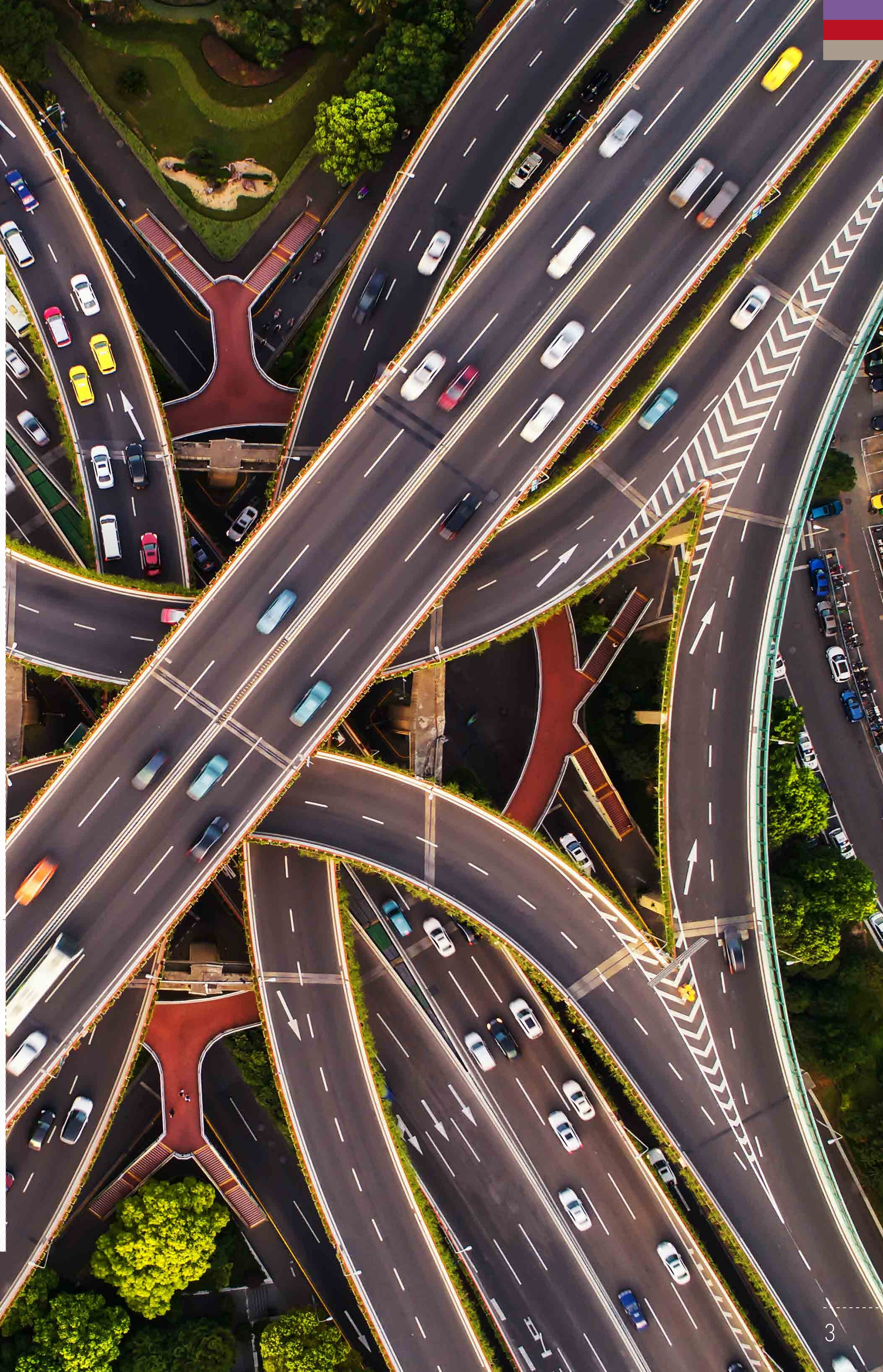
Sustainable Mobility: Navigating the Land of Disruption

2018 MAZARS GLOBAL AUTOMOTIVE STUDY

MAZARS

INDEX



INTRODUCTION

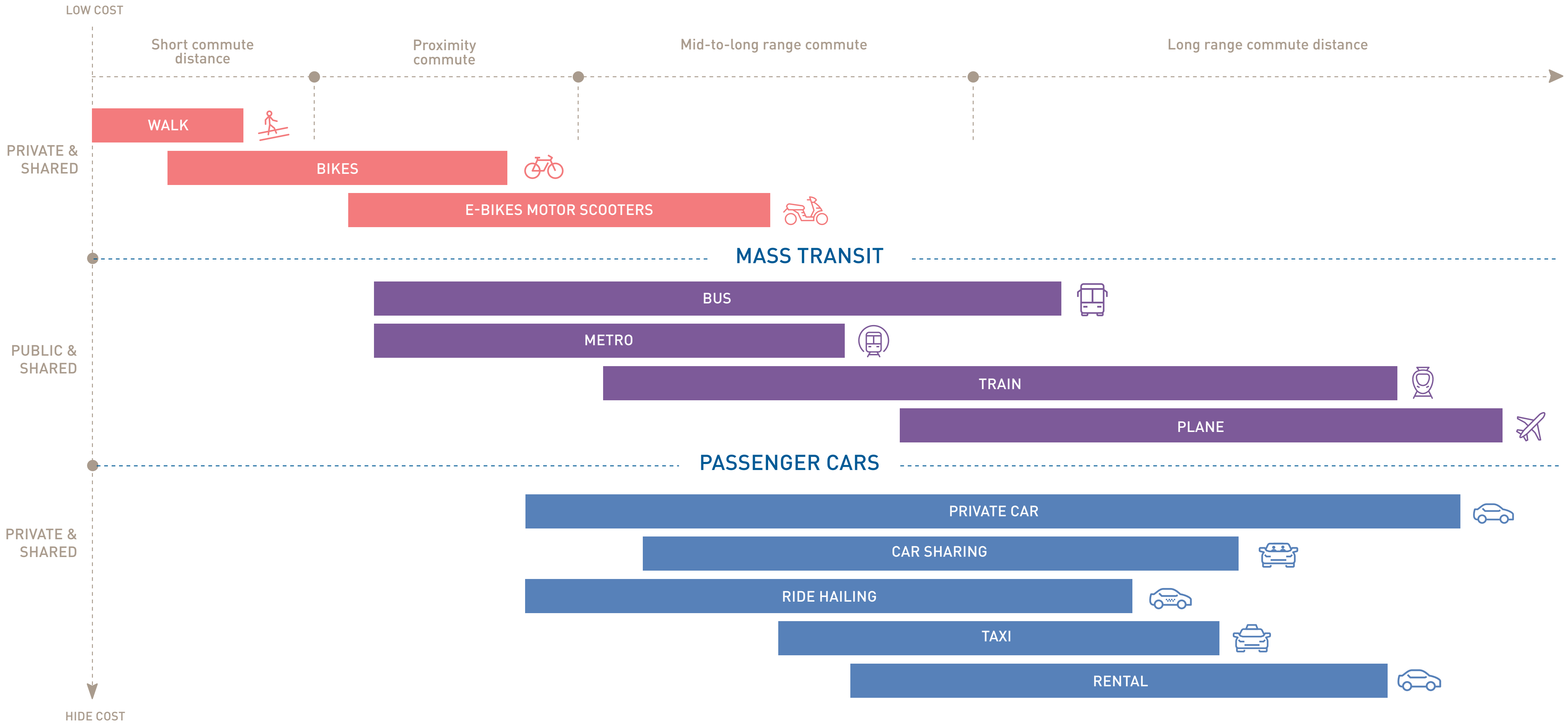
Sustainable mobility is putting the pedal to the medal, transcending the automotive industry. From fossil energy to electricity; from ownership based model to a shared-economy driven model; from a licensed--driver-only model to driverless vehicles, changes happen both to the vehicle itself and to the way we use them.

