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THE FUTURE OF MOBILITY: WINNERS AND LOSERS AND NEW OPTIONS IN THE PUBLIC SPACE

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The opinions expressed in the this report do not necessarily reflect the position of the three Global Union Federations and the FES

ABSTRACT

The massive proliferation of motor vehicles is leading to significant functional problems in the urban centers of major cities. At the same time, dependence on fossil fuels is no longer just a climate problem, but also a problem of world peace. More and more changed forms of mobility are developing, especially in cities. Digital platforms and sharing offers are attracting more and more attention among young people. "Use instead of own" is the megatrend that goes hand in hand with digitalization and is turning the relationship between private and public transport on its head. In the wake of the Corona pandemic, new forms of mobile work have also gained in importance, which have a strong impact on mobility behavior and further increase the dynamics of digitization through even more flexibilization.

At the same time, technical trends are having an impact: automated driving and new platforms are upending public transport and creating new options. New providers are upsetting established markets. Incumbents in the auto industry and public transport are struggling to keep up with this pace of innovation. Digital platform operators are better at mastering the new game because they are much better at serving the narrative of digitally networked offerings with high customer value and sustainable product design. This also has implications for employment. While the change in drive technology in the automotive industry and digitization in production have already led to a reduction in the volume of work at car manufacturers and their suppliers, new jobs are being created in software development and mobility services, by contrast. However, the transport sector is not gender-neutral; it is traditionally male-dominated. In principle, new technologies allow a design of jobs that meets the needs of women. This requires proactive regulation.

But who will prevail in the future of mobility and under what circumstances products and what business models can be developed, and above all with what consequences for working conditions, will ultimately be decided by the political players. The privileges of the private car with access to public space are over; in many cities, city tolls are being considered and limited space is being redistributed. In the future, whoever has access to scarce public space will do the business in the transportation industry. In this sense, local political levels, with their power to define the rules of the game for new services, are gaining importance for the enforcement of good work.

Trade union strategies face fundamental challenges in the face of digitalization and a new world of "private public transport": established industries are losing importance, as are companies as a place for negotiating conflicts of interest. Forms of work organization are shifting from the "store floor" to more location- and time-flexible formats, and content is becoming more abstract and dispositive. The pressure to

retrain is increasing, future training and qualification courses must be changed more quickly and convey more understanding of IT skills and know-how.

THESES ON THE GENERAL ASSESSMENT OF THE FUTURE OF MOBILITY

Theses No 1: Existing transportation systems are under pressure: not fit for the future

The Covid pandemic and Russia's invasion of Ukraine, as well as climate change, demonstrate the vulnerability and susceptibility of the global economy. The Western interpretation of modern societies with economic structures based on the division of labor and space is reaching its limits. Central to this is the policy of lowering spatial resistance by heavily subsidizing fossil fuel transportation systems in order to keep people and goods mobile as indefinitely as possible to ensure economic prosperity while achieving a high level of social integration. The result, however, shows that a permanent acceleration of mobility can neither secure social stability nor is it sustainable. Digitalization and demographic change further increase the pressure on social systems. This means, in a simple but also radical consequence, that the transportation modes of the Western world have no future in their present form: they neither contribute to lasting peace nor can they ensure sufficient social justice. They consume more resources than the earth can sustain, the indicators of which are wars, growing social inequality, and climate crisis.

At the center of the criticism is the car: it needs too many resources, too much space, and it no longer works in metropolitan areas. More cars do not promise more prosperity, not more social advancement. In the metropolitan areas of the West, no one gets ahead anymore. The model of the car is not suitable as a model for the future in America, Africa and Asia either.

From a trade union perspective, this already has two consequences for a future strategy: Means of transportation are always tied to the respective social system that they literally transport. One is well advised to regard the existing transport systems as fundamentally in need of reform. Thus, a commitment to the preservation of the existing makes no sense in fact, because no lasting success could be expected.

Theses No 2: Western mobility still has a strong focus on the automobile in passenger and freight transport.

The image of Western modernity with the automobile as its material core is fading. Nevertheless, all political formats have so far focused on this car as THE means of transport for people and goods. The Western model of the basic market capitalist order and individual freedom was closely tied to the privately used automobile. Public transportation, except for metropolitan areas, is organized only as an overflow or residual use: Planned for people who cannot or do not want to have a car.

Still, the automobile continues to be the focus of the Western world, with more than 80 percent of passenger and freight traffic being handled by it. Settlement patterns have been built around the car. Life and work are grouped around the car. Settlement patterns in the Western world are still built around the car. The "Athens Charter", then a progressive manifesto of Western modernity, is still relevant to all political planning programs, and the ordering of public space also still focuses on the car as the dominant means of transport. The auto industry and its unions have benefited from this powerful system. Corporatism has become a stabilizing factor of Western societies, good work brought good money.

But here, too, the limits are clearly perceptible. The Western model of unlimited mobility is also reaching its limits because societies have become more diverse and fragile in their social structure. Individualization and pluralization of lifestyles and work patterns are advancing, reinforced by digitalization. Societies are becoming increasingly "singular." Standard life courses with standard biographies are becoming the exception, old certainties of private happiness are eroding.

Theses No 3: The future of mobility lies in the digital networking of different means of transport in public spaces.

What will future mobility look like under these conditions? The decisive factors are an increase in efficiency, improved social integrity and independence from fossil resources. Increasingly fragile social structures and the dissolution of traditional conventions and reliability are also leading to a change in the basic order of transportation. What Jeremy Rifkin called "access" (and predicted in 2000) is now slowly becoming empirical reality: functions are becoming increasingly separated from ownership. It is no longer the exclusive ownership of a means of transport that is decisive, but access for a limited period of time. This is because it increases the situational flexibility of having the right transportation device available at all times in different places with different needs. This shift from "owning" to "using" is associated with general changes in the value chains: Less production – more services. This means that fewer devices are being built, while at the same time more digital networking is taking place. The individuality and plurality of social development cannot be stopped. The car made this development possible in the first place, but it must be redefined. Digitization allows everyone to access everything. Everyone can organize the desired form of mobility very personally and very privately. The smartphone makes networking cars, bicycles, buses and trains simple, convenient and efficient.

Digital access to all means of transportation creates the conditions for efficient and very convenient use of transportation. Individualization does not require an exclusive device; individualization means roaming through the transportation landscape. In the future, there will be two levels of transportation: firstly, the means of transportation

such as cars, buses and trains, and secondly, networking as a new service: Mobility as a Service.

Theses No 4: The arenas of political negotiation are changing

Trade union struggles have always focused on organizing to advance workers' interests. With a high degree of organization, it has been possible to shape working conditions and wage structures effectively and successfully in prospering industries. The auto industry, especially in Germany, is therefore considered a successful example of union politics. State interests have generally supported this arrangement in Europe, not least because automobiles have been able to dominate and occupy public space to a significant extent. The public transport sector is also - because it is under state direction and financing - usually a successful example of trade union interest politics. Working conditions and pay structures have to a large extent been positively shaped in the interests of employees, among other things through a high degree of organization and the effective threat of strikes. State interests here generally focused on the provision of minimum standards of transportation services, which were not usually based on efficiency criteria.

However, these venues of trade union struggle are losing their significance in the age of digitalization and sustainable transport policy. Due to the trends described above, it must be assumed that in the coming years, politics will be concerned with curbing the amount of cars and making less space available in public space. But the public transport sector is also coming under pressure, as more and more public payments will have to be justified in terms of whether buses and trains are still efficient enough after the pandemic and in the age of digital services. In general, policymakers cannot continue to ignore the shortcomings in the performance of classic transport providers - especially after the experience with the pandemic - and will be forced to take action. Germany has so far provided a strong shield for guaranteeing the continued existence of public passenger transport with the construct of services of general interest, also in the sense of the trade unions. However, with the amendment of the Passenger Transportation Act and the new options for the operation of autonomous vehicles on public roads, entirely new opportunities to change these basic orders are legally possible for the first time.

How this will then be reflected in changes to the employment structure can currently only be estimated roughly and limited to submarkets. Germany is of particular interest. Uber, Google and Tesla have already announced that they will be active here with new products, because Germany is considered a classic car country with a very restrictive bureaucracy. So those who can establish new products and services in Germany benefit from a great deal of charisma and can also hold their own in other markets.

In addition to a strong automotive industry, Germany also has - as mentioned - a public transport sector that is under special state protection. For Germany, therefore, calculations by the National Platform for Electromobility (NPE) and the National Platform for Mobility (NPM) have been available since 2012 as to what effects the shifts in the transport sector can be expected to have on the number and quality of jobs. Depending on the premises and biases, of course, these numbers look different. But when all the studies are taken together, a consistent picture emerges. It can be expected that about one-third of employment will be lost in the construction of automobiles by 2050. This is due to annual productivity gains coupled with a slight decline in output volumes. In the much smaller traditional public transport sector, a decline of around 10 percent is expected by 2050, because financing will no longer be possible at the previous level and capacities will be reduced. However, the development of new services around digital networking will compensate for this loss in total. As a result of the shifts, the future volume of employment will probably remain the same overall. However, the skills profiles will shift considerably, and what the pay structures and working conditions will look like will also depend on the success of trade union interventions. The conditions for these disputes are changing fundamentally, however.

Against the background of the challenges described above, the question of the future of transportation systems and the quality of work will be decided in the future by the political redesign of the public sphere. Prerequisites for union success will be their respective presence in these new arenas. In the future, it can be expected that business models will depend on the space available for operating the respective equipment and the conditions attached to it. While the "car system" as well as "public transport" have so far been politically protected, this will change in the coming decades. The companies of the digital platform economy have already been in the process of undermining this supremacy for some time. The Californian company Uber is a pioneer in this respect and has been successful worldwide in claiming new business areas. If such digital companies were to become more established in quantity, the options would be significantly altered not only for the classic cab and rental car industry, but also for public transport. Ultimately, however, companies in the automotive industry would also come under pressure because spaces in metropolitan areas are becoming increasingly scarce and the number of vehicles can be significantly reduced through new pooling services. It remains open who will do the business with autonomous vehicle fleets. Obviously, neither the car manufacturers nor the public transport providers currently master this because it cannot be integrated into the core business. It has been announced that public service contracts will be put out to tender as functional services in the future in order to limit more efficiency in transportation.

