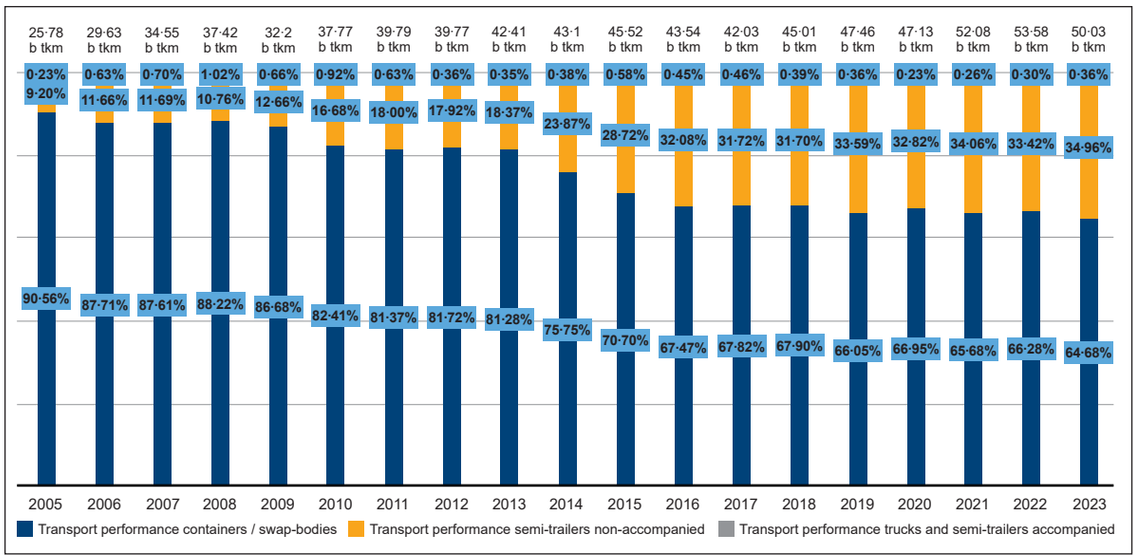


Fig 2. Evolution of intermodal transport tonne-km in Germany by loading unit, 2005-23 (%).