Mazars automotive expert community, together with the industry experts from IHS, are pleased to present this global study about sustainable mobility.

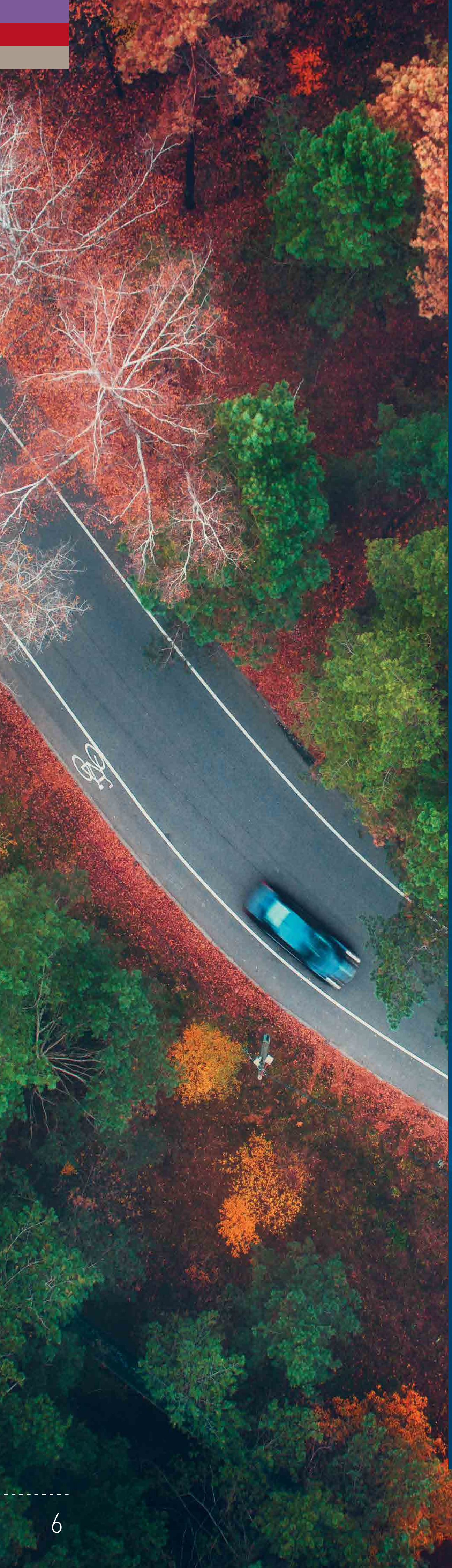
The study includes a roundtable discussion between Mazars' global leaders of automotive practices and industry experts from IHS Markit, followed by seven Mazars country leaders of automotive practices. We also conducted several mini case studies about the impact of sustainable mobility solutions on some major cities worldwide.

So please fasten your seat belts as we start the sustainable mobility journey!

Mobility Landscape



Graphic creation based on 'Relative Distance of Mobility Segments' and 'Relative Cost of Mobility Segments' from <Mobility as a Service>, IHS Markit, 2018



GLOBAL MOBILITY OUTLOOK

POPULATION 2016*
7 466 000 000

URBAN POPULATION %
54%

NUMBER OF PASSENGER CARS IN USE
947 100 000

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
127

95% OF ELECTRIC VEHICLES ARE SOLD IN ONLY 10 COUNTRIES
China, the United States, Japan, Canada, Norway, the United Kingdom, France, Germany, the Netherlands and Sweden

ESTIMATED SALES PARTIAL AUTOMONOUS VEHICLE SALES IN 2035
% of Automonous vehicle 2035
21 Million

GLOBAL MOBILITY MAKRET SIZE 2017
7 Trillion $

DRIVER LESS MOBILITY AS A SERVICE CAR NEEDED IN 2035
45 Million

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/ Population Division; Statistics from Departments of Transport

Round-table Discussion:

IHS Markit & Mazars

Gregory Derouet
Partner, Global Co-Head of Automotive, Mazars France

Dr. Christian Back
Partner, Global Co-Head of Automotive, GlobalMazars Germany

Egil Juliussen, Ph.D.
Research Director & Principal Analyst, Automotive Technology, IHS Markit

Jeremy Carlson
Principal Analyst-Autonomous Driving, Automotive, IHS Markit

The Automotive Sector : Navigating the New Mobility Landscape

The automotive sector is undergoing seismic change as mobility requirements shift from one person one car ownership to a more sustainable car sharing and usage-based model. Capturing insights and intelligence needed to ensure OEMs and suppliers can navigate these new challenges is vital, particularly as the industry moves from an engineering to software-based system of vehicle production. As part of our global study on the topic of sustainable mobility, we invited consultants from market intelligence and analytical experts, IHS Markit, to a Q&A discussion on the key mobility trends and how change is likely to impact the automotive sector going forward.

The discussion is split into four micro trends:

- ownership;
- sales and investments;
- regulation;
- skills.

What was clear from discussions is that interpretation is key. How we apply in-depth research alongside day to day market intelligence, as well as formal and informal contact with players in the market can reveal different insights and ideas that, combined, help to paint a clearer picture of the issues driving change.

By sharing these ideas and thoughts, our aim is to support the automotive industry as it adapts and evolves. Our sincere thanks to IHS Markit's Jeremy Carlson, principal automotive analyst and Dr Egil Juliussen, director of Automotive research for their insights that have helped produce this report.

Christian Back, Partner, Mazars Stuttgart & Grégory Derouet, Partner, Mazars Paris

1. Vehicle ownership trends

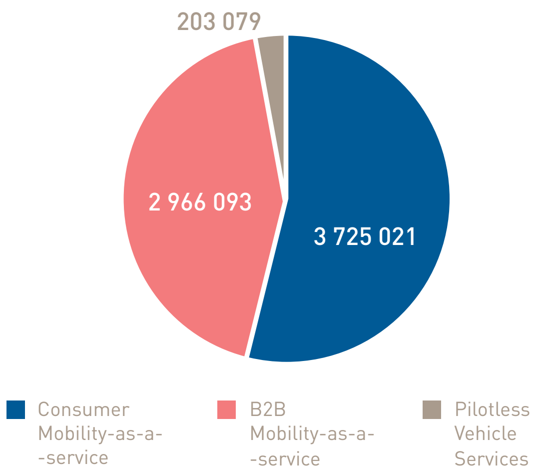
"If you still own a car in 40 years from now, you'll have to take it to a track to drive it."

Dr Egil Juliussen, director of Automotive Research at IHS Markit.

There are a number of key trends currently impacting players in the automotive industry. From a car ownership model to an ownership-sharing or even a pure usage-based model, cost is an important factor in how this shift will eventually play out. But market innovation and disrupters from outside the industry are also playing their part in offering attractive mobility solutions as we move to a sharing economy. The signs are it is not a question of if this will happen, but when. Remaining agile to opportunities and adapting business models to take advantage of the new mobility landscape will be increasingly important.

How will a shift from car ownership to a sharing or usage-based model play out and what is driving it?

PASSENGER ECONOMY – FORCASTED GLOBAL REVENUE BY SERVICES 2050 (USD MN)



Source: Catapult - Market Forecast – For Connected and Autonomous Vehicles, IHS report, Intel – Autonomous Vehicle Service

Egil Juliussen: Ownership trends can vary a lot by region and country. As a general rule in countries where car ownership is high, a move to an ownership-sharing or usage-based model is going to take longer than places such as India or China where cars per capita are much lower. Affordability is key and in countries where mobility as a service is less costly than owning a car, the shift to share and usage models will be much faster.

