Germany-wide autonomous ridepooling

A simulation-based analysis
of socioeconomic potentials

MOIA

Introduction

Autonomous vehicles glide silently and emission-free through cities and rural areas. Passengers board with ease, traffic flows smoothly, and accidents become increasingly rare – a vision of the future that is no longer a distant dream. The rapid development of autonomous technologies presents Germany with a unique opportunity to completely rethink its approach to mobility, make a visionary contribution to climate protection, and create new jobs and economic prospects.

Autonomous on-demand ridepooling will become a reality in the coming years, offering sustainable, affordable, and convenient mobility for everyone.

By digitally and intelligently pooling individual trips, near door-to-door service becomes possible within the public transportation system. Ridepooling has the potential to revolutionize traditional public transport, ensure comprehensive access in both urban and rural areas, and reduce dependence on private cars.

Even in rural regions, the transition to sustainable mobility can be accelerated through significantly improved service quality – without the need for major investments in new infrastructure. At the same time, this ensures that Germany retains its strong international economic standing, secures national mobility despite existing labor shortages, and develops future-proof digital technologies made in Germany with global export potential.

At a Glance

12 million

trips using a future autonomous ridepooling service across Germany have been simulated.

40 %

more passenger-km with environmentally friendly mobility modes – enabling truly comprehensive public transport access for everyone.

300,000

autonomous vehicles made in Germany are deployed to ensure full nationwide coverage.

€3.6 billion

in external costs saved and 5 million tons of CO_2 avoided annually.

