WISO DISKURS

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Siegfried Behrendt, René Bormann, Werner Faber, Stefan Jurisch,
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DESIGNING MOBILITY SERVICES

for employment, equity and access

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1

NEW MOBILITY AND SOCIAL CONSEQUENCES

Perhaps more than any other social system today mobility is characterised by a highly transformative dynamic. Mobility is undergoing substantial changes on both the service provider side and on the user side. Driven by megatrends such as urbanisation, individualisation, digitalisation, demographic change and sustainable mobility provision, preferences and business models are changing. Terms such as "transport transition", "new mobility" and "shared mobility" currently dominate public discourse. A key aspect of these discussions is the notion of breaking out of the decades-long path dependency of using private cars for all mobility purposes, towards a new collective understanding of mobility as a service.

The current discussion on "mobility as a service" (MaaS) is dynamic, reflecting a rapidly changing market, and driven by such terms as "new mobility".

Box 1
MOBILITY AS A SERVICE

Mobility as a service (MaaS) denotes the integration of different kinds of transport services in a single mobility service that is accessible as required. A single application enables access to different forms of mobility with a single payment channel. MaaS providers offer a diverse range of transport options, including local public transport, car or bike sharing, taxis, car hire or a combination thereof. MaaS approaches include new business models and organisational and operational options, as well as access to improved user and demand information (MaaS Alliance 2019).

Driven by the new possibilities of digital technology, MaaS promises flexible mobility free of transaction costs, representing an alternative to the dominant motorised individual transport (MIT). The new mobility services aim to be as convenient and sustainable as the private car but cheaper, as well as helping to achieve social goals. Connectivity, easy access and affordability are touted as the main benefits of MaaS, complemented by the minimisation of externalities such as accidents, pollution and congestion.

Potential benefits include above all a significant reduction in the use of private cars and, on the other hand, a strong increase in the use of public transport. Overburdened transport systems, local air pollution and increasing competition over use of public space are social and transport policy challenges, to which the introduction of MaaS approaches is a response. When it comes to designing the mobility of the future, however, the question of social justice arises and with it, the question of how much MaaS can contribute to fair and equitable mobility for all and the extent to which MaaS will be able to satisfy the abovementioned demands of service providers and users (see Box 2).

As was the case with electrification, it appears that the problem-solving potential of MaaS will also be accompanied by potential risks. Here, too, before new approaches are rolled out across markets and society, the risks need to be properly scrutinised and investigated well in advance. Solutions are needed to show how maximal use can be combined with minimal risks.

SOCIAL EFFECTS OF NEW MOBILITY SERVICES

While the effects on transport and the spatial system, as well as the ecological and economic aspects of the new mobility have already attracted attention, far-reaching analyses of the social consequences are lacking. These have been utterly neglected in transport science. In order to avoid social – mobility-related – exclusion and to design a fair and equitable mobility system, however, in future, transformative policy approaches need to take much more account of the social justice aspects. Thus as MaaS is expanded, a level of mobility that is affordable and oriented towards the needs of all must be made available.

Scholarly analysis of the social impacts of MaaS is still in its infancy and a number of research gaps are evident. Empirical data on employment effects have yet to be gathered in Germany (with regard to working time, quality and security, income distribution, the social costs of the new mobility and access to MaaS in terms of gender, income or age). This research gap is the starting point of the investigation presented here, which also provides the first inventory of the

Box 2
"FAIR MOBILITY": MOBILITY FOR ALL?

Mobility may be defined as people's ability to get from one place to another and thereby to carry out activities that are important for them. Whether it be a visit to the doctor, going to kindergarten, school or workplace, or cultivating social relations, mobility is fair when it is available to all.

In Germany today, however, mobility is not fair. Not everyone wants or can have their own car or make use of the relatively costly new mobility options. This development is intensified by the constant diminution and compression of urban spaces and a growing social segregation. Besides that, the social, ecological and economic costs of mobility are currently unfairly distributed. Against this background we can already discern a "social gap" in mobility policy.

When new mobility service providers enter the market the first question that arises concerns how fair mobility for all can be implemented in order to ensure societal stability, social inclusion and participation. Mobility has a key function in society today and must be possible for all (Rammler/ Schwedes 2018).

social consequences of integrated mobility services. In it, we take a closer look at the social impacts set out in Figure 1.

In addition to sifting the available information on the relevant three dimensions – employment, distribution and access (Section 2) – we take an exploratory look into the future (Section 3). To enable a first conceptualisation of the complex interaction of technological changes, the transformation of the mobility economy, the dynamics of user behaviour and the social consequences of MaaS approaches the social impacts will be analysed and discussed on the basis of three qualitative scenarios (see Figure 2).

Figure 1
Social impacts of MaaS

Employment
– direct and indirect employment increases and decreases
– new business and working models
– employment quality

Distribution
– income shifts
– changes in cost structures of mobility expenditures
– inclusion of users
– spatial distribution effects

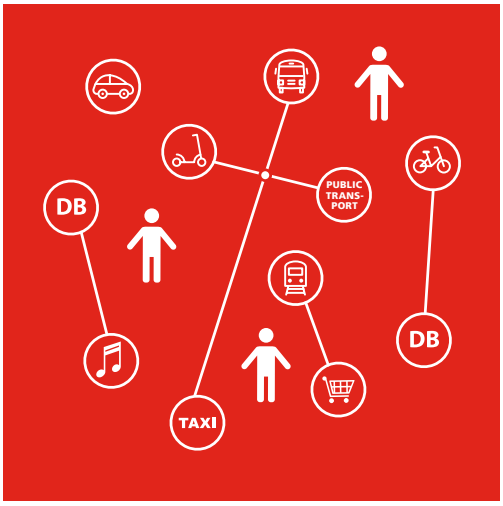
Access
– MaaS business territory
– accessibility
– physical and technical access

Quelle: eigene Darstellung.

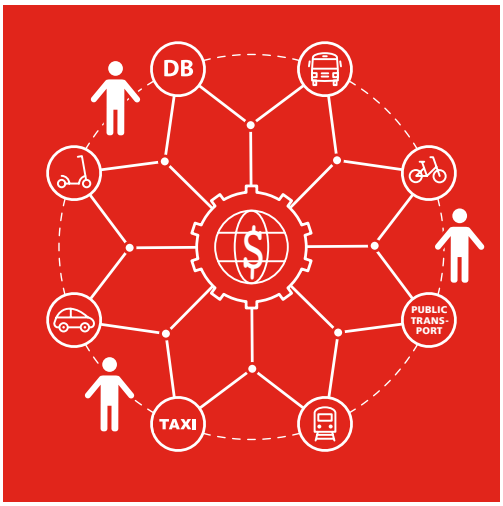
The three MaaS scenarios were developed jointly with experts from the mobility sector and politics and point to potential configurations of possible developments of the mobility landscape involving MaaS, as well as necessary actions.

Based on these results the first action and design recommendations for companies, trade unions and policymakers are presented (Section 4), which also form the basis for an agile, adaptive and sustainable municipal mobility policy. The aim is to identify obstacles to designing new mobility systems as part and parcel of services of general interest and to formulate the necessary guidelines for a fair and thus sustainable mobility policy.

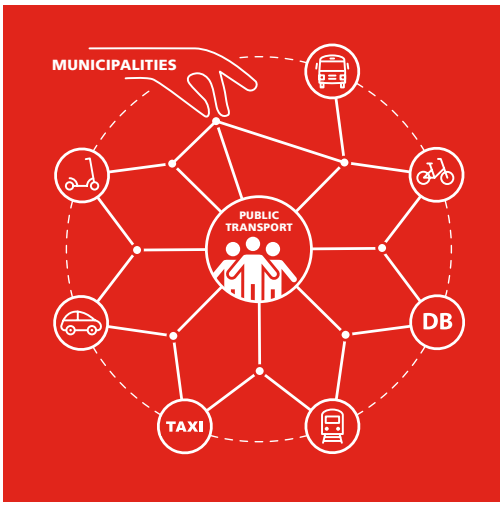
Figure 2
Three MaaS scenarios



1 – DIVERSITY
Fragmented mobility services landscape



2 – MONOPOLY
Market dominance by a single actor



3 – MUNICIPALITIES IN CHARGE

Source: Authors.

2

EFFECTS ON EMPLOYMENT, DISTRIBUTION AND ACCESS

Various MaaS service providers are entering the European market at a rapid rate. Market analyses and studies of possible economic and ecological effects of the new mobility services are shaping both the scholarly and the political discourse on the new forms of mobility. The dynamic development of the mobility market leaves important questions unanswered: the quality and quantity of the new work, social justice, incomes, inclusion and access to new mobility services. The extent to which MaaS can contribute to fair – and sustainable – mobility has yet to be seen.