Jeremy Carlson: I agree, a lot of sharing and usage models are being enabled by technology, such as an app on your smartphone and the use of cloud platforms to improve logistic efficiency. And while such innovation is heavily influenced by technology companies, there's certainly a growing interest from automotive industry players to become more involved. There is also a pull from the demand side that is starting to drive some of that change because it's all about giving consumers choice and cost options, whether its sole use of an Uber, a ride-share or taking public transport.

Egil Juliussen: The high tech industry has been the main driver behind the shifting landscape, but as the automotive industry gains a better understanding of the market potential we are beginning to see the likes of GM and Toyota getting involved. It's going to be a huge market and with profit margins potentially higher than core business earnings, they simply can't afford not to be part of it.

Jeremy Carlson: Of course, the service business model represents a change for no other reason than you're able to evolve and push change into that business model much more quickly when its service based. If we take GM's mobility and car sharing service, Maven, as an example they can make changes within a week. That speed of change is just not possible in vehicle production.

What is the likely impact of ownership models on OEMs and suppliers going forward?

Grégory Derouet: It's a shift that heralds structural change. As the mobility landscape shifts to a more technology--focused proposition, there's work to be done on analysing how traditional roles are likely to alter. This is particularly important from a supplier perspective in helping to define what their role will be in the future and how business models need to be adapted, particularly if car ownership becomes less important and sales fall. We need to explore how a traditional supplier can adapt and survive in a changing market that is underpinned by technology.

Christian Back: Certainly, suppliers focusing on car components will face changes as we see the percentage of technology in the component cluster increase. With autonomous driving and electric vehicles we can see that new technology will certainly impact traditional suppliers. Particularly when we see that many of the typical component cluster of a vehicle will decrease due to these technologies by up to 30% or 40%. Suppliers currently focusing on traditional cockpits face the real big changes when the number of alternative drive vehicles increase.

Jeremy Carlson: I think that's a very good point. But we are seeing signs that suppliers, particularly those that focus on cockpit electronics, are not sitting back as we move from a control to a user-based experience. They're creating flexible cockpits so that during this transition they can support the consumer demand in either situation.

Egil Juliussen: There's certainly evidence already that OEMs are looking at vehicle component elements they want to own themselves, so suppliers will face a squeeze in what they will be required to provide. OEMs are increasingly looking to own their own software platforms through acquisition like GM. It means going forward there's less opportunity for Tier 1 suppliers to become the major software providers to OEMs.

2. Impact on vehicle sales and investment plans

"In terms of allocating investments, we are entering unknown territory - one where already we have seen huge investments sunk into failed collaborations."

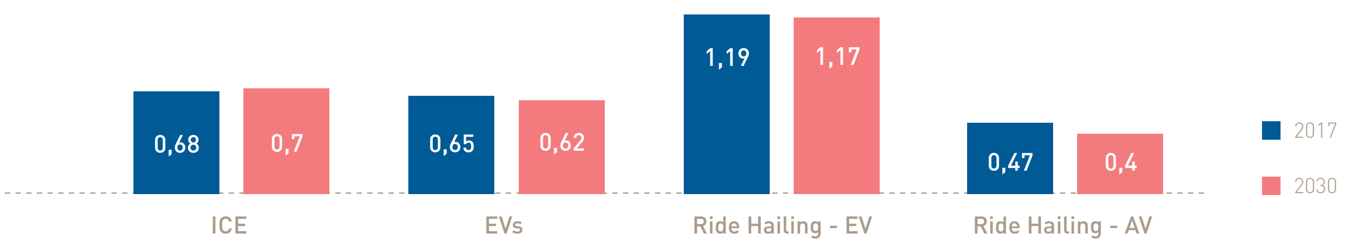
Grégory Derouet, Partner, Mazars.

While we are seeing contradictory trends emerging such as strong global vehicle sales forecasts up until 2030, a decrease in overall car sales is expected as the vehicle share and usage-based market grows. The emergence of new opportunities, particularly in the aftermarket sector, could increase to help counteract the drop in sales. At the same time, the higher importance being placed on technological development is set to increase R&D investment budgets. The lack of reliable KPIs as we step into new mobility territory could hinder the investment decision process and make it increasingly difficult to strategize.

Are there any firm signs to suggest that mobility models will impact car sales?

Jeremy Carlson: In terms of the impact on the market overall, over the next few decades we would probably expect to see a reduction in vehicles sales, and potentially a reduction in vehicle fleets on a slightly larger scale as we combine mobility services with autonomous technology. Obviously this can change dramatically depending on each specific market, but I think in the interim the picture is less clear as the industry is such a state of flux right now.

MOBILITY-AS-A-SERVICE:
Autonomous Vehicles (AV) are set to revolutionize light weight vehicle costs per mile by 2030 /USD/mile)



Ride Hailing EV: Includes cost per mile and net earning of the driver

Source: World Economic Forum, Catapult - Market Forecast – For Connected and Autonomous Vehicles

Christian Back: Indeed we have some contradictory factors such as higher number of people using cars, higher number of miles by the user and on the other side we have a higher level of car sharing leading to a less cars required and a lower level of production. But this may be an indication that the after sales market could increase which could offer new opportunities

Jeremy Carlson: Well if we expect that some people are going to give up owning a vehicle in exchange for service based mobility and, in turn, that to impact top line industry sales, then we also have to offset the fact that vehicles are going to run at a higher rate and therefore a reduced life cycle. This could certainly impact the after sales market in terms of utilization, wear and tear whether it's components on the vehicles side, controls, tyres, brake pads or internal electronics.

Christian Back: It's an interesting point, as in some areas of the after sales market there are better margins for the OEM and supplier, particularly in the area of maintenance. As the market progresses it will be interesting to see whether this area is one that some automobile players will begin to focus and specialize on.

Egil Juliussen: At some point there will be a decrease in car sales. If you take the United States, there are currently 2.7/2.8 cars per household which is forecast to drop to 2 per household. This is mainly based on the fact that an autonomous vehicle can handle more than one person's driving activity. The forecasted drop in car sales will depend on how aggressive the take up is as well as the time frame.

Jeremy Carlson: We know the impact is going to be pretty significant on a lot of different areas within the automotive industry. But there is also the question of the ripple effect on peripheral industries beyond automotive. While it's not yet clear, the bottom line is that significant change over a long period of time will certainly impact other industries as well.

Looking at the different mobility models, how will companies focus their investments moving forward?

Grégory Derouet: From an investment perspective, I think it's going to be increasingly difficult to strategize. On a traditional model you had the security of reasonably reliable forecasts on consumer preference and car sales that could formulate investment plans in terms of development going forward. In terms of allocating investments, we are entering unknown territory - one where already we have seen huge investments sunk into failed collaborations.

As business models evolve, the ability to add value will be dictated by how much to allocate to R&D and in identifying the right technology. There therefore needs to be a degree of speed and flexibility in processes to achieve this. There's also the question of which key performance indicators (KPIs) should investors take into account when allocating investments. For me, there will be a lot more valuable and non-collectable data to take into account in the investment decision-making process for mobility services. To use an analogy, the cockpit for the CEO and CFO going forward will be much more difficult to pilot.

Egil Juliussen: I estimate that the cost of investment in autonomous driving has up to now been around US$30bn with future yearly investments across high tech and automotive likely to be US$7-10bn per year going forward and it's probably going to increase fairly rapidly as deployment gets going in a few years. That's a pretty significant level of investment.

