

Barbara Flügge

Abstract

It is everybody’s right to be mobile. The current status quo is in flux as a greater demand on mobility and transport driven resolutions have emerged through established and new actors on the scene. Insights into mobility provisioning, mobility preservation and safe travel and sustainable offerings will be given throughout this chapter. Today, public and private actors are confronted with decisions about investment and infrastructure efforts that define the maneuverable space for tomorrow. Therefore insights into key parameters and measurements are being introduced, too. Those concern both individual and cargo transport needs. You will also find insights into traffic management systems and technological trends such as the Internet of Things and Industry 4.0.

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Who decides upon future mobility offerings? How do infrastructure measures look like in detail and how do condition frameworks appear?

The challenges that are apparent for any location around the globe are based on the need to maintain a *healthy hub economy* and participation in global trade. The challenge for mobility consumers is the design of a perfect mobility offering based on the consumers' needs and receive an optimal mobility result based on the variables of time, budget and comfort. In today's world the calculation is mostly done by hand and we as consumers need to invest time in it. Those efforts mean extra time and additional costs. Based on our own research the investment in a 1 or 2-day business trip requires up to 1 hour per trip in planning! These opportunity costs could be better used. What do you think?

An increasing world trade volume leads to a higher turnover and more services needs in hubs such as ports, airports and cities. Despite stagnating numbers and an increase in world population it is expected that two to three times more container and tonnage turnover in ports and airports will affect infrastructure over the next 5–10 years. Today's apparent and observable infrastructure burden is, on the one hand, a result of an increased goods turnover. On the other hand, cities, ports and airports have limited space and infrastructure available to cope with the increasing turnover and handling demand. The increase of demand fulfillment goes hand in hand with infrastructure consumption, too. Infrastructure embraces manufacturing sites and machines, ground, soil, energy and water. Moreover, means of transport, packaging, storage, loading and unloading facilities count as infrastructure assets.

The effect on infrastructure burden increases through the rise and expansion of the mega cities. Landwise the world's cities occupy just 3 % of the World's land, but account for 60–80 % of energy consumption and 75 % of carbon emissions. It is an outcome of technical advancements as well that the rise of entire cities does not take more than a decade anymore. The speed of urban development accelerates. Subsequently, the speed of building leads to an enormous consumption of required water supplies, soil, energy and further natural resources. These resources do not have the luxury or the capability to mobilize themselves and speed up in their own nutrition and energy lifecycle. Nature is not able to catch up.

Regardless of the size of an urbanization, its competitiveness depends on efficient, internal, operational procedures and an inter-organizational choreography of infrastructure needs. Concerning the latter aspect, enterprises and authorities seek to connect in an intelligent manner with all participating units on-site and virtually. In the course of our project efforts we were encountering in particular the following two barriers:

1. Missing interaction capabilities among business partners and data source providers leading to manual efforts, process breaks, delays and error prone decisions.

2. The choreography of goods, means of transport and personnel often takes place in a bilateral, hence one-by-one, manner and without knowing about influencing factors such as geo positions, congestion issues, construction areas, weather and available space.

Many questions arise. How is mobility affecting us? How is mobility being affected by global trends and developments? How can we firstly measure the degree of mobility of an urbanization – whether it is a city, a hub or a country? In the following text we are getting deeper and deeper into the topic. First, an overall perspective is presented from the Future Agenda perspective. Next we introduce measurements, discuss those and then present the resulting conclusions, innovations and arising requirements that result from an overall interest in the new kind of mobility. In this chapter we focus on the common criteria, meaning traffic volume of passengers and freight, economic contribution of mobility, infrastructure provisioning, impact of traffic volume and role of traffic management systems.

2.1 Mobility – Change for the Good

Tim Jones

There is a Chinese proverb “if you want to be rich, you must first build roads”. Car-based systems have brought much accessibility, connectivity and convenience but at the cost of introducing noise, pollution, significant land-use needs, urban sprawl, urban decay and, in some high-use areas, increased social isolation. Given the growth of alternative transport options, private cars are also an increasingly inefficient way to travel. So perhaps roads, or more specifically roads for traditional cars, may not make us rich for much longer?

The US Federal Highway Administration says that every 1 billion USD invested in highways supports 27,823 jobs [3]. Globally, many road-building strategies rest on that premise and the CIA Factbook estimates that in 2013 there were over 64 million kilometers of roads in the world [4]. Nations like the USA have become very car-dependent. This is compounded by under-investment in maintenance of other forms of transport. But not all countries are equally committed. According to the World Economic Forum Global Competitive Index, the United Arab Emirates (UAE) and Singapore top the rankings for all transport infrastructure, and in the European Union (EU), the Netherlands is the highest-ranking country and the fourth overall [5].

According to the OED mobility is “the ability to move or be moved freely and easily” [6]. Many would agree with this and see that it applies equally to the movement of people, goods and ideas. As we work to improve how people and things move across the globe, across countries and between and within cities, learning from others and adopting and adapting their successes is key.

Demographic and social change is fundamentally transforming where and how we live. At the same time globalization, digitization and significant shifts in geopolitical power are challenging the traditional movement of goods and services. Everything, it seems, is on the move and governments the world over are trying to adapt. In an increasingly connected

and populated society, many see the future of mobility to be a major focus for the next decade and beyond. There is a pressing requirement for greater capacity to manage the inevitable changes in global trade and the ongoing movement of humanity and, as a result, the basic transport infrastructure, our roads, rails, air and sea routes, must be transformed. This requires investment, co-ordination and a large dose of imagination.

A Prosperous Future? As we look ahead, 5, 10 or even 20 years, there are a number of mega trends that are having an impact on mobility. These include demographic changes such as population growth and urbanization; the proliferation of interconnected systems including smart cities and autonomous cars; and inequality of access including access to mobility both in urban and rural environments.

According to the London School of Economics' Urban Age project [7], in 2015 every hour over 40 people moved from rural areas into the likes of Mumbai, Karachi, Lagos and Dhaka – all one-way traffic. The United Nations (UN) estimates that around a third of the urban population currently live in unplanned areas – townships, slums, ghettos and favelas. What's more, by 2030, just under 9 % of the global population will be living in 41 megacities. This mass movement of people is having a huge impact on the look and feel of our cities and consequently the infrastructure needed to support them.

In a few countries where new cities are being created from scratch, the ability to embed intelligent mobility solutions from the very beginning is an obvious option which many are taking advantage of: from Songdo in Korea and Masdar in Abu Dhabi to multiple examples in China, technology and new design concepts are being used to realize the vision of the Smart City. However, it's not so easy for existing cities, where legacy infrastructure, sometimes over 100 years old, is difficult to upgrade. Roads and train lines cannot easily be re-routed and building new underground networks is extremely expensive, politically challenging and time-consuming. Indeed there are only a few examples of new infrastructure being built.

Sometimes the best examples of good practice come from unexpected places. Take Bogota in Colombia, which is widely praised for its TransMilenio bus rapid transit; one of the largest and fastest in the world, now moving 2.4 million people every day on dedicated lanes with fast access platforms. Far cheaper than installing a subway system, this has become a global reference for many. Medellín, also in Colombia, is where we find the Metrocable, a gondola lift system designed to reach some of the least developed suburban areas of the city. It is the first system in the world dedicated to public transport and, in comparison to alternatives, benefits from cost-effectiveness, low emissions and energy efficiency. This too has sparked imitators.

Some cities are now shifting their attention from keeping cars moving to making it easier to walk, cycle and play on their streets. Central roads are being converted into pedestrian promenades, cycle lanes added and speed limits slashed. As one of the first to close large parts of its center to vehicles during Sundays and bank holidays, Bogota again was ahead of the game and has set in train imitators from Sao Paulo to Paris. More well-known and building on lessons from Copenhagen's Bycykler program initiated in 1995, the Paris Vélib' public bicycle sharing system now has over 23,600 cycles across 1800 stations and has been copied by many other cities around the world including London,

Helsinki, Boston, New York, Montreal and Hangzhou. Elsewhere, we see other notable projects underway including introducing high-speed trains, faster subway networks and even moving pavements and escalators – all are being used to accelerate personal mobility between and within cities.

Future Agenda Views In all of the locations where Future Agenda ran workshops in 2015, from Mendoza, Singapore, Dubai and London to New York, Wellington, Shanghai or Mumbai, there was a widespread agreement around the need to bolster up the global transport infrastructure to provide for more in-built flexibility. Policy makers increasingly want to make bets on longer-term options designed to adapt to changing technologies and infrastructure use and most agreed that the adoption of multi-modal hubs was one way in which this could be achieved – not just in the mega cities, but also around the growth of more satellite cities and networks of midi-cities, particularly in Asia. Many of those in the West were also concerned about the funding challenge acknowledging that governments are increasingly unable to fund the maintenance of existing transport systems, let alone invest in new infrastructure irrespective of location. Who will take on the responsibility for future infrastructure investment was a widely debated issue.

The following considerations are a result of “Change for the Good” insights we gained throughout more than 125 workshops we conducted.

Multi-modal Public Transport The idea of multi-modal public transport is increasingly gaining traction and going forward EU research [8] sees that it “has the potential to contribute to a cleaner, smarter and more sustainable transport, shifting mobility of passenger and goods from road, making optimal use of infrastructure and reducing costs”. Key examples of integrated and “low-friction” experiences include those in European cities like Mendez Alvaro in Madrid, Birmingham New Street Station, the new Wien Hauptbahnhof, Helsinki’s Kamppi bus station as well as Asian examples such as the SMRT Sembawang Bus Interchange in Singapore and the KL Sentral hub in the heart of Kuala Lumpur.

Similarly for goods, multi-modal hubs are gaining attention whether they be integrated facilities, including those run by DHL in Leipzig or the UPS Worldport hub in Louisville, or new logistics hubs such as those being built in India in Gujarat, Punjab, Rajasthan, Uttar Pradesh and Maharashtra [9] and many in China including the Zhengzhou CGO multimodal logistics facility [10].

Beyond this, the benefits to be gained from bringing the same level of efficiency to the last mile as there is to the first 1000 are also attracting much attention and innovation focus. Whether the winners will be Amazon’s proposals around drone delivery or the more pragmatic, locally pooled collection points remains to be seen; certainly many options are now being trialed.

Autonomy The much-hyped concept of autonomous and driverless trucks is starting to have an impact. The vision of long-distance truck platoons all running on intelligent highways without drivers has been a controversial topic over the years but now, as shown by the recent licensing of Daimler’s self-driving trucks in Nevada, its reality is not far away.

There are also a number of simpler developments taking place which further facilitate the movement of goods in cities. In order to reduce congestion from goods deliveries, Stockholm is just one city experimenting with night-time access for trucks while elsewhere in Europe and the USA, the start-up, Starship [11], is using small, robotic, driverless delivery vehicles available to customers [12]. Taking all these together, much is already underway to enable free and easy movement.

What remains to be determined are the all-important issues that sit around the core platforms. Mobile operators are already sharing data, but key questions yet to be addressed include who owns the shared data required to make the whole system work, and how is it accessed? This is matter of trust, value and liability and, depending on where you are in the world, the balance between government, technology companies and vehicle manufacturers will shift significantly. By 2025, we will certainly see more assisted driving and autonomy on highways for both cars and trucks, where everyone is going in the same direction with controlled entry and exit, and maybe there will be full autonomy in cities for goods delivery pods. At the moment, though, it looks like full autonomy in cities for passenger vehicles is a few years away.

Integration Looking beyond city-based logistics, global mobility is being shaped by evolving geopolitical change. Since the onset of the global financial crisis many would argue that emerging markets are now the main drivers of growth providing a willing workforce and a growing middle class with money to spend. In 1987 these countries made up just 16 % of global GDP, but today they account for 31 %. The opportunity this presents for the movement of goods is enormous, not only due to new and growing domestic markets, but also because many emerging economies, in Africa and South America for example, are richly blessed with the raw materials needed for growth and development; these need to be transported around the world, in particular to China and India.