MaaS promises to enable sustainable, needs-oriented mobility through a mainly app-based IT model (Polis 2017). The new mobility services raise the prospect of a user-friendly and flexible mobility package, and are talked of as part of sustainable urban planning within the framework of Smart City approaches. The benefits of MaaS are also described in the European Commission's "Sustainable Urban Mobility Plans" (SUMP): in particular the step from mono- to intermodal transport chains raises the prospect of a shift in the modal split through the integration of MaaS in mobility approaches.[1] Journeys by private car are combined with public transport, as well as with e-scooter, bike- or ridesharing, thereby relieving the pressure on urban centres. The new mobility provision also promises social inclusion by facilitating access to services, education and employment for all citizens. Because the new services adapt themselves to users' needs more attention can be paid to temporal and spatial flexibilities. In particular for people who were previously unable or disinclined to use their own car or public transport MaaS provision promises more mobility and thus more participation and higher quality of life (ERTICO 2019).

Because MaaS approaches are so new, however, currently there are virtually no studies or research findings. The empirical database is overall not yet reliable enough to draw valid and generalisable conclusions. Some provisional conclusions are available – mainly based on modelling – about the effects on employment. For other dimensions only individual studies are available and it is possible to proceed only by drawing analogies and forming hypotheses. Questions concerning the quality of new areas of employment and, accordingly, the extent to which the new mobility can contribute to social justice are particularly ambivalent. In what follows, we shall thus take a close look at the social consequences of MaaS in three areas: (1) employment, (2) distribution and (3) access. Even if there are correlations between areas and effects, this overview provides the first hints at practical policy recommendations.

2.1 EFFECTS OF MOBILITY SERVICES ON EMPLOYMENT

In general, mobility services can affect employment in a number of different ways

1. Mobility service providers can themselves create jobs, for example, in setting up and operating a platform, in marketing, in repairs and maintenance.
2. Certain business models – on a peer-to-peer (P2P) basis – can offer new options for becoming self-employed or procuring an additional source of income.
3. Mobility service providers, as new market competitors, can have an effect on established providers, such as car manufacturers, public transport operators, taxis or car rental companies and their employment situation.

The effects on employment, the labour market and the quality of work vary considerably. As far as car-sharing is concerned, rideselling can have a range of consequences[2].

2.1.1 DIRECT AND INDIRECT EMPLOYMENT WITH MOBILITY SERVICE PROVIDERS

Employment generated at mobility service providers themselves, in public transport companies and in taxi services, as

1 Modal split is a technical term from transport science and refers to the respective shares of different modes of transport, such as walking, cycling, car, bus or rail, in the transport market as a whole.

2 Rideselling (also known as ridesourcing or ridehailing) designates passenger car services provided on demand – in distinction to ridesharing.

well as at private-sector car, bike, ride and scooter sharing providers, has a direct effect on the labour market (Eichhorst/Sperrmann 2015). For example, the number of permanent staff at, for example, the MaaS provider Uber is around 22,000, while the number of drivers – 75 per cent of them men – has been estimated at 3 million globally and 900,000 in the United States alone. Thus the company is one of the biggest players in the platform economy and estimated to be responsible for around two-thirds of all activities in the on-demand labour market in the United States.

Table 1
Areas of activity of companies in new mobility services

Area of employment	Areas of activity
IT and technology	Data processing and storage, user interfaces, electronic vehicle equipment with internal control functions
Marketing	Advertising
Management	Product, fleet and claims management
Operations	Vehicle distribution, cleaning, maintenance, care
Customer service	Booking channel support and processing customer inquiries
Billing	Invoicing, bookings, collective invoices
Customer services	Customer relations management and customer care

Source: Authors, based on Wagner et al. (2018).

For Germany, Bertschmann et al. (2015) estimated the possible employment consequences of car sharing on behalf of the Federal Environment Agency. Depending on the assumptions, job losses range from 5,700 to 6,300, while the potential employment gain would be somewhere between 72,000 and 109,000 jobs. The employment data are inconclusive because, among other things, they include the indirect as well as the direct effects on employment. Furthermore, downstream employment increases and decreases in the orbit of MaaS service providers have to be taken into account: besides long-established areas such as passenger transport, controlling, customer service and marketing, there is employment potential in, for example, fleet management, vehicle distribution, cleaning and maintenance, but also in IT. The following section illustrates typical areas of employment of the new mobility services.

2.1.2 (SOLO) SELF-EMPLOYMENT, ADDITIONAL INCOME AND MOBILITY PLATFORMS

New mobility services will create a number of new job profiles. One example is the "juicers" or "chargers" who collect, recharge and redistribute electric hire scooters. In Madrid there are 400 juicers for 8,600 e-scooters (Neuroth 2019). Sharing service providers generally employ workers on part-time contracts without full social insurance. According to sharing provider Circ (Flash) all those involved in the maintenance and charging of e-scooters are full-time employees. A suitable private car is usually required (Dervisevis 2019). Juicers receive around 3 euros for each e-scooter collected and charged (Dervisevis 2019). On average, between 12 and 15 e-scooters are collected per night, charged and the next day positioned at prime locations in the city. In this way they can only earn up to 45 euros a day, on average, and this job generally provides only supplementary income.

P2P platforms exemplify the new mobility services market. Mobility platforms offer private individuals the opportunity to offer mobility services themselves and thus to earn some money. The business model is based on the provision of passenger transport services by private persons. This includes the sharing of cars, the provision of rideshare and ridehailing services. Start-ups, which have limited capital, see self-employment as a means of cutting costs. Over the long term, however, mobility platforms pave the way for precarious work by replacing secure jobs with a new form of self-employment.

2.1.3 EMPLOYMENT EFFECTS AT ESTABLISHED COMPANIES

New mobility services can also affect employment at established service providers if their services substitute or supplement them. The extent to which such employment effects manifest themselves at established mobility firms depends, on one hand, on how demand for new mobility services develops and, on the other, how far the new mobility services actually represent a substitute. Given the relatively low overall economic importance of MaaS, the employment effects must be sought above all at the level of individual branches. To date, research has been confined to the taxi sector and public transport.

The available evidence indicates that Uber's entry has expanded the car passenger transport market. An analysis carried out in New York City found that, while there had been a fall of 2.1 million taxi journeys in the space of two years, during the same period the market for car passenger transport grew by 18 per cent (Eichhorst/Spermann 2015; Cunningham-Parameter 2016). Although other studies find no evidence that companies such as Lyft or Uber have a significant effect on the number of jobs in the taxi business, they do bring down taxi fares (Zickuhr 2016; Berger et al. 2018b). The providers of car sharing services have always been in competition with conventional car hire firms. Statistics show a relatively constant turnover for German car hire firms over the past few years (Statista 2019). By 2020, however, turnover in the German car hire sector will be falling at a rate of 0.4 per cent a year, according to one estimate (Statista n.d.). No link has been shown with the development of car sharing.

New mobility services can also affect public transport provision, potentially even complementing and strengthening it. As regards local public transport a number of studies enable us to infer the number of employees involved. For example, Graehler (2018) came to the conclusion that the market entry of platform-based transport providers in the United States resulted in an annual fall of between 1.3 and 1.7 per cent in public transport passengers. It was calculated for San Francisco that Uber and similar companies were responsible for a fall in passenger numbers of around 13 per cent between 2010 and 2018 (Marx 2019). Uber's own research division came to opposite conclusions, claiming that public transport passenger numbers had risen by 5 per cent over two years (Hall et al. 2018).

Trends of structural change in the world of work are also reflected in this area,. On one hand, a modest number of highly qualified and attractive jobs are being generated (programmers, management), while on the other, atypical or precarious employment is increasingly emerging (marginal employment, juicers). Because to date few studies have been carried out on employment in the new mobility landscape the labour market effects cannot be accurately quantified.

2.2 DISTRIBUTIONAL EFFECTS OF MOBILITY SERVICES

Mobility and transport are "society inducing" because they enable people to participate in life (Rammler/Schwedes 2018: 8). It is therefore important to take social equality and justice into consideration, in particular in relation to income, mobility costs, social inclusion and mobility budgets, data justice and spatial distribution.

2.2.1 INCOME DISTRIBUTION

Looking at the 3 million or so Uber drivers worldwide only a small proportion of them are active for 40 hours a week. In the United States, for example, drivers are active, on average, for only 17 hours a week and even then, only for around three months of the year. Furthermore, 76 per cent of them have a regular job (Florisson/Mandl 2018). In terms of full-time equivalents these figures correspond to a proportion of US employment between 0.07 and 0.56 per cent (Holder 2018; Mishel 2018). Data for the European Economic Area indicate that in 2016 a mere 0.03 per cent of the working population were active as Uber drivers (Groen/Maselli 2016).

What level of qualification the work requires and what impact this has on wage levels can likewise be assessed only on the basis of the experience with MaaS in other countries. Data on driver remuneration are available only for the United States. From this we can assume that the incomes of contract workers lie in the lowest decile of the US income distribution and make up an aggregate 0.02 per cent of total pay in the United States (Mishel 2018). The share in Europe is likely to be similar, as Berger et al. (2018a) show for the London area. A large proportion of drivers are thus marginally employed and subject to precarious working conditions. At the same time, the rising demand for low qualified labour may lead to a higher wage level as companies raise wages in response to increasing competition. Li et al. (2018) tested this hypothesis on the US labour market, while Khreis (2019) looked at the Canadian market. These researchers came to the conclusion that the proliferation of Uber has had a significant negative influence on the unemployment rate and thus on wage increases for low qualified workers. Such effects are stronger the lower the qualification.

