ADAC

zukunftsInstitut

The Evolution of Mobility

A zukunftsInstitut study commissioned by ADAC
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Content

Preface

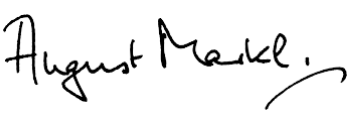
The world as we know it is changing. Tomorrow's challenges primarily affect individual, intelligent and connected mobility. Mobility drives us, it moves us. People want mobility, they require to be mobile. Personal mobility stems from the desire to decide for ourselves when, how and where we are moving. Mobility patterns are evolving ever more multi-faceted and complex. The need for safety, health, an intact environment and quality of life in general is growing. Gradually, digitisation is becoming the fundamental basis for the principles of tomorrow's mobility which needs to achieve one thing above all: it must be need-oriented, and make life easier and safer.

Against this background, the central questions for ADAC are: How can we as an institution contribute to upkeeping people's mobility in the future? How can we best support people on their way into a mobile future? Which new paths should businesses, lawmakers and society take today? Which decisions should we make today to successfully meet the challenges of tomorrow's mobile world?

With the present study on 'The Evolution of Mobility' we would like to kick-start a debate about the basic patterns that might define tomorrow's mobility. We commissioned the renowned think tank Zukunftsinstitut GmbH (future institute) to conduct research into the long-term trends and developments that, based on people's needs, could dominate our mobility up to the year 2040. What would the future role of the automobile be? What would inter-modal and multi-modal travel chains be like? How could tomorrow's cities address their traffic problems? And how can individual mobility far from urban centres be ensured?

Some of the study's results surprised us and some convinced us. Others again provoked reflection or even opposition. However, one thing seems to be clear: we are not facing a disruptive change in mobility. Rather, we can expect evolutionary development and transformation which will be all the more profound and fundamental.

ADAC would indeed welcome a dialogue with you about tomorrow's mobility!



Dr August Markl

President of ADAC

Introduction

Into a new era of multi-mobility

As our way of living grows more and more individual, mobility has an ever increasing impact on our lives. Mobility has become quite indispensable. Being mobile is a prerequisite for social inclusion and social progress as well as for economic growth, individual fulfilment and personal success. Mobility is a decisive factor in determining whether or not we can reach our professional and private goals, whether we are able to reconcile our wishes and requirements, and improve the quality of our lives. In other words, mobility is both a desire and a necessity.

Individualisation is the key driver

Individualisation is a megatrend. It is one of the key drivers of economic and social transformation. Like no other, this development plays a crucial role in shaping the transformation of mobility and the market for new mobility solutions. **The pursuit of individuality** stimulates the formation of differentiated worldviews, a variety of life designs and styles, biographies and consumer habits. Today, we can all shape our lives much more according to our personal wants and ideas. This creates freedom of choice and hence a growing – and continuously changing – demand for mobility. As our lives are becoming more complex, we want greater flexibility and independence. Organising daily errands and coordinating our family lives are as important as maintaining multiple social contacts. Last, but not least, the higher demand for mobility is also owed to our evolving work environment and the increase in recreational activities, travel and tourism.

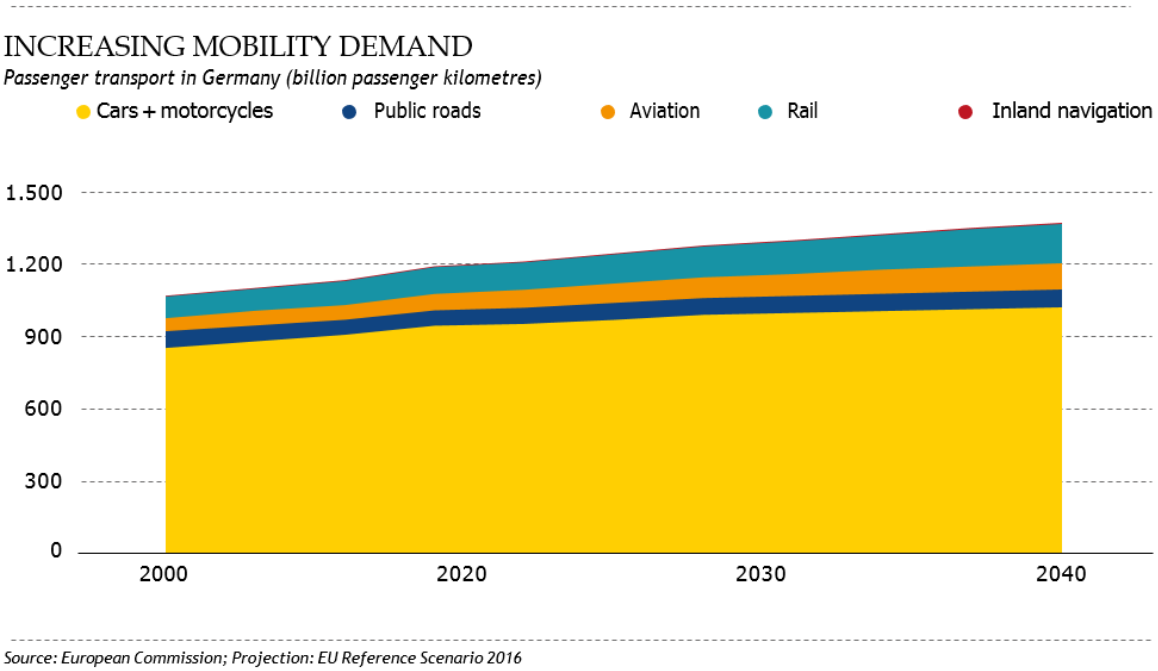
Only the correlation between the two megatrends, i.e. individualisation and mobility, will open up new opportunities, provide more options, and promote new discoveries and experiences. Because mobility implies the ability to get around and secures the potential for transformation and change. The need for mobility ensured by individual means of transport, i.e. individual mobility, stems from the desire to decide autonomously when, how and where to go. Not surprisingly, mobility has become a worldwide synonym for freedom, independence, individuality and self-determination. And it will still be in 2040.

Increasing demand, new mix

Mobility makes everyday life efficient – as it ensures the success of the global economy. Not only is it a basic need but also a crucial requirement of modern society. Bottom line: in the 21th century the world is not characterised by an increasing demand for mobility alone but rather by a diversification of mobility.

This is what makes this sector one of the most significant growth markets. All in all, private households across the EU invest more than €1bn each year in mobility. In Germany, this accounts for roughly €2,600 per capita and year in spending. One out of seven euros flows into services enabling transport (European Commission 2016).

Germans cover about 1.2bn passenger kilometres year after year – by passenger car, bus and train, airplane or watercraft. Since 2000, passenger transport in the Federal Republic of Germany has increased by over 11%. The European Commission predicts ongoing growth of the mobility demand hereabouts to more than 1.3bn passenger kilometres by 2040. With roughly 75% still covered by car, this mode will remain the most favoured transport option. After all, mobility patterns are shaped by the convenience of being able to travel independently. Individual mobility is such an essential element of prosperity that many would hate to abandon it. In 2040, cars will still be the form of transport guaranteeing flexibility in time and location.



Source: European Commission; Projection: EU Reference Scenario 2016

Smart mobility: a gradual farewell to cars as we used to know them

That cars nevertheless are losing the dominant position they had at the beginning of the 21st century is a matter of changes in terms of practicality. Not everything will remain as it was. As it happens, the statistics fail to reveal one important fact: (that) the consumption of mobility as we have practised it for decades has reached a historic turning point. Ahead of us lies the start of a new era of multi-mobility. We are facing a similar revolution as the world did when the car was invented 125 years ago. Hidden behind all the apparent continuity lies an evolutionary transformation of the mobility system, which must not be underestimated.

The personal car, long a symbol of freedom and independence to Germans in particular, denoting personality and social status, is losing not only its advantages over other forms of transport but one of its very basic applications: considering clogged roads and congested cities cars are no longer the means of getting us comfortably and fast from A to B everywhere and anytime.

In many places, cars will have a hard time and by 2040 may hold their ground only in a successful combination of individual travel and public transport: only if cars intelligently and smoothly integrate into tomorrow's mobility mix and make their contribution to the mobility we require. Though passenger cars will remain an important means of transport, they will cease to be our logical first choice. Rather they will be but one element in a new, integrated mobility and transport system and – on a more or less equal footing – one of many options.

The automobiles' crisis is also their biggest chance: in 2040, cars will primarily be a means to an end – not only as a means of transport but possibly as a central element of intelligent, sustainable energy management. And so, status mobility will turn into smart mobility.

MOTIVES AND NEEDS

The drivers of tomorrow's mobility

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The individualisation megatrend is the key driver of the growing demand for mobility and the traffic volumes that will predominantly be based on individual transport. But there are many other motivations for the mobility of people – or the want and need to be mobile. Some motives fade into the background – such as mobility as a typical luxury experience and display of status – while others remain and gain new importance.

Mobility patterns are growing more multifaceted and complex. Our needs and wants in terms of mobility are changing. New players and innovative platforms respond to our changed needs and motives offering user-oriented and need-based mobility options that make life easier. At the same time, however, this contributes to ever higher expectations and exigencies.

The question is: Which needs and requirements are particularly important for tomorrow's mobility?

1. Flexibility, independence and work-life blend

The world we live in calls for flexibility and mobility, decision-making and adaptation, permanent attention and availability – more than ever before. More and more people want and need more mobility in their lives and work, and as consumers. Especially families, young metropolitans and internationally connected 'high potentials' already need effective time and mobility management.

In view of the increased flexibility in our private and professional lives, most people will have more places to go to every day. So flexibility involves a rising number of regular trips.

In the future, working no matter where or when will be considered normality

The uniform nine-to-five office setup we are accustomed to, based on fixed business hours and strict separation of job and leisure is gradually giving way to a highly flexible, more mobile lifestyle. Above all, this new lifestyle is aimed at achieving higher individual self-determination, independence and sensible blending of work/life strategies through telecommuting and mobile working arrangements. Instead of desperately trying to make the balancing act between two seemingly separate worlds work, in the years to come we should wholeheartedly embrace the challenges, however great, of mobile working. The traditional concept of work-life balance is giving way to a new understanding of compatibility: employers and staff need to find solutions to compensate for the increasing pressure from business and professional requirements and achieve a balanced blend between work and life.

