Lernende Systeme

GERMANY'S PLATFORM FOR ARTIFICIAL INTELLIGENCE

AI business models for travel and transport

White Paper by
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Executive Summary

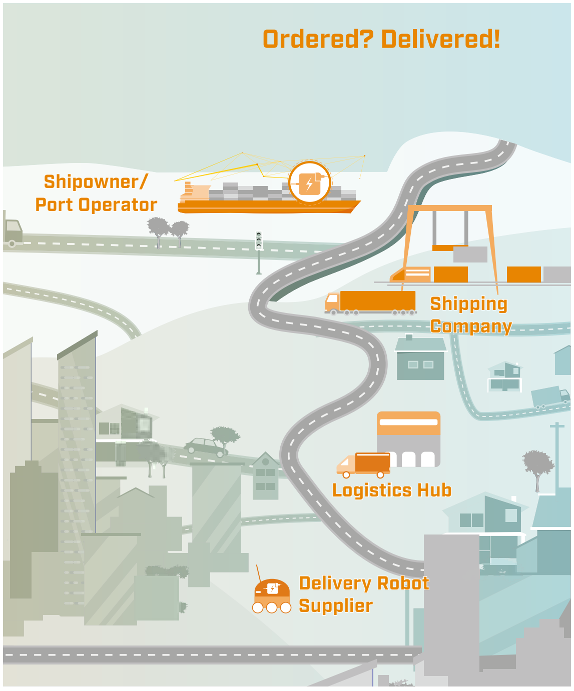
Whether through networked mobility spaces or the optimization of traffic flows, logistics and transport processes – Artificial Intelligence (AI) can make an important contribution to the mobility of the future, improving existing business models and enabling new ones. In recent years, decisive progress has already been made toward autonomous mobility. AI can help make transportation systems smarter and fit for the future. At the same time, AI-based mobility concepts enable completely new business models, for example for digital platforms enabling numerous companies of all sizes and industries to cooperate in the future. Experts from the working group *Business Model Innovations* and the working group *Mobility and Intelligent Transport Systems* of the Plattform Lernende Systeme have analyzed various stakeholder groups in fictitious logistics and travel scenarios to investigate new AI business models and the role of AI-based platforms for travel and transportation.

Along the paths of the application scenario "Ordered? Delivered!", which has been developed by the working group *Mobility and Intelligent Transport Systems* of Plattform Lernende Systeme, the actors involved are presented and analyzed regarding the potentials of new AI business models in mobility for more economic efficiency and sustainability.

Integrated transport management – Analysis of the actors along the logistics path

Carla Fuchs is on her way to an appointment in Berlin when she realizes she has forgotten the charger for her laptop. She quickly orders a new one, trusting it will be delivered to the destination of her choice in a few hours. This is made possible by self-learning systems that support a fast, efficient and environmentally friendly shipping system. At the heart of this system is AI-based multimodal transport planning, which uses predictive and tactical procedures to control and optimize the logistics and transport process for goods. Fully automated goods transshipment and a highly automated delivery truck get Carla's charger to a central logistics hub on the outskirts of Berlin. An electric van then takes the charger to a small collection depot in the city center, where a delivery robot takes over and brings the charger to Carla in a café. This scenario is an example of how AI-assisted logistics and transport processes may work – and it could be feasible in approximately five years.

More than three billion tons of goods were transported by truck on German roads only in 2018.[1] And the trend is still rising. The consequences of this flood of transport are clearly noticeable: trucks, but also cars and two-wheelers, are stuck in traffic jams for longer and longer periods; retailers and suppliers are finding it increasingly difficult to predict delivery times. Added to this is the environmental impact: Energy consumption in the transport sector rose by 6.9 percent between 2005 and 2017, marking a significant impact on climate change. But in just a few years, goods could reach their destination much faster, more reliably, more cost-effectively and more energy-efficiently – with the help of AI-based systems.