Theses No 5: The new players operate differently: New game – new luck

From a trade union perspective, it is crucial that all these new companies serve the megatrend of "access" rather than ownership. This approach of the platform economy is in line with a "higher reason." It fits right in with the times in terms of convenience, operating qualities, as well as the variety of options for sustainable transportation. This has significant consequences for the business model. After all, these companies are not guided by quarterly financial statements and are not disciplined by business management analyses (BWA) in small-scale business processes. They think "bigger" in the truest sense of the word and pursue the idea of time, namely to provide transportation services that are committed to using rather than owning. Operating in harmony with this "higher reason" also forms the crucial basis for financing these companies. The core of the business model is not primarily an operating profit, but the marketing of an idea. This only works if this basic idea is credible and plausible in individual references and, above all, can be demonstrated as scalable. If this is the case, then venture capital firms or even the classic capital markets are the primary financiers with a view to increasing the value of this idea in the long term. Whether Google, Apple, Tesla or Uber, all U.S. companies with a now very high stock market value, operate on this basis. At the same time, the traditional opportunities for trade unions to participate in decision-making are generally difficult to realize in these business models. They can only achieve something for the workforce if the earnings situation opens up corresponding scope for distribution in the first place. Capitalizing on an idea, a prospect or a hope and sharing in the profits represents a new challenge for the trade unions. Also, in order to be able to influence issues of working conditions more effectively in tech companies, new options of trade union activities beyond traditional works council work would be useful. In summary, the following boundary conditions for future trade union work in the transportation sector are thus defined:

- Conventional car production and the operation of public buses and trains are coming under severe pressure and will lose importance.
- Business success for future mobility providers will depend on the political design of the public space.
- Companies that are successful in the new mobility services operate by marketing ideas.

Theses No 6: The modes of struggle of unions must change

The strategic question for trade unions on the future of mobility is therefore how, under these changed boundary conditions, workers' interests can be effectively represented in the future. Probably, this can be done less by focusing on the companies and enterprises and more by a strong engagement in defining the

operating conditions of the new services in the public sphere. After all, in order to be in line with the "higher reason" and thus generate the funding opportunities, the public space must become playable as the new business field. But what the rules of future management look like can, in democratic societies, only be determined in a public discourse and regulated by parliaments in the appropriate forms of tendering and awarding. Who can credibly market the new ideas, where and how, in order to generate operational profits after all, is determined by the public sector through the management rules of these spaces. These rules must provide answers to the following questions: Who is allowed to park, drive, load where, and how much does it cost? What space can private vehicles occupy in cities at all in the future, and what does regulation for robotaxis look like? What data must be made available to whom, when and in what formats?

This would also redefine a lever of union power. The individual organization, the company, loses importance, while local politics gains as a defining point for business success. For whether good work is also well paid depends on the publicly defined rules for such services: it is becoming apparent that in the future not only buses and trains will be defined in their operating conditions by a public service contract, but also the offer of scooters, bikes and cars in the form of sharing, leasing, hailing or pooling. In concrete terms, this means that anyone who wants to do business in the public space in the future, including in the form of marketing a good idea, must ensure "good work." The trade unions can and must renegotiate with the municipalities what the conditions are for this in detail. As a result, companies are losing importance as a field of trade union activity, while the local level is gaining with its framework-setting competence. Influence on the guarantee of "good work" can be exerted on the one hand via the politically legitimized participation bodies, such as the political parties, but can also lie in participation in the public discourse. The central question, however, is what would such trade union activity look like? The public sphere can certainly not be defined so simply by a high degree of organization in the workplaces and the threat of strikes that this entails. It would be conceivable to secure "good work" with the definition of standards by the classic political representatives, but also to make the reputation and standing of the companies themselves an issue. Those who do not offer good work should also have problems marketing the good idea. Trade unions could form new and strengthened alliances with NGOs here to influence the formation of opinion and the reputation of companies. The example of Uber shows that if the reputation is damaged, state regulation can also block new markets completely, as the examples of France and Germany show. However, such a policy can only be successful in the long term if the entire political space is covered and completely redesigned.

However, local actors will always work within a larger political framework. Whether this will be the respective national legislative competencies or whether the EU will develop into a Europe of the regions has not yet been decided. In any case, trade

unions are well advised to actively shape the international and national framework conditions for the good work of new services in the public sphere politically.

PLATFORMS AND MOBILITY AS A SERVICE: NEW POWER RELATIONS

First of all, we would like to make some restrictions. The study cannot fully cover the broad topic of the future of mobility. The important trade union discussion on gender justice for example is only sketched out. The major issue of the development of the Global South is not addressed at all. Geographically, the study is related to the early industrialized and thus also early motorized world. The point of reference is primarily Europe and Germany as the strongest European economy. Even if the study focuses on more recent developments in the field of digital mobility services. This does not mean that the classic struggles for good working conditions and against tariff evasion through outsourcing and contracting and against exploitation are considered unimportant. They are important and will continue to be so in the future. Rather, our plea is aimed at broadening the perspective, which has so far been primarily industry-related and company-based.

In the future, traffic will be characterized by two different levels: On the one hand, the world of means of transport such as cars, trains, buses, bicycles, and the necessary infrastructures such as roads, bridges, and rails. A second level will take over the disposition of these things through digital platforms and decide on access, the form of use, and also control and billing of the systems. Whereas analyses used to be grouped around the individual modes of air, road, water and rail, and transport systems were differentiated between (private) road vehicles on the one hand and the (public) bus and rail systems on the other, the future of mobility will be determined by this second level. People no longer buy or lease a single means of transport, but book temporary slots, access points that are used for a limited time and place depending on availability and purpose of use. What is used how and how much is therefore increasingly determined by the digital presences of the devices on these platforms. Access to individual means of transportation no longer takes place directly, but only mediated via digital media.

New options through digital networking

The transportation market is comparable to a state the Internet was in before the invention of browsers. Before the introduction of Mozilla or Netscape, access to the options of the worldwide web was only possible through complicated hieroglyphic-like addressing and was practically only really usable by experts. With the help of browsers, an interface that could be used by everyone could then be found and, by agreeing on common protocols, also established, which made searching and finding addresses child's play. Browsing" through the entire world with an IP address was now easy and convenient for everyone.

Mindful of this importance, intermodal services could resonate strongly. By means of an app, access to all publicly available means of transport could be made possible. Booking information, access and usage is all managed under one customer account. The new service is responsible to the end customer for this service, it is the end customer holder with all rights and obligations. It simply buys the service clicked by the customer from the transport provider and secures the transaction by the corresponding digital available legitimation. During use, the tariff and terms of use proclaimed by the transport provider apply. With the app, all valid and digitally available offers of all public transport and affiliated sharing providers can be used. From one-way tickets, e-trolleys, pedelecs to long-distance journeys and car-sharing cars. With the app, planned trips can be booked and, as it were, spontaneous use. The app always shows the current surroundings and the means of transport available here. These services manage the master data of the customers. The transportation providers, in turn, only see the ID. This function could be called single sign-on, but the term roaming, borrowed from the mobile communications market, seems more appropriate.

In the digital age, self-mobility will thus be interpreted even more radically in the future and without any device-related restrictions. Slots will simply be managed. The "physicality" disappears behind the digitality. I decide here and now what I use. Planning and deployment efforts are radically minimized and application options become even more diverse. What appears digital can be used now and here - or even later. The technical characteristics of the various devices, whether car, bicycle, train or bus, recede in importance. Sociologically speaking, it is not likely that modern, democratic societies will leave the path of digitalization. In this respect, pre-modern structures are overcome by means of technology. Laws or regulations from the analog era can hardly stop the self-determination of the ego in the long term, even in traffic. And the really radical thing about digitality is that the private sphere no longer needs its own exclusive space. This means that - putting the circumstances of the pandemic aside for a moment - vessels "experience" a different meaning. With the button in my ear and the mobile device in my pocket, I have everything I need with me; the immediate surroundings and thus also the quality of the space around me disappear or at least become less important.

As a result, the weights in the value chain of transportation are also shifting. Automobile brands are fading, cars are becoming simple pieces of equipment, and their use is decided in a digital marketplace. It is one of the subtle effects of these digital applications: Wants and needs, indeed consumer behavior as a whole, are being changed by smartphone use without individuals always being aware of it. It is true that an app alone still does not transport a person from point A to point B. But it is also true that it is not always available. Everything that does not appear digitally, that is not available, ceases to exist.

If you take a close look at the individual stages of the value chain, the hardware components represent a much larger share of the value, but whether these components are used at all, how they are used and combined, is decided by the rulers of the platforms. The company Clever Shuttle - a provider of on-demand transport - has calculated that the software components, including all scheduling and billing processes, represent only 10 - 15 percent of the overall service process. But it is precisely this part of the product that determines whether the much larger remaining part is used.

Digital media are also increasingly changing the immediate driving and travel experience. The time of immediate experience is increasingly being eclipsed by the digital. The time spent in space is being used more and more to be online, and journeys on local and long-distance public transport are good opportunities for communication and information. Not with fellow passengers, but with friends, relatives and acquaintances somewhere in the world. With the exceptions of vacation and other adventure trips, the use of transportation is transforming into individual infotainment.

This has considerable consequences for employment and qualification profiles, but above all for power constellations. Whereas in the days of the analog transportation world, it was important to develop good hardware qualities, and the famous "gap dimension" was an indicator of a car's value, in the future this alone will no longer be sufficient. Whether the hardware can hold its own, whether it is bought and used, will be decided by the presence of the vehicle on the digital level. To put it bluntly, power has shifted from hardware to software, and the quality of the app and the programs behind it is crucial for economic success. It is obvious that this will necessitate different business models and, above all, completely different qualification profiles, and this will be discussed in more detail later in the text. However, fundamental professional understandings will also change. For successful software, "trial and error" is a decisive prerequisite, whereas in classic mechanical engineering, the opposite is true: a risk-averse approach dominates, which always operates from the secure "state of the art". The dominance of the skilled worker is thus clearly relativized.

The car as smartphone

These options offered by digital platforms are only just beginning to emerge. However, the extent to which digitization is already changing hardware can be seen in the car as a product and in the example of Tesla. The carmaker sees the vehicle as a kind of smartphone. Tesla is Apple and Foxconn in one company, as it were: high-quality hardware is produced, but it is shaped and also controlled by a software brand image. While the options are installed in the vehicle technology, the valorization is produced by the software. Analogous to the smartphone, the hardware

receives regular updates. The individual vehicles are permanently modernized, so to speak, by the company's own software via an open air interface. After an update, you suddenly find the images of a camera for reversing on the display, which was not activated before the update. This is revolutionary for the understanding of a car. It is no longer individual model series or permanently installed construction parts that characterize the vehicle's properties and value, but the latest update. And similar to smartphones, as these updates evolve, the hardware eventually becomes insufficient and has to be replaced by new hardware.

