Self-driving trucks: en route to transform Europe's freight sector

EU-funded researchers are accelerating the rollout of self-driving trucks on public roads to solve driver shortages and improve safety and sustainability in Europe's logistics sector.

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By Bárbara Pinho

Researchers are preparing automated trucks equipped with cameras, sensors and radars to transport cargo on Europe's public roads. © Einride

In the not-so-distant future, unusual looking cargo vehicles – sporting large black windscreens and with no human driver behind the wheel – could become a common sight on European roads.

These are automated long-haul trucks, key players in the future of Europe's freight sector. EU-funded researchers are working hard to make their roll-out as smooth as possible.

Self-driving vehicles are no longer a novelty. Small autonomous buses around airports, autonomous metro lines or monorails, and even driverless passenger cars have all become more common in recent years.

However, self-driving trucks are still mostly in the testing phase. They are big and heavy and need to move quickly to deliver goods on public roads, so researchers are carefully gauging their progress.

One of those testing the new trucks is Dr Ragnhild Wahl, director for research and innovation at ITS Norway. She is coordinating an EU-funded research initiative named MODI, which aims to improve Europe's logistics sector through increased automation.

“This project is about providing a stepping stone to the full-scale deployment of fleets of automated vehicles,” she explained. The main aim is to create and test a system that will allow us to have self-driving trucks transporting goods around Europe.

Ensuring safe rollout

The ultimate goal of the freight sector’s modernisation is to reach so-called “Level 4” automation, where vehicles drive within predefined geographical areas without the need for humans on board.

These trucks will be able to drive continuously without breaks, extending driving hours and improving logistics efficiency. They will use sensors, radars, cameras and advanced AI algorithms for decision-making and vehicle control.

There will also be command centres with remote operators who oversee operations round the clock. But to have automated trucks on the roads, the researchers need to make sure there are no surprises.

“We are working to identify and lower barriers to automation,” Wahl said. Her international research team is developing so-called cooperative, connected and automated mobility (CCAM) solutions in real logistics operations on the ground.

The EU is a global leader in CCAM research and is promoting it as the best way to modernise the transport sector, with MODI as one of the flagship initiatives.

Along with greening and digitalising transport, automation could also help tackle the growing shortage of truck drivers.

Recent figures show that an increasing number of truck driver vacancies remain unfilled across Europe. The International Road Transport Union predicts that by 2028, Europe could be short of 745 000 truck drivers – 17% of the total required workforce.

“There’s a severe shortage of drivers and it’s only going to get worse in the coming years,” said Pia Wijk, a project manager at Einride, a Swedish freight technology company specialising in electric and autonomous vehicles.

Wijk also works as part of the MODI research team, which brings together experts from 36 public and private organisations, such as the Volvo Technology AB and DAF Trucks, based in seven EU countries, plus Norway.

> *We believe that autonomous technology has the potential to make transport safer than ever before.*
>
> Pia Wijk, MODI

Greener and more efficient delivery of goods

At the centre of their efforts are self-driving trucks.

These sleek, white, futuristic-looking vehicles have a darkened windscreen in the front, packed with cameras and sensors for additional safety.

Einride's autonomous technology, based on AI and precision sensors, analyses more than 5 million data points per second, allowing their driverless vehicles to navigate complex routes, accurately detect objects and anticipate braking distances.

Wijk said autonomous vehicles could help reduce the number of road fatalities. This is in part thanks to accident-avoidance features and the reduced scope for human error.

In a recent study published in Nature, scientists who analysed thousands of accident reports involving both autonomous vehicles and those with human drivers suggested that in most situations, autonomous vehicles are actually safer than humans.

"We believe that autonomous technology has the potential to make transport safer than ever before," Wijk said.

In 2024, about 19 800 people lost their lives in road traffic accidents across the EU, according to European Commission data.

This represents a 3% decrease from the previous year, amid the EU's ongoing efforts to improve road safety. The objective is to halve the number of road deaths by 2030 and ultimately achieve zero fatalities by 2050, an ambition known as Vision Zero.

Testing in complex, real-life environments

The MODI research team are currently exploring how automated transport can be integrated into the logistics sector, with a focus on key transport corridors across Europe. In doing so, they are identifying a range of challenges that must be addressed.

It is crucial to ensure that essential tasks accompanying any cargo journey – such as border crossings, documentation, refuelling, and loading or unloading – can still be carried out effectively in an automated transport environment.

By the time the project concludes in March 2026, the team will have conducted detailed impact assessments, compiled their findings, and developed business models to inform both companies and policymakers.

MODI's primary focus is the 1 200-kilometre road corridor from Rotterdam in the Netherlands to Oslo in Norway. The researchers are assessing its infrastructure readiness for automated driving.

This route spans four national borders and, since Norway is not part of the EU, it also involves navigating customs and toll clearance between EU and non-EU territories.

MODI researchers are also testing technological solutions through four specific use cases in port areas along the corridor, each representing a different stage of the logistics supply chain.

In Rotterdam, they are studying how well autonomous vehicles operate in busy port environments with mixed traffic. In Hamburg (Germany), transitions between motorways and urban city roads are among the core elements.

In Gothenburg (Sweden), the focus is on hub-to-hub challenges like automated charging, loading and unloading. Automated tolling will be tested while crossing the border to Norway.

In Moss (Norway), they are testing communication between vehicles and infrastructure while driving on public roads.

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> Dr Ragnhild Wahl, MODI

A driverless future on the horizon

Einride is already using its autonomous vehicles in commercial operations in Europe, moving cargo between warehouses for one of Sweden's largest pharmacy e-retailers since December 2024. Their trucks use a public route, with a permit from the Swedish Transport Agency.

In the short term, Wahl expects the easiest deployment to be over short distances and in controlled and confined environments, such as terminals and ports.

When it comes to heavy, long-haul trucks, however, progress will be slower. "For the long-distance freight transport, automated trucks will need to travel at high speeds over hundreds of kilometres, so their rollout will have to be carefully planned," Wahl said.

Public roads are tightly regulated, more complex and essential to communities, making the introduction of self-driving vehicles both a technological and societal challenge. Still, early signs are encouraging.

"When we started working with automated vehicles in the 1990s, everyone was sceptical about them," Wahl said. "Nowadays, the social acceptance of self-driving minibuses is increasing, as we see in the use of robotaxi and small units moving slowly in controlled environments like airports."

Larger trucks will need more time and effort to win support and navigate regulatory hurdles. Still, thanks to EU-backed initiatives like MODI, that driverless future is edging ever closer.

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