In 2040, thanks to digital connectivity, cloud solutions and innovative workplace tools, we will be able to work largely untrammelled by the strictures of time and location. Whether on the move, from home, at a client's office, in a café or on the beach – mobile working will be the new standard. Telecommuting arrangements and remote working technologies will eradicate the boundary that has existed between work and home life with all the related consequences from working hours to IT security. Even as employees want and demand flexible working solutions, there is a clear and present need to find new ways of striking a functioning and sensible balance between private and work requirements

Remote working will eradicate the boundary between work and home life

Cars as 'third places'

The great opportunity of autonomous vehicles lies in that they may become the social environment known as 'third places': refuges between the workplace and home where you like to linger, you feel at ease and have the opportunity to make good use of your time while being on the move. In future artificial intelligence-driven cars, human drivers need no longer concentrate on traffic. Instead, they can relax, watch videos or get some work done. This will radically change the role of cars in everyday life. Self-driving cars will be the first true extensions of the office and the living room in one space, including all the multi-media and digital connectivity extending our lifeworld into the virtual world.

2. Personal supply logistics: mobile lives – situational consumption

Increasing urbanisation and urban sprawl create more traffic – especially on account of daily shopping trips for supplies. This creates particularly tough challenges for cities and urban agglomerations. Here, ever higher volumes of traffic must be condensed into finite spaces. Traffic jams are the inevitable result. Passengers and goods do not reach their destinations in time. As a result, the reorganisation of local service and shopping facilities in urban areas is developing into a dynamic field of innovation. Even as it undoubtedly booms, e-commerce does not reduce the number of errand trips either. Quite to the contrary, the massively increasing parcel flow it implies poses new challenges for commercial logistics and parcel services handling multiple, decentralised and small quantity deliveries. Likewise, online shopping does not usher in the complete disappearance of physical shops. Rather, stationary retailers are investing heavily into expanding their online branches to be able to compete with online-only suppliers. More and more retailers combine the typical advantages of stationary commerce – high-quality advice and tangible products with product and service worlds staged at the points of sale to offer customers their own 'experience'.

Parcel delivery into the boot: the car as a parcel deposit and pick-up station

The individuality of shopping sprees and the energetic revitalisation of inner cities as commercial landscapes both ensure that mobility volumes will not decrease in the future.

Not only is our society highly mobile, it has also become quite volatile and impatient. An increasingly mobile way of life ensues more flexible, situational consumption. Consumption increasingly happens at new expanding points of sale, practically 'in passing'. These are predominantly places of transit inviting customers to shop. Filling stations, for instance, have long adapted their business strategy – to around-the-clock retail shopping for personal supply needs. And as more and more classical transport infrastructure junctions are becoming 'third places', retail businesses take centre stage: these days mobility hubs such as railway stations, airports or hotels earn most of their income from retail and gastronomy. This brings being 'on the move' and shopping for consumer goods closer together.

3. Social contacts and family coordination

Maintaining contacts, interacting socially or managing everyday family life makes physical and spatial mobility indispensable even in the digital era. Mobility is required as much for joint leisure activities as it is for pursuing cultural experiences and keeping in touch with relatives, friends, acquaintances or colleagues. People will remain fond of, and need, personal interaction. Being mobile as a matter of necessity is part of our cultural DNA since the desire for mobility is also an effect of our quest for social inclusion and involvement. We want or need to belong: to a family, a circle of friends or a social group. The ubiquity of digital forms of communication itself is what makes us want to see real places and have real-life interaction with other people, be it family or friends or new contacts.

At the same time, lifestyles and family structures diversify and multiply, which will automatically increase the amount of travel or movement required. Whereas extended families or workplaces and homes used to be closer together in time and space, they will drift further apart in the future. Under this aspect, mobility gains new significance for maintaining relationships. Also, the more members of a family make their own decisions about their individual lives and consumption, the more complex everyday life grows. Moreover, as large commuter belts spread around major cities and urban sprawl progresses, individual travel distances grow longer.

Leisure activities generate permanently high demand for mobility

Mobility, therefore, is not only a guarantor for quality of life, self-determination and a high recreational value, but rather a basic practical requirement of everyday life.

Since social interaction, recreation and family life increasingly occur in many places in parallel, time pressure is not uncommon. At any rate, the need for more mobility increases as a function of the synchronisation requirements. Finally, the multiple mobility requirements in everyday life also massively stimulate the desire to reduce complexity and stress.

4. Work requirements: mobile working 2040

Social trends and disruptive economic processes are giving rise to a fundamental transformation of the working environment. A new work culture and increasing digital value creation characterise the transition from the traditional industrial organisation towards a service and network economy. The way we organise work will radically change by 2040: flexible, team and project-oriented working arrangements will be commonplace. While collective work-time regulations will not completely disappear and trips to and from work will continue to occur at more or less fixed peak times, mobile connected working will become an integral part of everyday life – with all its implications for business organisation and corporate culture, business models and products, communication etc.

Fewer companies will be self-contained hierarchical systems. Businesses will operate as open networks and platforms. Cooperation and collaboration will make them extremely agile in responding to customer demands. A variety of new business ecosystems will emerge. Such networks require higher levels of responsibility and autonomy of their staff. This again will increase the complexity of work environments – and have far-reaching consequences.

En-route time will become working time: travelling comfortably and being productive at the same time will become more and more important

According to the German Federal Institute for Population Research (Bundesinstitut für Bevölkerungsforschung – BiB), very high job mobility is a part of everyday life for around 14 percent – i.e. millions – of the workforce in Germany. This percentage is bound to increase further over the next decades. That commuters are exposed to higher levels of stress and health implications has been proven by many studies. A recent BiB study confirms the negative consequences for this group: workplace travel exceeding one hour implies clearly more physical and mental disadvantages than staying overnight for work reasons for more than 60 nights per year (Rüger/Schulze 2016).

Flexible working, i.e. flexibility in time and place, is becoming more and more important. More and more people wish to travel comfortably and want to be productive while travelling. We see an increasing demand for infrastructure that supports mobile work arrangements, making the daily commute to work part of the working hours. Where travel time is to be efficiently used for working, digital connectivity, quiet work and meeting environments are but a start. The future will be about developing clever and holistic mobile working concepts. Employers and mobility services providers need to develop productive, creative and safe work environments – including all that is required to achieve good performance while travelling. Means of transport as well as railway stations, airports, hotels and co-working spaces will become an integral part of our work and private lives. They are the 'hardware' of mobile offices in tomorrow's network economy. Not only will smart travel mean reliable, safe and comfortable transport, but effective working as well – and not least healthy travel.

The increasing digitisation and virtualisation of business processes further enhances the trend. But in spite of the threatening scenario of a working environment controlled by artificial intelligence, computers, software and algorithms will not make human workers superfluous. Because the key success factors are knowledge, talent and creativity, the future needs to build on clever interaction between man and machine.

Tomorrow's working environment will not be characterised by 360 degree virtualisation. In 2040, humans will still have a say in value creation. Social processes and human abilities based on team structures and interdisciplinary collaboration will still play a pivotal role in the digital economy. In an increasingly decentralised working environment, this will result in a high volume of work-related but more individualised commuter travel and continually increasing demand for business mobility.

5. Recreational activities: between mobility management and slowing down

Multi-modal mobility does not affect our working lives alone. It also has an impact on our leisure: be it for shopping, weekend trips, family visits or sports – mobility will become the crucial prerequisite for the leisure activities of most people.

Attending events, going on outings, playing sports and certain forms of mobility as such – e.g. motor biking – will remain an important part of our leisure activities. Then there is sportive driving which will increasingly shift from public roads to 'leisure biotopes'. More traffic will be generated by specific leisure activities and sports – such as when you take your car to drive to a nearby forest for a run or to the urban hinterland for a mountain bike tour or again to the mountains to go skiing or to the seaside for water sports. The growing leisure-related mobility demand will still need to be considered in road and infrastructure planning in the future.

Reversal of trends in recreational mobility: more quality and time for enjoyment

Like our work lives, our leisure is often subject to tight timing and logistics requiring efficient mobility management. Especially for recreational activities, integrated mobility options ensure easy trip and travel planning considering all means of transport options from start to destination. In the medium term, intelligent planning tools will provide context-related services and serve as 'digital assistants' in the decision making process: they will offer customised leisure activities and mobility services – from the travel duration to the costs and the desired means of transport. What we do with our leisure time, more than any other area of life, tells us about the real requirement structures and well-being in our society. While vacationers typically used to spend their time off work relaxing and seeking passive recreation, now physical exercise and activity is regarded as the ideal relief from the stresses of the job and the daily grind. New forms of leisure activity are emerging and more often than not they are related to sports. Physical activity is developing into a crucial element of recreation, of maintaining our health and restoring our energy.

Conversely, we now also see a growing appreciation of slowing down and of mindful mobility, and the focus is shifting towards their meaning and effects. This triggers a reversal of trends towards more quality and time for enjoyment in recreational mobility.

6. Travel: discover, relax and enjoy

Germans are the world champions of tourism. Hardly any other nation travels anywhere near as much. Today, we see a new generation of cosmopolitans grow up who think globally and act locally. One reason behind their open and pluralistic attitude is their increasing mobility. People who travel are more likely to question their own socialisation and view of the world. For most 18 to 30 year-olds regular travel is absolutely normal. And this is why their travel needs are changing: it is all about adventure, experience and emotions. Tourism is evolving into the most creative form of mobility.

Experiential travel is the new form of recreation

Today, the typical tourist roams about in closed tourist-only worlds. In the wake of globalisation, these worlds are growing more and more alike. This especially applies to a leisure society which aligns even over greater distances. This is why travellers no longer want to be 'tourists'. Tourism as an industry is facing disruptive transformation.