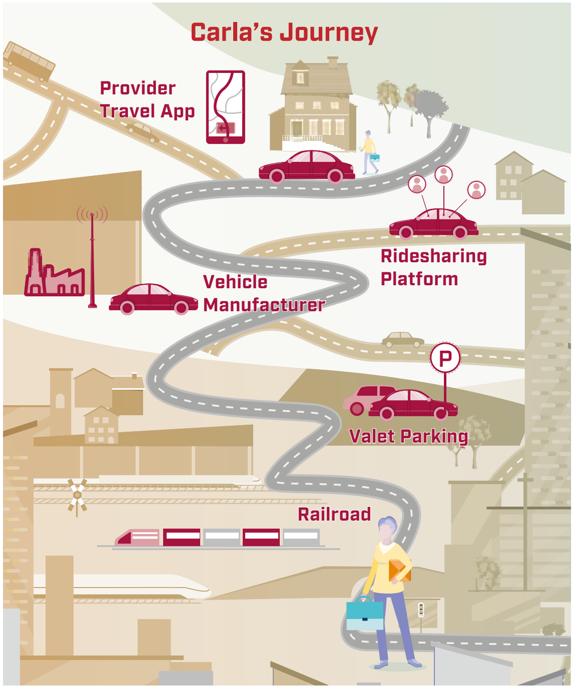
1 Due to its geographical location, Germany is a transit country for goods throughout Europe, whether from sea, with Rotterdam and Hamburg, or from land, such as Russia, Turkey, Ukraine, a particularly large number of forwarders pass through Germany.

Actors	Potentials for economic efficiency and sustainability
Shipowner	**Economic efficiency** After establishing nationally and internationally networked transport platforms, the shipping company can further develop its business model as part of this network. On the one hand, the office in Hamburg would be connected with the route planning platforms. Secondly, all the shipping company's ships would be connected with the platforms via IoT devices that feed various information into the platform in real time (swell, wind strength, precipitation, arrival times in ports, etc.). This would allow the routes and operation of the ships to be continuously optimized in real time, reducing delivery costs and enabling just-in-time delivery, as well as reducing layover times. Intelligent container tracking and control increase the flexibility of the transport system and allow interconnection with hinterland logistics. Experience like this could in turn be used to train models for optimal route planning. **Sustainability** Optimized route planning and real-time optimization in the operation of ships will not only reduce delivery times, but also the ships' fuel and mineral oil consumption. The use of new technologies for ship propulsion systems also poses considerable technological and organizational challenges, for example in terms of spare parts and energy source logistics. Predictive maintenance and coordination of spare parts supply and assembly can save resources here. Coordinated fuel supply and new fuels will only become feasible through AI-based planning and operational control.
Port Operator	**Economic efficiency** The switch to electrified and automated vehicles in the container loading sector generates battery capacity that can be offered on the energy market, since all vehicles are almost never needed at the same time. The use of AI is necessary to coordinate the resulting battery swarm storage and ensure that both power market bids are delivered, and vessel dispatch continues to be fast and on schedule. Based on the prediction software and battery swarm coordination, the market agent automatically trades in the energy market. Peak shaving makes the port's peak load smaller over a year: the port operator can save money because pricing for large customers is based on their measured peak load per year. **Sustainability** The fleet of Automated Guided Vehicles (AGV) is available as a swarm storage facility for storing electricity from renewable energy sources and can thus contribute to intercepting voltage peaks from renewable energy sources into the power grid.
Shipping Company	**Economic efficiency** Autonomous driving, smart trucks and platooning will change the tasks of employees in freight forwarding companies. Truck load capacities can be utilized more efficiently with AI. The use of (new) digital business models with the help of AI is crucial for the efficiency of freight forwarders, for example for planning truck capacities in advance or for real-time pricing. **Sustainability** Optimized loading of the trucks and optimized utilization of the freight forwarder's loading capacities conserve capacity. This reduces the number of trips required as well as empty runs and the energy/fuel consumption of the trucks. Platooning reduces the fuel consumption of the trucks driving in the convoy. →