As a result of this, the next decade will see the post-war trade routes gradually being eclipsed by the power of the Indian Ocean region where new port construction and proposed railways stretching from China to Turkey are the shape of things to come. Adding in major activities in South America such as new coast to coast railways, China's influence is growing: it owns five of the world's top 10 biggest container ports and is making huge investments in other developing markets, rich in natural resources. Boasting about a quarter of the world's container trade and as the largest foreign investor in Brazil, Laos, Myanmar, Iran, Mongolia and Afghanistan, its commercial power is indisputable. How it will integrate alongside other new and important markets into the global trading system remains to be seen.

Investment With regard to funding, many people agreed that the development of the Public-Private Partnerships approach is one which is particularly suited for twenty-first century needs. The theory is that private involvement will improve the quality of projects. A politically expedient but financially dubious initiative is unlikely to generate enough money to interest private investors. Unnecessary enhancements, short cuts or careless construction are also less likely to be tolerated. However, bitter experience shows that cost-benefit

estimates can sometimes prove wildly optimistic, as shown by the still only half-completed Sea Bridge in Mumbai. When projects over-run or run out of budget, leaving half-built roads or bridges that go nowhere, they become a public problem. Another negative is that big, iconic, infrastructure projects in some cities also take money away from local improvements. Also private investment might well end up being recouped in higher user fees, road tariffs and the like.

Prosperous cities are most likely to be able to generate big contributions from the private sector and thus often enjoy better infrastructure investment. For the city of Chicago alone the American Society of Civil Engineers reckons that underinvestment will end up costing each family in the USA about 10,600 USD between 2010 and 2020 and lack of funding for Washington DC's comparatively young subway system has meant that more people are turning to street cars (or taxis) to get to and from work, which causes unnecessary congestion in the already crowded streets of the capital. Despite this, continued austerity drives in Europe and the USA, mean that public-sector investment is projected to fall; in the UK from 3.2 % of GDP in 2010 to just 1.4 % in 2020. On the bright side, lack of funds can often stimulate imaginative measures to make effective use of the money available and sometimes the little things really can make the difference: traffic lights, the repair of pot holes or removing the connecting doors between railway carriages.

A major step forward is the US Department of Transport's Smart City Challenge [13], a focused accelerator model for improving urban mobility. After an open competition between cities across the USA, Columbus Ohio is receiving over 140 million USD of focused funding and will work with multiple private and public partners to reshape its transportation system to become part of a fully integrated city harnessing the power and potential of data, technology and creativity to re-imagine how people and goods move about.

Combating Inequality Inequality of access to healthcare, education and the growing digital divide between communities was a common issue across many of the Future Agenda discussions. The lack of decent transport links has huge consequences. Examples abound: in Nigeria, for example, where only around 20 % of the country's roads are paved, the tomato-growing farms and factories which make tomato paste have pretty much stopped producing because, without roads to move it and a network of refrigerated warehouses to store it, about half the crop is lost on the way to market. As a result, a country that should be exporting this product on a large scale currently imports about half of what it needs and high transport costs mean that food is expensive. Moreover, with big cities such as the capital, Lagos, bursting at the seams, workers have to travel for hours to get to work, wasting time and money.

Transport poverty, isn't just a developing world issue – the charity Sustrans says that it's a daily reality for millions of people across the UK as well [14]. The less well-off typically suffer most from a lack of mobility options and are often exposed to greater pollution and unsafe conditions [15]. To counteract this, avoiding the spatial marginalization of areas inhabited by low-income populations, improving (heavily relied upon) informal transport options, facilitating bicycle ownership for poor and low-income groups and providing

an adequate infrastructure for pedestrians (safe walkways, seating, toilet facilities, etc.) [16] are all vital. Fortunately, there are, however, many good examples to learn from. For instance, Hammarby Sjöstad is an eco-friendly urban development in Stockholm, and its sustainable transport mix features a tramline, bicycle and pedestrian networks, car-pooling and a ferry. Infrastructure here was planned as “closed loop” systems for water, waste and energy – all feeding each other [17].

Access Some argue that there is a need to focus less on providing transport and more on providing access. In its Future Demand Scenarios, looking forward to 2042, the New Zealand Ministry of Transport states: “We should recognize we are trying to improve access not just mobility. There are three different ways we can achieve this: with good transport systems; with good spatial planning; or by improving digital access” [18]. Others referred to the introduction of more balanced triple-access solutions for transport where physical proximity and digital connectivity allocated an equal role to mobility options. An important feature for some is the opportunity to use dynamic pricing to help balance supply and demand.

Already seen in many road systems as well as on Japanese and German trains, the principle of more sophisticated approaches to charging variably, beyond just peak and off-peak, is being investigated in a growing number of wider mobility solutions. Uber’s surge pricing is often highlighted as a potential way forward but others see the need for a more subtle approach. Especially when linked to more open data sharing on vehicle occupancy, emissions and purpose of journey, the ability to price mobility differently for different system users is turning towards more dynamic platforms.

As we enter the more integrated, multi-modal digital mobility era, much emphasis has been placed on the opportunity presented by personal mobility accounts; essentially a virtual wallet and information resource for all transport options. Many saw that this would be recognized and accepted by everyone in the transport eco-system. Most likely integrated into smart phones, and later potentially embedded into wearables, not only will these provide access to the full range of public transport options but also to all the add-ons such as car-pooling, car-sharing and on-demand services currently growing globally. Linked to multiple marketplaces they will allow us to make more informed mobility decisions, choosing options based not just on cost and speed but also on health, space and social criteria.

If mobility is indeed “the ability to move or be moved freely and easily” then there are clearly many ideas of how to better achieve this in the mix. No two cities are the same; each has its unique characteristics, so there is no global blueprint for the best place for us all to live.

2.2 How to Measure and Compare Mobility

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Getting into the driver seat, as urged in the introduction, requires an insight into mobility related criteria and the related issuing parties. A large number of measurements are being published: being federal and national statistical offices, federal and national road transport

authorities, or federal and national offices of economic and export control. Those bodies define, publish and keep mobility measurements up to date. In the following we selected a handful of references and parameters that are useful for national and regional, but also international comparisons and activities.

The German report called “Verkehr auf einen Blick” (Engl. Transport in Brief) outlines the key movement with respect to mobility development efforts in Germany [19, 20]. The Swiss report “Mobility and Transport Microcensus 2010” provides, in the multi-language report, insights into mobility consumption and a survey conducted among Swiss citizens about mobility and service requirements [21]. The Austrian institute called AustriaTech is acting as advisory body to the Austrian Ministry of Transport in research, deployable solutions and future trends in mobility [22].

Concerning freight and goods related measurements we encounter logistics associations and representatives of the transport industry. Furthermore, a comprehensive set of material, projects and assessment are being issued by European and internationally acting committees and foundations such as the International Transport Forum (ITF), the Intelligent Transport Systems (ITS) initiative, and CLECAT, the European Association for Forwarding, Transport, Logistics and Customs Services as well as the Smart Freight Leadership Forum. Automobile associations such as FIA (Federation Internationale de l’Automobile) [23] and UITP, the International Union of Public Transport [24], facilitate and drive the discussion about intelligent mobility.

Overall measurements are applied by the means of transport that have been chosen. In some studies we now encounter more measurements about cycling, the expansion of bike lanes and the usage of e-bikes. The trend of car-sharing continues to grow – once launched by ZipCar [25] and globally forced into the market through disruptive and in some geographies aggressive enforcement as conducted by Uber.

Throughout this book we will illustrate mobility measurements using text and graphics. A pure arrangement of data will not serve the purpose from our point of view and distract from the real message we want to communicate.

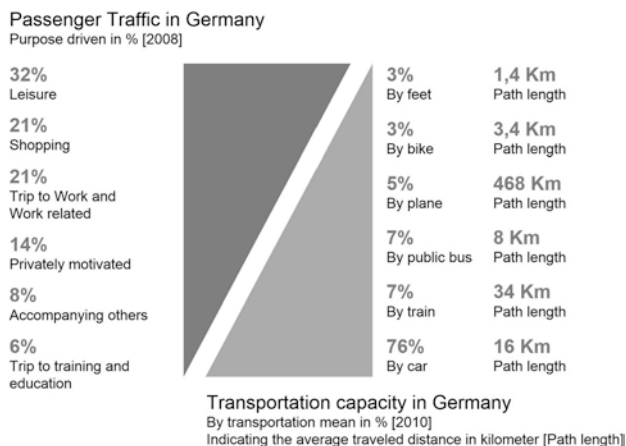
The figures and insights we present are based on publicly available material. Where applicable and sound we will provide insights into distinct countries. There will surely be a point in time that figures and data will be outdated or that are missing from an individual reader’s point of view. To our utmost effort, updates will be handled in subsequent editions. Thanks for your understanding.

2.3 Traffic Volume in Passenger Traffic

Barbara Flügge

Traffic volume to date is being looked at from a passenger and goods / freight perspective. Volume in passenger traffic is distinguished by chosen means of transport and travel purpose, i.e. purpose of the journey. Examples of travel purposes are trips for leisure, shopping or to work. Another term that is in use is transport “motif”. The following assessments for Germany exemplify the approach [19].

Fig. 2.1 Passenger traffic and capacity overview



From 2004 to 2008, on average each year 100 billion passengers chose transport services. The motives and the chosen means of transport are depicted in Fig. 2.1.

The referenced study does not reveal any detailing about *means of public transport* such as bus, taxi or car-sharing. Neither are distinctions made between publicly operated bus services or privately offered bus operators that emerge, for example, on municipality-to-municipality routes. An example is Flixbus [26] or the Postal Bus [27]. The latter operated until recently independently and has now been acquired by Flixbus. Compared to the German statistics detailing, the Swiss Federal Motor Transport Authority (ASTRA) [28] issues that level of detail for Switzerland.

Another means of transport that has being neglected in the referenced studies is the vessel. Same accounts for the relevance of vessel triggered mobility needs. A glance into the cruise business tells another story, a story of relevance. More than 50 % of cruise passengers reach the location of departure, the cruise terminal, by public transport (for example by train) – mostly in conjunction with further services such as city tours or an optimal use of the available transit time. It is highly recommended that you assess *cause-and-effect cycles* to depict the end-to-end mobility needs. It is also recommended to start engaging all relevant stakeholders in one mobility management effort. Only then decisions are made coherently. In the tourism segment, next to cruise travel, travel-by-bike is one of the largest-growing travel segments. And this effect is not only driven by the demands of the 50+ generation!

Another issue with the available level of detail concerning statistics is the following. With regard to car usage, knowledge about the volume of purchased and leased cars is mapped onto the measures of new vehicle registrations. Deriving decision criteria from those figures to distil further mobility management matters is not possible either with the currently available material.

An analysis by distance covered would reveal further insights. It is worth to compare the distance covered by a consumer in a familiar, known area with the distance he covers in an unknown area. This would disclose a different view on mobility consumption and required options of means of transportation. Known areas are those such as the working location, the training facility or the most visited city. In those comparisons of travels to known and

unknown territories, influencers make us change our focus on which mobility options to consider at all. Influencers are for example the acceptable radius of movement and the traveler's perceived comfort and safety level are made apparent. Furthermore, the assessment of a distance that is being covered in a public transport service portfolio signals the willingness of a mobility management office to invest in mobility. It can be generally said that short distances that are being covered by means of transport focus rather on city center or special interest areas. Medium distance that are being offered by public transport take into account the commuting needs and the regional spread of living, training and working locations and the urge to facilitate the commuters' efforts. Long distance offerings are mostly targeted to commuter communities as well as increasing the reach of service and education facilities for families and children.