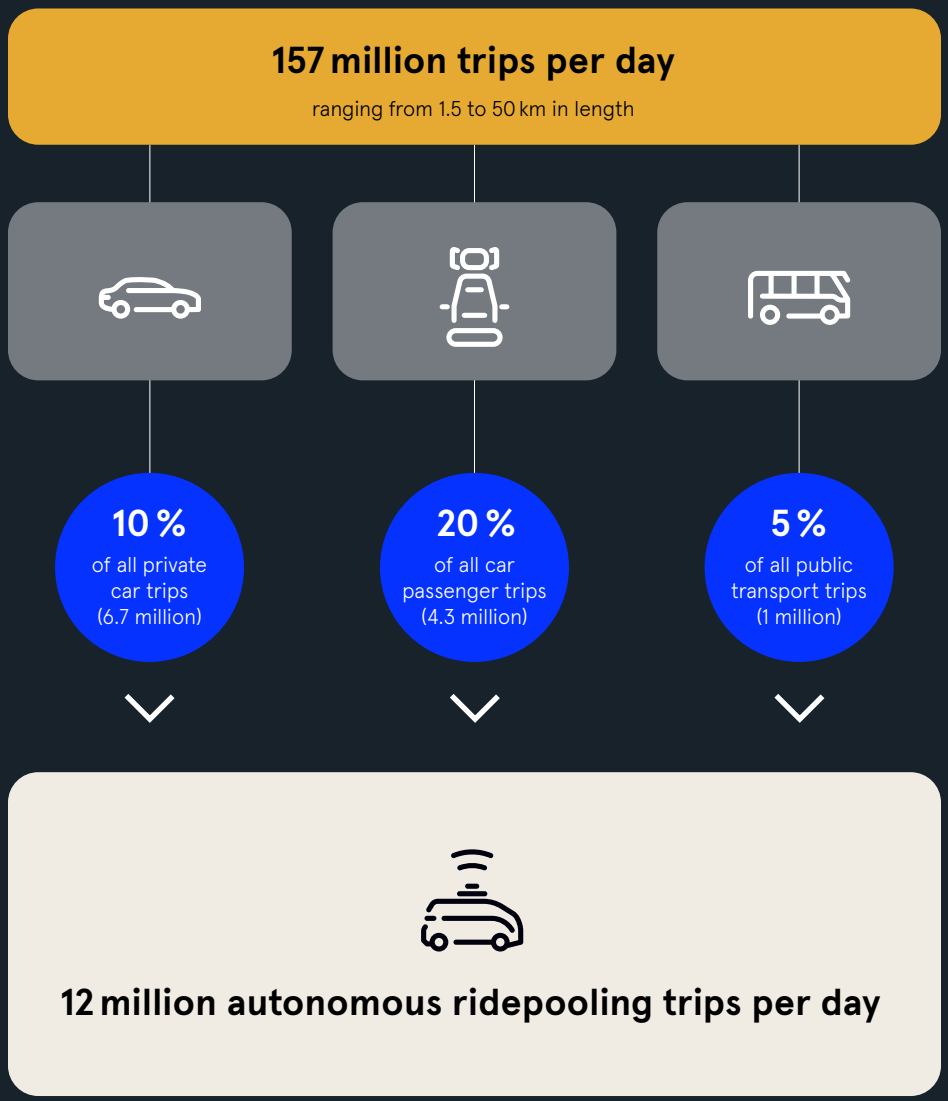


Figure 1: Schematic representation of how current daily mobility in Germany could be shifted to a scaled autonomous ridepooling service.

Simulation

This visionary, simulation-based feasibility study demonstrates how a nationwide autonomous ridepooling service could provide public mobility across both urban and rural areas – in close coordination with existing public transport systems.

Using anonymized cell phone data provided by Invenium Data Insights, the study captures daily mobility patterns across Germany – totaling nearly 300 million trips per day. Of these, 157 million trips are between 1.5 and 50 kilometers long and are considered suitable for the ridepooling service.

Each trip is assigned a mode of transport based on Germany's largest mobility survey, Mobility in Germany (MiD 2017), and the regional spatial structure (RegioStaR). A portion of these trips is then reallocated to the ridepooling service, as shown in Figure 1. In areas with low public transport coverage, the new service is used more frequently than in metropolitan regions.

In total, 12 million daily trips of up to 50 kilometers are served by the autonomous ridepooling service – representing a modal share of 4 %. As a result, the transport performance of environmentally friendly modes (public transport and bike) increases from 149 billion to 209 billion passenger-kilometers (PKM) per year.

12 million trips per day	**Ø 10-minute wait time**	**5 million tons CO_2 reduction per year**
183 million PKM per day	**Ø 1.7 vehicle occupancy**	**€3.6 billion reduced external costs**

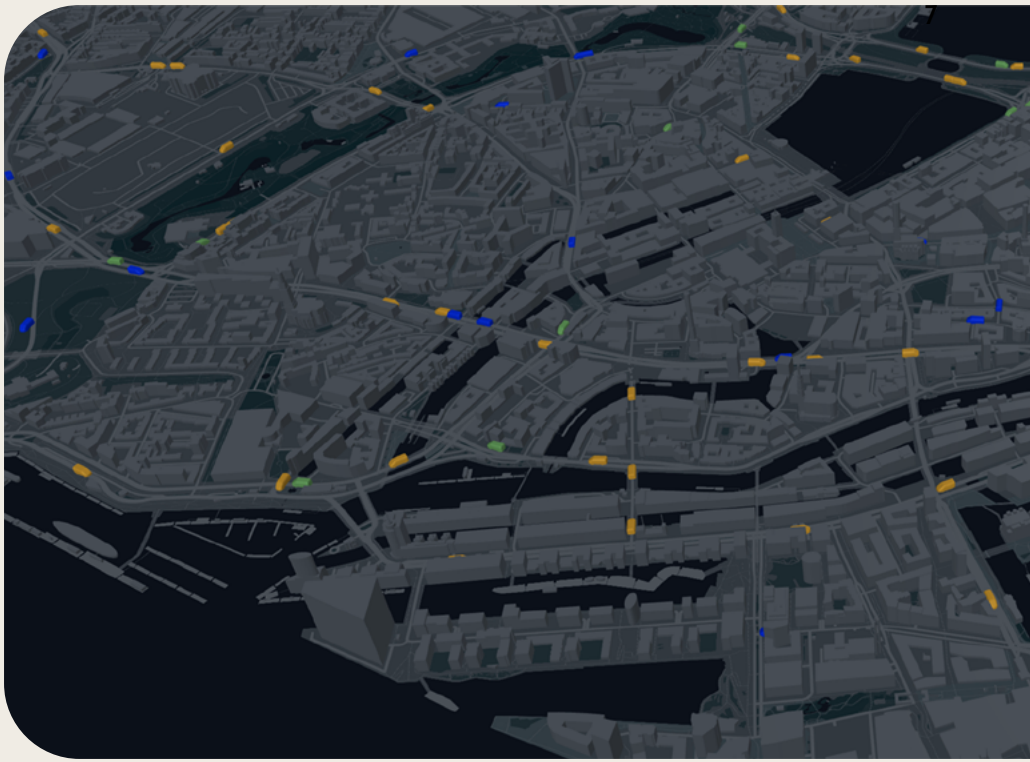
Figure 2: Selected simulation results.