A first transformation involved the transition from 'travelling foreigners' to tourists. Tomorrow's tourism will be about 'hospitality' and 'communities'. Especially in a digital world, it is face-to-face encounters and emotional experiences that will have renewed importance and make all the difference. It is about improving the guests' quality of life and satisfying deeply rooted human needs – for relaxation, inspiration, meeting friends and having a good time with them. Life has long since become a sort of everyday tourism. This is what Byung-Chul Han, professor of philosophy and cultural studies at the Berlin University of the Arts in Berlin, calls 'touristification'. And where our everyday life is essentially a tourist life – i.e. characterised by the continuous movement in terms of time and place – what we long for is the feeling of having 'arrived' at last.

Slow culture: not everything is getting faster

Even while it consumes more time and money, mobility does not imply that the future must be faster. For decades, the pursuit of progress has been motivated by our belief in acceleration. If you want to reasonably hold your ground in a competitive environment, you need to be fast and if you want to win you need to be the fastest. To progress your own development you must use your time as efficiently as possible. Management decisions, innovation processes, real estate projects, creative inspirations and above all travel – if something takes too long it cannot be any good.

However, the old industrial society's conventional logic of relentless growth is being challenged increasingly. 'Always more, higher, further, faster' – we gradually realise that this approach is not always and necessarily productive.

There are some signs that the era where speed alone defined the pulse of the economy may be coming to an end.

In 2040, we will have arrived in a new era of mindfulness where speed is no longer the measure of all things. Especially for leisure and travelling, slowing down makes a difference.

Recreation, inspiration, meeting friends: shared experiences motivate mobility

Not top speed will define tomorrow's mobile society but rather how we get around and 'the best way' to arrive at a destination.

Slow travel is gradually gaining ground beyond all-inclusive holidays, mass tourism and jet setting as a successful new form of experiential travel.

Safety will be a strategic issue

Safe travelling has always been a key concern to most of us. For the future, however, safety will gain new significance. While road safety is increasing, the world of tourism has become more and more dangerous over the past ten years.

Humanitarian disasters, global crises and political instability and even wars have caused countries and regions we had come to regard as safe destinations to disappear from the map of tourism. International terrorism has become an incalculable risk which does not even spare European countries and major cities.

Safety will be a strategic issue: objective safety but also subjective safety will become a major determiner of our travel and mobility behaviour. Finding out where and how people can (still) travel safely will become the key task of tour operators and mobility services providers.

A typology of tomorrow's mobile society

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The individualisation megatrend gives rise to a new variety of lifestyles and biographical patterns. People's lifestyles and phases of life will become more significant than sociodemographic attributes such as age, gender, place of residence and available income. They will determine the manifold circumstances of life which in turn define participation in mobility.

This is why when looking into tomorrow's mobility you need to factor in the individual lifestyles and situations, personal opinions, needs, requirements of everyday life etc.

Instead of 'biographies' we need to consider 'multigraphies': highly complex personal histories spanning alternating life phases and discontinuities. In an era of multigraphies, people's mobility requirements will increase. They will no longer be satisfied by individual albeit specialised products. Rather, a great diversity of mobility services will be required.

Lifeworlds set tomorrow's mobility trends

New mobility patterns emerge to go with our various lifestyles and phases. They are the prototypes for our mobile society in 2040. In terms of mobility, we can identify a number of different types, who have different needs and requirements and who form different mobility habits (styles):

Mobile innovators, forever youngsters, silver movers, mobile families, high-frequency commuters, global jetsetters, low-cost drivers, good urban citizens and public travellers.

The above mobility types appear in specific phases of life and vary as a function of one's biographical situation. They are not statistically confined to a specified, seemingly fixed setting.

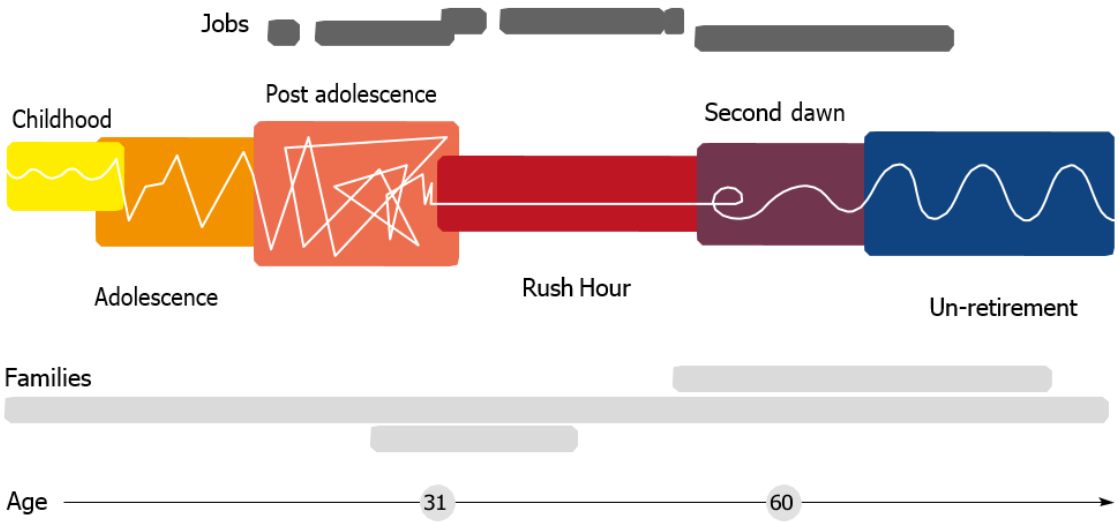
The different mobility styles do not add up to a complete picture of society in 2040 nor are they representative of the population. Rather, they are ideal types – sometimes overlapping – of a mobile society reaching from vanguard (innovators and early adopters) to mainstream.

Their significance does not lie in their quantitative distribution alone on which we are unable today to pin concrete numbers. More important is the effect they have. Their impact is a result of their role model function and the footprint they leave in terms of imitation for the purpose of market penetration. Mobility styles should not be regarded as minority phenomena. Rather, they are likely to meet with mass acceptance and produce a bandwagon effect.

When we speak of trendsetting mobility types, this does not mean they represent numerical majorities. Rather, they are influential in a particularly effective way. Indeed, they are highly attractive and they are iconic. They are the prototypes for the development of pivotal lifestyle-dependent mobility patterns that pave the way into the future of mobility.

FROM BIOGRAPHY TO MULTIGRAPHY

The conventional three-phase life history evolves into a flexible lifestyle



Source: Zukunftsinstitut

1. Mobile innovators: better travel

Among the mobility types, the mobile innovators group will have the greatest impact in 2040. Being the vanguard in matters of mobility, they will be the pioneers on the mobility markets. To satisfy their demand for innovative sustainability solutions, they will go for smart and sustainable mobility concepts which respond to the high mobility demand and flexibility requirements in intelligent ways. As pragmatic idealists, they will have high standards in terms of design, digital connectivity and environmental compatibility. High ecological awareness will be the hallmark of their mobility style: a sophisticated monitoring system will document the super clean sustainability balance of their mobile lifestyles. Mobile innovators will prove that certain forms of mobility can still have a high standing in 2040. However, the governing set of values will be different – which will serve as the distinctive feature in reference to their former status.

What distinguishes their lifestyle is a 'best-of-two-worlds' attitude: they will prefer country-style living without forgoing the amenities of urban life. They will be represented in all age groups and most likely belong to the high income bracket. For them, ecological awareness and innovative spirit will not be mutually exclusive. Compared with their peers, their mobility mix will favour intelligent means of transport in the form of individualised local public transport, increased use of bicycles and car sharing schemes. This mobility type will represent a growing percentage of the population. Mobile innovators will be prepared to pay a little extra for products with a clean eco-balance sheet. Mobile innovators want holistic ecological mobility concepts tailored to their own sense of well-being and that of society. They will prefer autonomous, electric or zero-emission cars, develop a high affinity to sharing schemes and look for sustainable and environmentally compatible mobility services.

Green, healthy and affordable: mobile innovators will be the most influential vanguards in matters of mobility

2. The forever youngsters: young golden agers

Demographic change will be the driver of innovative mobility. With the 'young golden agers' feeling ever younger, the 60-75 age group will become the key driver for new mobility options. Expected to count over 15.1m in 2040, this group will account for almost one fifth of the population in the Federal Republic of Germany. To meet their mobility demand, the emphasis will be on a mix of publicly available mobility options, conventional and alternative solutions, blurring what is public and what is private mobility.

The 'forever youngsters' are in the prime of life with unflagging energy and unrelenting curiosity. They will launch into new activities, test their limits and live out their dreams. Having reached retirement age, they will refuse the conventional old-age pensioners' approach, are adventurous and enjoy their new freedom. They will use their independence for ever more ventures, which will create more demand for mobility. They will travel a lot, explore new countries and regions and regularly visit close relatives. In doing all of this, they will pay good attention to their health. Only if they are physically fit, can they always be on the move. As a result, they will pursue ways of being mobile that are most suitable to maintaining their fitness: jogging, cycling and hiking, as well as active holidays will be high on the lists. For the forever youngsters, the emphasis will be on individuality, health and slow culture.

3. The silver movers: mobile and active older seniors

The silver movers represent the oldest age band of the mobility groups. In 2040, the 75+ year-olds will count over 13m in Germany, roughly 16 percent of the overall population. With high spending power but a restricted degree of mobility and radius of movement compared to earlier phases of life, theirs will be a high demand for comfort, safety and support. Their mobility requirements will focus on the near range. Working into old age will be considered normality for silver movers. In their leisure they will focus on educational activities, family tasks and voluntary and community work. They will be comfortable with autonomous driving, also because they will be the first group who had first-hand experiences with driver assistance systems and the benefits of more safety and easier driving. Such systems will provide assistance and comfort where catching connections and moving in crowds make using public transport a hardship.

Leisure time and family life: increased amount of movement required

4. Mobile families: stressed out midlife

Family-friendly mobility patterns will be the priority for both genders. Flexible mobility concepts will be as high in demand as families are growing into multi-local networks. In mobile families both parents will be working. Time and money will be tight resources in the 'rush hour of life'. Their mobility requirements will originate from the necessity to find the optimum balance between family and career, life as a couple and child education. They will keep an eye on their mobility costs but expect high service quality. Recreational activities, work and family life will be tightly timed and involve strict time management and permanent synchronisation. They will live an urban lifestyle without focussing mainly on inner cities. Rather, a great part of their lives will take place on the urban-rural fringe and in the countryside. They will have increased needs and demands for support functions and mobility services. They will need vehicles featuring clever, integrated solutions for a multi-mobile lifestyle with smart connectivity making everyday family life easier – from shopping delivered into the boot to coordinating schedules and homework help.