The path taken by Tesla is not only being rewarded by the stock market - the company's valuation has meanwhile been as high as that of all the major automakers combined - but the new understanding of an automobile established by Tesla is also being adapted by competitors. VW AG's "Trinity project" puts everything in the way cars have been built at Volkswagen so far in the shade and is practically a copy of Tesla. A company that has only existed in its current form since 2008.

But in the world of Tesla, the dominance of software and the associated skills is only the first step in the new digital networking. The car is already being sold in the U.S. as part of a domestic power plant that enables a complete energy supply based on renewable energies, because the storage landscape is expanded around the car batteries and becomes a "Mirco Smart Grid" through bidirectional charging. However, this idea, which is not new, is still being avoided by most automakers - the only exceptions besides Tesla are Toyota and Honda - because the control center is still in the hardware and not in distributed systems as in the case of grids. The dominant understanding among carmakers is that intelligence is built into the car itself and is by no means hidden in a multi-part system.

Tesla's next step - also already preconfigured - is to extend the vehicle into a sharing system. Buyers of a Tesla can simply "free up" their vehicle for use by others, creating a private sharing business. The open digital access allows easy use by others suitable for private but also commercial sharing as well as intermodal offers.

With all other manufacturers, this function is not possible either, because the CAN bus - the control heart of a car, so to speak - is a permanently installed relic of sealed-off firmware and still stems from a hardware philosophy that knows no networking.

Tesla is therefore the only car manufacturer that is able to use the options of automated driving (see below) to enter new business models.

Tesla has successfully managed to integrate both levels of hardware and software in one company. Tesla is therefore also part of a digital platform economy such as that already operated by the big tech firms.

The isolated world of public transport operators

Public transport operators, on the other hand, have not yet entered the world of new digital platforms. Neither the large state-owned railroad groups such as SNCF, SBB, ÖBB or DB nor the private international bus and rail operators such as Go Ahead, Transdev or Arriva have entered this segment beyond prototype applications. Quite the opposite: similar to the automotive manufacturers stuck in their (hardware) core business, public transport operators are busy securing their existing market segment. However, in Europe, or indeed in other parts of the world, public transport is organized via tenders, and the terms and conditions of the transport services to be provided are set by the authorities or agencies commissioned by them, and are generally very heavily regulated. There is virtually no entrepreneurial leeway in public transport markets.

In addition, all public transport companies around the world are struggling with the effects of the pandemic. Pre-pandemic traffic volumes have yet to be regained. Due to the complex political requirements, the entrepreneurial options of public transport companies in local and long-distance traffic are often very limited. However, as a rule, the companies that have won a transport contract are adequately financed, regardless of whether they are privately or publicly owned. They lack the incentives, the capacities and also the competencies to invest in the business with digital platforms. Companies are therefore more inclined to seal off their existing business from digital platforms and not to allow digital networking among themselves either. Above all, the large companies have a number of research projects on autonomous driving or new digital services, but these are not linked to the core business and do not play a strategic role. The decisive factors are solely the operational concerns, the famous circulation plans. Whether offers make sense is not decided by customers, but solely by the logic of the operation. Therefore, there are line offers that nobody needs, fares and honeycombs that nobody understands, but which are not noticed because nobody notices them. Those who have no alternative buy a subscription, the others don't even get on the train. There is no need to digitize the service. The ticket vending machine or even occasional service at the ticket counter is sufficient.

To date, no company or association in Europe allows external companies - even those from its own industry - to market tickets or other offers. The use of external customers remains excluded. Likewise, dynamic travel data is not made available, or only to a limited extent. In Germany, Deutsche Bahn AG has taken a particularly restrictive approach, and in April 2022 the German Federal Cartel Office issued the first warning in this regard.

The topic of Big Data is generally not yet an issue in transport. It is true that there are a number of static timetable data from public operators as well as position data from the many rental and sharing vehicles. But as a general rule, all providers are concerned to keep their systems rather closed and not to reveal any dynamic data.

National regulations also bear significant data protectionist traits. At the EU level, the revision of the European Directive MMTI DEL VO with regard to dynamic data and possible regulatory approaches for multimodal booking systems are scheduled for 2022, but these will then still have to be laboriously translated into the respective national law. In principle, the General Data Protection Regulation in Europe safeguards personal rights even when operating digital platforms. Personal data is only created and processed for billing purposes or at the express request of the person concerned. For the rest, the legal rules of digital payment apply, at least in Europe.

What about the role of big data and access to data? The transport sector can also benefit from Big Data. A lot of data is generated via sensors in the various means of transport, but also on the user side via positioning tools. Google's tracking data alone should provide an accurate picture of traffic flows and even individualized mobility patterns. There is interest in this data on the part of transport providers as well as transport planners and researchers. Although movement data must be anonymized for data protection reasons, they nevertheless allow patterns to be formed that are useful in many cases. Aggregated movement data are therefore in high demand. So far, however, the use of privately generated data by third parties is either not possible at all or only possible subject to payment. Data from public institutions, on the other hand, are already to be disclosed and access created for interested parties free of charge. However, there is a general need for platforms for the fast and efficient exchange of data of different provenance. This requires a clear regulatory framework and standardization of data formats and transfer points. An intensive discussion on this is currently being held at the EU level (cf. in detail LEMO 2020).

Old economy companies avoid new economy options

In summary, it can be said that the options of the digital platform are not yet being used by the existing players in the transportation industry. Automakers remain stuck in their core business of hardware production. Only Volkswagen has recognized that even the construction and functionality of cars will be controlled by software features in the future and that the chassis will be increasingly equipped with intelligence to bring the vehicles to automation levels 3 and 4 as well. However, all but one of the world's automakers have decided not to enter into the operation of digital platforms and sharing systems. Individual manufacturers such as Volkswagen are attempting to establish a presence in at least sub-segments through the company's own rental car company.

Admittedly, the "robo-taxi" business in particular, with its reinvention of public transport, is also seen as a growth market by other automotive companies. But the management teams of the largest manufacturers are hesitant because none of the

groups wants to go into operations. At present, for example, VW AG is in talks with Arriva and Transdev, and parallel activities are being prepared with the recently purchased subsidiary Europcar. Toyota and GM are also in trials with their own activities or with subsidiaries. But neither the carmakers nor the large private or public transport companies are willing or able to enter this future market.

The only exception is once again Tesla. The U.S. company is setting the pace for automakers and the future software offensive, and already has its sights firmly set on networking the car into new energy as well as sharing systems. Tesla is the only company that has a strategic and operational command of both levels of the new mobility market, i.e. hardware and software.

With a view to the aforementioned options of digital platforms in connection with automated vehicles, it must be stated that neither the automotive manufacturers nor the transport companies with public sponsorship or public service contracts will become relevant players at present or in the future. If one asks leading representatives of these industries, then one assumes here that the companies without an operative transport business will dominate the business with digital platforms. First and foremost, of course, Google and Amazon, but also Uber, Lyft and ViaVan. The reasons for this have already been alluded to. The corporate cultures do not operate in constrained traditional professional understandings and serve the narrative of the new mobility. This promises to be more efficient and, above all, more sustainable. The combination of high utility value, combined with significantly lower environmental impact, also leads venture capitalists to step in with large sums of money.

From a trade union perspective, this is relevant because the degree of organization is very high in the automotive industry, still good in public companies in the transport industry, but vanishingly low in companies in the digital economy.

EMPLOYMENT IN TRANSITION: STATE OF THE DISCUSSION

The discussion about changes in employment in the transportation sector involves several dimensions. First, automation and digitization as a double base trend have an impact on the scope and nature of employment as a whole. This affects production, as already described above using the example of VW, but also services, including logistics. Automated driving is one variant of this. Secondly, in vehicle manufacturing, the change in drive, i.e. from the combustion engine to the electric drive, is associated with a reshaping of the value chain and an overall reduction in the number of workers required. This will particularly affect traditionally highly unionized and attractively paid jobs in production. Some of these will be eliminated. And third, the structural change that has already begun in the transport sector toward growing service shares, such as in driving services or digital platforms, also has a significant impact on employment. In the course of this structural change, new employment relationships are also emerging in partially unregulated labor markets and with a high share of (pseudo) self-employed. There are also multiple interactions between these three dimensions of employment change. With in-company qualification programs, the driving change on the employment side can be organized in a socially acceptable way, at least to some extent. However, it is difficult to switch from the "old world of production" to a "new world of services". The skills and qualifications required in each case differ from the previous ones, as do the respective training and occupational biographies.

On a European or even global scale, it is only possible to a limited extent to make quantitative and qualitative statements about the impact of these trends in mobility on an empirically evident basis. In the following, the debate on the impact of changes in the transport sector on employees is traced using the "case of Germany". Here, there has already been an intense debate since the early 2010s, particularly about the impact of electromobility on employment. For a long time, the core competence of German manufacturers was seen in the highly competitive construction of combustion engines, especially in the premium segment. Moreover, the automotive industry was and still is a key industry in Germany. For this reason, a number of studies have been prepared, particularly as part of the "National Platform for Electromobility (NPE)" and subsequent "National Platform for Mobility (NPM)", in order to be able to assess the impending effects as early and comprehensively as possible. These studies can be taken as examples of the trends and also of the magnitude of the shifts in the transport sector.

Mobility economy as a whole: more employment despite structural change

Together with FhG ISI, M5 presented a study on the overall economic effects of the transformation in the mobility economy on behalf of the Böckler Foundation in fall 2020. The study focuses on the electrification of powertrains and the digitalization of vehicles and the resulting mobility services as well as production and distribution methods. The entire mobility economy is considered, and not just the motor vehicle sector. In two different scenarios, an electrification scenario (ES 2035) and a mobility services scenario (MM 2035), the employment effects in the areas of road vehicles, other vehicles (production), electrics and electronics, motor vehicle trade, land transport and other transport are simulated in each case. The elimination and creation of employment in all areas is finally accounted for in "total transport".

In the calculations for both scenarios, there is a loss of employment in road vehicle production. This is primarily due to the elimination of conventional powertrain components. As in other studies, the consequences of the reduction in powertrain parts for electric traction are evident here. The volume of work required to produce an electric motor is significantly lower than for the internal combustion engine. In addition, it is assumed that the value-adding input products will still be imported to a considerable extent in 2035. The loss of employment can only be partially offset by increases in the development and production of innovative components such as driver assistance systems, increased infrastructure expansion and more new jobs in mobility services (surface transport). At the same time, many jobs are lost to automation in both scenarios. New employment can be created by growing public transport and, in the MM 2035 scenario, by new car services - especially car sharing. Schade et al. see uncertainties in the employment effects of automation, digitization and artificial intelligence. They point to technological, regulatory and competitive developments that are difficult to predict.