When choosing a means of transport or deliberately walking, a traveler's fascination to explore the site could be another influencing factor. Another reason could be simply the available budget. The tourism sector introduced to the market some years ago new transport pass and exploring-the-neighborhood offers. Often those offerings are tradable via City Apps and navigation solutions to make exploring-by-feet consumable.

Coming back to the aspect of comfort that is being offered by means of transport we tend to opt for a taxi in an unknown area rather than taking a public bus or walking. The presence and guidance of a person that is familiar with the location is perceived as being safer, even for smaller distances. The perception of safety is not the only aspect that concerns travelers, also the targeted district and community. The Safe Cities Index issued by The Economist claims Mobility Security as one of the four criteria of a safe city [65].

2.4 Buying and Consumer Behavior of Individual Travelers

Barbara Flügge

The following figures and comparisons serve as a snapshot of a vast variety of statistical information at the municipal, regional and federal level. Any parameter could serve to compare one geography with another. However parameters need to be looked at from a contextual viewpoint and should not only take demographic, political and cultural habits into account. They should also look at external factors such as climate change, innovation movements and role shifts between governmental and private transport providers.

The average spend of households for mobility in Germany accounts for €346 per month [20, p. 5]. Minus vehicle tax and car related insurance the amount of €305 per month is the same amount that is for example being spent on average for food, beverages and tobacco [20, p. 26]. Car and fuel are the two dominant cost parameters according to Fig. 2.2. Thirty-five euros are spend on public transport. Car ownership therefore is the most investment related element in private mobility budgets. In contrast, the ownership of a bike is calculated at €6 per month and results in the most cost effective means of transport.

The utilization of cars in cities is typically expressed by the number of cars per 1000 of the population. In Europe, for example, Germany ranks in ninth place with 517 cars per

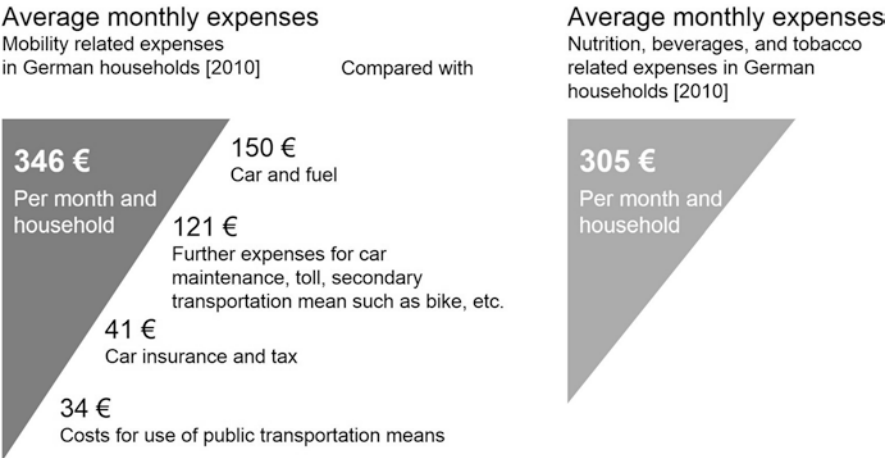
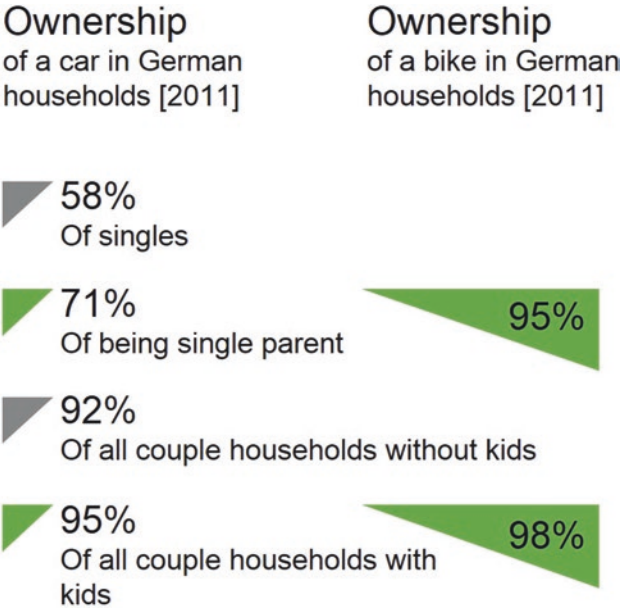


Fig. 2.4 Share of bike and car ownership in German households



Furthermore, external matters such as weather conditions, delays, congestions, cancelled bus or train services steer the last-minute, ad-hoc decision on which means of transport to choose. We refer to that phenomenon as a *situational mobility decision*. Predicting which means of transport is being chosen and which one not is then subject to the intelligent use of analytical tools and geo-referenced allocations. One of the key prerequisite is the consumers’ willingness and openness to share a minimum set of their habits to do with their mobility processes.

How ready are we as mobility consumers to trade mobility in a digital sense? What does it take to open up our sharing habits and preferences? Looking into the percentage of on-line and digital consumer demand and demand fulfilment the numbers are still growing. As reported for 2014, 491 million of the 817 million people that live in Europe use the internet and 274 million of them are electronic shoppers [29]. A further effect that manifests digital competence and therefore expectations built among consumers is grounded in the enormous boost of product variances. Consumers’ demand for more and more personalized products and services is made possible through technical advancements. Demand is being fulfilled in a much greater variety than we imagined a couple of years ago – for example, a high-value car assembled to meet our needs, the design of a pair of sneakers we want for a special sports event, our favorite burger composition or the coffee compilation we pick up before heading into the office. Personalized and preference driven offers give the physical touch back to online shoppers, allowing them to feel acquainted with the experience that they usually encounter when entering a shop. Information Technology (IT) even more brings back a 360° experience: being it the augmented interior car experience or the encountering of accessories that could pimp up a product, a delivery or provide further extra value to the consumer.

The evolvement of digital shopping behavior is not far away from considering arguments that the habits of travelers change. Change of habits come into play when deciding upon driving a car, sharing a car or taking advantage of a bus ride that offers a 10-minute podcast that is exactly meeting our interest and moreover fits exactly with the length of the ride. Being digitally trained to get any variance more or less on-line and in an electronic fashion, the ultimate mobility experience should meet our expectations, too. In the latter example the podcast accessorizes the mobility offer and aims to convert a product use (the car) into a service consumption (the bundle of bus, podcast and simplified consumption)!

Arguments about owning a car being the highest degree of accessibility and an expression of individual freedom and luxury do not add up anymore with car-sharing initiatives such as ZipCar [25], Uber [30] or the founders of the *Mobility-as-a-Service* (short *MaaS*) alliance. Founded in 2015, the MaaS alliance aims for a paradigm shift from owning to consuming, hence from owner to consumer.

To gather insights at first hand we conducted an interview with Hans Arby, CEO UbiGo Sweden, as one of the key promoter of MaaS. The interview can be found in [Chap. 17](#), as well as a reflection upon the *sharing economy*.

2.5 Travel Business as a Key Contributor to Economic Growth

Barbara Flügge

The economic power of the travel sector has grown further over the past decades. Adjacent and post-travel related industries as well as cargo and individual transport rely on the economies of scale of the travel sector. Adjacent industries embrace hospitality and tourism services in a wider sense. Post-travel related businesses target location-based services. On a global scale a revenue of \$7.17 billion was generated in 2015 in the travel and tourism segments as well as connected segments [31]. The underlying travel expenses relate to both, private and leisure motivated trips as well as business trips for individual travelers.

Some \$2.23 billion, or 31 %, has directly benefitted market participants in the travel and tourism segments [31]. Expenses relate to incoming revenue from airlines, hotels, and the railway sectors. However the indirect segments are the ones that make a profit from the main body of the revenue, some 69 %. Let us elaborate on a number of examples of indirect segments that benefit from the travel industry: capital expenditure in the field of hotel and resort building, airline operations and marketing efforts, administering travel and tourism relevant processes and regulations by government institutions, implementing and operating public and personal safety, and many others, as for example cleaning and healthcare services. Moreover further revenue streams relate to the purchase of consumer products, food and catering, vehicle related resources such as fuel and oil, and cleaning while travelling.

In the broader sense and in addition to private transport, cargo transport is contributing to the economic development of the travel sector, too. Its contribution results from food and luggage logistics as well as infrastructure provisioning and asset operations with respect to

means of transport and stowage such as containers and boxes. Indirectly, information and IT service processors contribute to economic development of the travel sector, too.

With respect to the value chain, Germany's economic contribution measured by its Gross Domestic Product (GDP) ranked third in 2014 after China and the USA [32]. One of the key measurement criteria is the number of jobs that have been created through the travel and tourism sectors. Germany's travel and tourism sectors, according to the World Travel and Tourism Council (WTTC), will have a share of 12.7 % of jobs generated in the year 2025 [32].

Relying on Mobility In the same way as for those that travel for leisure or business, mobility is a key asset for all those that work in the tourism sector, whether the trip to work, the outward journey to reach the cruise ship, or the self-booked sightseeing trip while in transit at the airport waiting for the connecting flight. Seamlessly functioning mobility is especially demanded by any travelers with multiple destinations and transit segments compared to travelers without a transit segment. Transit travelers are, for example, cruise passengers that travel via train or airplane, via taxi or bus, to the final point of departure, the cruise terminal. For transit travelers it is not possible or easily manageable to arrive late risking to miss the vessel. Nor do cruise passengers expect to deal with the administrative and logistics burden nor with finding alternative routings themselves.

The prospect of travelling smoothly is, however, not in the hands of vessel operators and airlines. In reality it concerns the operators of a functioning public and regional infrastructure network onsite that mediates short-distance and on-time transit requests in an intermodal manner.

In the field of business travel, the demand is equally as high as in the transit business. The more seamless and unexciting the itinerary planning and booking process and the actual travel, the more relaxed and focused our appointments, meetings, and conference contributions will be. The same accounts for meeting the very own or employers' budget guidelines in the case of choosing a different means of transport or seeking alternatives that include additional overnight stays. Export oriented countries not only have a high share of sales and consulting personnel, but installation and maintenance staff travelling abroad. It is expected that profitability rises by enabling a frictionless dispatching of staff, machine, tools, and information. It is no wonder that the export power of a country is not just being statistically captured in mobility related statistics [33], the associated travel needs of staff are taken into account, too.

Market Forces in the Travel and Tourism Segments There are traditional travel agencies, *online travel agents (OTAs)*, and meta layers that combine travel offerings or that act as aggregator for search sites. The last are mainly the type of companies that have intimate knowledge of the customers' needs and wants. By gaining insights into past customer behavior and projected future behavior and decisions, OTAs introduced the technical means to incorporate previous user numbers, click analysis, and comments that have been issued or tweeted in social media. Over the years nearly all related information and data pools have been brought together and issued to the customers through one single platform.

So-called Global Distribution Systems (GDS) as part of OTAs started in the 1970s rather humbly as former subsidiaries of the major airlines. Over the years, GDS spun off as independent companies and have spawned a large industry as a whole in the travel distribution sphere. Sabre [34] of American Airlines started in 1984, Travelport [35], brought to market by United Airlines in 1972, and the European organization Amadeus [36] was initiated by Air France, Lufthansa, and SAS in 1987.

The original mission was to systemize seat reservations, developing and operating an entire travel reservation system on behalf of the issuing airlines. Since then all named GDS have grown and have become independent publicly traded companies that obtain a major market share in the industry and dominate the market.

Over recent years know-how has been expanded and expertise built not only in the airlines industry but also in the mobility industry overall. More related sub-verticals, including cruise lines, railways, and the hospitality industry, were added. Furthermore, GDS trade travel data and customer profiles, and operate customer managements systems.