Christian Back: I think we can identify how traditional players are handling this in three steps and they are all linked. The first one is R&D; OEM's and traditional suppliers are investing significant amounts in R&D on an increasing annual basis. Then there's investment in solutions. Within the next 5 years, Volkswagen has annonced to invest $35bn in mobility technology solutions that is around 70% of their total R&D expenditure; Hyundai for example will also invest $17bn. Third, there is collaboration. Recent examples have seen Toyota, Audi and BMW all announcing collaborations with partners that progress the new mobility landscape.

3. Regulatory influences

> "Markets have been pretty aggressive in trying to control different independent drivers engaging in these services and we do expect that to have an impact on how different mobility services progress."
>
> *Jeremy Carlson, principal automotive analyst at IHS Markit*

Some countries have taken a more liberal position than others on regulating the sharing economy, particularly in the deployment of self-drive solutions. From a regulatory point of view, there's a balance to strike in terms of encouraging sustainable and sharing economy solutions and regulating safe use. While the automotive sector is already used to being heavily regulated, how countries deal with new mobility challenges is likely to change the regulatory environment which in turn is likely to shape how business models evolve.

What impact is regulation having on players in the mobility sector?

Egil Juliussen: In terms of regulation, states in the US such as California have been much more lenient on autonomous driving rules. This basically means everybody is testing in these cities. In California alone, 50 companies have a permit to test in California. Out of this 50, 10 are Chinese and just under 10 are European. It means that all of the testing knowledge is getting accumulated in the US because regulations in Europe have been much slower to adapt. However, we are seeing regulations in China beginning to change, which should begin to attract companies looking to test autonomous vehicles in China later this year or early next year.

The investment rules are changing

The calculus of where to invest is changing. It's no longer a question of one person's mobility equals one car. I think that fundamentally changes how auto makers and the rest of the industry allocate investment budgets, particularly when these auto makers and suppliers are already developing many of the technologies that underpin mobility as a service, autonomous driving and vehicle electrification. While such development has perhaps been used for a slightly different application, it's not necessarily representing a completely different area of investment for them.

There's certainly some nuance to that when you think about how you apply those technologies to different business models. For example, there has been a lot of technology investment based on the status quo of one to one owned vehicles which can also be applied to shared vehicles in the future.

But the sheer pace of change within the industry is accelerating and the agility that companies need to be able to stay on top of it and not fall behind highlights how complex the challenge is from an investment perspective. There are so many different elements of technology, vehicle control, computing, connectivity that have to go into a vehicle, it's an incredibly complex and costly machine.

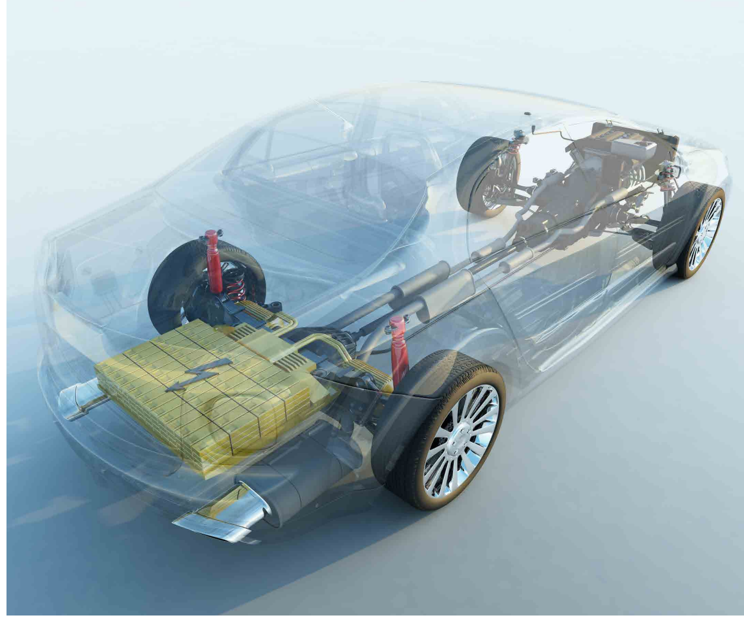
Of course, companies have been partnering to produce these vehicles for a number of years and that's not going to change, but I think that as vehicles become increasingly intricate it's leading many companies to realize that no matter how much money they invest, it's never going to be possible to do it on their own. So partnerships, investing in disruptive technology at an early stage, investing in suppliers and developing closer partnerships within the supply chain to develop those solutions will become a more important focus of any investment program.

Jeremy Carlson, principal automotive analyst at IHS Markit

Jeremy Carlson: Yes, the autonomous vehicle is a pretty big game changer for mobility services, which is why we see the likes of the US and now China at the vanguard. However, the European autonomous mobility market is unique in that we are seeing a lot of exploration between automotive providers, the supply chain and municipalities and they're having deliberate discussions about where and how they can deploy these services within existing infrastructure. Whereas if you look at regulatory environments in the US and China, there's a different and more company-led operating environment when talking about deployment that is impacting players.

Is regulation helping to shape how mobility service models evolve?

Jeremy Carlson: If we look at mobility as a service, regulation can certainly shape how the different business models evolve, particularly in terms of ride hailing with individual drivers. Certainly, we can see most markets have been pretty aggressive in trying to control different independent drivers engaging in these services and we do expect that to have an impact on how different mobility services progress.



Grégory Derouet: Players are both reacting and anticipating their responsibilities, particularly in the area of autonomous driving. But the automotive industry is already very heavily regulated, especially in terms of passenger safety and security. So even if the regulatory focus changes, I'm sure the industry would find it easy to adapt to any new regulatory environment. So while regulatory requirements will need to be managed, I don't see it as being a major risk for players.

4. Bridging the skills gap

> "... These specialists range from robotics experts, cloud architects and even developers in the gaming industry, which shows the diversity of skills now required in the automotive sector."
>
> *Christian Back, Partner, Mazars*

IT and software skills are a vital part of mobility services with demand for such skills increasing as the market evolves. How quickly and efficiently the automotive sector copes with incorporating the required IT skills into a predominantly engineering and production-led sector will be key. As well as demand and supply, investment in education, the ability to transfer existing skills, as well as recruiting from the non-automotive sector will all ensure that the industry meets the sheer numbers and level of skills required? However, pressure on employment costs and the push for further collaboration and partnerships to up-skill the existing and new workforce will prove challenging.

Will we see new skill sets emerging and how will the industry plug any gaps in the short to medium term?

Christian Back: Of course OEMs are currently looking for an enormous number of IT specialists. We have an example of Volkswagen looking for a thousand specialists in Wolfsburg, Germany alone. These specialists range from robotics experts, cloud architects and even developers in the gaming industry, which shows the diversity of skills now required in the automotive sector. Other examples include GM seeking 2,500 data scientists and also people who have experience in 3D printing and Ford last year hired 400 programming experts from Blackberry's mobile communication centre to develop in-car connectivity. So we cannot only see how IT skills are vital, but we also see how IT skills needed are changing. We can also see this on the non-tech side where skills on evaluating and creating new business models for the automotive industry is increasingly important, whereas in the past the focus was much more on continuously improving margins and processes. So we are seeing how skills across the board are changing due to new mobility models.

Grégory Derouet: We see a large part of R&D focused on the security of the car today. But as Christian says, looking forward there will be more and more focus on software rather than the engineering side. We already have a lot of movement with new players coming into the industry, as well as working with technology that is constantly evolving to cope with the new mobility market needs. Finding people with the right skills will become increasingly challenging when taking into account the sheer numbers of IT experts required. Looking forward, employment costs could be an issue.