300,000 ridepooling vehicles are deployed to transport 12 million passengers per day. They are routed on a digital German road network with real-world travel speeds provided by HERE Technologies.

MOIA conducts the simulations using MATSim (Multi-Agent Transport Simulation), a proven tool to simulate ridepooling systems in great detail. MOIA uses the tool to plan and adapt its services in both existing and new regions, taking local conditions into account. MATSim is an open-source platform, ensuring transparency and reproducibility of the simulation process.

Figure 2 presents selected simulation results. Figure 3 visualizes the simulated fleet using the Mobility Impact Analyzer (MIA).

Beyond the key finding that only 300,000 vehicles are needed to handle 12 million daily trips – meaning each vehicle completes an average of 40 trips per day – the simulations provide detailed insights into service indicators.



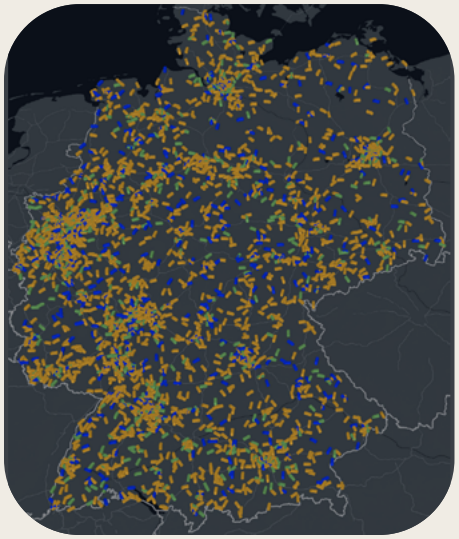


Figure 3: Visualization of the nationwide ridepooling fleet during a simulated day using the MIA simulation tool – shown in the center of Hamburg (top) and across all of Germany (bottom).

The simulated trips have an average distance of 16 kilometers, resulting in a total of 183 million PKM per day. Thanks to pooled rides, the service achieves an average occupancy of 1.7 persons per kilometer – for comparison, private cars during commuting hours carry only about 1.1 persons per kilometer. The average wait time is around 10 minutes, and, as shown in Figure 4, this is consistently achievable in both urban and rural areas.