2.2.2 MOBILITY COSTS

The effects of the spread of mobility as a service (MaaS) on the cost structures of the mobility sector are a central issue. This encompasses both direct infrastructure costs and external costs arising from traffic accidents and health and environmental impacts. Integration of MaaS in the public transport system holds out the prospect of a reduction in traffic volume and thus lower external mobility costs – although without well-thought-out traffic planning and corresponding regulation this development is not guaranteed. In relation to MaaS the general question also arises of how the direct and indirect costs of mobility can be fairly distributed, in the sense of the "polluter-pays" principle and social justice.

If flexible and user-friendly services lead to an increase in motorised individual transport (MIT), thereby putting even more pressure on the roads, infrastructure costs would rise. Furthermore, more traffic means a higher risk of accidents. Consider for instance the increase in accidents associated with the introduction of electric scooters.

By the same token, an increase in the attractiveness of motorised individual transport could put public transport under pressure, despite the latter having a lower environmental impact and lower per-passenger CO_2 emissions. The digitalisation of the new mobility services could also have ecological rebound effects.[3] Closer integration of modes of transport and increased attractiveness of MaaS cause more people to use services via mobile devices, causing higher electricity consumption (Sühlmann-Faul/Rammler 2018).

2.2.3 SOCIAL INCLUSION AND MOBILITY BUDGET

The transport system is already socially inequitable (Rammler/Schwedes 2018). Granting unregulated licence to new mobility services such as ridepooling or other on-demand services could boost the use of cars, with possible and serious rebound effects. Higher externalities arising as a result would mean higher environmental costs for the state and society, but also a "twofold justice gap" (Rammler/ Schwedes 2018). It is twofold because people on low incomes would suffer more from the consequences of increased traffic, given that they tend to live in areas affected by more noise and air pollution, while

3 Rebound effects are the negative impacts on environment and ecological systems arising from efficiency gains in resource use.

at the same time suffering restrictions in their choice of transport due to their lower purchasing power and higher dependence on public transport. Low-income groups have to pay comparatively more for their mobility than higher-income groups. Particularly in conjunction with other costs, such as rising living costs – for example, rents – mobility costs are a key factor for many people on low incomes. A tight budget often entails severe cuts in everyday spending and social exclusion (Aberle 2018). This development is already discernible in Germany, where the gap between highly mobile population groups and those with restricted mobility is increasing, and factors such as income, age and gender are related to this (Lenz/Grunwald 2018). Furthermore, people with disabilities and those with a migration background tend to have low incomes and are particularly hard hit by changes in the cost structure.

With the advent of the new mobility services the question arises of whether MaaS can provide solutions for these problems or whether social inequality will instead be heightened by the new mobility services and the changes they bring about in the mobility market. Taking a purely commercial approach to demand for mobility poses a potential risk to low-income groups. If MaaS is provided by private companies it could lead directly to privileges for high-income groups, as they generate the most revenue (Avenir Mobilité I Zukunft Mobilität 2018). As things stand, affordability is not an issue for the current market-driven MaaS concepts, which makes it more probable that segregation will increase (Lucas et al. 2016). In sparsely populated regions, in which as a rule public transport is weak, mobility as a service can at best supplement public transport, improving the mobility of certain groups and reducing their mobility spending. However, the provision of such supplementary services is not likely to be forthcoming from the abovementioned platforms, but will have to be ensured by public operators (including substantial marginal costs per passenger). There is already experience of this within the framework of the deployment of conventional (not web-based) flexible systems, such as pick-up taxis and dial-a-bus services.

2.2.4 DATA JUSTICE

Increased networking and app-based MaaS approaches raise new issues of data justice. As in the case of other big platforms (such as Amazon or Alibaba) MaaS also raises the prospect of key companies establishing a monopoly position on the market and acquiring sole control of the data. Administration by a private platform provider raises such questions as the extent to which data can be used for marketing purposes, who guarantees anonymity and how is the right to one's own data to be assessed?

It is also possible that a number of different mobility providers will combine to form a platform that will then be coordinated by either another service provider or by cities and municipalities. The challenge is the exchange of data between previously unacquainted actors. Transparency of data use and application is key to trust and users' acceptance. Legal consequences that might arise for companies, cities or municipalities from misuse of data also need to be clarified.

Basically, the current rule is that publically generated data are made available to platform providers, generally at low cost. In exceptional cases, however, the opposite applies. Examples from Barcelona and Singapore indicate that even today the municipality can benefit from the platforms' data to optimise its own services for citizens.

2.2.5 SPATIAL DISTRIBUTION

Although what is at issue here is the development of an open infrastructure the signs are that service providers are establishing their business model only in economically profitable conurbations (Avenir Mobilité I Zukunft Mobilität 2018). In order to maintain links between town and countryside, however, it is important to build a decentralised network and not to develop central routes within cities solely on the basis of profitability.

A one-sided focus on profit-maximisation can also mean that lower demand for public transport results in poor services. Such a turn of events is imaginable in structurally weak regions in which public transport connections are substituted by private transport services and pricing thus taken out of the hands of the local council (Avenir Mobilité I Zukunft Mobilität 2018; Pangbourne et al. 2018: 19). Rural regions already often have poorer links to the public transport network and an extension of mobility as a service could in principle exacerbate this. In reality, MaaS platforms at present show no interest in municipalities with below half a million inhabitants or so. To that extent they neither pose a real threat nor represent a possible solution to mobility problems in rural regions.

In urban centres the unequal distribution of an ever scarcer public space is already evident (Rammler/Schwedes 2018). The current rudimentary approach to parking management and the lack of safe infrastructure for walking and cycling limit freedom of movement in urban areas, especially for children, people with disabilities, and older people with walking aids. This significantly curtails their living space. In this context, more traffic and an increase in MaaS transport providers could exacerbate the space situation.

> Mobility costs could rise as well as fall as a result of mobility as a service, public transport services could increase or decrease and personal control over data could be weakened or strengthened. The direction that this development takes is a matter of regulation and distribution.

2.3 ACCESS TO MOBILITY SERVICES

MaaS systems promise a broad portfolio of mobility services. The question of whether socially just and inclusive mobility services will be provided, however, depends on spatial, physical and also technical access. In particular, accessibility and (as far as possible) barrier-free use should be ensured.

2.3.1 THE MAAS BUSINESS MODEL

The areas of business and thus the current spatial distribution of most new mobility services make it clear that the MaaS

target group is high-income, young, agile and tech savvy. For business reasons, low-income areas, mainly on the urban periphery, are not attractive for MaaS service providers. Aberle (2019) demonstrates this development for Hamburg. The areas of business of the three biggest ridesharing providers are – regarded sociodemographically – higher-income and younger than the Hamburg average. The results of the study are congruent with those from the United States. In low-income districts there is less provision or provision with limited quality or functionality (Cohen/Cabansagan 2016, Kodransky/Lewenstein 2014). In Berlin, too, business areas such as car-, bike- and e-scooter-sharing are currently concentrated in the urban core. Thus MaaS represents an additional alternative to an already dense public transport provision, while rural areas and the urban periphery are excluded from what the major MaaS providers have to offer.

2.3.2 ACCESS BARRIERS AND ACCESSIBILITY

Barrier-free access is crucial. In particular, mobility services such as e-scooters or bike-sharing are difficult to use for people with physical disabilities, and bikes or scooters that are not currently in use may block pavements and crossings. In particular, mobility is limited for older people with walking aids, such as walkers or walking frames, people with disabilities, and people pushing prams. It must also be asked how accessible sharing provisions are. Can prams, walking frames and wheelchairs, not to mention larger items of luggage and shopping be transported, if necessary? Depending on the MaaS provider, there are certain options which, however, need need to be clarified before travel. Generally, MaaS offers more flexibility and freedom only to people who do not face such challenges.

The providers' own apps and websites offer answers to these questions. A US study that investigated sixty apps of sharing providers concerning their accessibility found that only 18 per cent of them were adapted to the needs of the disabled (Gebresselassie/Sanchez 2018). Although MaaS providers in Germany are aware of the accessibility issue, access to these services for people with disabilities and people with limited mobility is difficult with their current designs.[4] Research is also very patchy concerning the everyday mobility of migrants. It is known from the United States that language barriers may make it hard for some people with a migration background to access MaaS infrastructure.

Most MaaS approaches are app-based: services, booking and payment are done by smartphone. Technical access in particular can be an obstacle for low-income groups. Groups without the option of digital payment cannot make use of the new mobility services. Older people who are digitally aware and use a smartphone generally do not know about most MaaS services and do not use them. Although studies show that mobility is increasing among older people, this generally involves more use of their own cars (Lenz/Grunwald 2018; MID 2019). Furthermore, the digitalisation of mobility services can lead to a usage gap between genders (Lenz/Grunwald 2018). Men are already more mobile than women (Heinrich-Böll-Stiftung/VCD 2019). The issue of technical access shows how much access differs for different groups. For example, young, tech savvy and high-income men have faster, easier access to digital services than women or older people (Lenz/Grunwald 2018, Gebresselassie/Sanchez 2018).