Egil Juliussen: Yes. The biggest requirement will be for software skills and there is already a shortage, particularly in the field of cybersecurity. If you look at all start-up companies in the autonomous driving and mobility service sector they are nearly all based in the US with China a strong second. There are a few in the UK and a couple in France. After that it's pretty scarce in terms of industry participation. If we are to ensure that mobility service expertise isn't clustered in one or a few countries, there needs to be wider global participation.

Jeremy Carlson: I agree and it kind of reiterates that this isn't all a brand new challenge as the industry has been hiring software engineers to develop a lot of the new automotive electronics for some time. But I think the challenge will become much more acute due to how much of the vehicle will be software defined in the future.

Does this herald a higher concentration of players in the mobility sector in future?

Christian Back: In Europe we see a lot of providers in the ride hailing and car sharing segment, which I think is very typical for a young and new market. But my expectation is that we will see market concentration within these segments further down the line.

Egil Juliussen: I think it will depend on how mobility evolves, as well as how much influence there is from regulators. We are likely to see between three to five major players as well as a number of niche players focusing on specialized areas. But much will depend on whether cities start to exert control as they do in the mass transit sector. In Europe particularly, there's more likelihood of controlling who gets to run driverless vehicles and mobility services in cities. In which case there may well be a higher concentration of providers.

Jeremy Carlson: There's also the question of whether municipalities deploy their own mobility fleets as a public transport function rather than outsourcing to a private company and regulating an industry that supports their citizens. We don't know how that will all play out yet, as it's still quite a fragmented market. While competition is going to be important, I certainly would expect some consolidation in future. there may well be a higher concentration of providers.

● ACQUISITION (yellow) ● OWNERSHIP (blue) ● INVESTMENT (purple) ● PARTNERSHIP (red)

	BMW	Daimler	Ford	GM	PSA	Renault	Toyota	VW
AD Maps (HERE, Civil Maps, Tom Tom, etc.)	Acquisition	Acquisition	Investment					
Autonomous technology (Nauto, SAIPS, Autonomic, etc.)	Investment	Investment	Acquisition, Investment	Acquisition, Investment			Investment	
BEV-bus (Protera)	Investment							
Business unit (Maven, InMotion)				Ownership				
Car-sharing (TravelCar, Rent a Car, Zipcar, etc.)	Ownership	Investment, Ownership	Investment	Investment, Ownership	Acquisition, Investment, Partnership	Ownership, Partnership	Investment, Ownership	Investment, Partnership
Driver data (Zendrive)	Investment							
Driverless mobility (MOIA)								Acquisition
Hailing (Uber, Grab, Lyft, etc.)	Investment	Acquisition, Investment, Partnership		Acquisition, Investment			Investment	Investment
Intra-city bus services (Flixbus)								
Mass transit information (Embark)	Investment							
Mobility app (Maas Global)							Investment	
Parking app (JustPark, Park Mobile)	Investment							
Platform (MyTaxi, Moovel, Moovit, etc.)	Investment, Ownership	Acquisition, Ownership						
Ride-sharing (Via, BlaBlaCar, Chariot, etc.)	Investment	Investment	Ownership					
Transit app (GlobeSherpa)		Acquisition						
Travel app (RideScout)		Acquisition						

Source: < Mobility as a Serivce> by Dr. Egil Juliussen and Jeremy Carlson, updated on 26 Sept 2017

IHS Markit™

UNITED KINGDOM

POPULATION 2016
65 637 240

URBAN POPULATION %
83%

NUMBER OF PASSENGER CARS IN USE
30 250 294

NUMBER OF VEHICLE PER HEAD (DATA IN 2016) PER 1000 HABITANT
587

TOTAL PASSENGER TRAVEL DISTANCE 2016
696 779

ROAD INFRASTRUCTURE INVESTMENT 2017 €
9 046 831 956

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
LESS THAN 5%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/Population Division; Statistics from Departments of Transport

Louis Burns
Partner, Mazars UK

Is consumer behaviour the key to a better sustainable mobility model?

With increasing signs that a shift from traditional powertrains towards electric and hybrid alternatives is underway, Louis Burns, Partner at Mazars looks at the sustainable mobility challenges the industry now faces and how paying closer attention to consumer behaviour can help manage the risks involved.

Over 49,100 ultra-low emission vehicles (ULEVs) were registered in the UK over the 12 month period to September 2017, according to the Department of Transport. Representing an increase of 22% on 2016 figures and 72% since 2015, it heralds a growing appetite for environmentally friendly cars. Of course, if we take a look at overall car sales, ULEVs still make up only 4.4% of all newly registered cars in the UK. So while indicators are pointing firmly in the direction of where the future of the automotive industry lies, the debate on how it gets there and how long it will take is currently concentrating the minds of OEMs and suppliers alike.

Yet looking at statistics in isolation doesn't always tell the full story. A sustainable mobility model that enables movement with minimal environmental impact requires a much greater level of collaboration between a wider range of stakeholders that not only includes commercial partners, but also environmentalists, government bodies, town planners and local communities. While these working relationships help the automotive industry understand policies that will impact decision making on powertrain development, plant design and location, relationships with the end consumer are generally focused on the pre-purchase and purchase phase. But by paying closer attention to consumer behaviour across the whole lifecycle of the car buying process, deeper insights can be gained that add value to the development of a sustainable mobility strategy.

REDEFINE CAR OWNERSHIP

Alongside the high cost of car ownership, government policies aimed at reducing the consumption of goods that harm the environment are guiding consumers to make more informed choices on car ownership, particularly second car ownership. Rather than paying for an additional car that is used infrequently, consumers are killing two birds with one stone by assessing car hire and shared ownership options to contain costs and help reduce air pollution. This does not necessarily mean a reduction in car sales, as it's expected that increased use of fewer vehicles will require more frequent replacement. More importantly, such trends open up doors to create or improve synergies between the automotive industry, car hire firms and car sharing platforms.

GENERICALLY CONNECTED SYSTEMS

From on-board diagnostics that remember where you park, tracks your travel history to turning your car into a Wi-Fi hot spot, vehicles are becoming more connected. Yet with consumers looking for a more fluid relationship with car ownership, plug and play systems that are intuitive and able to accept the widest possible range of consumer devices will become increasingly important when it comes to vehicle choice.

REMOVE BARRIERS

The lack of charging stations is a major barrier for consumers considering a more environmentally friendly car. Whether a sustainable mobility model involves hydrogen fuel cell innovation or full electric and hybrid engine development, it's crucial that the automotive industry collaborates with local government and stakeholders to speed up the process of enabling infrastructure so that the ability of consumers to refuel or recharge continues to improve. Ease of use and increased access to charging stations in major locations will help increase consumer confidence in low emission vehicles.

IMPROVE INCENTIVES

It's no surprise that the current growth in ULEVs in the UK is being helped primarily by government subsidies including lower tax and cash grants. At the top end of the range, Category 1 cars that have CO2 emissions of less than 50g/km and can travel at least 70 miles without any emissions at all qualify for a government grant that will pay for 35% of the purchase price, up to a maximum of £4,500. Combined with government subsidies, promotional offers on low emission vehicles such as cash rebates, a lower finance rate or special lease terms by car manufacturers and dealers have an important role to play in the consumer decision making process. Improved and continual financial incentives can help reach the critical mass needed to push sustainable vehicle sales further into the mainstream.

Feeding such insights on consumer behaviour through to the CFO and finance department can help formulate spending and investment budgets, as well as design and integrate sustainable development strategies. Taken into consideration alongside government policies, regulatory guidelines and global environmental plans, such insights can help the automotive industry manage financing and working capital arrangements more efficiently to give them a competitive edge? Importantly, it can help manage the many risks and challenges involved as the industry moves to a global sustainable mobility model.