Given their lifestyles, especially young families will need intelligent time and mobility management.

Efficient travelling: growing demand for business solutions which make mobility less stressful and smoother but also more productive

5. The high-frequency commuters: the daily rush

A highly flexible and mobile working environment will be the new standard. In an era of digital knowledge, working will be ever less location-based. High-frequency commuters are mobile job nomads. Their need to commute to the office, to clients, to business partners or to projects will be a day-to-day necessity. Mobility will be a prerequisite for being able to work. To them, being on the move efficiently will mean above all covering medium and long distances – at the national or international level – fast, without complications and as comfortably as possible and to get work done at the same time. Correspondingly high will be their demand for service and business solutions to make mobility as a whole not only less stressful and smoother but also more productive. Digitally connected work spaces guaranteeing a secure and protected work environment will be the focus of their demands. Waiting and en-route time will become working time.

High-frequency commuting will increase especially as a function of the increasing gainful employment of women. Mobility and time pressures will drive the demand for efficient mobility services. As more and more car-sharing models emerge to professionalised new forms of 'shared', the less will individuals need to own a car. Consistently implemented, car sharing will also solve the 'last mile problem'. Especially in urban areas, metropolitan regions and outer conurbation areas, coverage by a mix of public transport and individual mass mobility will make cars a complementary option for high-frequency commuters to fill the last gap left uncovered by public transport.

6. The global jet setters: the multi-mobile business class

Global jet setters are permanently on the move. They will regularly commute between the major cities of the world, often living in several places at the same time. They are cosmopolitans – citizens of the world – and creative knowledge workers. The driving force in this group is a highly mobile business class. Multi-mobility is defining both their professional lives and their leisure. Their demand for intelligent mobility services ensuring their flexibility en-route and at their destinations will be tremendous. Their key need is synchronising their everyday lives and finding adequate 'simplexity' solutions. Means of transport will need to become true 'third places' while responding to their desire for privacy and intimacy.

7. The low-cost drivers: intelligent and inexpensive mobility

As we gradually settle into the post-fossil era, mobility costs in 2040 will clearly be lower than today. According to projections of the European Commission, the 2040 energy demand from passenger transport will be around one fourth lower than in 2015 (European Commission 2016). Unlike fossil fuel prices, the cost of renewable energies will drop. But post-fossil e-mobility is not the only reason why mobility costs will continue to fall. By virtue of sharing concepts, cars will become 'privately owned public means of transport' that will transform public transport by answering the demand for mass transport with individual solutions. Automated pooling of ride sharing resources will be an option for job commuters as well as the increasing use of bicycles. Finally, all modes of transport will benefit from digital optimisation. All of this will allow us to tap into enormous efficiency potentials to drive mobility costs in 2040 well below today's levels. Nevertheless they will still represent a large share of the total cost of living.

Intelligent connectivity will also lower the price of mobility. Multiple integrated forms of mobility will become more affordable for low-income groups such as school children, trainees and college students who have no payroll to rely on as well as for socially disadvantaged groups: all those who are dependent on a reduction of their mobility costs. Car sharing, ride sharing, bicycling or walking are the preferred means of moving from A to B when it comes to optimising one's mobility budget. Nonetheless, vehicle and mobility solutions are expected to ensure high levels service quality and meet innovative product design standards. This extends into the middle class where mobility competes with other needs: housing, child care, shopping, health, old-age provisions, education and culture, recreation, media consumption etc.

Automated pooling of ride sharing resources: intelligent networking reduces mobility

8. The good urban citizens: conquering the cities green and fast

Good citizens are the new mainstream in major cities where they trigger transformation. They think of themselves as an urban vanguard linking the idea of community and a forward-looking environmental orientation. More and more cities are promoting a switch from cars to local public transport and bicycles. The new 'switcher' movement successfully pursues a radical re-designation of roads and transport systems. They benefit from 'all green for cyclists wave' arrangements and get through town faster than cars. Whether it is classic bicycles or e-bikes: the good urban citizens prefer their two-wheelers to cars. And they are happy with their choice because more and more cities are implementing transport concepts substituting bicycles to most of the car traffic to improve the quality of life. Thanks to many action groups and municipal co-management schemes, a reassignment of public urban roads and public areas in favour of traffic calming and no-car areas with higher amenity values is under way.

9. The public travellers: for want of alternatives

Public travellers, their choice of mobility mode is not driven by ecological, but rather by practical considerations. They are part of the lower middle income group, live in the countryside or in suburbs and predominantly travel by local public transport which often relies on independently operated small buses, car sharing and ride sharing. They have no sophisticated demands: above all, mobility needs to be affordable and uncomplicated.

Non-mobility vs. social deceleration:

Opting out of the mobile society?

In 2040, we will have a broad spectrum of mobility styles each catering to different requirements, habits and needs. What they all have in common is that mobility, more than ever, will be a basic human need.

At the same time, there will be individuals who are clearly less mobile than the average population. This includes the growing group of Germans in need of care. Their number today is approximately 3m and is estimated to be 4m in 2040. Also, demographic change is an undisputed factor. However, according to current official projections, the number of over 90 year-olds in 2040 will only amount to about 1.5m. While this is twice as many as today, it is still less than 2% of the total population. Even if a restriction in mobility is natural at this age, this will not result in a complete lack of mobility for this group.

There is no doubt that future framework conditions and structures must allow persons with restricted mobility – be it age-related or because of disabilities – to fully participate in social life and determine their own movements as much as possible.

Another justified question is how the remaining groups of the population relate to a reduction in mobility. While mobility is synonymous with freedom to many, there are limits to the degree of mobility that we can bear. For more than a few, the need to be highly flexible and permanently on the move, everyday life and the work week becoming more and more loaded are a burden. This is why many in the hyper-mobile society are looking for ways to slow down.

In our private lives, higher efficiency and speed are not the answer to time pressures and everyday stress. For most of us more quality of life is now associated with the motto 'better, not faster'. For all the advantages and new freedoms afforded by modern and pluralised lifestyles, the level of subjective and objective complexity has grown exponentially. This is the flip side of a multi-option society: stress levels rise.

The key shortage in life is no longer the lack of goods but rather the lack of time. Having time is becoming a luxury experience, more valuable than expensive products. What counts is control of our own time, individual well-being and quality of life. And this is why, more and more often, we question the values of a world which we perceive as extremely fast-moving.

Hence, society will become increasingly sensitive to the question of how meaningful and beneficial all-encompassing mobility is. More and more often will we question the necessity of being permanently on the move, and we will look for opportunities to slow down in our mobility for a while. However: not being mobile, eschewing mobility or even renouncing mobility is hardly a viable option.

PRINCIPLES

How tomorrow's mobility will work

③

Seven basic principles will underlie tomorrow's mobility. They specify what makes mobility work and how we organise and shape it.

1. Post-fossil, climate-neutral mobility

In view of the neo-ecology megatrend, mobility consumption will be determined to a considerable extent by environmental and natural resources aspects. More than ever creating a sound ecological framework for mobility will be an issue over the next few years.

New players and platform providers will not only focus more on people's needs and motives. Above all, they will aim at a more efficient use of resources and transport infrastructure and at providing ecological mobility on the basis of renewable energies.

The automotive industry is working on it, as are governments, setting the course ever more decisively. Decarbonisation is developing into the fundamental principle of economy and the key driver of the transformation of mobility. The political framework is in place: by 2050 or earlier, greenhouse gas emissions from the transport sector must be at least 60% below 1990 levels. In view of ever stricter regulations, fossil fuels will be facing tough times as the power source in road transport. Some countries are already working on ways to bid farewell to combustion engines: Norway plans to completely ban combustion-engine powered cars by 2025. And in the long run they will be phased out in Germany as well.

While today we are but at the dawn of the post-fossil mobility era, most of its key elements will be a reality in Germany by 2040: roughly 50% of the passenger car fleet will then be powered by alternative fuels from electric energy to hydrogen (cf. Shell Deutschland/Prognos 2014).

Paradigm shift towards emission-neutral mobility

Post-fossil mobility, however, does not hinge on cars alone. It will be achievable only through the comprehensive transformation of the entire mobility landscape including public transport, bicycles and pedestrian-friendly inner cities. Intelligent, connected use of transport will be one requirement, as are new, sustainable energy infrastructures without which electric and hydrogen mobility are inconceivable. Electric mobility is based on including vehicle concepts in a multi-modal transport reality, integrated into a world of 100% renewable energies.

Integrated into the smart grid, electric vehicles will become game changers for business models with a view to cars and the energy industry. As it is, electric cars are the launch pad for a different logic in the interaction between mobility and energy. To promote renewable energies, we need intelligent network management using advanced electricity storage. The batteries of electric vehicles are an obvious choice: 'vehicle to grid' will be tomorrow's formula turning cars into energy depots.

Sustainable system solutions

To keep cities attractive and competitive, public transport systems already are a key element in urban mobility concepts. However, to ensure ecologically sustainable operation, they will rapidly progress towards individual mass mobility. Innovation in fleet operation in particular is one of the key requirements in the successful establishment of electric mobility. It will be an essential accelerant in the paradigm shift towards zero-emission mobility.

So cars will become one element in an intelligent transport system. After all, to meet the demand and improve the quality of urban life, more and more cities are already remodelling their transport infrastructure in a way that makes the car more and more redundant. In addition, the increasing share of bicycle traffic – especially with powerful high-speed pedelecs – will revive the discussion of road safety and accident prevention.

Tomorrow's mobility will be post-fossil – in particular because it will be smart and multi-modal.

2. *Access vs. ownership*

How we move from A to B is subject to radical change, since individual mobility will be based on the principle of access: people will buy access to rather than acquire ownership of mobility products. 'Using not owning' will be the concept defining the logic of transport in the 21st century. This means that different business models are needed altogether. We will need more flexibility in time and space and increased availability of means of transport.

The principle of mobility will also impact how we relate to cars – for instance, we will no longer feel responsible for checking fuel or safety levels etc.