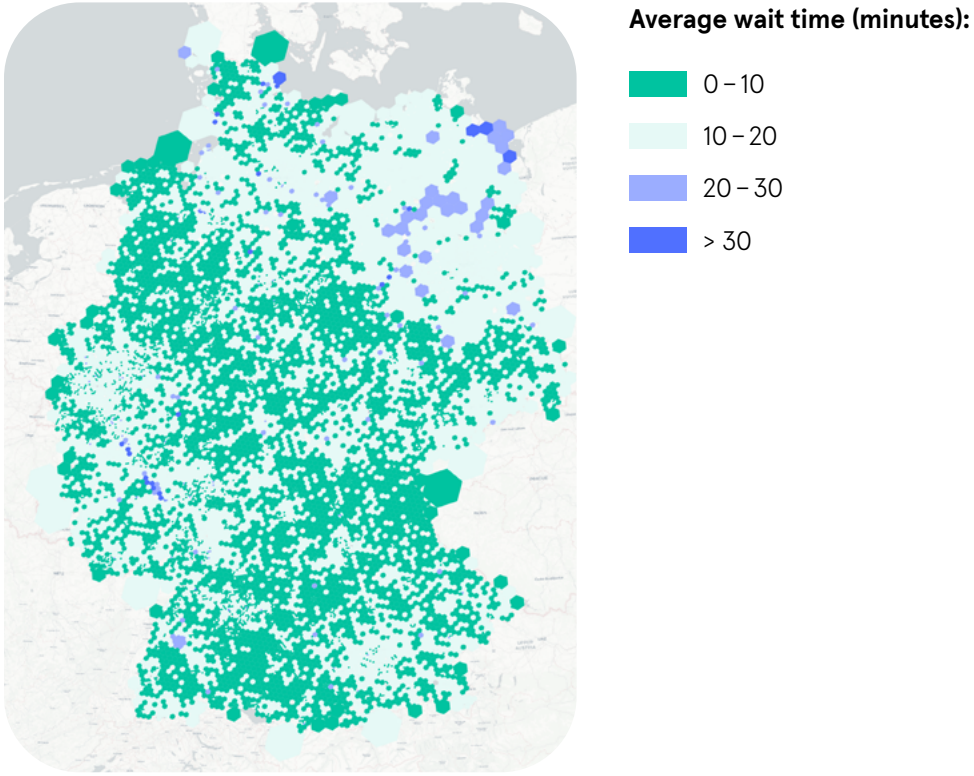


Figure 4: Spatial distribution of average wait times.
Only in a few very sparsely populated regions does the wait time exceed 20 minutes.

Socioeconomic effects

A nationwide autonomous ridepooling service has substantial impacts on the national economy. Based on the simulation results, effects on external costs, economic value creation, and other indirect societal benefits may be calculated.

Figure 5 illustrates how external costs within the mobility system change with the introduction of a ridepooling service. With each vehicle covering 130,000 kilometers annually, the ridepooling fleet is used very intensively. This high usage enables continuous fleet renewal, allowing for the deployment of the latest and most environmentally friendly generation of electric vehicles – resulting in 5 million tons of CO_2 saved every year.

A reduction of €3.6 billion in societal costs is achieved by replacing trips made with private cars and conventional public transport, both of which generate higher external costs such as emissions, accidents, congestion, and noise. The autonomous ridepooling service is operated with a fully electric fleet, and further reduces noise and accident-related costs through optimized routing and advanced safety systems.