Whether it's by developing internal data collection channels or partnering with experts, the ability to capture such a wide range of insights is key. As the decision making process becomes more complex and the number of stakeholders involved increases, the industry has to have a clearer understanding of customer needs and behaviours across the lifecycle, not just during the purchase phase if it is to develop relevant and compelling sustainable mobility choices.

CASE STUDY: London

~8,7Mn
POPULATION (2015)

~2,7Mn
CAR OWNERS (2016)

~5 Mn
TUBE RIDERS (2015 WEEKDAY DAILY AVG.)

~3,5 Mn
HOUSEHOLDS (2015)

1,572
LONDON AREA (SQ. KM)

GPB 44,000
PER CAPITA ANNUAL INCOME (2015)

2,688,161	125,223	241,651	20,812	35,546
LICENSED CARS	MOTORCYCLES	LIGHT & HEAVY GOOD VEHICLES	BUSES & COACHES	OTHER VEHICLES

CASE ASSUMPTIONS :

PERSONAL OWNERSHIP MODEL

It is assumed that the current (2016) licensed car stock (2,668,161) will grow at a constant growth rate of 1.55% (derived from the historical averages from 2013-16) for the next 14 years, bringing the 2030 total car stock to = 3,309,261.

The average distance covered by each car is assumed to = the total traffic flow of cars for 2016/total number of cars, which = 23,213,000,000 km /2,668,161 = 8,700 km/year.

The ICE-EV current ratio is taken to be equivalent to the amount of electric car stock outstanding in 2015-16 (as by International Energy Agency) to total number of cars.

RIDE SHARING

It is assumed that each ride sharing car will carry a total of 4 passengers across each journey.

In each case, it is assumed that 100% ride shared cars and 50% of personal cars will be electric

Each ridesharing vehicle is assumed to cover an average distance of 17,400 km/year.

VEHICLE ECONOMICS

- ✔ Cost for a Private 4-wheeler Petrol ICE and EV car is assumed to be GBP 0.126/mile and GBP 0.047/mile for each user (translating into km), based upon the current fuel/charging cost undertaken for a Renault Clio (Petrol) and Renault Zoe (Electric) in the UK, as well as the average service and maintenance expenditure for these models. A ratio of 4 users is taken to calculate the cost per user, keeping charging costs equal, for a Shared EV 4-wheeler.
- ✔ Cost of public transit is taken to be GBP 0.125/km, using the Gross expenditure taken for London buses, along with a 50% reduction in costs due to electrification.

ELECTRIFICATION SCENARIO :

80% EV Penetration Reduces Running Costs by 50.1%

20 % EVs

20% ELECTRIC VEHICLE + 80% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	8,700 km
Cars in 2016	2,668,161
Cars in 2030	3,309,261
Estimated Electric Vehicles 2030	661,852
Estimated ICE's (Petrol) 2030	2,647,409
Avg Distance covered by EV's	5,758,113,955 km
Avg Distance covered by ICE's	23,032,455,819 km
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: $ 1.96 BN

50 % EVs

50 % ELECTRIC VEHICLE + 50% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	8,700 km
Cars in 2016	2,668,161
Cars in 2030	3,309,261
Estimated Electric Vehicles 2030	1,654,630
Estimated ICE's (Petrol) 2030	1,654,630
Avg Distance covered by EV's	14,395,284,887 km
Avg Distance covered by ICE's	14,395,284,887 km
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: GBP 1.54 BN

80 % EVS

80% ELECTRIC VEHICLE + 20% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	8,700 km
Cars in 2016	2,668,161
Cars in 2030	3,309,261
Estimated Electric Vehicles 2030	2,647,409
Estimated ICE's (Petrol) 2030	661,852
Avg Distance covered by EV's	23,032,455,819 km
Avg Distance covered by ICE's	5,758,113,955 km
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: GBP 1.12 BN

Source: Mazars' Global Knowledge Center Analysis; London Data Store (Greater London Authority); Press Articles

RIDE SHARING SCENARIO :

Greater Ride Sharing Cuts Down on Number of Vehicles and Cost

20% RIDE SHARING

20 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	17,400 km
Avg Distance – YR (Personal Car)	8,700 km
Ride Sharing (2030)	165,463
Personal Ownership (2030)	2,647,409
Estimated EVs 2030	1,489,167
Estimated ICEs (Petrol) 2030	1,323,704
Avg Distance Covered by EVs	14,395,284,887 km
Avg Distance Covered by ICEs	11,516,227,909 km
Shared 4w EV (GBP/km)	0.00739
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: GBP 1.25 BN

50 % RIDE SHARING

50 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	17,400 km
Avg Distance – YR (Personal Car)	8,700 km
Ride Sharing (2030)	413,658
Personal Ownership (2030)	1,654,630
Estimated EVs 2030	1,240,973
Estimated ICEs (Petrol) 2030	827,315
Avg Distance Covered by EVs	14,395,284,887 km
Avg Distance Covered by ICEs	7,197,642,443 km
Shared 4w EV (GBP/km)	0.00739
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: GBP 0.82 BN

80 % RIDE SHARING

80 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	17,400 km
Avg Distance – YR (Personal Car)	8,700 km
Ride Sharing (2030)	661,852
Personal Ownership (2030)	661,852
Estimated EVs 2030	992,778
Estimated ICEs (Petrol) 2030	330,926
Avg Distance Covered by EVs	14,395,284,887 km
Avg Distance Covered by ICEs	2,879,056,977 km
Shared 4w EV (GBP/km)	0.00739
Private 4w EV (GBP/km)	0.029
Private 4w Petrol (GBP/km)	0.078

TOTAL RUNNING COST: GBP 0.39 BN

Source: Mazars' Global Knowledge Center Analysis; London Data Store (Greater London Authority); Press Articles

CHINA

POPULATION 2016
1 378 665 000

URBAN POPULATION %
57%

NUMBER OF PASSENGER CARS IN USE
172 000 000

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
194

TOTAL PASSENGER TRAVEL DISTANCE 2016
1 196 060

ROAD INFRASTRUCTURE INVESTMENT 2015 €
414 199 461 806

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
32%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/ Population Division; Statistics from Departments of Transport

Jean-François Salzmann
Managing Partner, Mazars China

How China is transforming shared mobility?

China is powering ahead of other countries in developing a sustainable shared mobility market. Jean-François Salzmann, partner, Mazars in China looks at how the market is already showing signs of maturity in comparison to the rest of the world and what the automotive sector can learn from China's approach.

With over 400 million registered customers in more than 400 Chinese cities, Didi Chuxing's smartphone app delivers 25 million rides a day, making it by far the biggest mobile transportation service provider in China, particularly since it bought out Uber's Chinese operations in 2016. But it's not just strength in the Chinese market that has turned Didi from a household name to an aspiring global brand, it's the ability to create a single ecosystem by aggregating big data that is helping to transform this sector of the shared mobility market and potentially defines our core understanding of what shared mobility is from a business perspective.

ONE APP FOR ALL

Using an app to call a taxi is no longer alien to consumers in many countries. However, China is already pulling away from the pack in terms of providers aggregating data to offer one stop transport platforms, whether it's a taxi, bus, chauffeur driven or private car to a wide range of private and business users on an as-needed basis. It's this ability to link up different demands without the need to go to separate service providers that presents both opportunities and challenges to companies looking to develop shared mobility services in China. Despite the current domination by a small number of companies in this space, there will always be room for niche services that cater for a particular market segments or exploit the growth in passenger experience innovation.

But companies that have the technical capabilities alongside expertise in data management and governance going forward will have more of a competitive edge as expected tougher regulations kick in.