Further market forces proliferated over time, the so-called content companies. Some content companies interact with highly relevant advice on travel needs from the end user's perspective. Others are recognized in the travel sales distribution and mediation process. Yet others offer value-add services along the value chain.

Expedia Inc. [37] and TripAdvisor [38] are two well recognized representatives of content companies. Expedia focuses on online travel distribution and comparability. TripAdvisor, on the other hand, handles user-generated content that we as travelers and interested travelers are prepared to share and make use of: whether in the form of feedbacks to an offering, or shared experiences about hotel stays with respect to quality, or the service performance rating of an agent-issued itinerary. The presence of content providers is undoubtedly apparent in the daily travel planning process.

Further market forces disrupted the market through the rise of the so-called *Sharing Economy*. Back in 2010, mobility and travel providers encountered disruptive offerings from Airbnb [39] for overnight stays, Uber [30] as taxi replacements, or BlaBlaCar [40] with its focus on long-distance travel in private cars.

Those *app economy* representatives (i.e. *app economists*) conquered the market more than anyone else. Their prowess in analytical models and mathematical methods prove their capability to match demand and supply (i.e. *matchmaking*). The *matchmaking* functioning lifts things to new heights and introduces in essence a platform offering where suppliers, hence asset owners, can seek renters much more directly and without intermediaries. The direct encountering moreover resulted in a community built up of like-minded people that can adapt easily in a participation-like manner.

The impact of app economists on other market forces and the increasingly controversially discussed exchange about legality, intervention in the market, and displacement of long-serving providers would have been out of Rogers' imagination when elaborating on adoption theory and diffusion of innovation [41]! Moreover it should be noted that the sharing economy per se should force a balance between shared, sharing, and shareholders' interests beyond the interest of one dominant shareholder. Otherwise app economists transform into oligopolies.

Traditional and disruptive offerings as well as much closer, direct, and chained digital processing between providers and consumers will no longer pause in front of infrastructure providers. Consumers seek access to the entire portfolio of products and services, regardless of who is operating or owning an infrastructure and regardless of the point of a demand's origin and fulfillment. An example illustrates the expectation of seamless and end-to-end service fulfillment, so-called *servitization*: consumers do not care anymore who is operating a train or a railway track or who manages the commuting service that is being chosen alongside the train service. Even once the services are fulfilled in the promised and expected manner, the consumer expects properly managed aftersales service from one single entity, in an ideal world.

The variety of combining bilateral and multi-lateral goods and service provisioning goes hand in hand with an increasingly customized usage period of these goods and service. Usage driven payment and invoicing more than ever are part of the *Unique Selling Proposition* (USP) of a modern, hence usage oriented, value chain. Usage-based management moves into the spotlight of private, public, and commercial service providers to gain a share in the form of revenue share, loyalty points, credits, or other forms of remuneration.

Decision makers and mobility designers will encounter an increasing demand from consumers and paired with a growing variety of distinct sources of offerings, service providers, and bundling opportunities to establish a transparent, coherent, and deployable *End-to-End (E2E) mobility* process. Bundling opportunities are manifold and one can think of front row parking, car cleaning and maintenance, luggage logistics services up to VIP services including office facilitation and onsite assistance.

The same applies to the efforts in jurisdictions. In Europe, for example, there has been a gradual change of ownership structure of the railway companies. The Fourth Railway Package [42] in particular, which is the European Commission's proposal for the community members, advocates changes in three major areas: (1) promoting interoperability related to signaling, (2) separation of railway operators from infrastructure managers, and (3) liberalization and opening up of the rail operator market. The last two changes relate to the E2E mobility vision that is postulated in this book.

Those two areas postulate a structural shift in the governance nature of railways in Europe. They will have a profound effect on how the providers of the service, hence the carriers, will collaborate with each other and hopefully, under acceptable Public Sector Agreements (PSA) and in alignment with their respective jurisdictions. An analogy was introduced in the airline industry, the so-called *Open Skies* agreement [43]. The Open Skies agreement is a progressive arrangement amongst nations to liberalize their respective air space to a free market, thus allowing airlines from other states to fly not only direct from each other's countries but also if there is a multi-lateral arrangement in place. One airline can be domiciled in one country, but has routes in two other countries. A simple example would be an airline company which is based in the Middle East and has direct routes between a US and European city. Such a flight could happen if there is an agreement in place, the Open Skies agreement.

The above introduced examples of transforming markets and the growing kaleidoscope of participating entities illustrates the interweaving of "who profits from whom". Blurring

boundaries will not stop short of the travel and tourism sectors, which will seek new pathways and routes. In fact the share of IT originated companies and community designers is constantly occupying the space of the traditional players.

2.6 Freight Transport Stimulating Economic Growth

Barbara Flügge

The situation in the freight transport segment looks as follows. Trade volume is being measured to date in tonnage, route length, and allocation to individual means of transport. Compared to passenger traffic, cargo has a significant impact on the economic strength of a region or country. In 2010, for example, 87,500 enterprises operated in the transport business in Germany [20, p. 34]. Herein, a significant share of 60,100 enterprises operated in business processing for cargo and passenger traffic.

The cargo transport business and transport services are two pillars in constructing and deploying a continuous and increasingly national, but also export oriented economy. Germany is playing a key role in the pan-European trade flow and the trade services economy. The figures from 2010 look as follows [20, p. 48]:

- German roads are used for European wide transport with a share of 27 % of the overall European road transport network. With respect to railway transport, German railway tracks transport 28 % of the European wide railway cargo. German waterways take part in 42 % of the total European waterway related cargo transport. Also, the geographical positioning of German rivers and hubs with regard to the European layout has an effect.
- The value chain in the operations management area shows quite a different set-up: 16 % of German warehouse and transport services and 18 % of jobs that are allocated in Germany are sourced to manage European wide cargo flows.
- Tax privileges and re-allocation of transport and traffic related service providers from Germany to other countries fostered over the years and decades an exodus. The transport industry overall and the vacancies for truck drivers, cargo maintenance, and security personnel are a result of the struggle to find young talent and attract experienced personnel from other sectors. These challenges intensify the impetus to seek outside the country and hire on-demand personnel. Another effect relates to the fostering of technical advancements such as autonomous trucks and to operate a higher share of cargo volume via railway tracks and waterways.

A comparison of cargo related means of transport with respect to managed trade and volume is shown in Fig. 2.5.

Asian ports in the top 15 ports worldwide dominate the leaderboard in seaborne traffic. Hamburg, for example, is keeping its position next to Rotterdam and Antwerp as one of

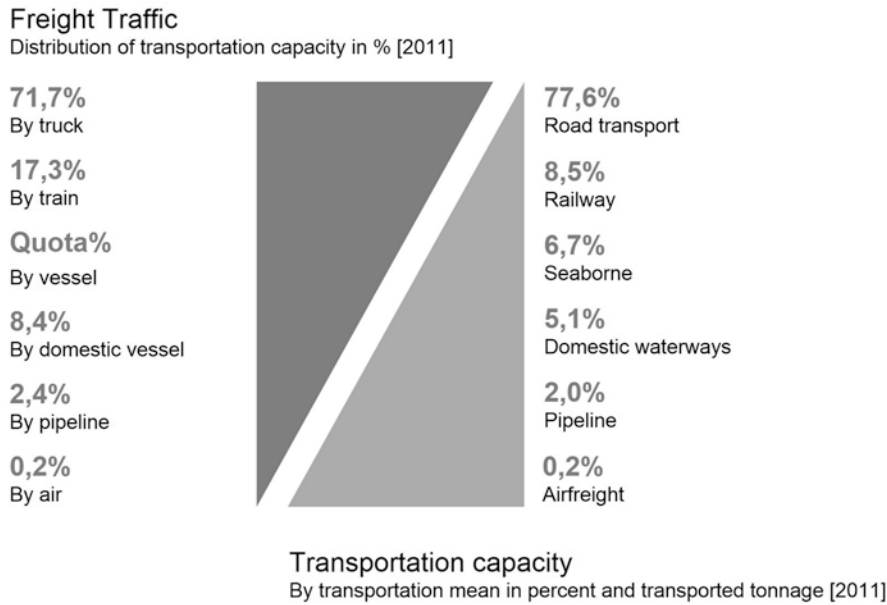


Fig. 2.5 Comparing distribution of transport capacity by means of transport and tonnage

the three European ports among those 15 [44, p. 4]. Positions however can change rapidly depending on managing not only container throughput but also leveraging a port's structural assets and capabilities. The latter aspect addresses the capabilities to operate a port's business efficiently and effectively concerning goods, containers and related equipment and tools, distinct and enlarging vessel sizes, industrial or goods related special requirements with respect to technology, on-site equipment and available on-site experts. Moreover, does a port's business steer the local and regional economy and influence it for the good or bad? The port operations business in Hamburg generates more than 150,000 jobs. An ecosystem wide analysis that we conducted revealed not only a direct effect with respect to job generation, but also indirect effects. Direct effects are, for example, traffic and transport related. Up to two million jobs in German apply to those two areas [20, p. 34]. Indirect effects emerge that are analogous to the individual travel and tourism sectors, with further mobility needs of personnel, equipment, and tools.

A successful port, as outlined above, and an integrated hub economy strengthen economic power overall and therefore the ranking of the location on a global scale and in the region. Figure 2.6 demonstrates the impact of efficient and effective operations for port operators and adjacent business segments. The outlined figures concerning export volume were diminished in the subsequent year (2012) caused by the Asian region. In 2013, Hamburg won back a trade volume of 9.3 million TEU compared to 2011 [45, p. 23].

To safeguard an active and profitable position in the international supply chain business mid- and long-term that requires predictable and timely acting. Hamburg Port, for example, initiated in collaboration with the authors of this book two of the six strategic

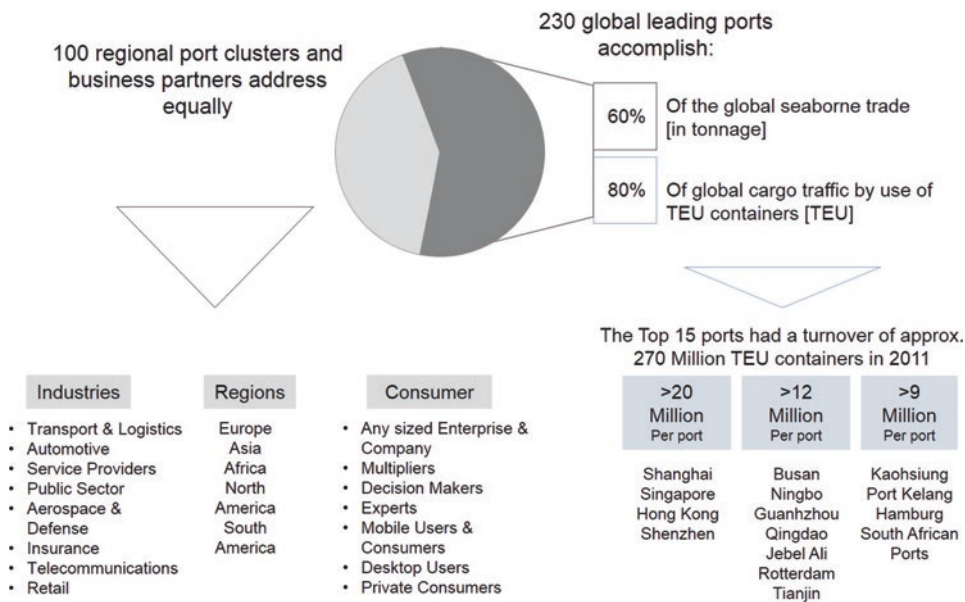


Fig. 2.6 Comparing cargo trade on a global scale

pillars of their smartPORT initiative [46]. Two key success factors facilitated the successful deployment of the first phases. Firstly, the decision to establish the projects as co-innovation projects and sticking to a collaborative and joint effort. Secondly, the project conduct in an inter-organizational, community driven manner with technology partners, economic entities, other government departments, institutes and mobility consumers, and facilitators such as dispatchers and truck drivers.