Micro-hub operator	**Economic efficiency** The new business model digitizes the tendering and awarding process for logistics services in the form of an electronic marketplace. In principle, this includes all forms of forwarding business. Several logistics marketplaces have already emerged whose transaction volumes, although still sub-critical today, are growing continuously. Consolidation through co-operations and acquisitions is to be expected – this could be accelerated by the entry of well-capitalized companies, especially those with good access, for example, through the demand side. **Sustainability** Higher utilization of loading capacity reduces the number of trips required and results in fewer empty trips.
Delivery robot operator	**Economic efficiency** The delivery location is dynamic and flexible, meaning that the delivery is based on the (probable, predicted or indicated) current location of the recipient ("Smart Last Mile Logistics" (SMILE)). The prediction of delivery patterns is made possible by AI systems. This applies both to the possible locations (delivery requests for locations in parks increase when the sun is shining) and to the items to be delivered (umbrellas are more in demand when rain is forecast). By connecting with other data sources such as attendance numbers at trade shows or number of travelers along certain focal points, locations can be dynamically set up as pop-up locations. Through a platform economy of locations and a rental service, microhubs can be established seamlessly with other providers, for example, by establishing a microhub for the convention center or in a popular café. **Sustainability** By capturing actual utilization and usage, the establishment of stations, as well as the distribution of equipment across locations, can be predicted in a data-driven manner and optimally planned. With the help of AI systems, a limited fleet of delivery robots can be placed cleverly. Tracking of usage (and locations) can be used to determine needs and for refinement and expansion of usage. Depending on the specific usage, prices can be dynamically adjusted over time and place. With AI, existing resources such as old but functional charging cables can be reused. Likewise, lost or discarded items ("forgotten pieces" such as power adapters, umbrellas, etc.) can be made available via a lending model. This avoids emergency purchases. Precise transport with the small, low-consumption autonomous delivery robots saves energy compared to transport by truck while increasing customer convenience.

Carla's Journey – Analysis of the actors along the trip

Carla Fuchs lives in a village in Brandenburg in the year 2025. In the afternoon, she has an appointment in the center of Berlin to which she wants to drive by car. Shortly before setting off, her virtual travel assistant alerts her that a construction site has just been set up on the highway. Although there is no traffic jam yet, the travel assistant nevertheless already allows an intelligent forecast: The congestion on the route and possible alternative routes would delay Carla's arrival by about an hour. So that she can keep her appointment, the travel assistant recommends her to go to the train station in the city about 30 kilometers by car and take the train to Berlin there.



Nowadays drivers plan their routes digitally, are guided by navigation aids and avoid traffic jams with the help of real-time routing. This makes traveling easier, but the quality of the recommendations has its limits: Don't all drivers want to avoid traffic jams on the same route? What about obstacles that occur at short notice? And above all: Could there have been faster and better means of transportation than one's own car for the planned route?

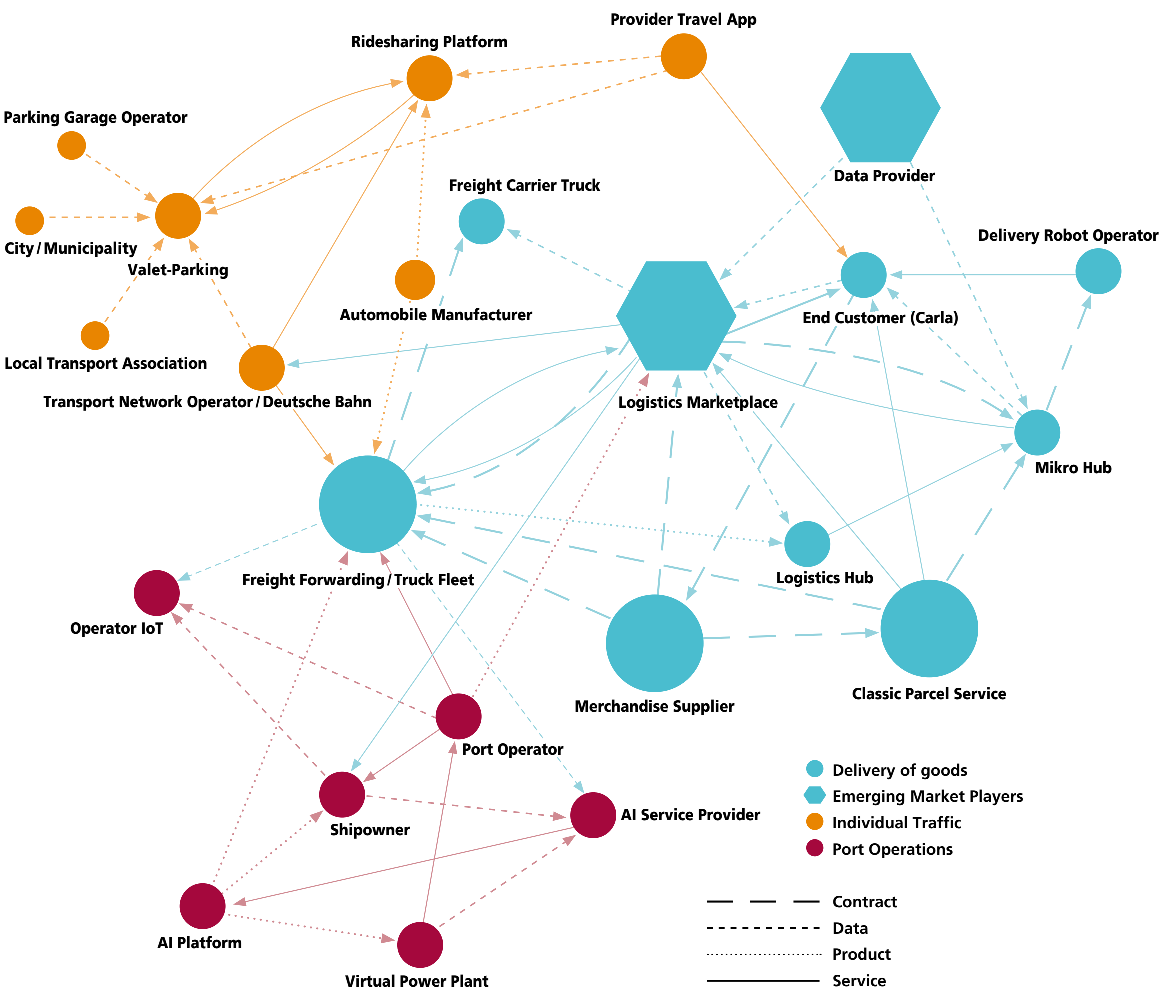
In just a few years, intermodally networked travel portals will lead us to our destinations even more flexibly, safely, and quickly, not only connecting different forms of mobility across the board, but also conveniently merging planning and booking functions across the board. In this way, they will make an major contribution to smooth traffic flow, especially in large cities and conurbations. The basis for this is a self-learning system that accesses very different data sources and uses them to develop options for individually sensible, economical and resource-saving routing.