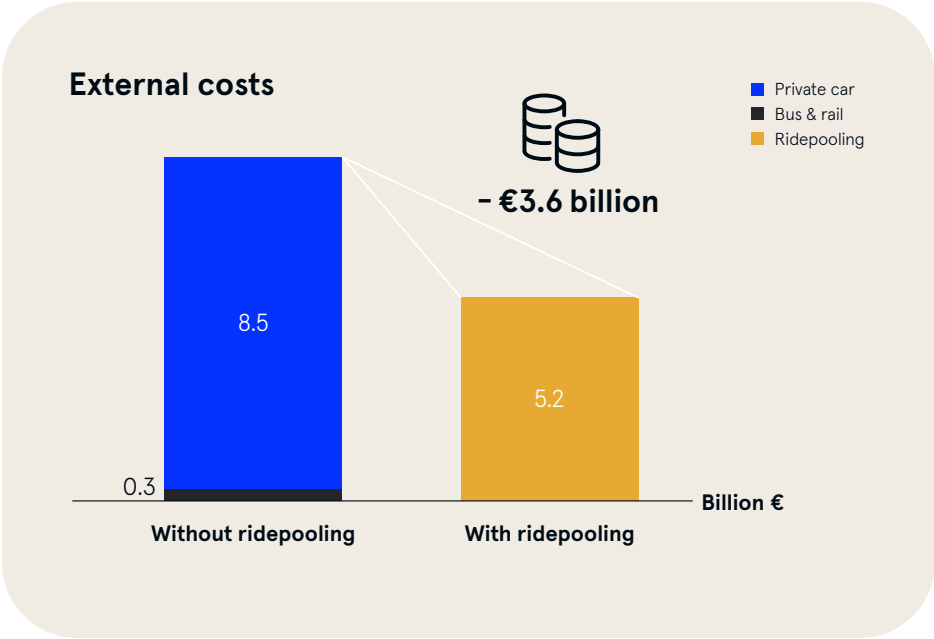


Figure 5: Yearly external costs with and without ridepooling service.

In addition to the reduction in external costs, other positive effects are expected. Poorly connected rural areas will be served comprehensively, ensuring economic and social inclusion in those regions. The shortage of personnel in public transport can be alleviated through the use of autonomous technology.

Because fewer vehicles are needed compared to private car traffic, large amounts of urban space currently used for parking can be freed up, particularly in cities where space is limited and highly valuable.

Despite the relatively small size of the ridepooling fleet, the economic value generated within the mobility sector increases, thanks to this new system, which is expected to be financially self-sustaining in the long term.

However, individual spending patterns will shift: Instead of paying fixed and variable costs for owning a private vehicle, individuals in the future will pay for single rides or subscriptions. These expenses could be covered by a personal mobility budget.

A scaled autonomous transport system not only expands the mobility market, but also creates new sales opportunities, which are especially important for Germany's automotive industry.

This sector faces the challenge of developing innovative business models to remain competitive in a changing international market landscape.

The introduction of autonomous technologies and high-tech software made in Germany opens up opportunities for sustainable growth, economic stability, and the creation of new, highly skilled jobs in software development, fleet control, and in the digital management of autonomous systems.

Conclusion

This simulation-based feasibility study demonstrates how a nationwide autonomous ridepooling service, with 12 million daily trips and 300,000 vehicles, can ensure comprehensive mobility across all of Germany. In the emerging age of autonomous mobility, such a service represents a powerful lever for securing and optimizing public transport, increasing the PKM with sustainable mobility modes by 40 %. Rural areas, which are often poorly connected to traditional public transport today, would benefit in particular.

Thanks to its high vehicle utilization, the service can be offered in a resource-efficient way – saving nearly €4 billion in external costs and 5 million tons of CO_2 annually.

Beyond the shift to electric vehicles, it would significantly accelerate the transition toward sustainable and shared forms of mobility.

This transformation will also drive the evolution of the German automotive industry, helping it secure a strong international position in the mobility services market. In doing so, a forward-looking sector of the economy in Germany is established.

MOIA enables this transformation together with its partners by providing the technical and digital foundations for autonomous ridepooling. It is now time to shape the legal, economic, and societal framework so that the broadly positive potential outlined in this study becomes reality on a large scale.

Outlook

Through its Mobility Consulting division, MOIA offers simulation-based analyses of on-demand mobility in new environments. These analyses are flexible and targeted, enabling the evaluation of the optimal service configuration within the context of existing local mobility systems.

This allows ridepooling and other services to be custom-designed for specific regions, taking into account local goals, policies, and constraints.

The results of our analyses are visualized using the web-based tool MIA, replicating the potential fleet behavior within a region and providing unique insights into service quality and economic viability.

MIA demonstrates how ridepooling can support any region in achieving its transport policy objectives, and allows for the evaluation of numerous scenarios using clear and concrete performance metrics.

For a tailored assessment of on-demand mobility in your region, get in touch at

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