Projects in other locations underline the need to incorporate distinct interests and act in a highly integrative and collaborative manner – up to the point you forget about your own organizational assignment and put yourself in the shoes of your government or any other project partner and mobility consumer. Joining forces is the glue that fosters global competitiveness for all participating parties.

2.7 Mobility as a Guarantor for Successful Supply Chain Management

Barbara Flügge

Compared to passenger transport, individual actors in the cargo business optimize their intra-organizational business activities. Taking a look into the hinterland logistics, city logistics and near shore logistics look for actors who are watching out for cost-effective and simple-to-use business processing. International supply chains do not sustain without

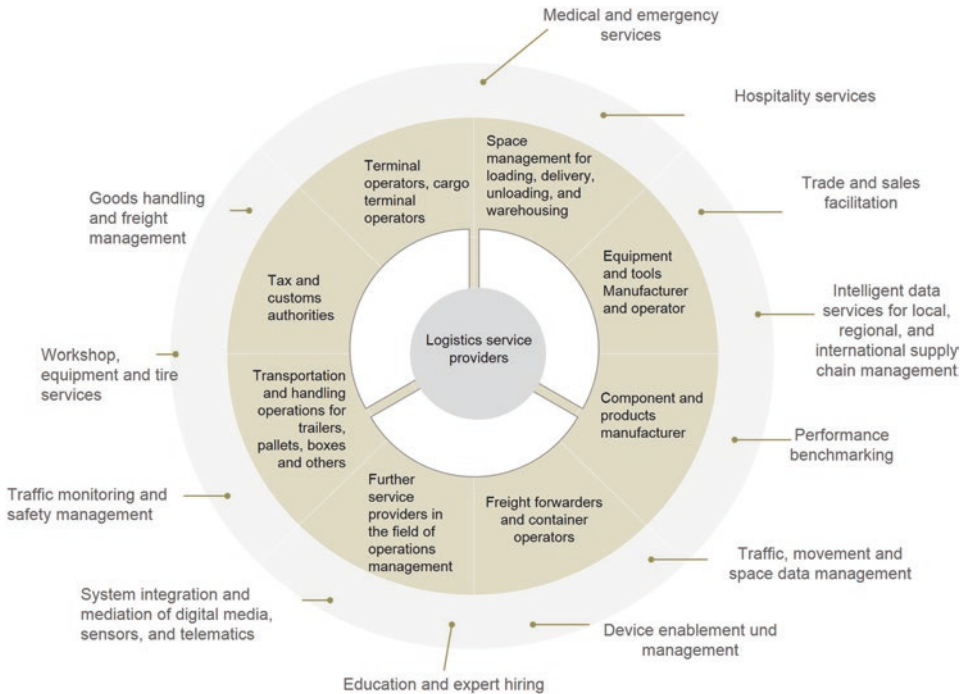


Fig. 2.7 Insights into the service world of logistics service providers

telematics applications and features, mobile dispatching, communications, and ticketing systems, or a digital transport management system. The connectedness among actors is not always an easy task to fulfill – not even in the digital age. However, connectedness is an essential criterion in a highly competitive market. An overview of logistics related services, hence a snapshot of the *service world*, is shown in Fig. 2.7. You might think of one service being performed by one business actor. Another actor is then adding value to that primary service and starts promoting it in a bundle of services back to the originator! Getting to know who is out there and looking for the unknown business partners are one of the fundamental skills that companies need to look into now and the near future. And it is all about connectedness!

Positively speaking, a successful and therefore sustaining economy will be able to secure its local position and be facing international competition. The international trade business generates export-based revenues for individual companies in those locations that manage to take part in global trade chains. Maintaining its position locally needs a hub-driven management of economic growth, employment programs, competence building, training as well as innovation and creativity facilities.

Germany was leading the *Logistics Performance Index (LPI)* in 2014. It outperformed as number one followed by the Netherlands, Belgium, the UK, and Singapore [47, p. VIII]. The set of criteria that result in the LPI is the following:

- Customs operations
- Existing infrastructure
- Percentage of international shipments
- Logistics competence
- Timeliness of delivery
- Supply chain monitoring, cargo tracking and tracing.

Cargo and the successful management of a global supply chain ensure those actors that are, for example, responsible for a smooth handover of the cargo to the next actor. Another example are actors that manage the handover of paper and information to the relevant government institutions or those that secure freight or perform diligence in dealing with the assigned goods and material.

Especially in heavy goods transport, a wake-up call and therefore a focus on digitizing services are urgently needed! Based on an internal assessment, truck drivers have to deal with and browse through 20 or 30 pages of instructions to identify bridges to be used and intersections or crossings to be avoided with hazardous goods. The manual effort does not even stop with manual information. It continues with little insights about who to contact at the municipal level. Very often it is the driver's decision and therefore his risk (legally or for security reasons) to choose a certain route or not. Drivers will act outside the judicial areas very soon.

We as decision makers, innovation leaders, and forward thinkers lose sight of those challenges when passing by drivers who are encountering issues or discussions with delivery personnel and technicians. The LPI index does not include a criterion concerning competency development. We should amend the LPI and include competence building for both mobile personnel and the mobility front and mobility back offices! It is worth take that into account when managing smart mobility properly – as discussed later in [Chap. 12](#).

Mobility consumers next to truck drivers are furthermore experts such as sales personnel, consultants, decision makers, security personnel, field staff, and auditors. Similarly to the driver community the expectations are to arrive relaxed and on time. Once a mobility process and the assignment requests are planned in a simplified and predictive manner, satisfaction on the job and identification with the task increase. Once travel and on-site operations are understood as one business processing effort, a future multi-media supply chain management eliminates efforts in travel booking and re-booking, dispatching, interim storage, cancellations, and planning renewals.

What has been missing until now is an optimization of the entire system of actors, mobile personnel, vehicles, and control towers.

Limited space and therefore infrastructure measures paired with extremely high waiting times are a result of missing transparency of infrastructure data and information along the transport chain. Furthermore, the limitations prohibit an increase in container throughput. Access to better and more reliable real-time information, whether infrastructure or traffic situation, will improve a dispatcher's planning capability. The mobile personnel encounter

a higher degree of accuracy and are prepared with on-site information before arriving at the targeted site.

Having conducted a series of interviews with drivers, dispatchers, and other mobile personnel, communication between the participating parties is not satisfactory. Employees that are on the road feel more and more isolated. Updates on the traditional traffic information channels or digital signs along the roads do not serve nonlocals. Another aspect of communication that is neglected concerns the interaction among those that are located onsite or transiting through one geo-fence and those who do not know each other yet. This crowd sourced information could turn into essential decision criteria once revealed and made public.

In addition, transport and accompanying personnel have little insights to the actual parking situation in conjunction with required storage space or requested special equipment to ensure the freight on-site. A location-based service discovery is dependent on the offering of geo-based apps and services. Those could turn into offerings about operation time slots, workshops, and hospitality services. Often the characteristics of the delivery profile as such are missing and this turns into yet another driver-based decision: (a) to gather an overview about the situation and (b) to judge the usefulness of the provided information.

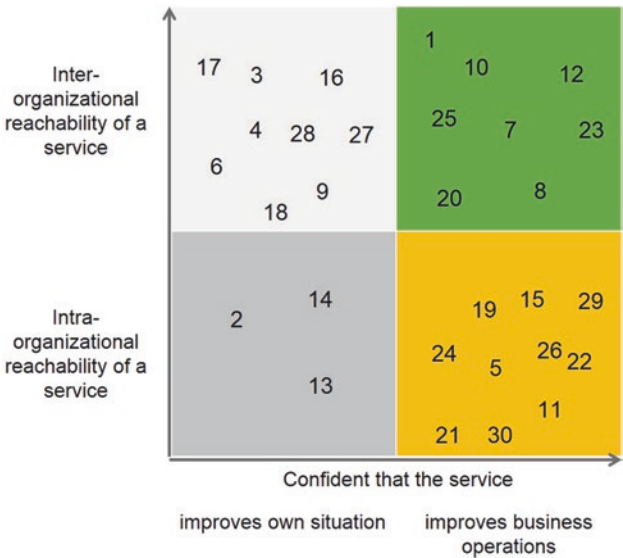
One of the outcomes of our initiatives in conjunction with the world of services for cargo transport is the following list of ideas for location-based services:

1. Informing truck drivers about the import and export status of container movements
2. Informing company colleagues about position and job profile – the latter aspect facilitates switchboard needs once a driver has to be replaced by another one with a certain skillset
3. Tourist app with points of interest and highlights such as vessel types and flag information
4. Currywurst app for truck drivers to foster electronic orders and payment for food services
5. Informing dispatchers about current positions of approaching trucks and goods
6. Meet-at-parking-slot app for drivers
7. App for mobile service providers in the field of food services or truck and cargo related maintenance services
8. Informing dispatchers about arrival times whether container or means of transport such as vessels and trains
9. Special offers at truck stations that are located in the harbor area to serve the mobile personnel
10. (Just-)In-time-sequences to optimize the projected arrival at the container terminals
11. Resting time monitoring for truck drivers
12. Oil and other consumption monitoring at truck stations plus discounted offerings for recurring drivers
13. Healthcare app for drivers to observe, monitor, and improve health status

- 14. Fitness app for drivers when resting or waiting
- 15. Terminal operator related app to indicate the total container throughput
- 16. Real-time video channel to observe docks and parking areas
- 17. Reservation system for parking slots
- 18. Expected waiting time
- 19. Empty container marketplace for dispatchers and drivers
- 20. Equipment-to-go for workshops
- 21. Available loading space in trucks and car trunks
- 22. Monitoring app to monitor critical vehicle and equipment components and plan maintenance needs ahead of time
- 23. Provide interaction with packaging personnel
- 24. Enhance routing lifecycle back to the carrier home base
- 25. App that offers location-based services based on user’s profile and preferences
- 26. Hub operator related app to monitor in real time as well as predict traffic flow and traffic situation
- 27. Apps that outline location-based events in the hub area such as meet-and-greet, those for lunch time and during waiting hours, cultural events, and language classes
- 28. App that oversees gas stations, their opening hours especially at night
- 29. App that instructs loading and unloading personnel
- 30. Equipment monitoring app for mission critical and/or high-value tools.

By categorizing the above introduced service ideas according to reachability and the trust they offer to ensure a smooth and enjoyable cargo transport business, the assortment looks like that shown in Fig. 2.8. The numbers in the graphic coincide with the above numbers.

Fig. 2.8 Insights into the service world of cargo traffic



2.8 Mobility Creation and Preservation, Traffic Safety and Sustainability

Barbara Flügge

2.8.1 Mobility Creation

Who cares about our mobility? The entire theme of mobility and traffic infrastructure concerns a complex, multi-diverse entity of assets that are designed, developed, maintained, and renewed for the above introduced means of transport and route networks. New means of transport and routes are being introduced based on structural, economic, and behavior directed criteria. The closure of railway routes on the one hand, the introduction of new and maintenance of already installed high-speed railway routes on the other hand, re-open again and again a debate about purpose, roles, and responsibilities. The debate that has been on-going in Switzerland was caused by a change in the train schedules that caused a disadvantage to commuters who traveled 60 minutes into Zurich and had to accept a longer transit time. The outcome of decisions concerning infrastructure provisioning and preservation is hardly made transparent to mobility users. Furthermore, the often promoted participation of constituents is delayed until close to the deadline when it is viewed as interference.

Statistics that concern infrastructure assets in the field of construction [20] outline a 5 % usage of Germany's total surface area. That percentage is subdivided into motorways and routes, railway tracks, and space related measures:

- Streets
- Bridges
- Railway tracks
- Tramline tracks
- City train tracks
- Waterways
- Pipelines
- Hubs such as central stations, seaports, airports, and terminals that are essential for commuters and transshipment activities.