If the issue of accessibility is taken into account in the development and design of MaaS approaches, access can be made easier for all population and income groups and mobility ensured. This, too, is a question of regulation.

2.4 CONCLUSION

The empirical data and the few studies on the social impact of mobility services demonstrate, first, that providers of mobility as a service are opening up new employment possibilities. The work options are particularly interesting as a supplementary source of earnings for people on low incomes, such as students, the unemployed and precarious workers. Although the new income sources create alternative forms of additional earnings they also open up new varieties of social exclusion: because these are second jobs responsibility for social insurance and liability risks fall to the workers (Degryse 2016). Furthermore, these jobs are often accessible only to those who own or have the use of a private car (Peuckert/Pentzien 2019).

In addition, the first studies on social justice as it pertains to the new mobility services show that they have the potential to exacerbate social exclusion. If mobility as a service is organised as a private business and services of general interest play no part in the business model high mobility prices will exclude low-income groups. On the other hand, oversupply and low prices could lessen the attractiveness of public transport and thus lead to a lack of connection and longer waiting times, even though public transport is talked of as the backbone of MaaS. In general, the integration of MaaS in the mobility system could well have an effect on costs. These might include infrastructural, health and environmental costs that rise with an increase in motorised traffic and thus disproportionately affect the lower strata of the population (Rammler/Schwedes 2018).

The current expansion of mobility options is awakening hopes of better access, but these approaches require coordinated planning and regulation by policymakers. Although accessibility has been an issue in existing MaaS services, access for people with disabilities, for older people and for

4 Although the website of the ridesharing service of Berlin transport company "BerlKönig" provides a booking option for a wheelchair-accessible vehicle, there is no information on availability, waiting times or whether the request for a wheelchair-accessible vehicle is compatible with the pooling algorithm and here, too, dynamic pricing makes it on average cheaper than taking a taxi (Berlkönig 2019). "Moia", too, the ridesharing affiliate of VW in Hamburg, provides the possibility of transport for people in need of assistance or with disabilities. On this issue, however, Moia mentions on its website that transport is generally possible if the booked seat can be occupied within the "legally required boarding time of up to three minutes" (Moia 2019). Also at present wheelchairs must be stowed in the luggage compartment and boarding is via a step of 50 centimetres. The Moia app does offer functions that make Moia services available to people with visual impairment.

families with children has been more difficult. The state – because there is clearly no other actor that can perform this role – must ensure inclusion and facilitate subsidised or free travel for people with disabilities. The design of booking and information options must also be accessible.

Because of the digital nature of MaaS services data security and use of private data will be key issues in future. Ultimately, in a connected world data sovereignty has a democratic dimension. If mobility is redefined as a service it is also important that the design not be oriented solely to immediate and purely economic efficiencies. Based on global megatrends (such as digitalisation, urbanisation and sustainability) and the social significance of mobility, its design is crucial for social cohesion. It is therefore important that participation be taken into account in the expansion of mobility as a service and integrated in planning and implementation because at present the design of MaaS approaches is based on a service-oriented logic (Hjerpe et al. 2017, Hensher 2017; Paulsson et al. 2017).

Finally, the few available studies indicate that the social impact of new mobility services can turn out to be either positive or negative, and on balance the overall outcome cannot be foreseen. Future development and the effects of the new mobility depend strongly on the creation of the right political framework and the smart design and use of new mobility services.

3

SCENARIOS

3.1 DEFINITION AND ASSUMPTIONS

Scenarios are just the right tools for dealing with complexity, lack of knowledge and uncertainty in turbulent times. They make it possible to develop a future-oriented approach to design that instigates reflections and strategy-building processes based on an alternative space of possibilities. They offer solutions to the problems currently perceived in connection with future developments. Thinking in terms of scenarios means linking together networked and strategic activities that are open to the future. The interactions of the various factors influencing planning systems become transparent to the relevant actors and promote a deeper understanding of the future consequences of decisions. The presentation of development paths and future models can, for example, anticipate unintended consequences of planning processes. To use a metaphor, scenarios are samples of possible futures in the form of constructed and simulated worlds. They are not predictions of the future, but intimations of futures in the present. For these reasons we chose a method that is capable of demonstrating possible configurations of a future mobility shaped by MaaS approaches and evaluating the corresponding social implications.

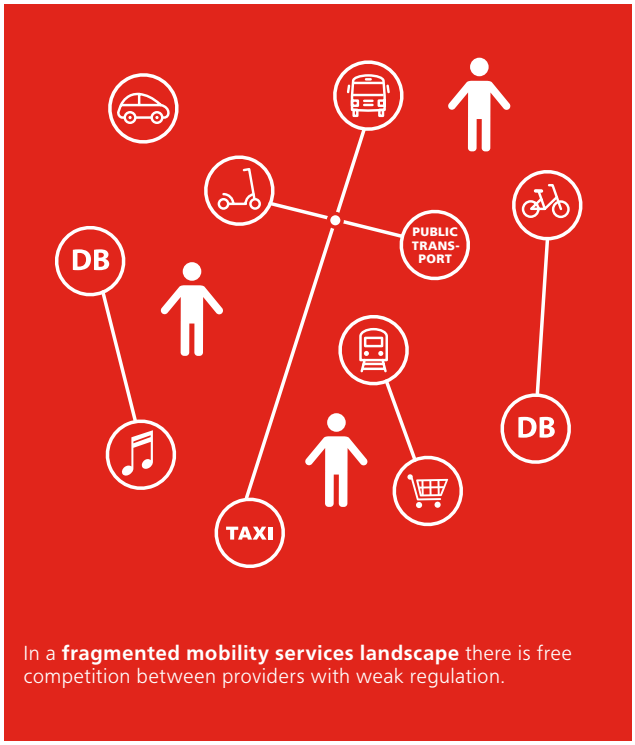
There is method to the order in which the scenarios are presented. Scenario 1 focuses on a diversification of the mobility services landscape – a competitive market with a range of MaaS providers, user needs and MaaS systems. By contrast Scenario 2 presents the constellation of a dominant MaaS monopolist – an amplification of current business models and an expansion of the market power of a MaaS company, like today's Uber (United States) or Grab (Singapore). Scenario 3 involves municipalities taking on active organisational tasks and exercising their authority – a regulated MaaS market.

The following assumptions apply to all the scenarios presented here:

- The scenarios and the MaaS systems apply to both urban and rural areas.
- Automated driving is possible, with technical and legal restrictions (level 4), and with the potential to disrupt mobility systems (level 5 as wild card).
- Differentiation and diversification of transport are the order of the day.
- Motorised individual transport (MIT) is present in the scenarios. The auto industry's traditional business model is coming under pressure because of MaaS and other shared mobility developments, as well as changes in mobility behaviour (local mobility).
- New mobility services are changing the mobility economy, transport policy and mobility behaviour.
- Digital media and systems are key drivers of the new mobility.
- New business models and value chains are developing.
- Transport is considered a service of general interest with the provider/user relationship opening up at the same time.
- Political and public discourse are shaped by climate change and sustainability strategies.

3.2 SCENARIO I: DIVERSITY – FRAGMENTED MOBILITY SERVICES LANDSCAPE

Figure 3
Fragmented mobility services landscape



Source: Authors.

In this scenario, mobility has been characterised by a free market dynamic for years. The liberalised transport markets, weakened public transport and the lack of a regulatory transport policy have led to a mobility system that is no longer adequate to the demands of a service of general interest. A free market system that relies on the unconstrained and pluralistic interaction of market forces, and in which prices are determined by supply and demand, has led to a diversity of mobility providers and is shaping a "brave new world" of digital mobility that is neither accessible to all nor guarantees comprehensive mobility.

To the extent that the previous mobility economy was shaped around the private car by the automobile and components industry and their business models, mobility increasingly became an economic good. New mobility services have emerged driven by technological breakthroughs in information and communications technologies, artificial intelligence and data processing, which have set themselves the task of making mobility individual, convenient and sustainable. They represent, on one hand, a response to people's developing needs for flexible and comfortable mobility. On the other hand, new companies have emerged that purvey mobility applications and solutions and respond to these needs commercially. Hopes were once pinned on mobility as a service as the solution to pressing transport problems. The integration of as many mobility services as possible represents the special appeal of these possibilities. But their downside soon began to emerge. The model is simple. Public and private transport services are combined by means of a standardised access portal. The whole journey is booked, implemented and invoiced via this portal or a single application, even through different providers and means of transport are selected. Thus a seamless, integrated mobility chain is created quickly and conveniently. In principle, this model has a lot to offer. To achieve integrated operations in practice, however, and thereby to organise mobility more sustainably, requires certain conditions. Only smart integration and regulation by policymakers whose guiding principle is the provision of services of general interest can ensure socially just mobility services. But that is just what has not been achieved.