Actors	Potentials for economic efficiency and sustainability
Provider Travel App	**Economic Efficiency** The success factor of a new business model is a wide selection of mobility forms (air, rail, public transport, ridesharing, carsharing, eScooter, etc.) and their seamless integration and combination, so that customers only have to go through one planning and booking process (door-to-door with one ticket). Artificial intelligence can create added value precisely when route selection and price comparisons are fully and securely automated for customers. Based on this, the travel app can track the actual travel history of customers and learn for future travel planning through real travel times and itineraries. Linking weather, traffic and parking data can further support the accuracy of planning. **Sustainability** The AI-based platform enables a more convenient use of more sustainable forms of mobility, such as rail and public transport. In particular, the first and last mile require more planning effort and buffer times compared to individual transport with car use. If AI-based platforms enable an automated planning and booking process and minimize buffer times, more people can be convinced to use more sustainable forms of mobility and connect individual transport more seamlessly with other forms of mobility.
Mobility Service Provider/ Ridesharing Platform	**Economic Efficiency** With the help of AI, ridesharing can be made more flexible and dynamic in all dimensions. A ridesharing platform that connects providers and users can bring together private/spontaneous or professional ride services with passengers. Drivers and passengers can be brought together more quickly and optimally in terms of route and time, eliminating the need for manual searches and making spontaneous trips possible. With the help of AI, not only can schedules and routes be optimized, but demand can also be predicted. On the one hand, based on the movement data of private drivers, a proposal can be made to offer a ride and possibly change the route slightly. On the other hand, a probable demand can be predicted based on the regular movement data of the passengers: Professional ride service providers can thus be steered to areas of high demand to increase their utilization. In the area of mobility services, self-learning systems will also enable new business models beyond ridesharing: With "car-as-a-service" models in conjunction with autonomous driving, the need for a personal car will continue to decline in the future. **Sustainability** Individual transport will remain even if the range of alternative, more sustainable forms of mobility is expanded. However, AI-based platforms can greatly increase the target group of drivers and passengers in ridesharing and bring them out of the current niche, thereby increasing the utilization of cars and saving trips.