Germany's traffic infrastructure system has been valued in the year 2010 at €773 billion [20]. The evaluation of capital assets has been conducted by the German Institute for Economic Research. The main asset is the traffic route network as outlined in Fig. 2.9. Hubs are 10 % of the main assets' value. In many cases hubs are operated by private entities and not by public institutions.

Infrastructure related assets and provisioning efforts are evaluated differently when it comes to a country to country comparison. Reasons are based on legal and structural conditions, and varying matters. A global study of infrastructure measures undertaken by the World Bank [48] takes those differences into account. The study projects for 55

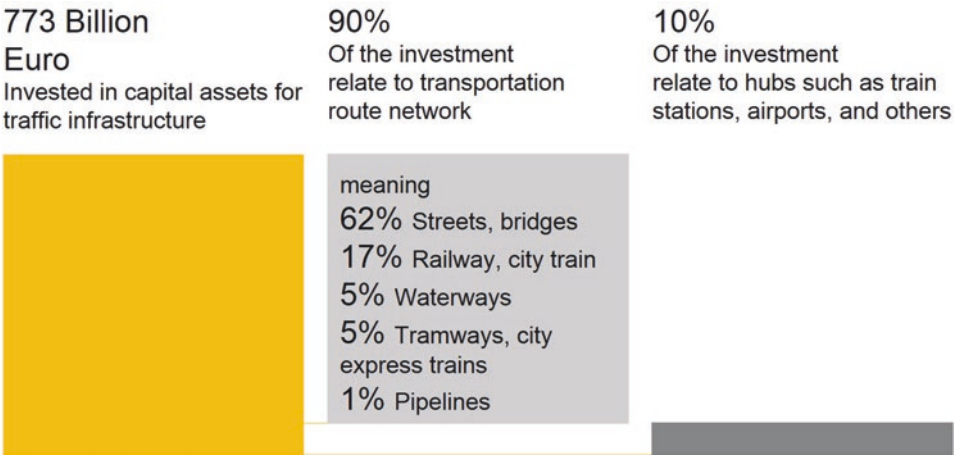


Fig. 2.9 Mobility provisioning in Germany

locations the right of all social classes to access mobility. All sites that have been investigated share the same balancing efforts to design space and infrastructure needs long term, and manage and steer short-term, annual, and/or incident relevant countermeasures and budgeting. With respect to long-term planning cycles we talk about 20–30 years. Infrastructure related concepts even take up to 50 years and more.

With respect to movable assets, 52 million vehicles were registered in the year 2012 in Germany. Those covered 34 million cars, 9 million trucks and tractors, 8 million motorcycles, and 1 million other vehicles [20, p. 21f]. The last category related to trains and locomotives mostly serves freight related mobility needs. The proportion of electric vehicles was insignificantly low and was therefore not measured or outlined.

Concerning infrastructure preservation, Germany introduced a German Investment Framework that manifests the preservation plan for the traffic infrastructure from 2011 to 2015. The investment sum of 2.6 % of the total asset value seems small [20, 49], see also Fig. 2.10. Next to the maintenance and expansion of the above introduced assets, a key focus is on streets and bridges. In addition, modern traffic management systems and IT are another element that is taken into account.

Judging the investment value as being low, acceptable, or high cannot be objectively assessed due to distinct publication periods and distinct definition of terms in statistics and studies. All that can be said is that the right to mobility is more and more focused at the political level. One way to measure the increasing interest and need are the number and subsidy amounts issued for funding and research projects. The European Commission for example announced in 2015 that it will provision a total sum of €13 billion for the traffic related program within the *Connecting Europe* program [50].

Connecting Europe overall is motivated to develop and expand a trans-European transport network, and expand infrastructure in the field of energy and telecommunications. Information technology is being recognized as one of the key building blocks as stated

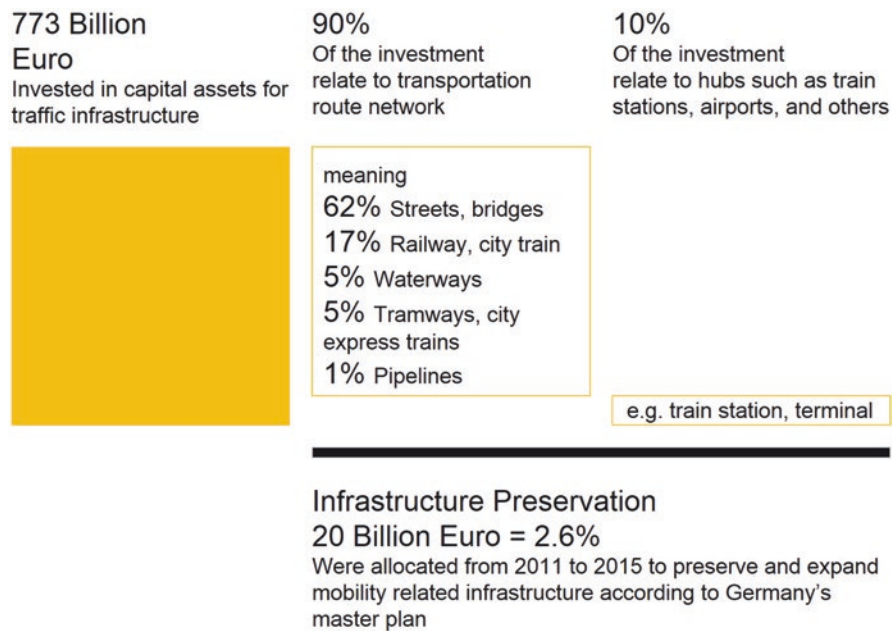


Fig. 2.10 Mobility and infrastructure creation in Germany

here: “[...] calls for the deployment of transport-related information and communication technology to ensure improved and integrated traffic management and to simplify administrative procedures through improved freight logistics, cargo tracking and tracing, and optimized schedules and traffic flows” [51, p. 1].

Comparing finance and cost parameters as outlined in Fig. 2.11 the financing of means of transport is realized by a mix of revenue streams, meaning ticketing revenue, tax money, subsidies from the public sector and contributions such as toll driven income from the transport sector.

Toll driven usage-based financing in Switzerland resulted in a revenue of €4.5 billion in 2010. Compared to the above outlined German infrastructure investment efforts of 2.5 %, the Swiss contribution resulted in 25 %. How Swiss citizens allocate income with respect to infrastructure was subject to a Swiss Bureau of Statistics survey in 2012 [21]. The result is shown in Fig. 2.12.

2.8.2 Mobility Preservation

Who are the actors behind the data we introduced in the section above? Looking at the reference list of the Germany Bureau of Statistics, an immense number of individual contributing actors, departments, institutes, commissioned auditors, and independent businesses are revealed [20, pp. 56–59]. Furthermore, surveys and observations that are conducted on

Fig. 2.11 Cost and financing parameters with respect to mobility creation

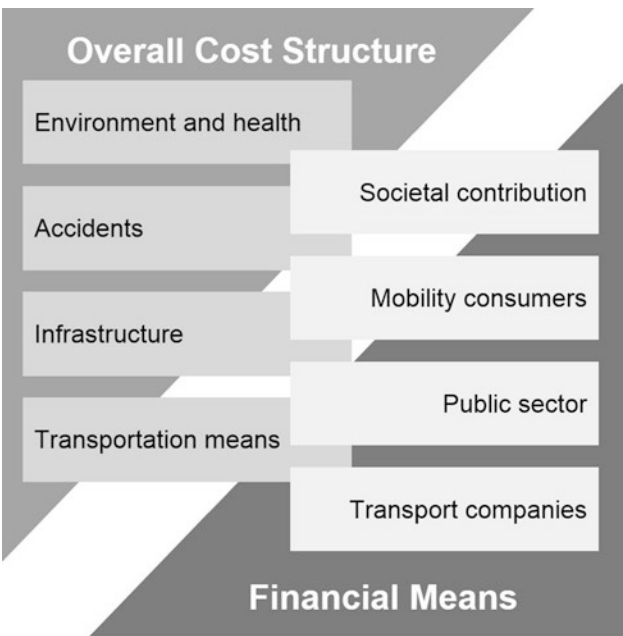


Fig. 2.12 Citizen survey measuring citizens' consent to or rejection of use of income and financial resources in Switzerland

Consent [in %] Relative consent following the poll results (an approximated value applied where necessary)	Rejection [in %] Relative rejection following the poll results (an approximated value applied where necessary)
Improving the traffic situation for pedestrians and cyclists [90%]	Increasing fuel prices [75%]
Financial funding of energy saving and environmental friendly new cars [81%]	Increasing parking fee in city centers [70%]
Environmental protection [88%] Traffic safety [87%] Road traffic [86%]	Regulating city center access via road pricing [rejected by two third]

a random basis reveal further actors and institutions that have been noticed as contributors and decision makers. [Figure 2.13](#) gives an overview of today's understanding of roles and illustrates the demarcation between institutional and commercial actors and their offerings. The presentation is not country specific and can be applied to other regions and countries.

As already observed, the fundamental roles of who is owning and who is sharing has shifted. The movement in the *Sharing Economy* that provokes a usage instead of ownership role will be reinforced by increasingly more automation functions in vehicles. New players replace or complement traditional car manufacturers in the automotive industry.

Selected actors and participants in the field of mobility	National level State level Municipal level	Environmental authority Cadastral office District office	EU Supranational Legislation	EU, UN Sustainability Development Goals (SDG)	National level State level Municipal level	National level State level Municipal level
	Regulation	Regulation	Directives	Recommendations and agreements	Public procurement	Private procurement
Transport companies	State level Municipal level	National Level Municipal Level	Operator acting on behalf of public institution	National level State level Municipal level	Field staff and personnel employees	Field staff and personnel civil servants
	Traffic operations and control center	Traffic management center	Traffic management center	Traffic safety	Field staff and personnel employees	Field staff and personnel civil servants
Freeway administration	Freeway Motorway Country road	Maintenance Transport route network by public sector	Maintenance Transport route network privatized	Housing and commercial construction	State level Municipal level	Private operator
Infrastructure service provider	Infrastructure service provider	Infrastructure service provider	Infrastructure service provider	Infrastructure service provider	Infrastructure service provider	Infrastructure service provider
Wholesale Retail	Bus	Taxi	Subway	Private car	Rental car	Transport routes Streets Bike lanes
Infrastructure service provider	Mobility service provider	Mobility service provider	Mobility service provider	Mobility service provider	Mobility service provider	Mobility service provider
Train	Vessel	Aircraft Cargo	Aircraft Airline passenger	Automotive industry	Pedestrian	Driver
Mobility service provider	Mobility service provider	Mobility service provider	Mobility service provider	Mobility service provider	Mobility consumer	Mobility consumer
Goods	Transport means	Pedestrian	3 rd party builder	Tourist	Transit traveler	Business traveler
Mobility consumer	Mobility consumer	Mobility consumer	Mobility consumer	Mobility consumer	Mobility consumer	Terminal for public transport
Cargo terminal	Terminal for public transport	Airport	Subway stations	City train stations	Tramline stations	Train stations
Hub	Hub	Hub	Hub	Hub	Hub	Hub
Blind and partially sighted people	Deaf people	Elderly generation	Children	Car related, AAA [USA], FIA [global], others	Bike eBike Scooter eScooter	AAA [USA], ADAC [D], OMTG [AT], TCS [CH], others
Interest and lobby groups	Interest and lobby groups	Interest and lobby groups	Interest and lobby groups	Interest and lobby groups	Interest and lobby groups	Traffic research
Chamber of commerce	Research institutions	Educational institutions	Community buildings	3 rd party builder	Cooperatives	Commercial entities and consortium
Training and further education	Training and further education	Training and further education	Housing and commercial construction	Housing and commercial construction	Housing and commercial construction	Land property

Fig. 2.13 Selected actors and participants in mobility

Alternative offerings span from vehicle offerings, components, to infrastructure management by offering vehicles, components, and infrastructure themselves. These providers are nowadays players that conquer the market with disruptive and innovative offerings as for example technology providers and location-targeting consortia focusing on mega cities and metropolitan areas. Furthermore, they offer usage-based services such as deliveries and pick-up services in rural areas. Other providers evolve as for example wholesale and retail chains that offer their fleets to customers or hub operators. Pricing might vary from mileage-based, distance-based, usage-based to the amount that has been spent.