Commodity and access mobility

Drivers of the development include new user habits and enormous efficiency potentials lying dormant in today's individual transport which can be realised by means of digital connectivity. Tomorrow's customers will buy mobility flat rates they can use when, how and where they need them. The key to designing smart mobility is the integration of a number

Electric or hydrogen?

'Hydrogen is the new oil' claimed Daimler boss Dieter Zetsche in 2011. Carmakers and the energy industry took until 2017 to launch the Hydrogen Council aiming at promoting the breakthrough of this type of alternative fuel. According to a study by Shell, hydrogen can soon be produced entirely from renewable energies. Over 500km on one full tank will be the standard, refuelling will take only three to five minutes – faster than any electric car.

Access mobility: the smartphone as a digital key

of options into a digitally managed network. 'Access mobility', i.e. completely unrestricted access to a variety of different mobility options – national, international, global – will be the new status symbol.

Digital connectivity will penetrate all spheres of life: the many opportunities it provides have long made their way into our work and private lives. Then again, digital services will also determine how people are mobile. Digital connectivity will be an integral part of traffic flow control.

The wealth of car sharing operators and platforms such as Uber are prominent examples for new business models shaping mobility on the basis of access to a network. More and more start-ups and cities are experimenting with similar methods to innovate urban transport.

Individuality, ease-of-use and smart connectivity providing flexible and comprehensive access to mobility services are ever more important aspects of mobility for most of us, while status representation based on engine power and the experience of luxury is losing ground. Dynamic mobility, ease-of-use, comfort and smart design are much more desirable – not to mention the additional utility of vehicles: means of transport becoming an extension of our work place, our living and communication environment. Far from being stressful, they become a means of coping and integration in the daily grind.

The smartphone as a digital key

It is digital services in particular which makes giving up car ownership easier than ever before without having to miss out on comfort. In the future, for instance, we will be able to call self-driving cars as autonomous shuttles to our location via app. After conquering cities and conurbations, the new services will also be available in outer conurbations and the countryside by 2040.

'Always on and connected' will be our motto in a society where smartphones have become everyday companions and multi-functional tools. They will also be the digital key, the universal control instrument for access to tomorrow's multi-modal mobility – no matter where or when.

This also shows that the principle of 'using not owning' requires new standards, defines different requirements with a view to monitoring the roadworthiness of vehicles, to improved type-approval tests and in terms of the quality, availability and reliability of modern mobility services.

3. Shared mobility

Sharing is the 'leitmotif' of a new generation of consumers that grew up bartering and sharing on the Internet. In online networks, they learned a different logic of taking and giving: they are collective and collaborative consumers. Today, this is no longer the principle of young consumers alone: sharing will be part of the cultural DNA of a connected society – a new way of doing things and the functional principle of mobility. For more and more people ownership is no longer a privilege but rather a burden – all the more so when it concerns a car.

In fact, sharing does mean giving up, not at all. Rather, sharing expands the individual scope of opportunities: sharing to have more – of something you cannot otherwise afford or which would be a burden if you owned it.

Car sharing via online platforms – from professional operators or on a peer-to-peer basis between private individuals – is becoming ever more popular because we can use a car when we need it – without having to own it.

Car sharing is booming because, like no other concept, it satisfies the desire to have transport and flexibility while reducing mobility costs and doing something environmentally sound.

In Germany, the number of car sharing users has increased ten-fold to over 1.7m since 2010, while the number of shared vehicles has almost quadrupled over the same period.

While car sharing was the subject of ridicule for a long time as an eco-freak alternative not suitable for mass markets, nearly all carmakers have now jumped on the bandwagon and designed new business models. Even rail operators are working relentlessly to further develop their car sharing products. Fleets are being enlarged, more and more cities covered and electric vehicles are taken on board.

Car sharing is individual mobility on the access principle – and some day it will also work in rural areas even if the location of access points is still an open issue. Some carmakers plan to bring car sharing to remote areas through their authorised dealer networks. Filling stations are also an option: as hubs in the transport infrastructure of the future they could become customer touch points for new mobility services.

Thanks to mobility networks such as Flinc, ride sharing is made available even to corporate and business customers – and not just in cities but also in outer conurbation areas and surrounding regions.

Sharing not owning: private cars will be facing tough times

In a highly connected world, sharing will become the functional principle of mobility

Higher flexibility at decreasing cost

More and more people will give up car ownership in favour of car sharing which gives them access to using a passenger car when and where they actually need it. This will increase flexibility and cost efficiency.

A study by the strategy consulting firm Oliver Wyman concludes that shared mobility will be responsible for a 25 to 30 percent drop in private spending for car ownership by 2040 over 2015.

The more professional these forms of shared mobility become, the less will we feel the need of always having the same car parked at the kerb. The advantage of car sharing lies not in flexible access at low cost alone. Many appreciate the modular variety of options meeting specific needs that car sharing supports. You need not settle for a specific model but will find the perfect vehicle for any situation: saloons for long cruises, minivans for short family trips, e-roadsters for top-down fun on weekends, utility vehicles for bulk shopping or commercial transport.

New logic of using means of transport

Using cars instead of owning them – that will be the logic of individual mobility in the 21th century. Car sharing vehicles will become 'privately owned public means of transport'. As 'public private vehicles' they will complement and reinforce public transport, reduce the environmental impact and alleviate the burden on local transport systems and provide customised mobility. Benefits also include reduced density of the traffic flow. Extending bicycle networks at the same time will help to bring the number of vehicles in cities down by as much as 30 percent by 2040. Especially in urban areas providing high levels of mobility by means of public transport, the need to use your own car will continue to decrease.

Shared mobility: spending on cars will drop by 30 percent

This transformation will give rise to novel ownership and usage concepts – and new challenges on the markets. Expanding and professionalising sharing options will also increase the demand for professional safety and insurance services. For instance, prominently, vehicle safety needs to be ensured in peer-to-peer car sharing schemes.

Manufacturers need to evolve into mobility platforms to be able to market their products at a profit. After all, car sharing will have the same impact on the automotive industry Airbnb has today on the accommodation business: the number of vehicles we need will drop immensely. Scientific studies confirm that one shared car replaces at least three private passenger cars. This effect will intensify when driverless car sharing vehicles move autonomously to where they are needed.

Finally, sharing will be the functional principle not only for the individual private use of vehicles, but also for job commuting – in the form of corporate car sharing, ride sharing, shared bike systems in cities and energy sharing as far as electric power for electric vehicles is concerned.

4. Digitisation of mobility

The connectivity megatrend is the foundation of tomorrow's mobility. Digital connectivity will not only increase the number of available mobility options. Rather, it will add a whole new layer to the mobility structures. With road users, vehicles and the infrastructure around them exchanging data, we will reach the next level of mobility. This results in a self-regulating system of real-time traffic planning, on-demand availability and seamless transition from one means of transport to the next.

Thanks to digital connectivity, we will be able us to enhance our use of inter-modal transport options. The connectivity megatrend – and the Internet of Things in particular – is having an ever increasing impact on mobility behaviour and the transport system. The mobile Internet, social networks, online platforms, intelligent, connected vehicles will all act as enablers of a new mobility. This will be the basis of innovative mobility concepts and new transport and safety architectures.

Digital connectivity will 'enable' new mobility and become the basis for innovative transport infrastructures

The intelligence of autonomous systems

E-mobility, sharing, access principle, autonomous driving – everything that will distinguish the mobile society of the future is based on comprehensive connectivity and eventually artificial intelligence. The Internet of Things will allow us to systematically synchronise transport, navigation and vehicle systems, including movement data. This will not affect mobility services providers and integrated public transport systems alone, but private vehicles, whole fleets, the road, parking and charging infrastructures, telecommunication networks, mobile devices and much more as well.

By capturing real-time data from users travelling on roads, in buses and trains, we will be able to model and forecast traffic flows near airports, at mass or seasonal events – or during the notorious start of the holidays in Germany – much more precisely. As a consequence, transport systems and eventually mobility as a whole will be much more self-regulating than today. Cooperation and strategic alliances between vehicle manufacturers and IT platforms will gain more importance.

Optimisation of traffic flows and road safety

Data-based mobility concepts will make traffic faster, smoother, simpler and more ecological. Feeding anonymised location and travel data into the network, mobility consumers will be much more than just that – they will be the enablers of tomorrow's mobility. Thanks to local mash-ups, i.e. the linking of topical and relevant information, allowing transport systems and operators, passengers and vehicles to stay abreast the pulse of the mobile society, we will be able to detect congestion, vehicle breakdowns and accident risks early – and avoid them.

Hyper-local data management involving car manufacturers, transport operators and mobility services providers, infrastructure operators and mobility consumers – be it motorists, pedestrians, cyclists or passengers in public means of transport – will ensure the optimisation of route and trip planning, the provision and on-demand availability of means of transport, the use and occupancy of vehicles, and eventually traffic flow and road safety.

Broadband data networks, intelligent personal devices, the mobile Internet and open data infrastructures, high-performance navigation systems, public interfaces and cloud computing – the technical prerequisites for connected mobility are developing at a breath-taking pace. Digital technologies will be an indispensable element of efficient traffic flow control and

Digital connectivity and data-based systems will allow us to control the traffic flow intelligently and efficiently

contribute towards improving the quality of life in cities and urban regions.

Autonomous vehicles

The wide-ranging automation of mobility will be based on so-called cyber-physical systems: self-driving cars are an extremely advanced example. They will know their relative position in traffic, receive a continuous stream of data over the Internet and, ideally, drive safely and autonomously to their destinations. Cars will be so intelligent that they will be able to interpret and act upon sensory data measurements and become systems acting autonomously.

Today all manufacturers are equipping their vehicles with digitally connected systems taking a huge step towards the Internet of Things' wide-ranging penetration of automobility. What was originally intended as emergency or entertainment applications can now basically be used for any and all conceivable new mobility services in connected cars.

Connectivity generates obvious added value: from automated search for and reservation of parking, to enhanced route planning and traffic flow control to finding charging stations or booking additional services.

Data security as a minimum requirement

The above raises questions – of data protection and of who owns the information. The condition for acceptance by society is a maximum of data security. As a basic hygiene factor, data protection will be of immense importance in 2040: as a quality criterion it will be a minimum requirement for new players to enter the mobility market.