The assumption is that the climate policy target is to be met in both scenarios. The internationally defined and binding CO2 emission reduction targets (which have since been tightened again) are to be achieved. Therefore, in the ES 2035 scenario, a steep electrification curve is assumed with a moderate reduction in the number of vehicles, while in the MM 2035 scenario, the number of vehicles decreases drastically and a shift to public transport as well as significant bundling effects due to a boom in sharing services are assumed. As a result, the two scenarios differ not only in that the mobility market in 2035 looks completely different in each case. The employment effects of the two development paths also differ significantly: "In both scenarios, the negative total employment shift by 2025 compared with 2015 is in the order of 1 million gainfully employed persons (FTEs). By 2035, the figure increases to around 2 million. This means that at least two million workers will lose their current jobs because they will no longer exist. However, the positive employment shift is even larger at both points in time, and in 2035 it is about twice as high as the negative

employment shift, so that up to 4 million people can be offered new employment in growing sectors" (Schade et al. 2020: 193).

Overall, both scenarios assume an increase in employment by 2035. The authors are thus significantly more optimistic than Cacilo and Haag, who published a study on the "Employment Impacts of Vehicle Digitization" in 2018, in which they outlined a Mobility-as-a-Service (MaaS) scenario by 2030 that would lead to employment losses in the vehicle manufacturing sector. These would actually intensify after 2030, according to Cacilo and Haag. Anticipating a widespread establishment of MaaS only in the late 2020s, they wrote: "Since the period under consideration ends in 2030, the deceptive effect of a moderate development is created. However, if the period under consideration were extended, between 2030 and 2035 employment needs would shrink to a fraction of what they are today" (Cacilo, Haag 2018: 96). However, the M 5 authors link their optimism to the expectation that battery cells and entire battery systems, including power electronics, will be produced in Germany in the future. Such a shift of cell and battery production, which has so far mainly taken place in Asia, to Germany and Europe is also assumed in the scenarios. This is the only way to achieve a high level of employment and the targeted value creation in the mobility industry. This also applies to the production of semiconductors and sensors for driver assistance systems (DAS) through to autonomous driving, as well as to development and software-side control. Important potential for employment and value creation in the country lies in the production of hardware and software.

The authors see two possible variants for the development path of multimodality in the MM 35 scenario, although they do not hide the fact that they lean toward the second variant: On the one hand, they see a "low-cost variant," by which they mean cross-financing of low-cost mobility services by using the data generated. Ultimately financed by advertising and neglecting the real costs of mobility, this variant is likely to be not only detrimental to privacy, but also associated with low incomes for employees. On the other hand, they consider a "premium variant" to be possible - and desirable. In this variant, users' mobility data remain private. Mobility services are not cross-financed, but priced to include environmental and privacy costs. Employees in this market would, they assume, be adequately compensated. They link these market predictions to the fact that certain preconditions must, however, be in place: strong data protection is needed, as is the existence of one or a few European IT companies that have the necessary competencies in Big Data, cloud storage and sufficient credibility with regard to privacy. In their view, creating these conditions should therefore be the goal of an ambitious European industrial policy.

Using Volkswagen (VW) as an example and on behalf of VW's Sustainability Advisory Board, Herrmann et al. from FhG-IAO also attempted to capture both the quantitative and qualitative effects of electrification and digitalization on the automotive sector in their study "Employment 2030" (see Herrmann et al. 2020). As far as the scope of employment is concerned, a picture is drawn that is characterized

by a "multiple intertwined juxtaposition of job creation, job upgrading and job loss" up to the year 2030. In view of the demographic change, i.e., foreseeable waves of retirements and a shortage of skilled workers, the associated adjustments can probably be made. Changes in the demands on the future workforce pose a greater challenge, as they require a "massive buildup of skills." According to the authors, this is associated with a "profound change in corporate cultures." The keywords are well known from corporate culture debates: more interdisciplinarity, more flexibility, flat hierarchies, cross-company cooperation, open data and more diversity. All of this is associated with a broad transformation of the previously rather pillarized and clearly functionally divided industry. Hermann et al. therefore see the core tasks of the upcoming structural change not only in the development of competencies, especially in the development and application of information and communication technologies, but also in the necessary transformation in actually all company dimensions.

The latest interim report of WG 4 of the National Platform Mobility (NPM) also argues that power electronics will be of crucial importance in terms of employment policy, also and especially in future vehicle construction. This applies to all vehicles with an electrified powertrain - from mild hybrids (in some cases already micro-hybrids) and plug-in hybrids to battery- and fuel cell-electric cars, trucks and buses. It is required for both a high AC voltage for the drive itself and a low DC voltage for auxiliary units. Favorable energy consumption and thus a high vehicle range require efficient power electronics. Both on the vehicle side and for the charging infrastructure, power electronics play a major role. WG 4 therefore sees considerable employment potential. Particularly high employment effects are seen in the use of hydrogen fuel cells, but this is likely at best in niche applications, at least in the passenger car sector. Overall, one of the authors, Borrmann, sums up the employment development for German manufacturers as follows: "With the know-how available in this country, Germany can play a leading role, or even the leading role, in the fields listed and beyond, and tap the value creation and employment potential offered in each case. However, this is also necessary. After all, the value added and employment that will disappear in the course of the transformation with the internal combustion engine will be considerable. Compensation will only be possible by operating in a dominant position in as many of the future relevant areas as possible" (Borrmann 2022).

In the recent discussion about the employment effects of structural change in the mobility economy, the areas of logistics and CEP services are increasingly being addressed. For example, Alexandros Nikitas et al. (2021) estimate employment effects of a progressive spread of Automated Driving in freight transport and distribution. They examine the impact of these technological changes on logistics employees and their labor relations. The focus is on digitalization in urban food logistics in terms of perceptions of autonomy and control from the perspective of the workforce. They want to know what labor relations look like. The analysis is based on a qualitative study with professional drivers as well as courier drivers in urban food

logistics. As a result, the simultaneity of autonomy and control that occurs with the integration of new technologies into work organization is evident in everyday life. An important role is played by managers and their need for control. On this basis, the authors call for the scope for shaping digitization processes to be used so that employees' autonomy can be strengthened.

In their short study for the Rosa Luxemburg Foundation, Cadeis and Krull (2022) also focus on the employment effects of structural change in the mobility sector as a whole. For the automotive industry, they see - as in the other studies - the digitization of mobility and the change in drive systems to e-mobility, in addition to increased competition in the course of transnationalization and an accompanying surge in rationalization. Each of these aspects is associated with increasing pressure on collectively agreed standards, pay and working conditions, as well as rising demands on employees and more work intensification. As a result of these factors, some of which are mutually reinforcing, the authors expect a reduction in employment in the vehicle manufacturing sector in the order of several hundred thousand. They therefore call for independent and more far-reaching concepts and practices for a real and just mobility turnaround and a socio-ecological restructuring of the mobility industries. In their view, this is only possible together in an alliance of employees and trade unions from different sectors, together with the environmental and climate movement, the social and political left, and critical science.

The similar effects in Europe

This discussion on the effects of automation and digitalization, the drive turnaround and the structural change of the transport sector toward electrification and more services, as presented in the German example, finds its counterpart in the Europe-wide view. For example, the CAR Institute has presented a simulation of the effects of stricter CO2 emission limits leading to accelerated electrification of powertrains for the European automotive industry (CAR 2021). The starting point for the simulation is the EU Commission's plan to impose stricter limits on CO2 emissions from new cars. According to this plan, from 2030 onwards, fleet average emissions of only 47.5 grams of CO2 per kilometer are to be permitted for new cars, which corresponds to a halving of the current limit and cannot be achieved with internal combustion engine technology. The impact of such stricter regulation on employment in the automotive industry of the five EU member states Germany, France, Italy, Spain and Slovakia was examined. These countries assemble approximately 70% of the total number of passenger cars produced in the EU. The analysis based on data for 2019 and 2020 shows that only minor negative employment effects are expected for the automotive industry from the accelerated electrification of powertrains. The losses range from 1.8% in Germany to 2.1% in Spain. Overall, 1.9% of today's jobs in the European auto industry would no longer be needed in 2030 to produce the

slightly increasing number of cars by then (with a rapidly increasing share of e-vehicles).

After the partly dramatic warnings of drastic job losses as a result of the drive turnaround in the 2010s, the mood has recently turned. In the fall of 2021, Agora Verkehrswende, together with Boston Consulting, published an overview of the job losses often feared in the public debate in some key European automotive-producing countries as a result of an accelerated drive transformation by 2030 (Agora Verkehrswende 2021). According to this, the transformation will have only a minor impact on the number of jobs. The reasons for this are not only to be found in electrification: in addition to the elimination of jobs in the labor-intensive production of internal combustion engines, this is in fact also due to continuous productivity growth, which in developed industries is 1 to 2 percent per year. Incidentally, the risks of transformation in the auto industry and thus also the employment losses are unevenly distributed in several ways. Firstly, between the OEMs and the suppliers, and secondly between the suppliers themselves. The suppliers who have been producing parts for the combustion engine are particularly hard hit. It is therefore not surprising when the consulting firm Deloitte assigns the highest risk ratings to the manufacturers of combustion engines, exhaust systems, interiors and fuel systems in its "Global Risk Monitor" 2021 (Deloitte 2021).

The forecast relatively low negative effect on employment in the automotive industry is based not least on the assumption that the competitive position of European automakers will improve compared with their Asian and North American competitors. For as the authors argue, "An early switch to electric cars promotes the build-up of economies of scale and future competitive advantages in the automotive industry. If the switch to CO2-free passenger cars in Europe comes too late, Europe will be exposed to competitive and cost disadvantages, in contrast to Asia and North America" (CAR 2021: 2). In their study, they emphasize the potential for new jobs in battery cell production, for example. Stricter EU emission limits thus lead to positive employment effects. This aligns CAR's authors with the findings of a 2018 Cambridge Economics study, "Reviewing the impact of the low-carbon mobility transition on jobs," which also assumes only minor losses in vehicle manufacturing employment (Cambridge Economics 2018). Coping with the employment losses will also be facilitated by the fact that the advanced average age of workforces in car companies will lead to an above-average number of retirements in the decade that has just begun. This could avoid layoffs. However, this does not diminish the relevance of retraining and qualification programs.

In fact, the transport sector as a whole is likely to see slight job growth. The authors of Agora Verkehrswende and Boston Consulting expect a net increase of 25,000 jobs: While up to 180,000 jobs will be lost at traditional automakers, 95,000 new jobs will be created in battery production. The great demand for charging infrastructure will lead to the creation of 70,000 new jobs. The demand for skilled

workers with an electrical engineering focus is rising massively. In their estimation, one of the things that is needed is a further training offensive. As a result of the transformation, there are around 260,000 new jobs to be filled in battery manufacturing, software development and the construction and operation of charging infrastructure. Agora Verkehrswende and BBC draw attention to the fact that, in addition, retirement and fluctuation are expected to create a need for more than 800,000 personnel by 2030. Every second job in the automotive industry will have to be filled. At the same time, many activities are changing or jobs are being eliminated completely. Almost as many employees will have to be retrained, a good third of them for completely new requirement profiles (Agora Verkehrswende 2021).