Valet Parking	**Economic Efficiency** The core of the business model is a plannable and individually bookable parking service for one's own car, which enables a seamless mobility chain linking individual transport with public transport and long-distance travel. The parking service offers an intelligent platform for booking parking services, security for one's own car and a rail connection in case of delays. In addition, for valet drivers, it provides timely guidance on how to get to the parking lot, necessary rescheduling in case of delays, and adjustments to planning and costs via predictive models of traffic and demand, and planning of parking spaces. A service that uses AI to broker parking garages, parking spaces and a valet service may provide better use of parking space resources and control the service according to traffic volume. Also, self-learning systems may be used to align offers to specific identified user preferences. Prices are calculated in a dynamic offer and are based on predictions of traffic and usage volumes. Based on static, but also continuous dynamic data of customers, means of transport, utilization, fulfillment of accessibility, etc., safe models can be learned in which a minimum delay or delay occurs. **Sustainability** By offering a pre-plannable parking service, individual passenger transport is optimally linked to local and long-distance public transport. If commuters or travelers have the certainty of a parking option for their own cars, the willingness to use public transport for most of the route can increase, thus reducing fuel consumption and exhaust emissions.
Rail-bound Local and long-distance traffic	**Economic Efficiency** The creation of a mobility platform with a digital twin of the transport infrastructure is crucial: This will make it possible to implement an adaptive transport service for users and to optimize the internal processes of local and long-distance rail transport providers by means of predictive train planning and maintenance. The platform could be operated centrally – either by the providers themselves or by a network partner. The platform enables the exchange of various data (traffic plans, information from infrastructure, transport monitoring, data sources from mobility partners, public and freely available data such as weather, events, migration flows) and provides an interface for easy integration with various applications in the mobility sector. **Sustainability** Individualized services, greater comfort and increased punctuality through predictive maintenance make local and long-distance rail services much more attractive for passengers. Due to the adaptive and individualized transport offer, customers use their cars less often, so that (inner) cities are relieved of car traffic. If more people make use of the services, individual traffic is reduced, and fuel and pollutants are saved. Adaptive train composition means that only the exact number of trains and wagons required is operated, which optimizes energy consumption. A targeted maintenance strategy also ensures a longer service life for the infrastructure, and new acquisitions or replacement of parts are only carried out when really needed.

The interaction of the different actors of the scenario and the business models of the future can be visualized in a network. For this purpose, a network was developed around the actors of the environment scenario using the networking mining method co-developed at the Karlsruhe Institute of Technology (KIT), which describes the relationships to other actors relevant for the business model.[2] Based on this scenario analysis, the authors formulate key findings. The authors are particularly interested in emerging, intelligent and AI-based mobility platforms as a connecting element between different forms of mobility and mobility providers. These can be new business models themselves or platforms for existing as well as new business models of players in mobility.

Figure 1: Interaction of actors – network analysis based on scenario analysis



2 Existing market players are represented by nodes in the form of circles, market interactions by edges (connecting lines) between the nodes. Completely new market players are represented in the form of a hexagon. The respective size of the circles exemplifies the so-called "structural relevance". This metric identifies actors that have a strong or low influence on the network in terms of information and knowledge transfer. The larger the circle (or hexagon), the more relevance in terms of network relationships.

Possible design options

As AI systems will permanently change the business models of the future in the mobility sector, major opportunities are arising at the same time for existing and new market players. The new technological possibilities require determined and forward-looking planning and action on the part of the players. In view of the international dynamics in the development of AI systems, politics, business, science and society have a joint responsibility here. Therefore, the authors formulate design options to enable the structural, economic, legal and entrepreneurial framework conditions for successful AI business models in mobility.

Thus, it is central that the business models in mobility based on self-learning systems must be considered holistically. In addition, people must be at the center of attention when designing the mobility of the future: Acceptance and user trust in learning systems are basic prerequisites for successful AI-based business models. And finally, shaping the mobility of the future must be taken up as a European project: Germany should act as a driving force for a European path in shaping mobility. The appropriate digital infrastructure is another crucial prerequisite.

The establishment of new business models with AI for existing and new providers of mobility services is also supported by the gradual development of a mobility cloud in conjunction with a data ecosystem. This will enable players in the mobility sector to obtain freely available data on an equal footing and evaluate it in conjunction with their own data for their business models. In addition, suitable framework conditions must be created for better growth financing of new players as well as legal foundations for the ownership, access and evaluation of data at an early stage. For optimized transport planning, these framework conditions must ensure, for example, that mobility data is made available to the public sector for overarching (state) transport route planning. The development of an intermodal mobility platform could also integrate different functions and providers in one platform and enable comprehensive travel planning and booking with just one ticket.

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