Within the framework of prolonged underfunding of local government, an unsustainable transport policy and thus a weakened public transport, considerable portions of mobility have been privatised. The municipalities have not been able to integrate MaaS services in public transport and run them efficiently. Initial attempts in urban areas foundered and half-hearted efforts to set up such services in rural areas failed. There are a number of reasons for this. On one hand, a reform of the Public Transport Act lowered the access barriers for private mobility providers. At municipal level, there has been no real transformation of transport planning in terms of competence building and, in particular, intermunicipal cooperation. There are still over 250 fare systems and the companies responsible for them. If anything, their overall ability to run services has further diminished, as a result of which many areas have been decoupled from the public transport network.

At the same time, traditional mobility providers, such as car manufacturers, have expanded their product portfolio with their own mobility services in response to the growing MaaS market. In addition, a flourishing start-up scene has emerged around the MaaS approach. The market potential of these applications has been predicted to be worth several billions and thus provides considerable incentives. Their market value implies a need to provide mobility services to regions and municipalities. Diversified mobility providers thus rapidly offered their services, as if they had really analysed people's mobility needs and municipal transport problems, and secured market share and user segments.

As a result of this dynamic development the various combinations of mobility services have become almost unmanageable. The providers are characterised by enormous volatility because it is relatively simple, both technically and in regulatory terms, to come up with a service and to put it on the market. A mobility operator buys mobility benefits in kind from various mobility service providers and sells them on as a package. Depending on the composition of the package a bike or car sharing service, taxis and the use of the public transport network are made available to the customer (basic provision). Although perplexed users initially asked what they were supposed to do with these new services when they already had a monthly ticket for the public transport company, many need these MaaS provisions because a monthly season tickets for fragmented and rudimentary public transport is no longer sufficient. Given the growing costs of maintaining a private car this is not always a viable alternative either.

Besides flexibility and simplicity, MaaS providers promise multifarious additional services, which go beyond the traditional core provisions of integrated mobility and include privileged or discounted purchase of other services and products. Users thus not only receive mobility packages, but may also enjoy other services that have nothing to do with mobility. These include entertainment offers, financial services, the purchase of goods or health care services. These highly developed smart services correspond to very specific requirements on the demand side. Individualisation is also still the central focus and driver with regard to mobility. With MaaS integrated and modular services meet multi-optional patterns of use.

A new market with new providers, fares and prices, as well as rules, has really shaken up the traditional constellations. A new, diverse and unregulated mobility services landscape has emerged and brought forth interesting fruit. Not only has a profitable new market arisen for new mobility services, innovative service approaches and cooperation in the traditional mobility and infrastructure sector, but mobility is not always paramount in the business models of providers. For example, most of the turnover of car and bike sharing providers comes from the advertising on their vehicles. The trading and commercial application of users' mobility data have become established as the real business model among many providers.

At the municipal level a multitude of isolated solutions have emerged. The level of integration of mobility systems is very low in regions surrounding cities and in rural areas. Each municipality has developed its own solution or engaged a service provider, which hinders a comprehensive transport strategy. A cooperative and integrated EU mobility market, which was once the aim, is now out of the question. This is particularly detrimental for rural areas. Here, too, initiatives are isolated, providing mobility as a service for a certain area but not linked to other areas. In order to facilitate mobility nevertheless, isolated P2P or rather door-to-door solutions provided by or on behalf of users are emerging in rural areas. But these are not comprehensive, either.

The users of integrated mobility services are not only consumers of them. They also play a part in designing and shaping the new mobility landscape as providers. New platform-based models provide incentives for people to operate as mobility service providers, for example, by repurposing their own vehicle from private/individual use to collective use. This is made easier by the fact that MaaS components, including hardware, the back- and front-end and the user interface are now easily acquired, enabling the creation of new services relatively quickly.[5]

This dynamic and the transgression of users' conventional notions of mobility has inevitably put other branches under pressure. The taxi business model was directly assailed by ridepooling and ridesharing and the situation has only got worse, with fewer taxi firms remaining in existence. Ridehailing, shuttle services and integrated services implement transport solutions and have extended their areas of business outside city centres to rural areas – at least where it pays to do so. At the same time, a new branch of the mobility economy has come into being, with new and different jobs, both in management and in IT, as well as in the service sector.

The economic, employment or competition-related consequences of the brave new world of mobility are one thing. But what has really become of the fundamental promise of these integrated mobility services? In an unregulated market clear imbalances are evident. Negative incentives for sustainable mobility have also been created, in particular when it comes to cannibalisation effects in public transport. MaaS solutions continue to enjoy rising user numbers and what the public transport network has to offer is being starved by falling demand. The central mission of enabling adequate mobility for all, barrier-free, can no longer be provided across the board. The numerous mobility services have done little to alter the cultural understanding of mobility – the status symbol of owning a car. Although MaaS solutions are also increasingly being used on the urban periphery and in rural areas, the expected rebound effects have been in evidence, especially in peri-urban areas and in city centres, leading, for example, to the knock-on effect of more traffic, leading to more stationary traffic. Pedestrians are increasingly obstructed by parked cars, bicycles, e-scooters and electric mopeds. The upshot is that the level of motorisation, not to mention the proportion of motorised individual transport, has scarcely changed.

As exciting and innovative as new mobility services are – and even if they progress – they still have so many shortcomings which pose problems, particularly from the standpoint of users. Many mobility services are available only in a particular operational area and often do not extend beyond the city boundaries. That means that only certain population groups have access to these services at all. The pricing jungle that characterises many MaaS providers is often confusing and opaque. Price competition also leads to dumping or discounting, which does not encourage high-quality services. The deregulated market has led to the emergence of so-called "McShare" services. These are low-price MaaS solutions with correspondingly basic provision as regards means of transport and integration. Because of deregulation many service providers are jostling for position and mergers and acquisitions are rife.

Society's inequalities and injustices are reflected even more clearly than before in the diversified mobility landscape. The long-standing social split into a hyper-cultural new middle class, the shrunken old middle class and a growing precarious class is particularly evident in MaaS provisions. Premium services, medium-quality services and discount services are available. In this context public transport is increasingly being forced into the discount sector. Anyone who can afford to do so avoids public transport. This has set in motion a negative spiral of lost passengers, lower revenues and deteriorating quality.

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5 "Backend" refers to the data levels invisible to users; "frontend" refers to the visible presentation levels, for example, in the form of a graphic user interface. In terms of business models that means, for the backend, all internal components or a service (partnerships, providers and data management, accounting) and for the frontend all externally visible (to customers) components (service provision, products, customer communications).

3.3 SCENARIO II: MONOPOLY – MARKET DOMINANCE BY A SINGLE ACTOR

Figure 4
Monopolisation of mobility

Platform-based, market-driven economy with a **dominant, globally active mobility service provider**. All means of transport, structures and providers are digitally networked.

Source: Authors.

At a joint press conference at the Ministry of Transport the head of HOOL Germany announces his plans to develop the firm, which to date has specialised in ridehailing solutions, into a comprehensive mobility service provider. Besides the familiar shuttle services, e-scooters and bike-sharing, tickets for local transport are to be made available via the app throughout Germany. In this way the firm will enable users nationwide to buy single and season tickets digitally at a standard price, including daily and monthly tickets. The transport minister has long been calling on public transport providers to open up their ticketing programming interfaces in order – so the reasoning goes – to remove barriers to competition and increase passenger convenience. Depending on the region, between 3 and 5 per cent of the ticket price goes to HOOL.

The company started as an online transport agency and has grown to become a global technology firm that has established an extensive and diverse network of holdings, cooperation agreements and partnerships, making it a focal point for urban mobility and ancillary services. Extensive investments in a next-generation transport network create the conditions for further integration of services, such as the implementation and provision of key services in the health care sector.

In the subsequent years provisions are progressively expanded. Its financial strength enables it to expand gradually into other market segments and branches and to build up a multi-layered service portfolio. On one hand, it is possible to get German Railways (DB) RE (regional express), IC (intercity) and ICE (intercity express) tickets for journeys within Germany, but at the same time HOOL is beginning to combine the services of its numerous affiliates. For example, buying a monthly public transport network ticket also includes the free use of JUMP e-scooters, HOOL's own rental provider. Buying a first class intercity express (ICE) ticket includes the journeys between home and station by means of the premium shuttle service HOOL X.

HOOL is utilising advances in AI and is able to inform its customers with 99.1 per cent certainty, 48 hours in advance, whether a delay can be expected. Attempts by German Railways (DB), in response to the declining number of customers of its DB Navigator app, to withdraw HOOL's access to real-time train information meet with vociferous public protests and they are forced to back down.

HOOL's customer base grows exponentially over the years. Not only has the injection of outside capital made its services cheaper than those of municipal providers, but it offers a steadily increasing number of additional services. Customers of Amazon Prime, for example, receive a rebate on ticket prices and the option of having goods delivered in a HOOL vehicle. In particular, customers enjoy the convenience of finding all available mobility services on a single app and also being able to use it (with the "International" package) in over 800 cities abroad with no extra charge.