INTERMEDIARY OR PROVIDER?

Despite current high market concentration in China, which business model holds the balance of power when it comes to mobility solutions is far from clear cut. There are intermediaries such as Didi who aggregate data to act as a link between providers of cars, bikes, taxis etc. with potential customers. Then there are providers such as Mobike which manufacturers the majority of the distinctive orange bikes on its platform to capitalize on the growth of on-demand bicycle use. While there is the undoubted power of data, there is also control and expertise in the manufacturing process. Both use technology in different ways, but there are service synergies which more recently has seen Didi sign partnership agreements to help OEMs market auto-sharing services and electric vehicles. Equally, Mobike integrated its services into WeChat, which is China's largest social media platform. Either way, forging the right partnerships with a shared vision will continue to be key.

BRAND RECOGNITION

It's counterintuitive to think that regulation can create a brand, but there's potential in China. In terms of the traditional automotive sector, China's focus on its home market has left it behind in the race to create a globally recognized car brand. Instead it has used deep pockets to buy global brands such as Volvo, which is now owned by Chinese OEM Geely. However, with EV development very high on the agenda for the Chinese Government, there is still potential to create a globally recognized Chinese brand in this fledgling sector. Government regulations that ensure a certain percentage of car manufacturing in China are EVs are already filtering through to share mobility platforms where EVs are increasingly the norm.

In addition, industry players are using this regulatory push to exploit expertise in integrating artificial intelligence (AI) and work together to ensure infrastructure such as charge points match demand.

As a densely populated country, China's enthusiasm for shared mobility is undoubtedly fuelled by necessity. But China's involvement in EV and wider sustainable mobility developments so far, means it is not only putting its own stamp on future solutions but is also intent on leading the way.

CASE STUDY: Beijing

~13.5 Mn
POPULATION (2015)

~5 Mn
CAR OWNERS (2016)

~3.3 Bn
RAIL TRANSIT – ANNUAL PASSENGER (2015)

~5.3 Mn
HOUSEHOLDS (2015)

16,808
BEIJING AREA (SQ. KM5)

¥48,458
AVERAGE ANNUAL DISPOSABLE INCOME PER CAPITA (2015)

4,403,000
PRIVATE CARS

5,350,000
CIVIL AUTOMOBILES

306,000
TRUCKS

23,287
BUSES & TROLLEYS

68,284
TAXIS

5,024
RAIL TRANSIT

CASE ASSUMPTIONS :

PERSONAL OWNERSHIP MODEL

It is assumed that the current (2016) licensed car stock (2,668,161) will grow at a constant growth rate of 1.55% (derived from the historical averages from 2013-16) for the next 14 years, bringing the 2030 total car stock to = 3,309,261

The average distance covered by each car is assumed to = the total traffic flow of cars for 2016/ total number of cars, which = 23,213,000,000 km/2,668,161 = 8,700 km/year.

The ICE-EV current ratio is taken to be equivalent to the amount of electric car stock outstanding in 2015-16 (as by International Energy Agency) to total number of cars.

RIDE SHARING

It is assumed that each ride sharing car will carry a total of 4 passengers across.

In each case, it is assumed that 100% ride shared cars and 50% of personal cars will be electric

Each ridesharing vehicle is assumed to cover an average distance of 17,400 km/year.

VEHICLE ECONOMICS

- ✔ Cost for a Private 4-wheeler Petrol ICE and EV car is assumed to be GBP 0.126/mile and GBP 0.047/mile for each user (translating into km), based upon the current fuel/charging cost undertaken for a Renault Clio (Petrol) and Renault Zoe (Electric) in the UK, as well as the average service and maintenance expenditure for these models. A ratio of 4 users is taken to calculate the cost per user, keeping charging costs equal, for a Shared EV 4-wheeler.
- ✔ Cost of public transit is taken to be GBP 0.125/km, using the Gross expenditure taken for London buses, along with a 50% reduction in costs due to electrification.

ELECTRIFICATION SCENARIO :
80% EV Penetration Reduces Consumption Cost By 52%

20 % EVS

20% ELECTRIC VEHICLE + 80% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	14143 km
Cars in 2015	49,81,000
Cars in 2030	66,05,859
Estimated EVs 2030	13,21,172
Estimated ICEs 2030	52,84,687
Avg Distance Covered by EVs	18,685,332,864 km
Avg Distance Covered by ICEs	74,741,331,458 km
Private 4w EV (RMB/km)	0.17
Private 4w Petrol (RMB/km)	0.45

TOTAL RUNNING COST: RMB 36.7 BN

50 % EVS

50 % ELECTRIC VEHICLE + 50% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	14143 km
Cars in 2015	49,81,000
Cars in 2030	66,05,859
Estimated EVs 2030	33,02,930
Estimated ICEs 2030	33,02,930
Avg Distance Covered by EVs	46,713,332,161 km
Avg Distance Covered by ICEs	46,713,332,161 km
Private 4w EV (RMB/km)	0.17
Private 4w Petrol (RMB/km)	0.45

TOTAL RUNNING COST: RMB 28.9 BN

80 % EVS

80% ELECTRIC VEHICLE + 20% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	14143 km
Cars in 2015	49,81,000
Cars in 2030	66,05,859
Estimated EVs 2030	52,84,687
Estimated ICEs 2030	13,21,172
Avg Distance Covered by EVs	74,741,331,458 km
Avg Distance Covered by ICEs	18,685,332,864 km
Private 4w EV (RMB/km)	0.17
Private 4w Petrol (RMB/km)	0.45

TOTAL RUNNING COST: RMB 21.1 BN

Source: Mazars' Global Knowledge Center Analysis; BeijingStatistical Yearbook; Press Articles, MDPI

RIDE SHARING SCENARIO :
Greater Ride Sharing Cuts Down on Number of Vehicles and Cost

20% RIDE SHARING

20 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	28,286 km
Avg Distance – YR (Personal Car)	14,143 km
Ride Sharing (2030)	330,293
Personal Ownership (2030)	5,284,687
Estimated EVs 2030	2,972,637
Estimated ICEs (Petrol) 2030	2,642,344
Avg Distance Covered by EVs	46,713,332,161 km
Avg Distance Covered by ICEs	37,370,665,729 km
Shared 4w EV (RMB/km)	0.22
Private 4w EV (RMB/km)	0.17
Private 4w Petrol (RMB/km)	0.45

TOTAL RUNNING COST: RMB 25.2 BN

50% RIDE SHARING

50 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	28,286 km
Avg Distance – YR (Personal Car)	14,143 km
Ride Sharing (2030)	825,732
Personal Ownership (2030)	3,302,930
Estimated EVs 2030	2,477,197
Estimated ICEs (Petrol) 2030	1,651,465
Avg Distance Covered by EVs	46,713,332,161 km
Avg Distance Covered by ICEs	23,356,666,081 km
Shared 4w EV (GBP/km)	0.22
Private 4w EV (GBP/km)	0.17
Private 4w Petrol (GBP/km)	0.45

TOTAL RUNNING COST: RMB 19.7 BN

80% RIDE SHARING

80 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	28,286 km
Avg Distance – YR (Personal Car)	14,143 km
Ride Sharing (2030)	1,321,172
Personal Ownership (2030)	1,321,172
Estimated EVs 2030	1,981,758
Estimated ICEs (Petrol) 2030	660,586
Avg Distance Covered by EVs	46,713,332,161 km
Avg Distance Covered by ICEs	9,342,666,432 km
Shared 4w EV (GBP/km)	0.22
Private 4w EV (GBP/km)	0.17
Private 4w Petrol (GBP/km)	0.45