The positive overall balance cannot hide the fact that there will be significant shifts in value creation at OEMs and suppliers, and thus also in employment. Boston Consulting, for example, expects European OEMs and first-tier suppliers to shed 500,000 jobs by 2030, while new suppliers, the energy companies and infrastructure providers will create almost as many new jobs (Boston Consulting 2021: 26). Cambridge Economics, but also management consultancies such as Boston Consulting or McKinsey, repeatedly point to the creation of new cross-sector employment. This is because a completely new charging infrastructure has to be built for electromobility. Sectors such as the construction industry, the electricity industry, the hydrogen industry and, last but not least, service providers for billing and roaming for charging processes will benefit from a rapid transition to electromobility.

The change in drive technology from the combustion engine to the electric drive in the vehicle industry is at the centre of professional and public attention. Apart from electromobility new good jobs will be created with the digitalization of the mobility sector, especially in the IT sector. For some time now, there has been a greater need for workers in the transport sector, on the one hand in traditional occupations such as vehicle drivers and in the logistics sector, especially truck drivers. On the other hand, employment in the likewise classic counter operations for ticket sales is declining. Automation and online ticketing are the reasons for this. New and generally well-paid jobs are being created in software programming and maintenance. The demand for IT specialists is growing both in the automotive sector and in public transport. It can only be met in part by retraining employees. This demand for IT skills is meeting with competing demand in other sectors, resulting in an overall higher level of pay. In addition to higher wages, the new IT employees in the transport sector are likely to have additional individual demands on working conditions. Issues such as work-life balance and home office will take on greater importance.

What skills will be needed in the future and how they can be secured

On the one hand, the skill level in the automotive industry continues to rise. The drive turnaround and, above all, connected and automated mobility require a great deal of software expertise. Software developers are recruited through new hires and company acquisitions. The automotive industry is setting aside substantial budgets for this purpose. IT competencies are fiercely contested. Both the OEMs' platform strategies and their powertrain electrification activities rely on IT specialists.

In addition to IT skills, more classic design and engineering skills will be needed in the future, especially in manufacturing (Cedefop 2021). At the same time, electrotechnical skills will become more important for vehicle and (charging) infrastructure maintenance as well as for monitoring operations and crisis management. The qualification requirements in these service sectors will also be high; not least, soft skills are also required in direct customer contact. The same applies to public transportation. In particular, a PT extended by MaaS needs a professional customer connection, for which soft skills such as empathy skills, crisis management and improvisation skills should not be underestimated. The specific competencies and qualifications required in the future are therefore diverse. To a large extent, they are demanding and include soft skills, such as in MaaS offerings with customer contact.

The challenge is great. In the future, competencies and qualifications will be needed on a large scale both in the automotive industry and in the other branches of the transportation sector that have not existed or have existed only inadequately up to now. For the key automotive industry alone, considerable retraining and qualification efforts will be necessary in order to successfully manage the change in drive technology from internal combustion engines to electric drives on the one hand, and the even more far-reaching transformation from the dominant private car to the networked and automated hazard. In their joint study, Agora Verkehrswende and Boston Consulting described three different qualification paths for approximately 800,000 employees for the adaptation services of the European automotive industry to an accelerated drive turnaround (Agora Verkehrswende 2021: 15). First, "in-service training associated with remaining in the company and with slightly changed requirements." This concerns the majority of those employees who will not retire by 2030 or who will be newly hired with new qualification requirements, i.e., about 500,000. Second, "retraining and job changes to a similar industry and/or job description," which concerns about 190,000 employees. And third, a "transfer to another industry and/or to a new job description." This is recommended for about 70,000 employees.

In the EU Commission's study "Study on the social dimension of the transition to automation and digitalization in transport, focusing on the labor force," which was

prepared by a consortium led by the Dutch consulting firm Ecorys, a number of proposals are made on the basis of a stocktaking in order to be able to achieve the necessary adjustments to qualifications and skills in a socially acceptable manner. This catalog of recommendations primarily addresses sectors outside vehicle production, i.e. public and commercial transport. However, it is largely applicable to the automotive industry, which is currently undergoing radical change.

As it were, the preamble to the catalog of recommendations is the call for a broad awareness of the urgency and scope of the adjustments to qualifications. In addition, a number of recommendations are proposed both at company and inter-company level and for the political framework at European and national level (EU-Com 2021). These can and should bring more binding force to the qualifications sector, which is often plagued by non-binding declarations of intent. For this reason, they are presented in detail below:

- Lifelong learning system: At an early stage, as it were in preparation for the digital transformation and automation in the transport sector, employees should participate in lifelong learning programs. Companies, trade unions and employee representatives should jointly identify skills gaps that need to be addressed. Use should also be made of existing support tools such as the "European Skills Agenda".
- Duty to train: The duty to provide continuing education includes the responsibility of companies to offer such continuing education. Accredited training institutions should develop continuing education programs, with the involvement of the social partners. New legislation should be enacted at EU level for this purpose.
- Joint training teams of younger and older employees in companies: In these mixed teams, a mutual exchange of know-how should be facilitated. Older employees can support younger ones, particularly in routine tasks, while conversely younger ones pass on their knowledge of new technologies to older employees.
- Attracting young and, in particular, female employees and retaining them in the long term: Young and, in particular, young female employees should be recruited in a targeted manner by offering flexible working models and, in particular, career options for female employees.
- Mitigating the risks of digitalization and automation in collective agreements: Decisive provisions on the consequences of digital transformation and automation should be included in collective agreements. For example, a budget for further training and health promotion can be made available at company level. In addition, joint change management plans should be drawn up in companies.
- Industry-specific social funds to manage the transformation in the short and medium term, especially for lower-skilled employees.

- Establishment of national social funds: these funds should be used to set up courses and curricula needed to train the future workforce in the skills required to be ready for the new occupations that will be created by automation and digitalization.
- Use EU and national funds to support SMEs: For example, support SMEs in particular, use European and national funding to address the social impact of digital transformation and automation.

Beyond this catalog of recommendations, it is necessary to align the specific training courses and degree programs at universities with the new qualification requirements. This is an education and science policy task that must be carried out primarily at the national level. Training and study content must be modernized accordingly.

CASE STUDIES

Case Study (1): Automated driving

Background

As already described above, the path dependencies of the classic car producers, which have been successful for decades, are very great. They generally have difficulty with digitization, but above all with forms of use other than exclusive, private access (see Canzler, Knie 2016; Boes, Ziegler 2021). Car manufacturers want to preserve the "joy of driving"; they understand "automated driving" to mean sophisticated driver assistance systems. The development and testing of automated vehicle concepts, whose technical scope ranges from distance warnings and lane assist to automatic parking and convoy driving on highways, is taking place in the automotive industry under the auspices of the prevailing state of automotive technology. The narrative of the private automobile continues to be regarded as the fixed point, and the valid performance and quality standards are also aligned with this. The goal of all research and development projects is the somewhat more comfortable and safer, privately owned car with the basic idea of "self-driving".

US-American digital companies such as waymo or cruise, but also Chinese platform providers, on the other hand, are working on the software and hardware of actually autonomous driving vehicles (Daum 2019). They are equipping existing vehicle models with it. However, the underlying business model is "becoming a hazard" services.

From hell to heaven: automatic driving

Electrification of drive technology is one step toward the transportation turnaround, but at least as important is a drastically more efficient organization of transportation with fewer passenger cars and a significant shift to resource-efficient public transportation. Asking whether automated driving can become part of the solution or part of the problem reveals the immediate need for political design. This is also, but not only, about a radical technical innovation. It is about a paradigm shift in transportation policy from driving to "becoming dangerous."

We are still a long way from the goal of comprehensive mobility with fewer vehicles and with a drastically reduced use of resources. At present, the professional and media attention for automated driving (AF) is mainly focused on the classic car. Images of cars whose occupants no longer have to steer and pass the time playing parlor games have dominated media representation since the 1960s to the present day. But automated driving does not necessarily have to be thought of as a continuation of private automobility. An alternative path opens up if we think of the

development toward automated vehicles as a shift toward a radically modernized, multi-optional public transportation system. In this development path, autonomous driving vehicles are part of a modernized public transport system. Passengers are driven in these vehicles of various sizes and equipment. The principle of use is commonly referred to by the somewhat futuristic term robo-taxi. This expresses the high degree of automation, in which there are no drivers and the influence on the driving process by the dangers is excluded. The vehicles are actually autonomous in their operation, their mission is programmed and they are remotely monitored if necessary. Therefore, it makes sense to speak of autonomous driving in this case - also in distinction to automated driving as support functions for the private car that continues to be controlled by the driver.

And what is about shared automated mobilities? With regard to the acceptance of sharing and on-demand services, reliability is particularly important in addition to price. Real-time information and precise positioning functions are indispensable. This is why nationwide network coverage is needed. This applies to transportation sharing as well as to MaaS. But good IT network coverage alone is not enough for integrated mobility services. There needs to be cooperation between the various service providers that is not even noticeable to the users, as long as not all mobility options are already integrated with one provider. So far, this is the exception. As a rule, public transport companies and one or even several sharing providers must work together and speak to the customer with one voice. However, a dilemma quickly reveals itself, because in such a cooperation none of the partners wants to become a mere supplier and thus invisible to customers. The question at issue is who has the "face to the customer". One way out of this dilemma is whitelabel offerings on technical platforms - from the customer card to an app and a telephone hotline to the invoice with different logos. These allow the cooperation partners to maintain their own customer relationship. However, this requires a "neutral service provider" to operate these white label platforms. This service provider of service providers demands a corresponding margin.

For the acceptance of pooling offers and in particular of bundled rides in automated driverless shuttles, it is crucial that the objective safety of passengers from harassment and violence is guaranteed and likewise that the subjective feeling of safety is not disturbed. In the case of driverless shuttles, the safety issue has not yet been definitively resolved. Up to now, the usage procedures have always included the collection or comparison of the personal data of the inquirer for identification purposes. Individual usage criteria such as "drive only alone/maximum of two" or "as a woman, drive only with women" can also be stored in the usage profile. Otherwise, all operators rely on remote monitoring via video technology. Whether this is sufficient and what the consequences of possible acts of violence transported by the media can be, is open.