HOOL's standard service includes monthly subscriptions, which combine journeys, goods deliveries, bicycles and scooters. Different rates can be chosen with corresponding services. Discounted journeys and free delivery when ordering food above a certain amount are also available as premium services. HOOL has expanded its range of services beyond personal mobility and has won significant market shares in goods transport. A HOOL app links freight forwarders with commercial customers, thereby reducing the number of empty trips.

Ridehailing now accounts for a 24 per cent share of Germany's modal split and is on the verge of exceeding the number of journeys made with private cars. Climate protection advocates point to the disastrous environmental effects of this and are calling for a boost to mass public transport. HOOL lobbyists, however, have so far been able to prevent statutory regulation.

Over 80 per cent of the German population have purchased tickets using the HOOL app. The last competitor, the Berlin Transport Company's (BVG) JELBI app, withdraws its service after a hard-fought price war (at a loss to the City of Berlin of 1.2 billion euros). HOOL decides shortly afterwards to increase its cut of ticket sales from 3 to 15 per cent. Many municipalities protest and the Association of German Public Transport Operators (VDV) labels it extortion. The city of Cologne goes one step further, threatening to withdraw HOOL's license to sell tickets. When HOOL deactivates all services in the Cologne area in response traffic chaos ensues (only a few people still own their own car and shifted to HOOL quite some time ago) and there is a demonstration in front of the city hall, involving around four hundred people. HOOL prevails and the city of Cologne accepts the rate hike. The governing party stays out of the dispute and a spokesperson points to the four hundred thousand employees who now work for HOOL across Germany.

In 2030 social and political protests against excessive prices force concessions from HOOL. From now on a much cheaper rate will be offered, although it entails having to view advertisements throughout the journey. A further rebate is given to customers who agree to allow data on their mobility behaviour to be harvested and sold on to other companies for commercial purposes. Around 75 per cent of HOOL customers take up this option.

A regulation comes into force that the trade union confederations have long demanded. From now on HOOL has to pay its drivers a minimum wage of 15 euros, as well as social and health insurance contributions. Although this reduces drivers' financial uncertainties critics point out that despite the minimum wage HOOL drivers are still among the population groups most at risk of poverty.

A data breach at HOOL leads to months of scandal. It turns out that the company has for years been passing on the mobility data of German MPs to groups close to the US government. The US president denies any knowledge of this.

Urban areas are HOOL's core business territory. HOOL has largely neglected the periphery and rural areas for years. Indeed, the latter have been virtually excluded from mobility as a service options. Exceptions include culture-related and natural landscapes which are served by HOOL's seasonal provision that caters for the tourist market in these regions. Apart from peak tourist periods HOOL's services are pared back or even terminated for reasons of cost.

For its HOOL Pop and HOOL X services the company uses fully autonomous vehicles, which destroys the jobs of 150,000 people at one fell swoop. The effects of digitalisation and automation not only impact on the number of drivers, but also lead to rationalisation in sales and marketing. Several hundred jobs have already been lost in these areas in recent years in the course of extensive restructuring measures.

The public transport network is dependent on HOOL's planning data and operates under HOOL's umbrella. If HOOL steps up its presence on a particular route, planners consider reducing public transport provision in that area. HOOL's market interest is decisive when it comes to developing networks and services.

3.4 SZENARIO III: MUNICIPALITIES AT THE WHEEL

Figure 5
Municipal governance of mobility

Municipalities guarantee **mobility for all** and strengthen the public transport network. The transport system is reregulated and organised on a sustainable basis – also with the help of new forms of digital mobility.

Source: Authors.

What had long been only a dream of academic mobility researchers and sustainable transport activists is successfully implemented at municipal level: innovative mobility services in combination with strong public transport. In the context of a successful transport transition cities and municipalities guarantee mobility for all. Digitally networked forms of mobility, bundled in service packages, support municipal mobility and thus ensure public services of general interest. With a community orientation innovative transport companies in collaboration with strong municipalities provide for an intelligent mobility that is accessible to all citizens.

Mobility services started out in the urban start-up culture. Professional providers of integrated mobility services combined their capabilities in the implementation of information and communication technology (ICT) with the mobility and planning needs of municipal transport policy. Providers of combined sharing services, route planners and other mobility services sprang up like mushrooms. They all promised to revolutionise the world of mobility and, at the same time, to make a major contribution to solving transport problems – for appropriate recompense, of course. Municipal authorities were overwhelmed by proposals of new mobility providers and keenly aware of their own shortcomings: their lack of knowledge with respect to the new MaaS services, the need for a municipal transport transition and their lack of strategic orientation. Mobility providers and managers made grand promises, but were not particularly willing to cooperate with

municipal administrations. Municipalities learned fast from their dealings with mobility services and MaaS companies and gradually came to play an active organisational role. Under separate management and in cooperation with local partners (such as mobility service providers and universities) municipalities organised their own MaaS solutions, which were integrated in existing public transport services and provided the population with attractive, convenient and inclusive mobility services.

Reinforcing municipalities as central control bodies and service providers in mobility was made possible by a series of successful transformation processes. Functional reforms redefined the tasks and responsibilities of existing administrative units. These administrative structural measures led to a reordering of the administrative organisation of municipalities themselves, which means the physical dissolution, merging or re-establishment of administrative units. This created a joint sense of mission across departmental lines and municipal administrative and planning authorities were able to improve their agility substantially. Organisational and process innovation supported the transformation process in the administrations and, based on new public management initiatives, one of the biggest administrative management challenges was overcome: the establishment of collaborative governance on the basis of digitalised administration (IT planning councils and resource bundling) and consolidated e-government structures.[6] Municipal budget modernisation was achieved by means of new business models based principally on participation and cooperation, such as public–private partnerships and federal or *Land* subsidies. The latter were contingent on sustainable mobility regulation and transport policy. Since then all mobility service providers are required to disclose and share their data, comply with a sustainability index (drive systems) and consent to a code of conduct. The old "patchwork" system, especially as regards fares, was superseded by territorial and administrative reforms in favour of more flexible, more transparent and, above all, comprehensive mobility planning, with a focus on user-friendliness. This is also manifested in fare innovations, which enable fare and ticket systems to be simplified across the country.

The mobility provision that municipalities make available to their citizens in cooperation with public transport companies ranges from a strong public transport network in densely-populated areas and cities, through mobility pooling stations (mobility hubs) and multi-modal sharing solutions (including electric vehicles and bicycles), to individualised on-demand services. The mobility needs and requirements of the respective municipalities determine the design of modular mobility systems. For example, automated mini-vehicles or micro-buses provide public transport in certain urban districts, as well as portions of commuter traffic between central and suburban areas. There are also driver-linked services (ridesharing or shuttle systems), which are in particularly high demand among older citizens who tend to cling to certain psychological and cultural aspects of mobility, especially that of "being driven" and the social aspect. On-demand services, autonomous vehicle systems and shuttle services have been successfully implemented in rural areas, too, and thus ensure the connection to urban areas. In this way adequate solutions were found for less densely populated areas.

The public transport network represents the core of a municipal integrated mobility system. This is also related to the fact that public transport can demonstrate its strengths much better: fast connections with higher frequency, better punctuality and higher quality. This fast public transport network is increasingly being augmented with individualised services and thus becomes more attractive for users, intermodally upgraded by means of so-called fleet-driven measures, such as car-sharing and ridepooling, above all over the "first and last mile". This integrated/modular mixed service corresponds to customer needs and market segments. Fares differ minimally. Besides comprehensive and slightly higher fares, prices are graduated in terms of functionality (those who use only certain services, for example, for commuting in and out, pay a different rate from those who need more comprehensive mobility services), as well as in terms of social needs and circumstances. Social and environmental aspects are reflected in student, social and environmental rates. Besides the flexibility of their rates mobility systems are innovative in terms of their functional complexity. Besides conventional mobility services commercial mobility management systems are incorporated. Overall, public transport has extended its traditional service network and augmented it with new services on an integrated basis. The basis for this intelligent and efficient transport planning was observation, recording and evaluation of specific mobility needs.

Integrated mobility chains and a clear fare system are rewarded by high user numbers. Municipal new mobility services are financially supported by revenues from parking management, licence fees from MaaS providers and fees paid by beneficiaries (business tax surcharge). This has made it possible to stabilise the municipal share of funding, despite massive investment in the traditional public transport network. The acceptance and usage of mobility services also has a lot to do with users' mobility preferences, however, which are oriented towards the sharing of goods and services (sharing economy). This reflects a revival of the idea of social responsibility. A successful and agile municipal approach to mobility is thus based on a transformation process across society, which included the will and courage to bring about change and thus unleashed a decisive impulse for innovation in municipalities.