Smart and safe: super-safe transport

Intelligent traffic control systems will not only identify recommended means of transport and fastest routes from A to B in specific situations, above all they will contribute to increased safety in all modes of transport. To the extent to which the increasing automation of mobility systems can contribute to a visible improvement in safety, it will gain broad acceptance. This especially applies to autonomous vehicles: they will contribute to faster and cleaner and not least safer travel on Germany's roads. Autonomous driving and automated assistance systems will be the key to driving without severe or fatal accidents in the coming decades.

Accident prevention concepts are certain to benefit from the development of intelligent vehicles and new technology applications. Accident frequency will drop considerably if human error is eliminated as a cause of accident. Wide-ranging prevention strategies will continue to be important, but will increasingly be based on the interaction with manifold initiatives in technology to bring the number of victims of road accident down further.

5. Global mobility – a redefinition of 'roaming'

A continuous increase in international mobility is fundamentally characteristic of our lives and our economy. Mobility has become a synonym for a cosmopolitan society and the achievements on the global market. Mobility is an elementary factor in the global economy and society. Air transport, in particular, is taking on a key role of increasing importance and is becoming the driver of international mobility. Moreover, the 7/24 non-stop culture of the digital era shatters the conventional dimensions of space and time.

The world is growing closer and closer together. More and more people partake in the globally mobile society. Over the coming decades, we will see a continuing boom in international travel first and foremost. The dynamics of worldwide tourism are unbroken: year after year the World Tourism Organization (UNWTO) counts over 1.2bn arrivals around the globe, more than half of them in Europe. Germany is one of the top 10 destinations – in terms of travellers and turnover.

International travel: borders will lose their importance

By 2030, the UNWTO estimates a further increase to 18.bn international travellers worldwide. It is obvious that tourism will be one of the largest future markets in the globally mobile society of the 21th century. This will be complemented by further growth in international business travel – one of the most important drivers of globalisation.

Boundless mobility

The world is on the move. Mobility is both a requirement and a vital necessity in a global society. Nothing affects our lives in the global society as much as mobility. Our future competitiveness hinges on our mobility in the international economy. Our lifestyles will continue to be contingent upon customised, unrestricted and global mobility.

A mobile world culture will continue to evolve in the coming decades. Companies and their business models will face new challenges and new markets will develop. Especially global connectivity will stimulate new trends, growth and innovation. Boundless mobility will remain a prerequisite for welfare and growth.

In a globally mobile society, borders will lose their significance. There are signs that in 2040 we will move in a world of boundless mobility. International and global mobility will work in analogy to roaming in telecommunication: you no longer have to worry about how you get around in a foreign country, new city or region. Renting a vehicle, sharing a car or using public transport abroad – all this will be as natural, easy and intuitive as crossing inner-European borders or using mobile phones abroad today – including booking and paying for services.

Be it via global online car sharing networks, European mobility flat rates or digital assistance tools for international travel management – mobility in 2040 will be possible without a hitch and just as we need it

Using local public transport abroad? It will be as easy as using a mobile phone

everywhere. With plans ranging from low-budget all-inclusive to premium at extra charge for additional services that will become the basis for commercial success in the global business world.

6. Seamless mobility: overcoming the modal split

To reach their destinations, people will change the means of transport more frequently, selecting – situationally, ad hoc, from a pool – what is most convenient for them: a car, or a train or a bus, or a bicycle.

The driver of future demand, connected, inter- and multi-modal mobility requires the development of integrated mobility concepts. This means that we should no longer conceptualise mobility in terms of separate means of transport and organise and offer mobility accordingly, but rather along mobility chains. Those who want to secure their foothold in tomorrow's mobility markets need to abandon the idea of the modal split and position themselves more as 'intermediaries' at the interfaces of different modes of transport. The individual means of transport will no longer compete with each other but need to interconnect intelligently.

Mobility will be ultra-integrated

Increasing connected, inter-modal mobility goes hand in hand with ultra-integrated mobility concepts. This will ensure that mobility is a smooth process, usually. Fluid and seamless transitions from one means of transport to another – the vision of highly flexible, efficient mobility without interruptions will become reality thanks to digital connectivity.

Local public transport will evolve into individual mass mobility

Individual mass mobility

This will also transform local public transport as a part of public services. Local public transport will strongly shift towards individual mass mobility: buses and trains will be supplemented by a close network of 'public private vehicles' and micro-carriers such as electric scooters, autonomous shuttle vehicles and bicycles. The future will see a revival of bicycles as a central means of urban transport. Sharing platforms will make private cars a part of the public fleets as individual public means of transport.

The linking of individual and public transport will be the foundation of tomorrow's mobility. Local public transport and individual transport will merge into individual public transport. Thus complemented, local public transport will pick people up wherever they are.

Along these lines, by 2040, we will have found an intelligent solution even for the 'last mile problem'. Thanks to innovative solutions, cars will take on a supporting role especially in areas where public systems provide a high density of mobility services, tackling the last deficits of public transport. And not only in urban areas but out in the countryside as well.

Seamless mobility requires a greater variety of viable and flexible options that can be combined in a time and cost-efficient way to ensure truly demand-based mobility. This means that mobility will function seamlessly, economically, ecologically and in a socially sustainable manner. Mobility must not waste valuable time and must go easy both on resources and our purses. This will be the key challenge for the years to come and the basis for all other innovation efforts.

7. Managed mobility: mobility services providers as companions

We outsource more and more everyday tasks. What we do not need on a permanent basis, we buy as a service as long as needed. This creates a different new demand in terms of mobility management products – and ultimately new mobility markets.

The mobile society defines itself through its appreciation of convenience and the need of reliable guarantees of trouble-free arrival. To this end, we require individual mobility management that organises our lives within an integrated mobility system and along mobility chains.

Only comprehensive mobility management will enable us to organise and shape innovative services along mobility chains. For this type of holistic integrated mobility solutions to become reality, the automotive industry, transport operators and all stakeholders in the transport sector must evolve into mobility managers. Mobility services providers will become our companions, invisible escorts in our mobile everyday lives and in a world on the move.

Liveable cities, efficient transport: seamless mobility will be the key challenge for the years to come

Intelligently combining services that are integrated network-style, they will provide solutions to fit specific situations, needs and requirements.

New alliances

This will unlock enormous potential for extending the value chain by expanding supply. But it will also require the actors' willingness and competence to grow beyond their present-day core business, to open up to strategic partnerships and integration. Because the above can only be achieved in a network of different suppliers.

'Coopetition' will be the universal principle. Both cooperation and competition will determine the dynamics of innovation in tomorrow's mobility markets. Competitors will become 'frienemies' – companies and institutions which are both competitors and allies. For instance when it comes to working together on common standards. Countless highly innovative start-ups enter the market as new players, often from outside the industry. In the medium term, large established companies will recognise in the start-ups not enemies but rather cooperation partners who have business models to contribute, likely to enhance their own range of products.

This is how a great variety of open networks and platforms creating new business eco-systems for innovative, forward-looking mobility in an extremely agile, customer-friendly and demand-oriented manner will emerge by 2040.

SPACES

Local structures of tomorrow's mobility

④

An increasing variety of mobility forms will be the hallmark of our world in 2040. We commute or go to school, we visit family or see a doctor, we go shopping or to recreational activities, on holidays and business trips. We use smartphones, laptops and the mobile Internet. We are on the move: always, everywhere and simultaneously, and to more places than ever before. Multi-mobility is the result. The better part of our lives in a 24/7 society will happen in the 'in-between'.

Even in 2040, for the most part, mobility will take place in real spaces. Virtual applications may extend physical movement in some situations, but they will not substitute it on a large scale.

Mobility will be increasingly multi-local. We may still be thinking in terms of large cities, regions, small and medium towns and rural areas – in reality though, the lines between physical spaces are blurring. But how people will get from A to B in the future will depend more than ever on where they actually spend most of their time and what distances they need to cover every day. This will have a considerable impact on the vehicle fleet and vehicle ownership, for instance. Both will vary depending on the preponderant locale in which you are on the move. The number of passenger cars per capita will be clearly higher in rural areas than in cities, even in 2040. But the simple distinction between city and countryside is becoming increasingly inadequate. When looking at tomorrow's mobility, it is therefore all the more important to consider different spatial structures. We identified six different spatial patterns that will be of particular relevance for future mobility.

1. Condensed space: cities (e.g. Hamburg, Munich)

2. Clustered space: metropolitan regions (e.g. Ruhr area, Rhine-Main region)

3. Linked space: outer conurbation areas (e.g. Frankfurt – Hintertaunus)

4. Lined space: inter-city connections (e.g. Frankfurt – Cologne, Berlin – Wolfsburg)

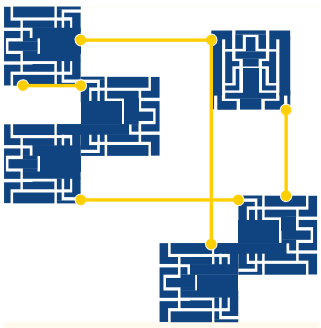
5. Interspace: international, global mobility (e.g. Munich – Manhattan, Leverkusen – London)

6. Off-space: offsite-mobility in rural areas (e.g. Uckermark)

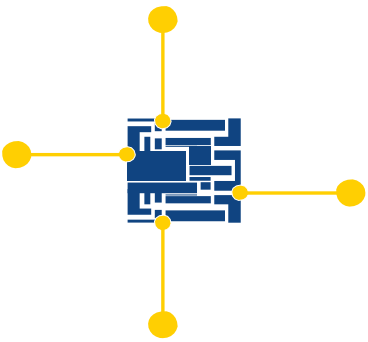
Blurring boundaries:

Tomorrow's mobility

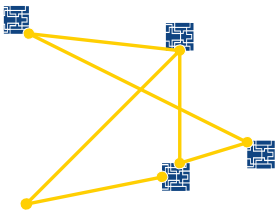
Condensed space
Intra-urban spaces where public and individual transport ensure high levels of mobility (e.g. Berlin, Hamburg, Munich)



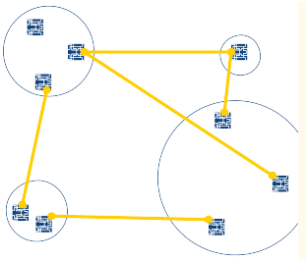
Clustered space
Metropolitan regions and conurbations with high volumes of regional traffic (e.g. Ruhr area, Rhine-Main region, Rhine-Ruhr region, Greater Hamburg, Greater Munich or Greater Stuttgart)



Linked space
Links between outer conurbation areas and cities forming catchment areas extending far beyond the suburban belt and the immediate urban hinterland (e.g. Hintertaunus – Frankfurt, Havelland – Berlin, Eifel – Cologne)



Lined space
Axes between major cities which despite long distances are used for daily commuting thanks to fast, high-frequency connections (e.g. Frankfurt – Cologne, Berlin – Wolfsburg, Bremen – Hamburg)



Interspace
International medium and long distance connections, not limited to metropolitan cities, which are becoming faster thanks to global connectivity (e.g. Munich – Manhattan, Leverkusen – London)

Off-space
Predominantly rural regions where transport infrastructures are rather sparse (e.g. Uckermark, Wendtland, Rhön, Hunsrück, Schwäbische Alb)

1. Condensed space: cities as transformers of mobility

The urban mobility mix is undergoing radical change. Especially in cities and conurbations, the use of the means of transport will shift in favour of public transport, cycling and walking, to name just a few.