In recent years, the discussion of automated and autonomous driving has been dominated by a view of the internationally agreed gradation of levels of automation (Canzler et al. 2019). Implicit in this was a continuation of the dominant model of the private car, with successive additions of assistance functions. The focus was on convenience and safety gains for the car as we know it. The battle over the potential of autonomous driving beyond these convenience and safety functions has only just begun. International consulting firms (e.g., Arthur D Little 2021) are also getting involved. A more detached overview of the strengths and weaknesses as well as the manifold implications of automated driving is provided by a recent article, which concludes that in addition to a large number of ambivalent findings, there are still a number of unanswerable questions that lie beyond the foreseeable technical advances (Othman 2022).

In automated driving, there have been more or less spectacular announcements for years about when which vehicles will be on the road and how they will revolutionize road traffic. The terms "automatic" and "autonomous" are often mixed up or used interchangeably. As a rule, however, the term refers to partially automated vehicles, since there are still no practical examples of actual autonomous fleets. However, in the U.S. and China, test vehicles from various digital companies are driving under real-life conditions and gathering a great deal of experience, or to put it better: they are collecting data in order to learn. The Google subsidiary waymo in particular has amassed a considerable wealth of experience and built up a lead over its competitors.

When looking at development and testing projects, a fundamental difference between the European and American innovation cultures stands out. In Europe, pilot tests are carried out in protected laboratory situations, usually on hermetically sealed test tracks, under strict prior control and following elaborate approval procedures. In the U.S., on the other hand, tests are carried out in real road traffic, with one or even two occupants who can intervene in the event of danger, and of course in compliance with applicable regulations. There, however, the vehicles are on the road in real life, exposed to erratic road traffic. The willingness to also take risks and make technical adjustments in a trial-and-error process is much higher among the Californian digital companies than among the European car manufacturers (cf. Daum 2020).

The vision of car manufacturers: the automated private car

In addition to the technical and legal challenges, however, it remains to be seen which vision of the use of automated and later autonomous vehicles will prevail. The visions of the traditional car manufacturers differ from those of the American tech companies in particular.

The major automakers are primarily working on the gradual expansion of driver assistance systems such as the "Traffic Jam and Highway Chauffeur". This will enable drivers to avoid having to steer, at least temporarily, in traffic jams and when driving on highways, and to turn their attention to other activities. As usual, these technologies are being introduced via the luxury segment in the case of expensive and complex additional technical systems.

The big issue here is the return phase – that is, the period of transition from automated driving of the vehicle back to driving. There are no standards for this yet. The central problem has not yet been solved as to where the responsibility of the human ends and that of the machine begins. To avoid accidents, it is crucial that there are clear processes for the driver to return to the role of the vehicle operator. User acceptance will only occur if this transition is stress-free (cf. Stilgoe 2017). The question is which 'secondary activities' are allowed to the drivers and how a quick role change – within a few seconds and possibly from a state of relaxation to half-sleep – from being in danger to driving oneself can be achieved.

In general, it must be ensured that the occupant of a partially automated vehicle can actually intervene in the event of a malfunction or emergency. Paradoxically, this is all the more difficult the less frequently the emergency occurs. There is a great danger that the person in danger will 'forget' how to drive on his or her own and take too long to settle into the unaccustomed role of the driver. Pilot tests with partially automated vehicles have been plagued with these difficulties of the so-called handover for years without finding a way out so far (cf. Morgan et al. 2017). A number of research projects are testing rules and technical warning signals for when the passenger returns. Vehicle manufacturers are thus holding on to the core of the classic model of the car as a private vehicle. Automobility is to become even simpler and more convenient thanks to automation functions - but as little as possible is to change the actual business model.

The vision of the American digital companies

U.S. digital companies are pursuing a completely different vision. Google and its waymo subsidiary are using artificial intelligence methods to improve the algorithms for actual autonomous driving with every test kilometer driven. In selected areas, the test vehicles offer comprehensive point-to-point mobility as robo-taxis without any driver intervention. Technically, the Google subsidiary relies on a combination of radar, camera and lidar (light detection and ranging).

Before a waymo vehicle rolls onto the road, it is fed with data from a detailed map of the driving environment, which contains information such as roads, intersections or fixed objects on the side of the road. This prior knowledge of permanent features of

the operational terrain allows the sensors to focus on moving objects and other road users.

Waymo and the other digital companies are "open" in the exploitation of their technical options. They are banking on the fact that products and services that have demonstrated their mass utility value will find their business model without the immediate operational business having to produce a positive result. Neither strict business ratios nor ecological indicators are therefore the yardstick for the strategic success of these companies, but in fact the big picture. However - and here European companies regularly underestimate their American competitors - they rely on blueprints that work. After all, the imagination of investors in particular is only really stimulated if proof of success can be provided in principle.

As a result, the American and Chinese digital companies seem to be in a much better position to implement the options of autonomous driving in new business models, because the old path dependencies of private and exclusive access to a means of transport do not play a role here.

Case Study (2): The public transport and public space

"Private transport becomes public, public transport becomes private"

Until now, high car availability has always gone hand in hand with underutilized public transport services. In principle, (partially) automated driving opens up additional options for public transport and can therefore make it more attractive. The old dichotomy between private and public transport could disappear, because automated on-demand services are flexible and more geared to individual needs than any conventional bus or train service, no matter how short the interval. Conversely, with individually assembled intermodal mobility solutions, private mobility is at least partially managed by public transport. The new relationship can be described as "private transport becomes public, public transport becomes private."

Connected public transport linked with automated driving is still a dream of the future. However, new areas of application are already opening up for (partially) autonomous shuttles in rural areas. Gaps in a "hub-and-spoke concept" can be filled well, especially since the shuttles need exempted routes or lanes to operate, which are easier to set up in rural areas than in cities (Hunsicker 2018). Overall, and not just for rural areas, automated systems come with high hopes given driver shortages and the high share of personnel costs in public transportation operating costs. In terms of operating economics, shuttle systems not only offer more flexibility, but also significant advantages over buses in the medium and long term with significantly lower operating costs.

Automated shuttles could act as catalysts and at the same time as an element of a new flexible public transport that is so attractive that it becomes a real alternative to the private car. If, at the same time, the privileges of the private car, i.e., above all the lavish supply of roads and the (almost) free parking, are consistently reduced, the number of cars can be reduced step by step - down to one tenth of the previous car population. Vehicle savings of such magnitudes can only be achieved if not only the technical prerequisites are created, but at the same time comprehensive changes in the traffic framework conditions are implemented: for example, in the form of an area-wide pricing of road use and parking, a consistent reallocation of public spaces in favor of the most efficient modes of transport, and a reduction in parking areas for private vehicles. There is also a need for an intelligent regulatory framework that cleverly links the new and old forms of service in a user-friendly way. In summary, automated vehicles in a fleet operating mode as part of a linked public transport

system will enable a significant reduction in transport devices if the necessary policy framework is in place. Whether automated driving fleets hit the road, whether they are a blessing or a curse, therefore depends less on technical developments than on the political will to regulate.

Innovation window opened

On-demand transportation, automated shuttles and, in perspective, autonomous vehicle fleets can become game changers because they have the potential to fundamentally change the transportation landscape. However, these fleets must be politically enabled and designed. Considerable room for maneuver is offered - quite surprisingly - in Germany by the draft for a new law proposed by the Federal Ministry of Transport at the beginning of 2021, called "Law on the Amendment of Road Traffic Regulations [...] on Autonomous Driving as well as on an Ordinance on the Approval and Operation of Motor Vehicles with Autonomous Driving Functions in Specified Operating Areas (Autonomous Vehicles Approval and Operation Ordinance - AFGBV)." This explicitly authorizes driverless vehicles on public roads. Accordingly, it is possible that the operation of a motor vehicle is no longer controlled by a vehicle driver, but by a "technical supervisor" who is not stationed in the vehicle. This actually makes the outlined paradigm shift from automatic driving to "becoming dangerous" possible at all. Given the progress of digital companies, especially waymo, there is now indeed an opportunity to make autonomous vehicle fleets part of a modern and flexible public transport system with proactive regulation.

In a widely acclaimed model study, the International Transport Forums (ITF) outlined a scenario back in 2016 in which autonomous shuttles are used to complement an integrated public transport service. In the scenario, widespread deployment of public autonomous fleets is associated with a radical reduction in private car use (OECD/ITF 2016). Self-driving vehicles thus become a new public transport service that, in combination with an efficient rapid bus and (road) rail network, achieves a high level of individual serviceability. Based on empirical studies, it can be approximated that a system of fully autonomous shuttles - embedded in a hub-and-spoke system - would enable the stock of vehicles in cities to be reduced to around 50 vehicles per 1,000 inhabitants (see ITF 2018).

Public transport operators in a dead end

The idea of autonomous fleets understood in this way is in fact a play on public transport. More in the focus of public attention, however, are other varieties of automated driving. Both the gradual automation of the private car and the vision of the "robo-taxi" actually driving autonomously are being driven forward by traditional

car manufacturers on the one hand and digital platform providers on the other, with a great deal of research and development effort. But neither vehicle manufacturers nor the platform providers have sufficient experience with management in public spaces. It is also questionable whether they have the necessary empathy to do so.

However, transport is public because it is supposed to serve a general, precisely public, transport interest. Therefore, a community can force operators to also present offers in spaces and relations where transport demand is weak and far below the threshold of economic viability. There are several ways to achieve this: The city or municipality operates the transport service under its own management and pays the deficit from the municipal budget - this is the most common procedure to date. Or - if external funding is available - the service for the relevant area is put out to tender. In this case, high-frequency routes are usually combined with low-frequency routes. There are a number of other variations, but they are similar in that a public interest is defined in a particular standard of service that would not be provided using the usual entrepreneurial formats.

The incumbent operators of public transport services, typically rail and bus operators, are not in a position to generate the necessary investment funds and provide the necessary skills, either in Europe or in North America. The drivers in the technology development of automated driving are instead the digital companies, which are spending immense sums on the development of autonomous fleets. The automotive industry's investments in these systems are also in the billions worldwide. Public transport companies, on the other hand, have not played a major role in the race to develop this technology, with no money earmarked for research and development of autonomous systems. Public funding is not even enough to modernize rail infrastructure, let alone develop and test automated fleets. While there have been a number of pilot trials, these have generally been discontinued after their test phase or even before. An overview of these trials - as of the end of 2019 - is provided by Antonialli 2021.