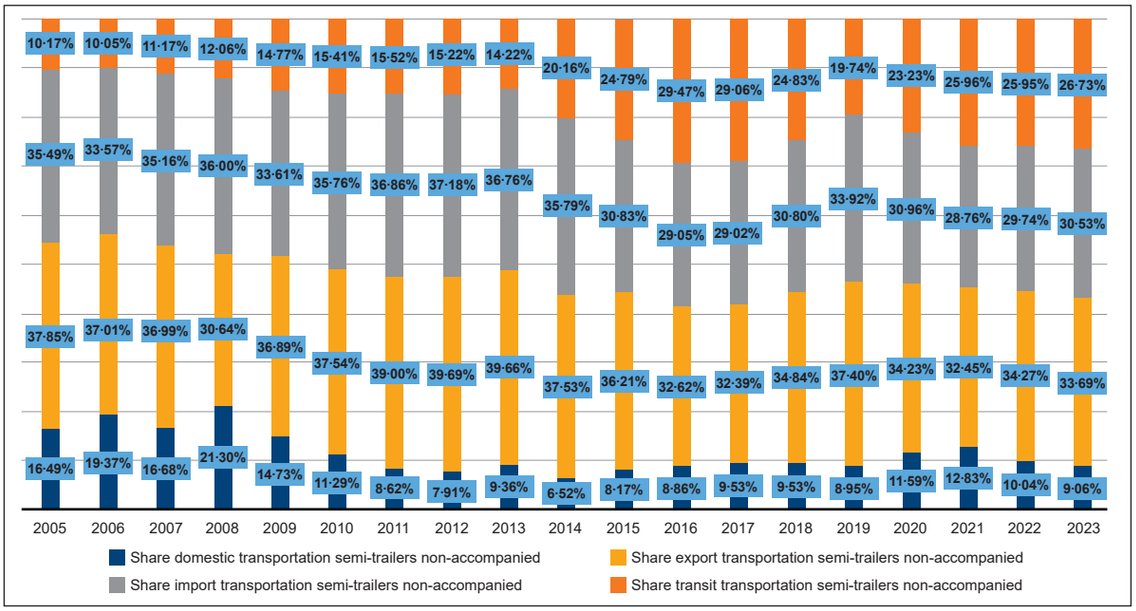


Fig 3. Increase in intermodal transport in Germany moving in unaccompanied semi-trailers by direction, 2005-23.

Fig 2 shows transport performance (tonne-km) by loading unit for intermodal transport in Germany. That country was selected as a case study as it is the largest contributor to rail freight transport in the EU, with 125 billion tonne-km in 2022 accounting for 31·3% of the EU total.

Intermodal transport in Germany more than doubled from 25·8 billion tonne-km in 2005 to 50 billion in 2023. Unaccompanied semi-trailers saw the most dynamic increase, with a compound annual growth rate of 12%, compared with 2% for containers/swap bodies and 6% for rolling motorway traffic, reaching an historic peak of 34·96% of intermodal rail freight transport in Germany in 2023.

According to UIC[4], intermodal tonne-km in Europe as a whole increased by 51% between 2011 and 2021, whereas overall rail freight tonne-km only increased by 3%. Intermodal is clearly taking a greater share of the rail market, and this can be seen in the German figures, where the proportion increased from 29% in 2018 to 43·1% in 2021, surpassing the European average of 30%. Fig 3 shows that the increase in the share of unaccompanied semi-trailers is mainly driven by import, export and transit flows, with the latter showing consistent growth over the period.

Considering the impact of business models on the transport market, Fig 4 considers the ownership of semi-trailers by company size in commercial road haulage in Germany in 2020. Of the total 216 738 semi-trailers, 68% are owned by micro and small enterprises with up to 49 employees.

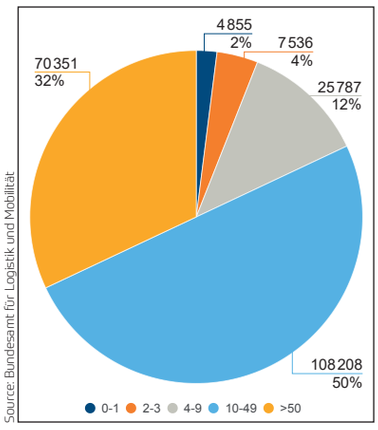


Fig 4. Ownership of semi-trailers in commercial road haulage in Germany in 2020 categorised by company size, in number of employees.

Dedicated policies needed

Improving the transport of semi-trailers by deploying a mix of transhipment technologies seems key to facilitate a further shift of freight from road to rail. A focus on interoperability between vertical and horizontal systems would avoid the risk of creating rival networks with different technologies and contribute to development of an EU-wide intermodal network.

It is worth noting that space constraints at existing intermodal terminals often do not allow for the expansion of horizontal transhipment technologies. In such cases, the ability to load a semi-trailer using horizontal transhipment on departure, and then unload it via vertical transhipment on arrival (or vice-versa) would facilitate connections to a broader network of terminals. That in turn, would make intermodal more attractive to decision-makers.

In the case of greenfield projects, integrating both vertical and horizontal transhipment technologies in one terminal would allow rail operators and their customers to harness the systemic benefits of each. Vertical transhipment would be primarily aimed at containers and swap bodies, while horizontal transhipment may be more important for semi-trailers.

Given that semi-trailers play a major role for both intermodal and road haulage, they clearly have a key role to play in driving modal shift. However, there seems to be a distinct lack of attention from policymakers, in terms of specific measures to promote and support semi-trailer operation. We believe that stronger and more dedicated EU transport policies will be needed to encourage semi-trailer transhipment technologies, contributing to the achievement of the EU's green agenda.

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