The municipalities position themselves as technical and process management bodies, which is not necessarily the same as the role of (technical) operator. The municipalities do not have to create or provide all mobility services themselves. Rather they can order the required mobility services or integrate them in other cooperative processes. The municipalities regard themselves as regulators, shape the regulatory framework for integrated mobility services on a regional basis and taking account of needs, and define the cooperative role of transport companies within it. Transport policy

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6 Collaborative governance means a system of regulation and control based on informal types of cooperation in a society that is not steered by a central authority, and which integrates a multitude of actors from various levels and is characterised by non-institutionalised forms of governance.

impulses come explicitly from the municipalities themselves and although transport companies are strong players in this system as regards cooperative mobility value creation, they are only partners.

The municipalities lay down criteria for all cooperation partners that all service providers in the mobility system are obliged to comply with. They range from the operational (so that access to the system is guaranteed for all)– to social standards that MaaS providers must meet as employers and quality criteria for the services themselves. While this might sound paternalistic, it is motivated and legitimised by the municipalities' aspiration to guarantee convenient, functional and equitable mobility for all – users, employees and employers. This depends crucially on the services offered by the mobility service providers and the values they embody. Mobility systems are considered to be ecosystems that interact and are operated on the basis of the collaborative networking of the partners, open social and environmental standards and a pronounced culture of cooperation.

What was previously confined to downtown areas or found application in metropolitan regions has been extended over the years to rural areas. In particular in rural regions with structural deficits, MaaS approaches found the biggest resonance because they enabled mobility not dependent on owning a car for all population groups: old, young and low-income. Technological developments, new cooperation regimes (cooperation with the church, especially social and welfare work), intensive promotion and investments (including the promotion of grassroots initiatives), and new approaches in urban and landscape planning have made it possible for municipalities to open up rural areas for flexible and also sustainable mobility and mobility has become a key component of services of general interest. Integrated mobility chains made it possible to connect rural with urban areas, thereby enhancing municipalities' attractiveness. Inter-municipal cooperation developed into a key competence and resource, which opened up new areas for action. Municipalities systematically built up and reinforced long-term institutional readiness – the staff and policy required for management and regulation. Tendering and organisational innovations enabled the municipalities to obtain qualified personnel to design their own MaaS systems. Municipalities no longer have to make use of outsourcing to external consultants and can attract qualified specialists with benefits including job security. Cooperation with private mobility service providers is not excluded, management and regulatory competence remains, in the case of all imaginable cooperation between private and public entities, certainly in the case of the municipalities.

3.5 CONSEQUENCES AND CHALLENGES

In this section the findings for each scenario and the possible and specific social consequences are summarised. In this way the relevant core challenges for the policy recommendations can be worked out. In accordance with the alternative design of the scenarios the effects on employment, distribution and access vary.

SCENARIO I: FRAGMENTED MOBILITY LANDSCAPE

The high density of providers that characterises the first scenario produces strong competitive pressures, leading to an increase in forms of self-employment and the precarisation of jobs. At the same time, price competition provides an opportunity for affordable MaaS services and thus may offer something for low earners. The main consequence of the first scenario is the need for political regulation. Regulatory capability is only ensured, however, if the corresponding authorities have sufficient capacity, in other words, have the requisite competences and resources. Programmes and measures must be put in place under the heading of "municipalities' MaaS readiness" (see Table 2).

SCENARIO II: MARKET DOMINANCE OF A SINGLE ACTOR

The abovementioned ambivalence as regards employment relations can also be observed for the second scenario (see Section 2). The new mobility labour markets are, on one hand, characterised by an increase in precarious jobs and, at the same time, create the potential for highly qualified work and thus demand for training and occupational qualifications. However, the fundamental challenge evident in this scenario is the potential privatisation of parts of the mobility sector. Hand in hand with its monopolistic structure political regulatory options vanish and the mobility system runs the risk of becoming extremely inequitable. It is questionable in these circumstances how standards of decent employment, freedom of access and inclusion can be ensured. Who controls the monopolists? Dynamic pricing and fares may permanently exclude parts of the population from using these services and would – in parallel with the weakening of the public transport network – put even more pressure on the budgets of low-income households. Here, too, policymakers need to ensure participation (see Table 3).

SCENARIO III: MUNICIPALITIES AT THE WHEEL

This scenario provides an opportunity for both employment security and an increase in quality employment. Characterised by strong regulation, this scenario highlights the challenge of designing an institutional framework and holds out the prospect of municipalities organising mobility autonomously, safeguarding high quality services of general interest and contributing to value creation. Strong and competent political regulation require a reform of the Public Transport Act (Personenbeförderungsgesetz), as well as investment in skills and

resources at the administrative level. In general, the agility and flexibility of municipalities and administrations need to be improved (see Table 4).

3.6 SUMMARY

Reviewing the three scenarios and the associated challenges together reveals a pattern. Political regulation plays a particular role in each scenario – it varies with the different functionalities, but it is always important. These circumstances heighten the urgency of training and qualifications. Regardless of the particular scenario, in future new skills and qualifications will be required in the area of mobility. The importance of data security was mentioned in relation to the effects of the new mobility services, but it also pervades all the scenarios, located at the interface between technological and political measures.

Table 2
Consequences and challenges arising from Scenario I

Dimension	Positive effects	Negative effects
Employment	– New business models and cost structures – Rising demand for drivers – MaaS companies create jobs in other sectors, too: automobile sector, ICT, personal and goods transport, energy, insurance, maintenance and repair – Transformation of qualification profiles of traditional actors	– Precarisation of jobs – Increase in forms of self-employment
Distribution	– Diversification enables multiple options and rates	– Competition between MaaS and public transport network – Certain MaaS options are only for the urban elites – Exacerbation of inequalities possible due to the separation of users, transport providers and transport authorities
Access	– New mobility access via a "low cost market" for MaaS in combination with flatrate systems	– Fragmentation of operational areas (for example, in rural areas)
Challenges	– Support for municipalities' MaaS readiness – Mobility becomes a contested local service business – Data protection	

Source: eigene Darstellung, nach Wagner et al. 2018.

Table 3
Consequences and challenges arising from Scenario II

Dimension	Positive effects	Negative effects
Employment	– Job growth: qualified and low qualified – Emergence of new labour markets – New jobs generated both internally and externally by mobility service providers, as well as various degrees of vertical integration – New skill profiles	– Job losses in the automobile industry – Contraction of taxi sector and public transport network – Precarisation of jobs: no social insurance and protective rights
Distribution	– Cost benefits can arise from scaling effects	– Operational area determines accessibility – Exacerbates inequality because (premium) mobility is offered
Access	– Relatively low entry barriers	– Price discrimination: exclusion due to rates (algorithmic rate setting) – Commercial intermediary can determine access rules
Challenges	– Regulatory needs and data protection – Mobility guarantee: inclusive provision of services – Distribution of regional profits and corporate taxation	

Source: eigene Darstellung, nach Wagner et al. 2018.

Table 4
Consequences and challenges arising from Scenario III

Dimension	Positive effects	Negative effects
Employment	– Job security and possible growth – Employment in municipal administration – New occupational profiles – Employment subject to social insurance and collective agreements – New jobs created by service providers	
Distribution	– Ensures inclusivity – Fares determined according to need	– Flexible price options are difficult to implement
Access	– Access safeguarded by mobility as service of general interest	
Challenges	– Design of institutional framework – Legal safeguarding of organisational innovation – New forms of staff training and administrative competence profiles – New occupational profiles, qualifications and curricula – Structural design of fares – Interoperability and data protection	

Source: eigene Darstellung, nach Wagner et al. 2018.

4

PRACTICAL POLICY RECOMMENDATIONS

The first premise of the demands set out below is that, in the course of redesigning mobility and integrating digitally based mobility services (such as mobility as a service approaches), decent and secure livelihoods must be created and ensured, with minimal externalities. Inherent in this premise is another. It also has to do with mobility, but it goes beyond it: socially equitable and politically managed mobility also constitutes a contribution to quality of life for all and promotes social, environmental and economic sustainability.

The recommendations set out from the reference scenario "Municipalities at the wheel" and are aimed resolutely at strengthening municipalities' agility, strategic capacities and ability to get things done. They are and remain the central actors in the transformation of mobility: their political remit is to ensure mobility for all. All this can be expressed in three guiding maxims: strengthen municipalities, adapt regulations and provide incentives.

STRENGTHEN MUNICIPALITIES

Municipalities' ability to get things done needs to be strengthened overall to put them in a position to provide mobility for all in a socially equitable way. This entails resources and funding, but also organisational innovations, staff qualifications and new forms of collaboration among municipalities.

- Mobility must be more closely defined as a municipal management task. This includes local councils' provision of mobility guidance for companies and citizens, as well as municipal and company mobility plans.
  This also requires capacity-building and qualification measures for staff, as well as organisational innovations to enhance administrative agility and flexibility.
- There must be investment in institutional and structural development and adaptation in municipalities and municipal administrations. Investments and subsidies enable municipalities to develop their own long-term MaaS approaches, and to regulate them themselves. Innovation must be driven by new forms of tender and organisational structures and transformation processes should be initiated in the administration.
- There should be closer interlocking of municipal management with the real estate sector. For example, sustainable mobility guidelines could be incorporated in sales contracts by means of a legal entity in which investors are members. A binding modal split could also be defined within the framework of a mobility law.
- The mobility budget is a key instrument for the targeted control and design of new mobility. Municipal employers should make fixed budgets available to their employees for mobility.
  Instead of company cars budgets should be made available for using public transport, such as buses or trains, bike- and car-sharing, e-bikes, MaaS or similar for work and private journeys. If anything remains from the monthly budget it could be used for other purposes. Occupational pension provision, for example, could be supported on a pay-as-you-go basis. The approach could also be upgraded with tax concessions for avoiding use of motorised individual transport.