Opportunities and risks of automated driving for sustainable mobility

The intermediate stages of semi-automated vehicles already reached today, both in the form of the partially automated private cars of the major car manufacturers and the robo-taxi prototypes of waymo and Co., raise the question of which technical developments are conducive to climate protection goals, a desired reallocation of public transport space and a generally improved quality of life, or conflict with these political goals (cf. Dangschat 2017, Fleischer, Schippl 2018). That is where the main focus is on possible safety and convenience effects for the (partially) automated car: new functions such as automated driving on long distances, on the highway, or even the traffic jam assistant are being developed by manufacturers with the aim of

increasing the comfort status and strengthening the attachment to the devices. If this succeeds, the number of vehicles and kilometers driven with a low occupancy rate would presumably increase. After all, if the time spent on the highway or in traffic jams can be better used than before for phone calls, entertainment or relaxation, it becomes more attractive to take a longer commute to work, for example. The currently existing advantage of public transport is thus lost, and transport would become even more exclusive (ISI 2019).

Unregulated automated vehicle fleets that are not intermodally contained are not sustainable in any way (Lyons 2018). However, to develop autonomous driving vehicles as integrated elements of attractive public transport, many municipalities lack the understanding and know-how. Using the Stockholm metropolitan region as an example, Wallsten et al. were able to show how few municipal transport politicians and local transport authorities were able to play an active role in the design of a networked public transport offer: "At present, there are several obstacles and difficulties for municipalities in taking a clearer leadership role. They do not have all the necessary institutional conditions to lead a smart and sustainable transition. (...) Most importantly, if public actors do not take on a proactive governing strategy now, they might end up in a future situation with diminished institutional capacity (Wallsten et al. 2021). Moreover, there is often a lack of appropriate operational actors pursuing a public interest. Neither platform operators nor car manufacturers have sustainable and socially balanced public transport in mind; they want to sell their services or their vehicles profitably.

The development of autonomous vehicle systems in the sense of modernizing public transport is therefore not least a political issue. The design task is to use autonomous driving as a building block of multi-optional and environmentally friendly mobility in the sense of the transport turnaround. The framework conditions of transport must be designed or existing regulation must be changed in such a way that automated driving vehicles are integrated into a multi-optional transport structure (Knie, Ruhrort 2019). Then, in perspective, the development of automated vehicles can play a key role for both ecologically efficient and urban-friendly transport and for improving transport accessibility in rural areas. In concrete terms, this would also involve giving vehicles their own lanes. This is difficult to implement in European cities, but much easier on the outskirts and in rural areas or in new neighborhood projects.

In addition to the potential cost savings, another advantage for operators compared with conventional buses is that (partially) automated shuttles can be deployed much more flexibly and are more adaptable to changing topographical and infrastructural conditions. The typical area of application is in the connection to stops and stations ("hubs"), they serve settlements, but also commercial areas, hospitals or (high) schools in on-demand mode in the form of feeder services ("spokes"). Although the transport volumes are limited due to the limited space capacities, the flexibility in the

service forms and times is significantly greater than with conventional buses. Even classic scheduled services can be operated by such shuttle systems during off-peak periods (Hunsicker et al. 2017). The costs per kilometer in regular operation are difficult to estimate. In a first cost simulation, McKinsey calculated kilometer costs for trips in pooled robo-taxis for the year 2030 that are higher than those of the classic scheduled bus, but significantly lower than the costs for trips with a private car (Mckinsey 2022). However, the calculations only consider moderate additional cost burdens for private car traffic until 2030; an ambitious city toll for private vehicles, from which robo-taxis are at least partially exempt as part of public transport, would change the results considerably.

However, the shuttles that have been (partially) automated to date are currently still far from regular operation. Many technical and operational issues have neither been technically standardized nor legally clarified. There is currently a considerable gap between the technical standard achieved and robust series operation, and economies of scale are not yet achievable. However, there are already some studies on possible fields of application. In particular, commuters can use it to overcome the "last mile" (Mira Bonnardel 2021).

If one wants to introduce such a system, a fundamental problem in the public transport sector becomes apparent. It is not only the lack of financial strength compared to other industries, it is primarily the lack of an innovation culture that prevents operators of long-distance and local public transport systems from catching up. Moreover, the legal structure of public transport operators, transport associations and special-purpose associations is not at all geared to dealing with open issues of the future. The transport operators are operational providers and the ordering organizations are bodies set up for the court-proof tendering of standardized transport services. Tender competition is fought exclusively on the level of costs. The logic of the public transport system prevents innovation because it is not reflected in the system, let alone rewarded (cf. Canzler, Knie 2016: 39 ff.).

The classic indicator of patent applications in the field of automated driving points to a solid know-how base in Germany; in the years 2005 to 2017, Germany was even ahead worldwide, since then still among the top three (cf. Sievers, Grimm 2022). Nevertheless, there are hardly any real-world applications to date, nor are there any models designed specifically as shuttle vehicles. In view of this, the conclusion of Sievers and Grimm can be agreed with: "The concrete embedding of autonomous driving in the overall mobility system, the design and interaction of vehicles and infrastructure, and the resulting opportunities and risks with regard to ecological and social sustainability are open questions. Strategy formation is therefore of central importance. Exchange between stakeholders from politics, business, science and civil society plays an important role in this" (p. 9). The arena of this exchange is the urban public space. This is where it will be decided whether and how automated driving will get 'on the road'.

Case Study (3): Gender aspects of new mobility

The transportation sector is not gender-neutral. It is traditionally male-dominated and characterized by various gender differences at all levels of employment. Gender disparities exist not only in job compensation, but also in career access and advancement opportunities. Now, while improvements can certainly be expected with the New Mobility in view of these grievances. In principle, new technologies allow a design of use – also of jobs - that meets the needs of women. Digital technologies can be used flexibly. One problem, however, is an unclear data situation, because there are often no traffic data disaggregated by gender: "For example, in the context of urban travel, understanding what it is that women want from cities and how this translates into a vision for urban transport should be at the heart of public policy. This will require much finer and differentiated knowledge of travel behavior and people's needs than has been the case in the past. New data sources can help develop that knowledge base, but it is important to avoid biases that have become ingrained in past transport policies" (ITF 2021: 5). Transport policy, like transport planning, is still made from a male perspective. The proportion of women in decision-making positions has increased somewhat in recent years, but overall the dominance of men remains unbroken. This is also the case in educational institutions.

Over the past two decades, the differences between men and women in employment rates, the share of part-time work, unpaid care and family work, management positions, and wages have hardly narrowed (EIGE 2020). On average in Europe, 22% of employees in the transport sector are female (compared to 46% of the total workforce). In the COVID19 crisis, after the first impressions, the differences have even worsened again (ITF 2021: 11f. & 37f.). Even though the share of employees within the transport sector differs significantly between maritime and aviation, for example, historically the low overall share of women has led to gendered patterns of behavior and, within these, to discriminatory working conditions. It is widely recognized that a better gender balance not only benefits women, but also has business and economic benefits. Economic productivity increases in companies and organizations with a balanced gender ratio and, conversely, the overall risk of poverty in society decreases. Since the risk of poverty is generally higher for women than for men, not least because of the significantly higher proportion of part-time employment, a higher employment rate is at the same time also a promising step toward effective poverty reduction.

In the traditional transport companies in vehicle production and also in public transport, gender balance is still a long way off. Now, with the advent of smart mobility, there were - and are - high hopes that the gender gaps, both in employment shares themselves and in pay and management appointments, will become smaller than they are known to be in the traditional transport sector (Woodcock et al. 2020). So far, however, this has not been the case. Rather, old industry patterns seem to be repeating themselves. The EU project TInnGo

(Transport Innovation Gender Observatory) should be seen against this background: "TInnGO is a 3 years research project funded in the context of the HORIZON 2020 Programme of the EU, aiming to create a framework and mechanisms for a sustainable game change in European transport through a transformative strategy of gender and diversity sensitive smart mobility". The project will look for the reasons behind the problem of gender stereotypes that continue to be effective in ten European countries and develop recommendations to get out of these outdated patterns (Pirra et al. 2021).

Female movement patterns and digital inequality

On the usage side, gender differences play an equally important role. How do movement patterns differ by gender? Due to the gendered division of labor in the household, women often have multiple tasks and activities. Women make shorter commutes and have more trip chains with a higher proportion of non-work-related trips. They travel off-peak more often than men and are more flexible in their choice of transportation. They use public transport and cabs more often and their own cars less than men (see Ng & Acker 2018). Given these findings, it can be assumed that women have a high interest in flexible digital mobility services and in intermodally enhanced public transport.

Both for new mobility services and especially for automated driving, the motives and interests of the users are of great interest. Acceptance depends on this. Thus, in addition to the reliability and affordability of the service, which are important for all users, safety immediately comes into focus, especially for women. In addition to cost and accessibility, the subjective feeling of safety is decisive for the acceptance of existing and also new mobility offers. Inclusivity is another requirement for mobility services. All age groups and especially the disabled and elderly must be addressed. The expectation is that, on the basis of identified requirements for new mobility services and a corresponding product design, the necessary qualifications of the employees can also be defined. In this context, the TInnGo project also problematizes the gender-specific attribution of transportation technologies, especially the automobile, which has often not been disclosed to date. Using the example of automated driving, the authors show the interpretive disputes about images of the future: "Existing studies of the emerging field of smart mobilities point in different directions when it comes to attraction and use by various groups. On one hand, there is a utopian notion of a new beginning with automated cars as an avenue toward a more equal and genderless mobility regime. Here the coming of the driverless car is foreseen, at least in principle, to loosen the strong bonds of men, masculinity, and cars from the automobility era (...). On the other hand, several studies find serious exclusions of women and potential racism of smart mobility proliferated in the automated car (...)" (Christensen et al. 2020: 19).

With regard to digitalization, there were and are two concerns: first, that the design of digitally based mobility services has a male bias, and second, that there are significant gender differences in the availability (and possibly also in the quality of use) of digital devices.

Impact of New Mobility and Digitalization on Employment and Good Work

The flexibility in New Mobility employment is definitely attractive to many women. Nevertheless, as in the conventional occupational fields of public transport, they encounter gender-specific stereotypes: it is still not uncommon for their suitability for work in public transport to be doubted. But that is not all: violence and sexual harassment continue to be a major problem for female employees in the transport sector. Shift work exacerbates this problem (Wright 2018). The proliferation of ticket vending machines is leading to the loss of counter jobs, which particularly affects women. Further automation of ticket sales is to be expected, although this is often regretted by passengers.

A large proportion of new driver jobs are emerging in platform-based ride-hailing services. Ride-hailing and -pooling services are increasing worldwide, but unregulated platform-based operations are nonetheless a general problem. The overall risk of exploitation is high, and there are additional dangers for women. The risk of violence and sexual harassment, for example, may cause female drivers to avoid night shifts as well as certain urban areas. While IT technologies can also be used for warning and protection purposes, trust in such protection technologies has not been particularly high (ITF 2019: 28f.). In addition, there are the stresses from the car work disproportionately performed by women and the requirements of maternity leave. Both factors put women in an unfavorable competitive position when competing with men for coveted driver jobs.