To increase the quality of life, more and more cities are implementing transport concepts focusing on cycling to replace a large share of car traffic. In many places, the new e-bikes are the fastest means of transport. This is owing to the fact that average rather than top speed is now decisive in urban mobility. Bike rental stations and cargo bikes are part of this redistribution of urban mobility and reassignment of public spaces. More and more inner cities are no-car areas with higher quality of life and amenity values.

The cities of tomorrow will be smarter and more humane: fewer vehicles, requiring less parking space and causing less environmental pollution. Historically disparate systems will become integrated. Commercial and delivery traffic will also become connected, smarter, greener.

Mobility in the cities will be all about digital life, intelligent streamlining, connected transport and autonomous driving. Particularly the latter will radically alter efficient vehicle use and inner-city and metropolitan transport systems and bring about the advent of a new on-demand mobility.

Supplemented by self-driving vehicles, local transport will be as intelligent and comfortable as riding a taxi is today. Urban dwellers will flexibly combine the means of transport available to them. Finding and booking transport will be easy and take only a few steps, or will be completely automated and happen in the background. Especially large metropolitan cities will see less car traffic, or none at all in designated zones. The political and legal framework conditions will be the drivers of this transformation.

Condensed space
Intra-urban spaces where public and individual transport ensure high levels of mobility (e.g. Berlin, Hamburg, Munich)

Unbroken attraction of cities

Putting mobility on an ecologically viable basis will become more and more important especially against the background of growing cities, rising volumes of road traffic and the resulting environmental problems. The population in Germany's metropolitan cities will be growing: Frankfurt will have 80,000 more inhabitants by 2035, Munich and Berlin will see a rise in population of 200,000 and 500,000, respectively (Cologne Institute for Economic Research).

In inner cities, cars will increasingly obstruct traffic while their average speed falls. Many cities already have neighbourhoods in which cycling is faster than driving. Transport in tomorrow's smart cities will be controlled to smoothen traffic flows. This will reduce both congestion and transport-related emissions.

Tomorrow's cities will be more liveable, greener and quieter. Where cars shaped the cities in the past, today cities are shaping the cars. Combining different modes of transport, including integrated booking and payment processes will become much more efficient. Open data interfaces will implement a uniform distribution system and strict data protection.

Transit points will take on a central role in everyday life. Being on the move more will give 'third places' increasing importance. Public space will be restructured and reassigned. Urban gardening will create new oases. Parks on disused tracks or roads will be

meeting points for pedestrians and cyclists. Urban life will integrate the new 'outdoor' places. Nature will be part of urban everyday life and an important element of the cities' high-density life.

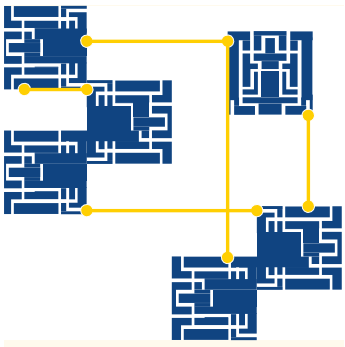
Individual public means of transport
Above all, the cities will see local public transport transform into individual public transport, which will become the key mobility player. Owning a car will be redundant in the city – ownership will no longer make sense. Access to an urban mobility network is more important. The users expect a comprehensive, holistic mobility network.
We will have a vast variety of differently sized means of transport and varying levels of transport capacity. Micro-shuttle buses will pick up passengers wherever they are.

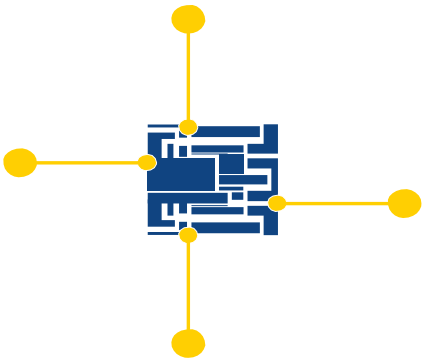
Metropolitan regions will be the innovation labs for tomorrow's mobility

2. Clustered space: metropolitan regions as transport labs

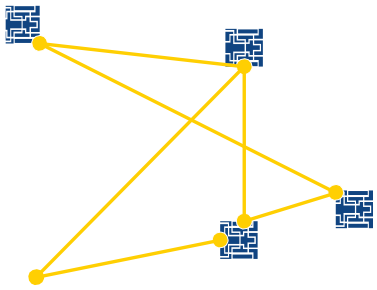
Traffic volumes in urban agglomerations will grow. At the same time, metropolitan regions will become innovation labs for tomorrow's mobility. Thanks to the trend towards micro-mobility, metropolitan transport in 2040 will make do with fewer and fewer cars. Short trips under 50 kilometres will increasingly be covered combining fast cycle tracks and public local transport. Even if bicycles cannot be the only problem solvers, e-bikes will have a massive impact on transport. Standard pedelecs will travel at regular speeds over 40kph – and be safe to use in view of multi-faceted prevention. Fast bicycle tracks will be part of an ever denser network within metro-politan regions. Cities and companies will promote bike & business models. Digital mobility networks will support nearly real-time carpooling, and corporate car sharing models will be standard for work commuters. Online platforms will fashion local and global market places matching mobility options and demand. True to the access philosophy, they will become multi-modal mobility players specialising in the arrangement and invoicing of trips instead of the provision and operation of means of transport.

Clustered space
Metropolitan regions and conurbations with high volumes of regional traffic (e.g. Ruhr area, Rhine-Main region, Rhine-Ruhr region, Greater Hamburg, Greater Munich or Greater Stuttgart)





Linked space
Links between outer conurbation areas and cities forming catchment areas extending far beyond the suburban belt and the immediate urban hinterland (e.g. Hintertaunus – Frankfurt, Havelland – Berlin, Eifel – Cologne)



Lined space
Axes between major cities which despite long distances are used for daily commuting thanks to fast, high-frequency connections (e.g. Frankfurt – Cologne, Berlin – Wolfsburg, Bremen – Hamburg)

3. Linked space: commuting between outer conurbation areas and cities

Commuter mobility between the urban-rural fringe and cities is on an upward trend. The number of work commuters flowing in from the so-called 'exurbs' into the cities is growing in Germany as well. However, the adverse effect of commuting on health in the future will decrease and commuting will be less stressful. It will become easier, have a lower impact on the environment and be easier to plan. Transport will be inter-modal, intelligently connecting means of transport. In 2040, commuters from outer conurbation areas will share e-cars to the nearest train station and cover the last mile to work by rental bike or e-scooter. This will be based on public local transport extending into outer conurbation areas and the rural area. Commuters will also cover larger distances on fast bicycle tracks without congestion or stress. A more flexible work routine and new decentralised forms of working will untangle mobility.

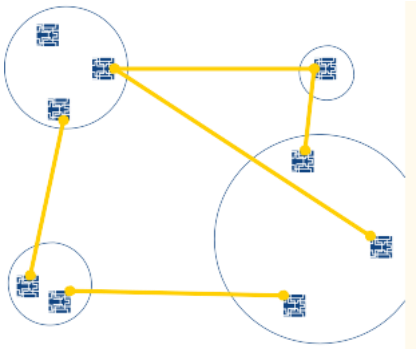
While so far digital mobility solutions have been discussed and promoted almost exclusively in the context of smart cities, future new digitally connected services should extend to outer conurbation areas, the surrounding regions and the countryside. This will also call for fast and simple solutions in terms of platform-based mobility and smart transport infrastructure hubs for uncomplicated use of a varied mobility mix.

4. Lined space: city to city every hour

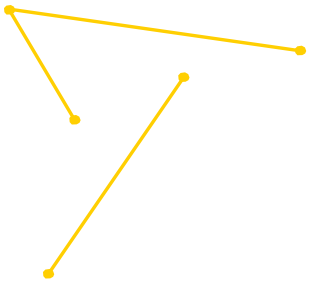
In 2040, Germany will see the dawning of a new era. Autonomous trains and buses running every hour will connect even small towns with 5,000+ inhabitants. Reliable high frequency connections will be the nationwide standard thanks to virtual connectivity and intelligent hyper-local mobility management also covering rural regions.

The primary supply of transport will be based on access and seamless mobility not only in major cities and commercial capitals. Autonomous vans and self-driving cars will cover the 'last mile' and pick up passengers right at their doorsteps. The costs for the pick-up will be linked to the fare for the public means of transport.

In view of the considerable time we spend to cover distances, we have higher requirements relative to transport: means of transport will become 'third places' between work and home where you travel comfortably and without health hazards, where you like to be, you feel good and have the opportunity to make good and productive use of your time. Lined spaces will ultimately stand for the clever combination of mobility and recreation providing a timeout for brain workers.