ADAPT REGULATIONS

Competence-building will not be possible without changes to existing regulations. This applies to the national level, *Land* regulation and municipal regulation. The Public Transport Act (Personenbeförderungsgesetz) has pride of place here. A well-thought-out reform could enable the well-ordered integration of mobility as a service. Another central regulatory mechanism is inter-municipal collaboration, in which new forms of municipal learning and competition between approaches could be established. The instruments of the workplace mobility concept, as well as specific mobility laws represent effective measures.

- MaaS should be incorporated in municipal responsibilities. This requires, first of all, municipal structures that are in a position to meet the performance requirements pertaining to planning that this entails, for example, by building

up the requisite know-how. Furthermore, municipalities need legal powers to integrate MaaS in their public provision and to undertake design and organisation as a public utility. At present, the Public Transport Act (PBefG) provides a good basis for this. However, the time frame of four years for the deployment of flexible services on the basis of the so-called experimentation clause is much too short. MaaS should be treated like regular transport services and approvals could be granted for at least ten years. This would put municipalities in a position to handle MaaS as an integral part of their own local transport plans and make decisions on types, duration and territory of provision. That also applies to the integration of fares in general public transport network provision. The priority given to "economic viability" in the Public Transport Act could pose a problem here because municipalities are exposed to the risk that MaaS providers use this opportunity to establish their business model as it were through the backdoor. In that case, MaaS would constitute the backbone of a privately initiated system with (residual) elements of conventional public transport, rather that the public transport network integrating MaaS elements. Given the aggressive business practices of international MaaS companies this course of events seems entirely likely. The priority given to economic viability thus constitutes an alien element and factor of uncertainty within the framework of the Public Transport Act.

- Cooperation between municipalities needs to be strengthened. Mobility planning should not cease at the city limits and in future linked transport systems also have to be coordinated. Cooperation should not be confined to mobility, but also encompass the economic and other sectors. Alliances and associations of public bodies end themselves to running integrated transport systems and would lead to standardised fare systems. Dynamic price and fare systems over network and *Land* borders are an attractive option, especially for digital services. The disclosure of interfaces and hence cooperation is required to ensure the interoperability of mobility services. Agreement must be reached on how, generally speaking, MaaS will be incorporated in the overall system: within the fare system (similar to dial-a-bus), via additional charges or by means of its own fare structures?
- Here in particular digitalisation could be the key. Innovative digital technology could provide municipalities with the possibility of harmonising MaaS, fares, timetables and networks. Mobility surveillance to accurately record mobility needs could be carried out jointly using user-based mobility data. Municipal associations could guarantee data protection transparently and securely, excluding its commercial exploitation. Joint data analysis would enable integrated and seamless mobility chains reaching beyond network and *Land* borders. Intermunicipal cooperation would also boost social innovation, implementing new forms of participation, and supporting bottom-up processes in municipalities.
- Communication paths and transparency in interfaces with customers and MaaS providers have to be expanded in order to ensure security and ownership rights to user data. Data on mobility behaviour should be used only to improve seamlessly integrated services and communicated to customers transparently. Similar to the situation in Finland, a national data protection scheme could ensure that all actors participating in MaaS systems are required to publish their data and citizens can be sure that they will not be passed on for commercial exploitation. These processes could be controlled by a subordinate authority set up specially for the purpose.
- Mobility laws with clear, operationalised and measurable goals, which, on one hand, focus on the "environmental alliance" – that is, strengthening bicycle, pedestrian and local transport and guaranteeing safe cycle paths, more bus lanes, fast cycle connections and higher frequency public provision – and on the other hand, monitor the sustainable integration of MaaS solutions. Accompanying packages of measures could be put together with this instrument of transport planning. Stricter regulation of MIT should be considered in this context.
- Strengthen company mobility management and focus on and embed MaaS. Employers should contribute proportionately to integrated MaaS with public transport. Employee allowances for season tickets and MaaS systems are possible means. Tax deductibility should be tested, as should the extent to which processes could be set up – similar to occupational pension schemes – that offer tax benefits. Travel and mobility managers should be compulsory at companies above a certain size.

PROVIDE INCENTIVES

In order to accomplish sustainable and equitable integration of mobility services, such as MaaS, in existing mobility systems, incentive systems need to be modified and incentives established in multiple dimensions. Ranging from standardised and uniform fare systems through tax incentives to the establishment of a comprehensive mobility education system, this would be sufficient to instigate a transformation of mobility.

A uniform ticketing and price system, along the lines of a German mobility card, and a dynamic pricing system would realise enormous transaction cost savings for operators and users and finally bring clarity to today's pricing jungle. But new mobility services can achieve their potential in the system as a whole only if they are integrated, standardised and cross-regional. Reasonable prices should be prioritised. The aim should not be unfettered mobility 24/7, which in turn encourages new traffic, but a socially efficient and equitable mobility that meets individual needs on the basis of social responsibility.

Measures for transforming mobility could be implemented more quickly and in a much more targeted way using functional tender procedures that include concrete fulfilment criteria, which, for example, define employment and remuneration standards. This could be accompanied by a tightening up of procurement law in terms of social criteria and environmental and qualitative standards, such as accessibility. Financing options should thus be re-examined: the federal government or Länder should award funding subject to certain conditions, such as social and environmental standards or the Robin Hood

variant. Financial redistribution should make private cars and MIT more expensive and thus subsidise MaaS.

Tax deductibility should be used to encourage people to use certain – more sustainable and more socially equitable – means of transport, such as the public transport network. Tax concessions should be used as financial incentives. At the same time, the costs of using private cars, in particular as regards infrastructure and stationary vehicles, should be raised (negative conditioning). Public awareness of the real costs of mobility, especially of cars, should be enhanced. In general, regulation of street space and related financing should be modified. Stationary traffic is central here. The idea must be to free up urban space. Higher parking fees, fewer parking possibilities and more efficient parking space management would encourage a change in awareness and, at the same time, create space for effective MaaS as digitally based mobility services also need space for implementation. They cannot function optimally where surfaces are highly sealed, streets choked by parked cars and in general there are too many vehicles for the space.

Integrating mobility education at all levels of education in order to encourage sustainable mobility behaviour should become a state task. An essential aim of mobility education should be to strengthen social skills in the normative sense. Such skills include an informed choice of means of transport, route planning and journey avoidance. Besides mobility education, however, new mobility management occupations and qualifications programmes should be defined, combining digital skills with mobility expertise. In institutional terms, the venues include not only nursery schools, schools, training colleges and universities, but also driving schools, which must do more than teach people how to drive a car.

5

OUTLOOK

At present it is difficult to assess the consequences for transport of the integration of digitally based mobility services in mobility systems. Despite the high potential for shaping ecologically and economically sustainable mobility, no measurable positive effects can currently be identified. The social sustainability dimension has to date been entirely neglected.

This discussion paper represents a first attempt to analyse the new mobility services in terms of their potential social consequences. To that end three scenarios have been developed representing possible future constellations. Besides describing possible future developments, the scenarios have been used to identify the social consequences for employment, distribution and access. In light of these effects we have been able to outline challenges to which policymakers must find answers at federal, Land and municipal level.

Whatever the real world developments might be, the analysis presented here makes it clear that future mobility systems must be politically regulated and that this will be possible only on the basis of an intelligent mobility strategy. Only in that way will it be possible to shape mobility so that it is socially equitable, ecologically sustainable and economically profitable.

Studies of the future should on the one hand provide orientation for decision-making in the present, and on the other hand cast light on alternative perspectives and modify the mental maps in the minds of decision-makers. It is in this framework that the scenarios, consequences and challenges, and above all the practical policy recommendations presented here should be understood.

Regardless of the perspective in which the future of new mobility services is considered, it has to be tackled in the present and that means political intervention. If mobility is to remain part of services of general interest we need a policy characterised by a courage and willingness to change, agile presence of mind and an assiduous attention to detail.

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Abbreviations

API	Application Programming Interface
BGG	Behindertengleichstellungsgesetz (Equal Opportunities for Disabled People Act)
BVG	Berliner Verkehrsbetriebe (Berlin Transport Company)
CO_2	Carbon dioxide
ICT	Information and communication technology
MaaS	Mobility as a Service
MIV	Motorised individual transport
P2P	Peer-to-Peer
PBefG	Personenbeförderungsgesetz (Public Transport Act)
SUMP	Sustainable Urban Mobility Plan
VDV	Verband Deutscher Verkehrsunternehmen (Association of German Transport Companies)

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