A fundamental problem with any digitization, as in transportation, is the digital gap. When approximately 90% of jobs require basic digital skills, but, as in Europe, just under one-fifth of students and employees in information and communication technologies (ICT) are women, the problem becomes more entrenched with each digitization push (ITF 20201:7). Without specific support programs for women in New Mobility and in the digitization of the traditional transport industry, the gender gap will actually widen.

Necessary qualifications: Systems understanding and user perspective

Even if the battle for interpretive sovereignty over future images in mobility has not yet been decided, this study pursues the vision of integrated and intermodal mobility based on personalized information and communication technologies. Such a future Smart Mobility is intermodal and, from the user's point of view, an integrated service. It is undisputed that this will require new skills and qualifications on the part of the providers, which are more than just IT competence. In addition to specific technical expertise, these include a "systems understanding of mobility" and an empathetic "user perspective. In order to achieve these qualifications, a change in general (high) school education is needed, as well as a change in in-company education and training. A gender balance in the transport sector, which has yet to be achieved, is a necessary prerequisite for this.

As with other hitherto male-dominated sectors, the following also applies to the transport sector: The more women are able to move up in the hierarchies of companies and organizations, the more they can serve as role models for others. This can succeed in changing gender norms in this sector. Less male-dominated work structures are in turn attractive to women, who can "choose" their jobs, as in the field of information and communications technologies. The key factors in this competition for qualified women are: flexible working hours, a safe and appreciative working atmosphere, good remuneration, and opportunities for further training. This is even more true for the smart mobility sector and MaaS providers.

There is another reason why gender balance is so important in the transportation sector: half of the customers (at least in passenger transportation) are female. Female customers have different movement patterns and also different needs. We know from feminist transportation research that "female trip chains" are often different because work trips are often connected to trips as part of caregiving as well as family work. Women's trips tend to be shorter but more complex and have larger non-motorized components (Joelssen, Lindkvist 2019). In public spaces, women are often victims of sexual harassment; for France, for example, nearly 90 percent of women surveyed reported harassment in train stations, trains, and other public transportation (Trautmann 2019). For this reason alone, it is important that public transportation in particular be designed from a female perspective. In general, the importance of public space becomes clear. Transparency in the design of public spaces, transport stations and of transport means themselves is a prerequisite for improving the sense of security for women - and for everyone: "The more women are involved in designing, operating and managing mobility services, the more female transport users will feel at home on public transport and the better the image they will have of public transport through the high-quality services they experience daily" (Trautmann 2019).

The traditional bastions of the unions in the transport systems are therefore in decline. This is particularly true of the automotive industry. The industry has long been familiar with the "productivity dilemma" (Abernathy 1978), and the unions in particular are in a quandary. Let's look at the powerful German IG Metall: On the one hand, IG Metall sees itself as an admonisher and has traditionally called for entrepreneurial foresight in order to secure jobs in the long term (IG Metall 1990). On the other hand, it is precisely the works councils of Daimler, VW and BMW that have long denied the corporate managements basic innovations such as different drive systems, new vehicle concepts or excursions into other industries such as digital platforms (Canzler, Knie 2019). The chairman of Daimler's works council, for example, was still vehemently calling for an exit from the business field of new mobility services in the fall of 2020 - in stark contrast to his IG Metall representative, who is, after all, proposing this as a perspective for the future (Tagesspiegel Background, Oct. 12, 2020). But the works council is not only a powerful player at Volkswagen and Daimler. At BMW, practically all activities in new business areas of digital services were personally torpedoed by the powerful works council head Manfred Schoch. The maximum change that is being supported is the change in drive technology.

The automotive industry is evidence of the "corporatism" that has long characterized Germany and France (Esser et al. 1983). This was a tightly knit network of the state, companies and unions that regulated, controlled and, above all, stabilized the basic order of the markets and the quality of industrial relations. The high degree of reliability and mutual trust guarantee growth and job security – but at the expense of flexibility and innovative capacity.

However, it is not only the automotive industry that faces this dilemma. Public transport, which is repeatedly discussed as an alternative to the car, is bound in a similar corset, albeit with considerably less relevance for the transport economy. Let's stay with the German case again: in the overall transport market, long-distance transport by Deutsche Bahn AG and regional transport by the various operators together with local transport by cities and municipalities (public transport) account for no more than 16 percent (MiD 2019). This is also due to the fact that public transport is financed and provided by the state in the form of services of general interest. As a rule, it is not organized as an entrepreneurial task, but as a utility. In particular, more than two-thirds of local public transport is in municipal hands. In these companies, verdi is the dominant union; in rail transport, it is the EVG or the much smaller GDL. There is no entrepreneurial profit motive as a basis for the daily tasks in this transport segment. Since the rail reform in 1994, elements of competition have been introduced, but these relate solely to the invitation to tender for transport contracts. Companies compete for these contracts, which are usually

very generous, and are then protected from competition for 10 to 15 years. In the case of local public transport in particular, the unions make sure that this protection mechanism continues to exist. The product and its manufacture remain "frozen," so to speak. While this safeguards employee rights, it prevents new services from being developed, tried out and, if necessary, repositioned, similar to the automotive industry. As a result, public transportation continues to function as it did 50 years ago, with its tried-and-tested large containers, ticket vending machines, ticket counters, tariff zones and paper tickets. Dynamism and growth are deliberately not envisaged in this form of "corporatist provision of public services"; rather, the individual segments such as long-distance trains, regional trains, buses and cabs are finely sorted and their forms of operation are legally secured. New forms of service do not appear in this world or, like car or bike sharing, are accepted at best as niche services.

The dilemma for the GDL, EVG and verdi unions is therefore the same as it is for IG Metall: defending existing interests comes at the expense of the new. Innovations in public passenger transport are indeed rare. At the same time, the unions are not taking action against the politically intended disadvantages of buses and trains and the preference for the private car. After all, the popularity of buses and trains can only increase if, in addition to the necessary improvements in service, the privileges of car use are restricted at the same time. These privileges are enormous. For example, parking private vehicles in public spaces is legally a "public use" and can take place anywhere. Road traffic regulations have as their primary goal the safeguarding of optimal traffic flow with cars, and company car privileges create the condition that car sales are financially lucrative for employers and employees alike at the expense of lost tax revenues and social security contributions.

A crucial question is: How can a race to the bottom be prevented in the new service jobs? The minimum wage should be that high that it acts as a safeguard against wage dumping. This is particularly relevant where there are no collective agreements to date or where a flight from collective agreements has already taken place. However, underpaid work in self-employment cannot be prevented in this way. Therefore, all tenders and licensing for mobility services must require proof of sufficient payment, also for the individual consortium partners. Anyone bidding for mobility services as a partner in a bidding process must be able to declare and prove that all employees are adequately paid. This also applies to self-employed persons who are subcontracted, for example. A local fair pay level should be part of the tender itself. Finally, a transparency requirement for working conditions and likewise for pay in the bidding process not only helps in the decision-making process, but is also the basis for critically assessing the reputation of bidders among the interested local public. Reputational competition fueled in this way is likely to result in good work being well paid.

So far, unions have done little to change the prevailing structures of the transport market. For a long time, they have helped to stabilize the existing forms of supply, including their legal safeguards. They have helped to put a kind of "innovation lid" on the transport sector: everything remains as it was. However, this is no longer sufficient to secure the existing sales channels - and thus also the volume of employees. The markets are changing, the political framework is shifting globally. This is obvious in the automotive sector. Large markets such as China or the US state of California are changing the rules of the game in such a way that vehicles with combustion engines will no longer be an option in the future. Europe is following suit with the "Fit for 55" program.

For public transport, equally drastic changes are on the horizon. The future of transportation systems, like the quality of work, will be determined by how public space is designed and how access to public space is regulated. If the scarcity of space leads to the dismantling of the privileges of the private car in the future and, at the same time, the digital prerequisites for sharing and pooling business models are in place, urban transport services will change fundamentally.

The advance of the American company Uber also indicates the limits of previous business policies for companies in the public transport sector. Although it has been possible to push back the American company in a number of highly regulated markets such as France or Germany, the "Pandorra's box" is now open. It is clear to all involved that the flexible use of existing resources is the right, contemporary path to sustainable mobility. Who will operate and offer the new mobility services is currently still an open question. This depends not least on the character of the public tenders. If public service contracts are put out to tender as functional services in the future, the competition for efficient intermodal offerings could become a competition among providers of "total packages." From the perspective of employees in the transport sector, the question of "good work" will then be decided in the requirements of the tenders. It is the task of the trade unions to ensure that the conditions for "good work" as well as good wages are part of the tenders.

The background to the changes in the transport sector - and ultimately also to the trade union strategies - is the megatrend of "using instead of owning". The success of platform business models built on this megatrend will depend more than on regulation and on the political design of public space. For union strategies, this means that the individual company will become less important, while both the regulatory and local policy levels will become more significant. This is shown again by looking at the tenders: if not only classic transport services with buses and trains, but also sharing, leasing or pooling options are put out to tender as potential offers in overall packages, the concrete tender conditions will matter. What the conditions actually look like should be the subject of negotiations between trade unions and local authorities. The local level with its framework-setting competence becomes more relevant. It is then more important than ever to gain the authority to interpret

what "good work" is. Then the reputation of the companies themselves can become an issue - and a problem. Those who do not offer good work should not stand a chance in tenders for several reasons.

How unions become players with power to define and interpret public policy? The starting point of our argument is that in the future, more than ever, it will be decided at the local level what is and is not possible in the public sphere. The transport sector is strongly affected by this. For example, public transport can benefit significantly if a city toll is introduced for private cars or if parking spaces on urban land are reduced. Which transport and urban planning decisions are made depends, on the one hand, on the respective political majority and, on the other hand, on the activities of civil society actors. Both factors also influence each other. Against this background, we advocate that the trade unions actively engage in the discourse on the design and use of public space. In doing so, they should first develop their own coherent position and defend it in an evidence-based manner on the basis of studies. For this purpose, an exchange with scientific partners should also be sought. As a next step, alliances with political and civil society actors should be sought. In this way, it may be possible for trade unions to become strong voices in the struggle to define what the "livable and sustainable city of the future" should look like. However, such a proactive discourse strategy requires that trade unions and their functionaries not only focus on representing interests in their sector, but also get involved in fundamental discussions. In addition to "good pay" and "quality of work," "fairness of land use in the city" and "safeguarding the quality of urban life in the light of the climate crisis and resource efficiency" will then also become central trade union issues.

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