2.8.3 Traffic Safety and Sustainability

An analysis of mobility without getting into the aspects of the negative outcomes of mobility would be fatal. In the field of personal safety, government institutions have registered a shrinking number of fatalities since 1970, for example in Germany [20, p. 36]. Nevertheless in the course of 2.4 million car accidents in 2010, 4009 people died. Accidents have been mainly caused, meaning up to 90 %, by human error. As reported in 2011, cyclists and motorcyclists caused most of the accidents.

The present assistance and warning systems – for example the lane departure warning system, the night optical systems, and distance driven adaptive cruise control – accompany and steer our behavior. Moreover, they increase our comfort zone and in correlation with the likelihood of accidents increase traffic safety, reduce the number of accidents, and even more importantly the number of fatalities [50, 51].

Despite the above-mentioned assistance and warning systems the groups that have been put at risk through car accidents are mainly pedestrians and cyclists. Elderly people walking are the most affected group. In that context there is an ongoing discourse and questioning about elderly people and their mental and physical fitness when using e-bikes. At this point in time there are no studies that prove a link between e-bike related accidents and the cyclists' age.

Driver misconduct is apparent at any age [20]. Misconduct is happening in the following situational contexts:

- Turning, diverting, backing-up and exiting maneuvers (16 %)
- Situational reaction time with regulations concerning right of way and precedence (15 %)
- Unadjusted speed (13 %), as well as
- Unadjusted distance (12 %).

Public transport by bus and rail as well as travel by plane are perceived as relatively safe.

One could only wish that innovative and creative undertakings continue to focus on safety measures independently of an individual's perceived safety or the relative safety that is being encountered in an actual traffic situation.

Residents are furthermore exposed to noise and air pollution. The increasing volume of transport and alternative routing due to traffic congestion on the main roads are also an outcome of a growing number of construction sites aimed at private and commercial needs. With respect to environmental protection measures, both decision makers and mobility consumers are not looking solely into the increase of air pollution in Asian mega cities. Fine dust pollution has reached other far regions, too. Another aspect to be reflected on is the fact that passenger traffic in Germany generates three times more carbon dioxide than cargo traffic [20, p. 42].

The pressing questioning about measurability, accuracy, and verifying carbon dioxide emissions from cars will not be discussed here. It is important to design, finance, and deploy intermodal traffic management offerings in the near future that include a desirable proportion of environmentally acceptable means of transport. An undertaking denoted as

the *Sustainable Urban Mobility Plan (SUMP)* aims to underpin sustainability-oriented and multi-modal targeted mobility management. Throughout our exchange with experts it has been claimed that only those urbanizations with an already comfortable budget will be able to deploy SUMP. If that turns out to be true it will be subject of further investigation. In this context, the *Circular Economy* movement postulates the following four deployable and relevant contributions for the near future [52, p. 56f]:

- Electrification and electro-mobility (short eMobility)
- Autonomous driving
- Materials evolution
- System-level integration of transport modes that from our point of view should embrace cargo transport next to individual transport.

Those contributions, according to the Ellen MacArthur Foundation, are achievable and deployable through joint efforts from governments and businesses around the globe.

2.9 Traffic Management Systems and IT Trends

Barbara Flügge

2.9.1 Intelligent Transport Systems

Intelligent Transport Systems (ITS) is the umbrella term for all traffic related technical and construction concepts. Here you will find traffic light control systems, telematics solutions, transport management and furthermore analytical tools that concern traffic and transport management. Applied as individual building blocks or in combination, ITS support traffic managers and operations personnel to safeguard and increase efficiency of traffic operations, infrastructure operators, and mobility providers. ITS encompass therefore also those information and control systems that are in use by stakeholders such as traffic managers, traffic operations managers, fleet managers and fleet control units, and transit and commuting specific traffic control units.

Concerning the taxonomy of ITS, we encounter distinct entries and listings depending on geography and interests. One example is the taxonomy of the US Ministry of Transport [53]. [Figure 2.14](#) outlines the overall structure of the ITS content.

Another way to sort ITS related solutions and the innovation potential they might offer is by requirements. Here the ITS taxonomy serves as a baseline and is typically extended with customer specific or location individual offerings. A structure of ITS based on requirement profiles is illustrated in [Fig. 2.15](#).

Through their dedicated focus on traffic management, ITS are reaching their boundaries as soon as traffic planning hits constructional, geographical, and building specific matters or seeks alignment with sustainability related regulations. It is recommended to define

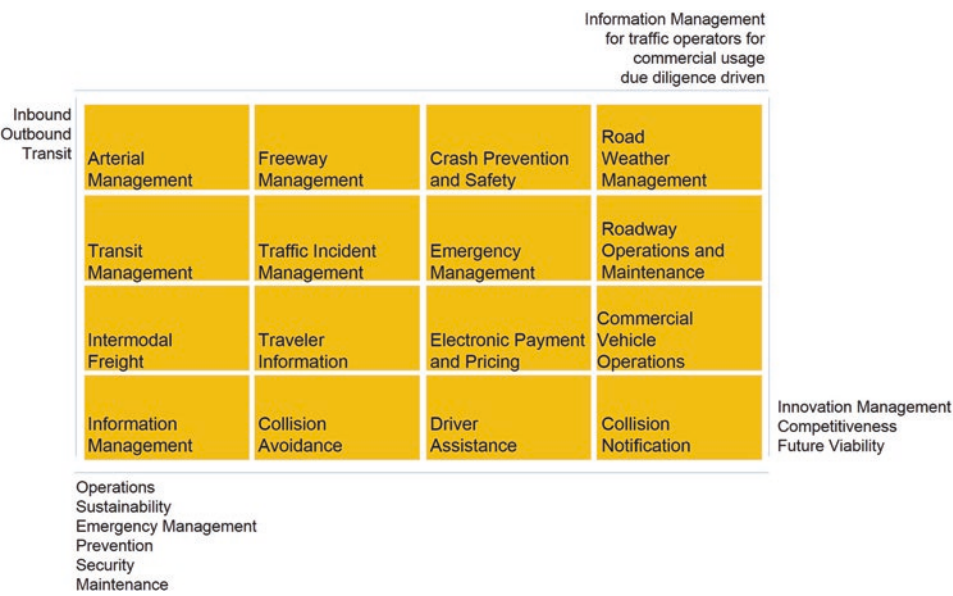


Fig. 2.14 Taxonomy of ITS

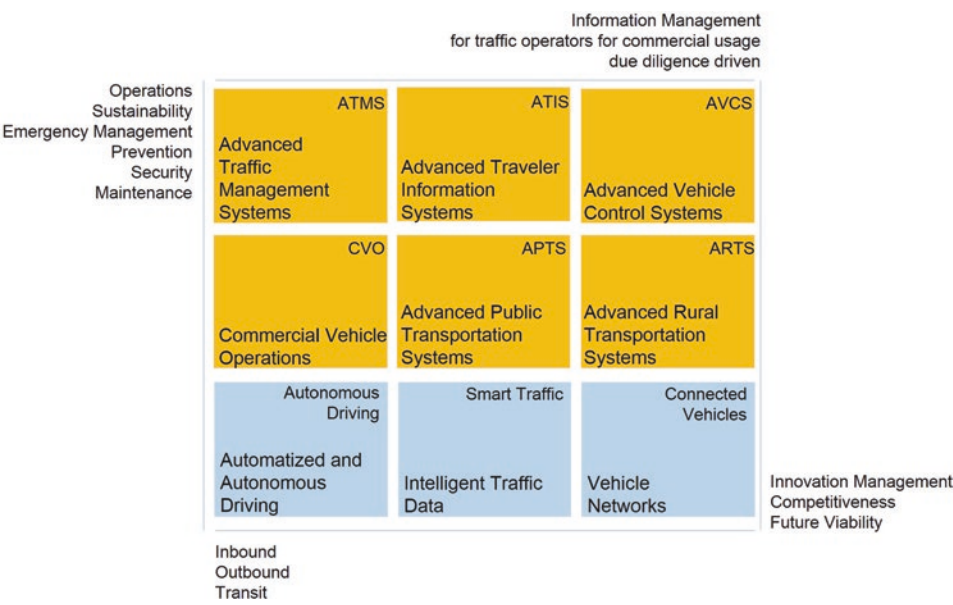


Fig. 2.15 Taxonomy of ITS based on requirement profiles

a requirements catalogue and a range of solution offerings that meet present and future requirements. Furthermore, the ITS framework needs to be adjusted.

2.9.1.1 Intelligent Traffic Management Systems in the Rural Area

To ensure a functioning and sustainable traffic infrastructure and serve households that are situated in rural, yet remote, areas the prediction capabilities of traffic management systems need to be much more in focus. Predicting traffic volume, travel and traffic behavior, and type and number of means of transport are subject to *Advanced Rural Transportation Systems (ARTS)*. ARTS detect, collect, and evaluate those data. They cover routes, number of waiting passengers, pedestrians, punctuality, delays, and the cancellation of public transport services, as well as sustainability monitoring such as emissions.

Compared to cities, the infrastructure needs and budgets for rural areas ask for even more reliable results and protection. Moreover, reliability is expected to protect past investments and assure that those keep their promise for future demand. Another aspect of future demand is to keep the mobility rights of the supposedly shrinking population in the countryside and not target it only to mega cities and metropolitan areas. It is expected that interests and investment decisions will concentrate even further on cities. The right to mobility is in danger for those that live outside and have a less-influential voice to express their needs when it comes to public participation and decision making.

What are the key elements for ARTS? Innovations in the sensor area that ensure and manage the connectedness of assets and traffic related analytics will lead to more precise forecasts for the region itself as well as for the mobility needs from region a to city b and city c to region d. This approach of digital asset mapping requires however recommender and decision making parameters and a business process logic to ease the deployment. The simple “what we know” is not sufficient. The next and harder step is about acting such as convincing suppliers to target rural areas despite shrinking margins: being suppliers for food, pharmaceuticals, construction material and other kind of service providers. Moreover, they are faced with the decision to propose available space in their transportation means to other suppliers, even competitors.

In addition to digital asset mapping, the use of communications media, smart phones, or *OnBoardUnits* serves traffic participants once they agree on the usage of their movement patterns. In Canada, for example, a service is being envisioned for street cleaning in the winter season and the optimal use of snow plow trucks through temperature and surface sensors. As snow plow trucks by number are limited and distances are large, an optimal dispatching leads not only to a street-by-street but a meter-by-meter accurate dispatching and cleaning.

One other element that features ARTS are solution offerings that relate to *connected vehicles*. Those are vehicles that drive nearby and communicate with each other – independently from owner, driver, or operator of the vehicle.

With respect to project undertakings for rural areas we consider the use of *autonomous vehicles*. The idea is, in future, to bundle order fulfillment for individual constituents and optimize the usage of loading and driving capacities of vehicles to ensure remote delivery. It could be said that households get served digitally right up to their front doors! In fact carriers and online retailers ask themselves if they are able to afford remote deliveries that

make only $x\%$ of the overall consumer market while profit margins get tighter and tighter. Autonomous driving once intelligently used offers a real chance to get served wherever consumers are based.