Interspace
International medium and long distance connections, not limited to metropolitan cities, which are becoming faster thanks to global connectivity (e.g. Munich – Manhattan, Leverkusen – London)



Off-space
Predominantly rural regions where transport infrastructures are rather sparse (e.g. Uckermark, Wendtland, Rhön, Hunsrück, Schwäbische Alb)

5. Interspace: boundless multi-mobility

Individual staff and entire companies must be globally mobile as a matter of necessity in 2040. The world is drawing together closer and closer, requiring us to frequently change location. Mobile job nomads and global jet setters will be the vanguard: people who commute between the world's metropolitan cities, frequently several times a week. The globe is becoming a workplace, the world is becoming home. For the multi-mobile business class, being constantly on the move will not be the exception but rather normal work routine. A maximum degree of flexibility, connectivity and internationality will be a given. Multi-mobility will no longer be a lifestyle feature of the ultra-hip globetrotters and smart high potentials. Rather, it will have become natural and decisive for the success of each of us and a prerequisite for professional work/life management. Means of transport, points of transit, hotels and business events will be part of the mobile office.

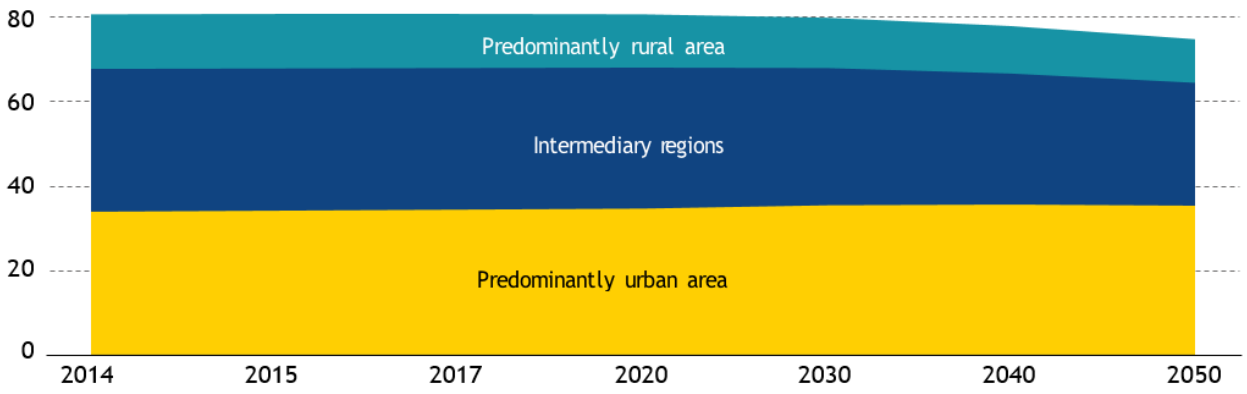
At the same time, the above mobility contexts will imply ever rising security requirements. Interspace refers not only to boundless global multi-mobility between commercial capitals, it includes holiday destinations. 'Holiday travel' will be replaced by 'decelerated mobility'. Faraway places will become the vanishing points of our aspirations, experiences and encounters. Getting there will be part of the experience.

6. Off-space: reorganised rural areas

In tomorrow's world, people will still live in small towns and villages. In view of the urbanisation megatrend cities will be the undisputed lifeworlds of the future. However, according to Eurostat projections, 11.4m people will live in predominantly rural regions in Germany in 2040. By then, the population will have dropped by approximately 1.6m, but this will not mean the depopulation of rural spaces. In fact, the relative proportions will remain nearly unchanged: in 2040, 15% of the total German population will still live in the countryside (2017: 16%). So the rural areas will not be completely marginalized. Quite on the contrary. High and hardly affordable real estate and rental prices in the cities make the outer conurbation and hinterland areas highly attractive. Since more people will live there in the future than is hypothesized in the current public debate, rural areas will be dependent on efficient mobility systems and functioning transport infrastructures as well. Villages could see a revival as places to live and dwell – always subject to good transport connections to cities and urban centres. Travelling longer distances to work will be acceptable to ever greater numbers of commuters. In addition, the countryside's high recreational value is becoming a key factor for a growing number of people. Especially the rising number of city dwellers looking to 'recharge their batteries' and recreational activities in the countryside generates permanently high levels of offsite mobility in the rural areas.

RURAL AREAS: TOMORROW'S PLACE TO LIVE FOR MILLIONS

Population in Germany by location of residence (in millions)



Source: Eurostat, Projection: main scenario

What kind of transport we will use there will depend more than ever on infrastructure. In addition to modern road transport infrastructure, innovative transport planning and control, it will be relevant that we use innovative means of transport, new types of vehicle drives and smart mobility services.

Smart grid, smart car, smart home

Also, the digital connectivity of vehicles will be as important as smart grid integration e.g. of filling stations for tomorrow's decentralised power supply which will be unthinkable without electric mobility. In order to decentralise the networks, energy supply and energy management, we will need to interconnect systems which are different in nature, i.e. mobility with energy supply, telecommunications with intelligent facility management. Until 2040, in the rural areas, in particular, we will need to network different so-far disparate systems: from buildings and households with intelligent devices to energy efficient homes to e-cars or wind farms in the region which will supply tomorrow's fuel – be it in the form of electricity or hydrogen energy storage. The functional extension of automobility – integrating the smart grid, the smart car and the smart home– will have an impact in the off space, above all: by combining electric mobility and digitisation, vehicles will become energy storage facilities in the infrastructure of a sustainable energy system – especially in the countryside where eco-energy farms will generate tomorrow's fuel.

Life in small networks

Rural areas are reorganising themselves. Blockchain communities are establishing themselves as hyper-local networks in rural areas providing access to mobility to the older population, above all, and to groups with diversified mobility needs such as families and teenagers.

Physicians and other service providers will still be touring the villages regularly in 2040, which means that rural areas will not be decoupled but reconnected in structural terms. Decentralised fleets of autonomous vehicles will be available especially in sparsely populated regions, collectively operated as mobility cooperatives. Vehicles will transfer passengers to the nearest individual local public transport point which is a multi-modal transport hub serviced by buses and trains connecting into the surrounding small and medium-sized towns.

IMPLICATIONS

Agenda: actionable areas for a forward-looking mobility policy

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Megatrends such as individualisation, connectivity, urbanisation and new ecology will shape tomorrow's mobility. The key drivers of this transformation include new technologies and people's need for different forms of personal mobility: connected, digital, post-fossil and shared. It will be a gradual but fundamental and profound transformation. We will witness mobility evolve. Law-makers, business and society must now support this development.

1. Digital connectivity

Germany has every opportunity to become a technology leader in a connected and digital mobility world. The digital connectivity of users, services, vehicles and infrastructure will become the key driver. Tomorrow's mobile world will focus on the entire mobility chain rather than on single modes and means of transport. The new mobile world promises better service for users, easy access, more road safety, lower emissions and noise but higher efficiency. Our aim today must be to prepare Germany as a hub for the digitisation of mobility. This is a task for society as a whole.

2. Multi-modality and smart mobility

The boundaries between public and individual transport will blur. User requirements and needs must be at the centre of any long-term transport policy. In the future, connected, inter- and multi-modal mobility will drive the demand. We will need to think of and organise mobility in terms of mobility chains and offer integrated mobility concepts.
In cities and urban regions, cars will lose their dominant position, but they will continue to play an important role in rural areas in combination with new intelligent public local transport. The value we place in cars will change. 'Using not owning' will be the new motto. Smart mobility will replace status mobility. In this context, Germany needs to play a leading role worldwide.

3. Mobility for everybody everywhere

New forms of mobility offer numerous opportunities – not least for the rural areas. Individualised intelligent public transport will make efficient mobility available down to the urban-rural fringes and the countryside. Mobility as a challenge for the entire society implies that nobody should be left behind. Mobility will be affordable for all. In the long term, autonomous driving as a new technology will become the accepted standard determining everyday mobility. If cars drive on auto-pilot, we have more time for other things.

4. Mobile working

Digital connectivity will allow people to work at any place and at any time. Mobile working will be the new standard for an ever growing part of the workforce. Means of transport and transit points such as train stations, airports and hotels will become an integral part of our work and lives. We need to develop and promote the adequate models and technologies. Increasingly decentralised work organisation will result in more work-related commuting.

5. City-to-countryside mobility

We will need new mobility options (car sharing, rent-a-bike schemes, advanced cycle track infrastructure) in outer conurbation areas and in the countryside to cover increasing commuter traffic. This will give rise to a new multitude of mobility options. Pilot projects will help us to gain valuable experience with hybrid mobility solutions interacting with individualised public transport consisting of passenger cars and public transport.

6. Public services in rural areas

Shaping mobility in rural areas will remain a key challenge on the political agenda. The countryside needs guaranteed public mobility options whose quality is assured. Without a primary supply of mobility, rural flight will continue and increase.

7. Travel and tourism

In view of an increasingly flexible and multi-local working environment, we will also have different travel needs. Tourism will become the most creative form of mobility. Our craving for slowed-down and mindful mobility in our spare time is increasing. As a consequence, we see a trend reversal towards more quality and time to enjoy. More than ever will Germany be an attractive destination for a mobile and global hedonistic society. More people from other cultures will join us. This will open up new opportunities for rural areas. Increasing the potential and intelligently developing tourism will also be a political challenge.

8. Safe travelling

Travel will continue to shape our demand for mobility and connect different cultures. At the same time, the world of tourism will become less safe. Actual and subjectively perceived safety will determine future travel and mobility behaviours. Tour operators, mobility services providers and governments will have the primary task to define where and how people will be able to travel safely.

9. Secure data

The exchange of data between road users, vehicles and the infrastructural environment will facilitate the next step of mobility – a self-contained system of real-time transport planning, on-demand availability and smooth transition between means of transport. The prerequisite for society to accept digitally connected mobility is a maximum level of data security. Data protection and data sovereignty will be standard minimum requirements in 2040.

10. Consumer policy and new mobility

In an ever more complex world of mobility, citizens need more transparency to independently evaluate mobility products and providers. For this purpose, they need a neutral, reliable, encompassing digital mobility platform providing user information and digital competence. The new political challenges range from enabling the implementation of platforms on a competitive basis, their supervision, data regulations (access and availability), transparency and the prevention of market abuse.