2.9.1.2 Traffic Data Analytics

Regardless of whether the field of application is ARTS or the respective, preceding elements of ITS, functioning is based on the digital offering, usage, and reasoning of traffic data. Not only does traffic data encompass public transport related data but all traffic related data that private travelers and organizations generate and provision. Thus smart traffic decision management systems rely on data from other operators, such as taxi and bus operators, as well as behavioral and decision making data from passengers.

Traffic data categorizes by:

- Real-time data: data that is up-to-date by a maximum of 15 minutes. Real-time data are the oil of real-time monitoring, situation-based traffic management, and decision making. One example of real-time monitoring is the required time span that is needed to identify a car registry record triggered by a sensor that indicates car passed at 3.00 p.m. in city “A” and street “B”. Another example relates to the identification and counting of cars that pass by a digital checkpoint within one minute. A third well known example is speed detection.
- Historical data: data history is the starting point for analytical and forecasting methods. Examples are data related to surface abrasion depending on climate zones and weather conditions.

The overall advantages of traffic data management are traffic monitoring and interactive steering – for example, to adjust the speed limit dynamically. Another benefit is related to road and traffic network planning, especially in the field of designing street crossings and critical intersections to balance incoming and leaving vehicle flow.

The so-called UK *London Congestion Charging (LCC)* scheme [54] was introduced in February 2003 with the objective of reducing and avoid congestion in central London. How does LCC function? Vehicles that are approaching London’s city center and seek to enter a defined area were charged, in the beginning, £5. Exceptions were made at weekends and at night. A positive outcome led to a reduction of congestion in the city center, but caused an increase of congestion in the surrounding areas. To counter manage that effect, the fee increased over the time from £8 to £11.50 and the area that is liable to the charge was expanded. The registry of those vehicles that are allowed to enter the area takes place with *automatic number plate reading (ANPR)*. A digital image is created that registers the number plate, the used street, and captures an entire geo-fence related image of the car and the used street. The registry is then counterchecked with the database entries. In cases of a missing entry of the captured vehicle, the system detects car owner and issues a traffic warrant. The LCC is still in use.

2.9.1.3 Intermodal Traffic Management

The means of transport that is provisioned or used is referred to as a *mode*. Intermodality refers to transport needs whereby “at least two different modes are used in an integrated manner in order to complete a door-to-door transport sequence” [55]. This referenced definition of the European Commission related originally to the transport of goods. It also refers to a minimum two different modes. Concerning the first condition, we hereby expand the addressees to the transport of persons. With respect to the second condition, the real challenges rely in the intermodal planning and deployment for three, four, and more distinct modes of transport – regardless of regional, country-wide, or international application.

Compared to intermodality, *multi-modality* looks into one means of transport as a closed system without integrating other means. As the theme of this book is the management and processing of distinct means and ownerships, multi-modal aspects are not in focus.

Most commonly used means of transport for intermodal transportation, are car, bus, train, e-bike, plane, motorcycle, city train, subway, and vessel. Depending on political, economic, and geographical conditions these are operated by private persons, or private or public institutions and organizations. Often transport modes are structured by road management, rail operations, sea traffic, and air traffic.

A typical intermodal travel sequence looks like the following:

- Taking the bus from home to get to the central station
- Travel by train from the central station to the train station nearby the event location
- Travel by taxi from the train station to the event location.

To identify travel plans and intermodal needs door-to-door we make use of customer journey mappings. Those are applicable to business travelers, event participants and families, and any other traveler profiles. The most common combinations of transport modes are bus-train, subway-walkway, and train-plane. Next to the technical transport modes, walkways are a transport mode, too. Especially in the digitization of intermodal routing and planning, walkways and efforts for pedestrians need to be considered. The optimal transport and transit efforts, adjustments, and re-calculations along a journey takes into account an individual’s walking preference, how much, how long and under which conditions. The latter aspect depends on luggage to be carried or a hilly route to be taken. Next to walkways the e-bike as well as car sharing are added, too. Offerings next to train services already include bike and car rental options. Overall we observe an increasing number of transport mode operators – not forgetting the ones that offer their private cars!

In the *sharing economy*, operators such as DriveNow and car2go are two out of more than 150 car-sharing service providers solely in Germany at the beginning of 2016 with a total number of 1.26 million registered mobility consumers [56]. Latest figures as presented at the Fourth World Collaborative Mobility Congress [57] talk about nearly 300 car-sharing service providers in Germany only!

The worsening driving situation brought about by congestion and longer waiting and down times does not only harm the traffic system but also the economic situation of a hub or location. Supply and retail chains suffer because of a congested truck and a delayed or even canceled terminal check-in at the destination. The domino effect leads to physical as well as business processing issues driven by commercial agreements, agreed estimated time of arrivals, and shipment timetables. Furthermore, delays cause stress, waiting time, annoyance to participants and those nearby, and harm to the environment through noise and air pollution.

A sustainable concept for intermodal transport of persons and goods – such as SUMP – asks for intelligent dispatching systems, inter-organizational collaboration, and a settlement of interests to best utilize the existing assets and infrastructure.

2.9.2 A Global Study About Mobility in 20 Cities

We have been assessing the mobility offering of 20 cities as part of a global study. The analysis is based on publicly available material. Where relevant, accompanying interviews and surveys are being conducted. The study focuses on private transport. The key questions we have been asking are:

- What is the situation to date concerning private transport overall?
- Which offerings are available?
- How can the road transport network be described?
- What are the main reasons for traffic density and congestion?
- How does the traffic situation, especially congestion issues, influence the population?
- Which user groups are being affected by the traffic situation mostly and how?

To compare the analytical results and the research framework between the individual findings, a morphological box [58] has been designed. The applied attributes and units are shown in Table 2.1.

Table 2.1 Morphological box to derive mobility offerings for cities (source: own graphic)

Population ^a	0–5000	5000–10,000	10,000–15,000	15,000–20,000	20,000–25,000
Area [in m²]	0–4000	4000–8000	8000–12,000	12,000–16,000	16,000–20,000
Density	0–4000	4000–8000	8000–12,000	12,000–16,000	16,000–20,000
Rail network [in km]	0–100	100–200	200–300	300–400	400–500
Number of rail stations	0–100	100–200	200–300	300–400	400–500
Size of public bus fleet	0–5000	5000–10,000	10,000–15,000	15,000–20,000	20,000–25,000

Table 2.1 (continued)

Daily rides ^b by train	0–2000	2000–4000	4000–6000	6000–8000	8000–10,000
Daily rides ^b by public bus	0–3000	3000–6000	6000–9000	9000–12,000	12,000–15,000
Road network [in km]	0–6000	6000–12,000	12,000–18,000	18,000–24,000	24,000–30,000
Road density	0–4	4–8	8–12	12–16	16–20
Number of motor vehicles ^c	0–1000	1000–2000	2000–3000	3000–4000	4000–5000
Number of private cars ^c	0–600	600–1200	1200–1800	1800–2400	2400–3000

^a Population in '000, ^b Daily rides in '000, ^c Number of motor vehicles and private cars in '000.

The studied cities are Bangalore, Barcelona, Beijing, Berlin, Guangzhaou, Hong Kong, London, Madrid, Melbourne, New York, Seoul, Shanghai, Singapore, Stockholm, Sydney, Taipei, Tokyo, Warsaw, Washington DC, and Vienna.

To gain a detailed insight into the study, please contact Barbara Flügge through <http://ch.linkedin.com/pub/barbara-fluegge/0/b1b/146>.

2.9.3 Industry 4.0 and the Internet of Things

The fourth industrial revolution perceived as the evolvement in manufacturing and production planning, under the term *Industry 4.0*, predicts in the following years an increasing, stronger connectedness with traffic management and planning systems. What is Industry 4.0 about? What are the current developments?

The *Machine-to-Machine (M2M) communication* evolvement has been labeled as *Industry 3.0* and focuses on connected machines. A scenario as typically circumscribed by Industry 4.0 is the following. The aim is to enable connectedness amplified with the aim to gather information from any (connected) object, not only machines, and by measuring the object's conditions. Consequently, a building decides on its own about energy consumption, absorbing energy or releasing energy to another building nearby. The incorporated business processing resonates with the overall condition of the targeted building and informs the human stakeholders about changes, adjustments, or approvals to be made.

The embeddedness of machines into business relevant and business nearby activities is subject to *Cyber Physical Systems (CPS)*. The functioning of CPS is as follows. A machine executes a maintenance service based on key performance indicators and conditional monitoring. In Formula 1, for example, a race car is already supervised during the race in real-time by its engine performance, the conditions of tires and brakes, and the driver's

behavior and reaction time. In the case of Smart Mobility, a CPS scenario looks like the following. The use of public transport is being measured by the occupied seats in a bus. Once all nearby seats are occupied and the demand for the next station has being predicted due to the number of people waiting at the station, another bus is being provisioned. The station related estimates will become more precise by the numbers walking towards the station, browsing for traffic information, and waiting at the station's geo-fence. Thus, the tedious look at bus schedules and estimated arrival times becomes obsolete.

Looking at CPS the term *Internet of Things (IoT)* relates to the entirety of all to-be-connected and connectable objects or things. Today, a true IoT scenario embraces monitoring and steering functionality via the Internet, mobile, and desktop apps. In the future, there will be sensing fabric and further device-like engagement modes. We all encounter IoT scenarios in our own environment: the remote use of the shutters at home, starting the coffee machine before getting home, or the remote monitoring of the elevator's operation to prevent dangerous situations or to countermeasure an incident as fast as possible. Through IoT advancements into consumers' households, namely the connected refrigerator that tells the supermarket to issue the delivery or the connected plants triggering fertilization, we can follow the digital movements more easily.

IoT as a subject of its own converges into mobility needs and efforts especially through the physical interaction and connectedness with infrastructure assets and devices. We recommend to take a look into an *IoT Role model* that has being investigated by the authors for quite some time.

Another IT advancement is the collection, capture, and re-use of data, massive volumes of data. The term *Big Data* refers to huge data pools, *data lakes*, and the consequent related data processing. Data lakes result from an information explosion through online, desktop, and mobile use of apps and services. Accelerated by the connectedness of things, goods, and services we expect an exponential increase of data volumes in the nearby future. From an operational perspective and to make as much purpose driven information available for further processing, organizations rely more and more on mobile apps and cloud offerings. Downsizing in-house operations and moving into the cloud is perceived as one way to keep data processing and data access manageable and affordable. Data processing itself takes place in cloud systems based on digital platforms.

The advancements in the manufacturing industry under the label Industry 4.0 create awareness in other segments, too. Among Industry 4.0, *Logistics 4.0*, *Workforce 4.0*, even *Information Technology 4.0* and *Infrastructure 4.0*, the term *Mobility 4.0* enters the stage. A vision of Mobility 4.0 has been shared by the Taiwanese Minister of Transportation and Communication, Mr. Tan Ho-Chen, at the 16th Germany–Taiwan Joint Business Council in Berlin [59]. Mobility 4.0, according to Minister Ho-Chen, is capable of deploying the following:

- People centered transport
- Mobile technology
- Seamless integration.

People centered transport offers personalized services, builds customer relationships, helps before passengers ask, and offers help to those in need. Mobile technology ensures an “always connected” momentum and feeds passengers and decision makers with real-time information where necessary and useful. A seamless integrated mobility offering can be looked at as an outcome of smart mobility, but also as helping to improve the service flow and find intelligent ways of new mobility offerings.

The plethora of players that are encountered with regard to the above outlined “4.0” movements influence and boost mobility initiatives. Everything and everyone connected will not stop in front of a governmental bulletin, a public transport bus, or a group of travelers that met “coincidentally” through a pop-up mailing that offered vacancies in a seminar that takes place “accidentally” nearby and matches with the travelers’ business profile. Industry segments converge, and the same accounts even more for those that seek the optimum mobility offering.

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