TOTAL RUNNING COST: RMB 14.2 BN

Source: Mazars' Global Knowledge Center Analysis; BeijingStatistical Yearbook; Press Articles, MDPI

Tomorrow's car won't be the same as today's... Neither will the expertises involved in building it

Component cost of an ICEV
Internal Combustion Engine Vehicle

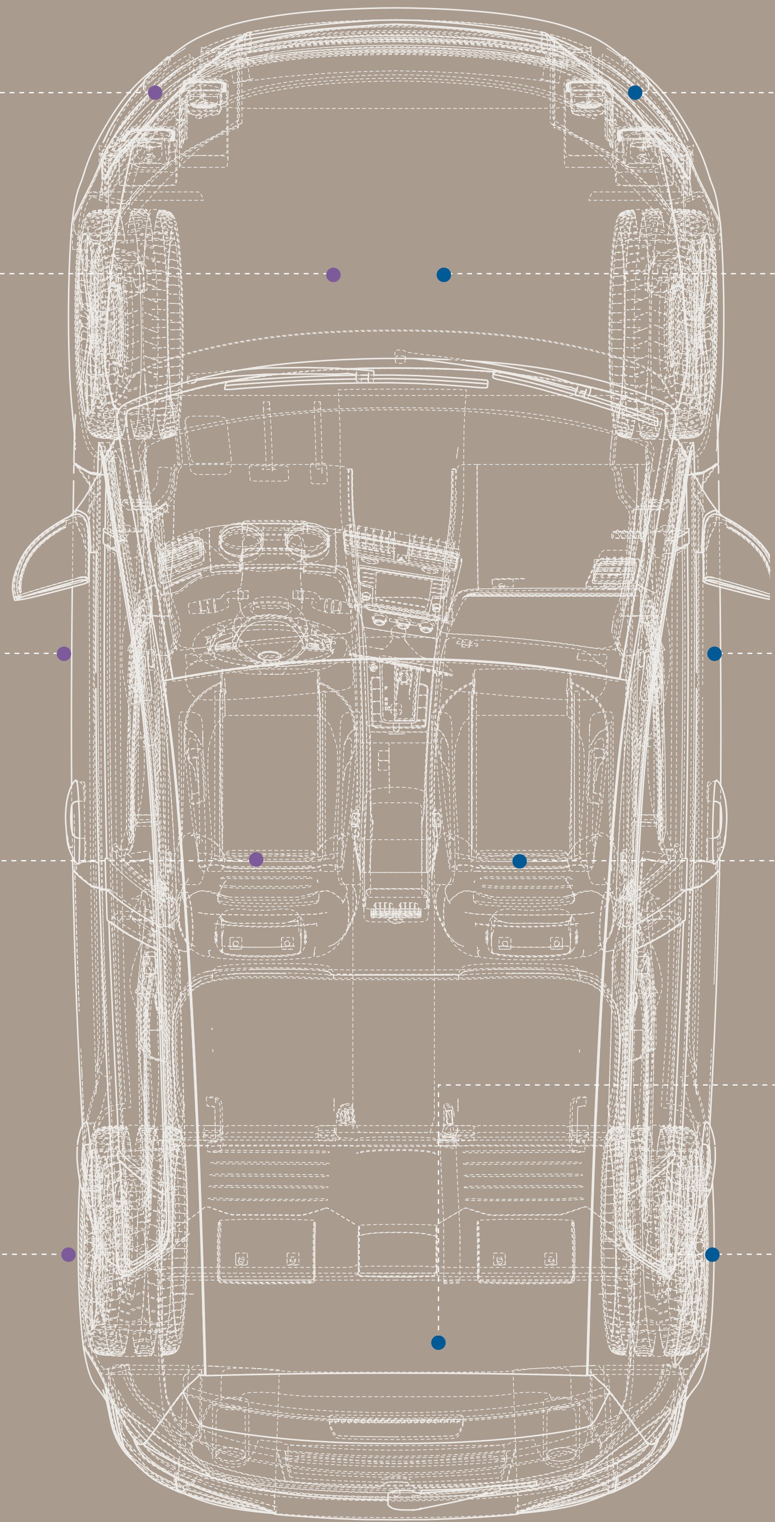
11 - 20 %
VEHICLE BODY

22 - 24 %
DRIVETRAIN

9 - 12 %
CHASSIS

30 - 37 %
VARIOUS EQUIPMENTS

15%-20 %
OTHERS



Component cost of an EV
Electric Vehicle

7 - 19 %
VEHICLE BODY

8 - 20 %
DRIVETRAIN

4 - 9 %
CHASSIS

11 - 27 %
VARIOUS EQUIPMENTS

35 - 50 %
BATTERY PACK

5 - 15%
OTHERS

Focus : ICEV Drive train cost structure

35 - 40 %
ENGINE

18 - 22 %
AUXILIARY UNITS

20 - 27 %
TRANSMISSION

8 - 11 %
EXHAUST SYSTEM

7 - 9 %
OTHERS

Focus : EV Drive train cost structure

33 - 43 %
ELECTRIC MOTOR

39 - 47 %
INVERTER

8 - 10 %
TRANSMISSION

4 - 6 %
ON-BOARD CHARGER

Source: Kampker, A., Deutskens, C., Nee, C., "Produktion von Elektrofahrzeugen", in: Kampker,Vallée, D., Schnettler, A., "Elektromobilität – Grundlagen einer Zukunftstechnologie", Springer, A.,Berlin Heidelberg, ISBN: 978-3-642-31985-3, 2013.

USA

POPULATION 2016
323 127 513

URBAN POPULATION %
83 %

NUMBER OF PASSENGER CARS IN USE
122 322 000

NUMBER OF VEHICLE PER HEAD (DATA IN 2017) PER 1000 HABITANT
910

TOTAL PASSENGER TRAVEL DISTANCE 2016
5 356 301

ROAD INFRASTRUCTURE INVESTMENT 2015 €
85 436 193 223

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
16%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/ Population Division; Statistics from Departments of Transport

Jeremy Rice
Senior Manager, Mazars USA

How the US can hedge its bets on sustainable mobility?

Jeremy Rice, Senior Manager, Mazars USA, looks at how the US automotive industry can use geography and demographics to develop focused sustainable mobility solutions that cater more specifically to consumer needs and preference.

While the US is the location of choice for testing on autonomous driving and is home to tech giants such as Tesla, Google and Uber who are taking the lead on shaping the sustainable mobility landscape, the picture for the traditional US automotive industry is less than clear.

With large combustion engine SUVs still the best selling vehicles in the US, OEMs are struggling to find an approach that takes advantage of cutting edge thinking on sustainable mobility development, while at the same time keeping Wall Street happy. Conscious that the sustainable winds of change are blowing stronger, Ford has recently announced an $11bn investment program in electric vehicles by 2022, which more than doubles its previous commitment. General Motors has already seen growing, albeit small, interest in its electric vehicle (EV) offering, the Chevy Bolt, and has announced similar intentions to increase its electric and hybrid fleet. But while sustainable mobility momentum is picking up at company level, taking into account the geographical make up and demographics of the US is key to catering for consumer needs and preference.

ARE WE THERE YET?

Despite a decrease in engine cylinder size over the past 10 years, the market for larger vehicles such as SUV/Crossovers has never been stronger. This is not surprising based on the sheer size of the US, where 97% of land is rural. Interstate driving needs require vehicles that have the power and capacity not only to cope with very long distances but often rugged driving conditions, which is why SUVs are a popular choice. For EVs to match their combustion engine counterparts, significant investment in infrastructure and continued development in longer life battery technology is required. OEMs that can achieve this will be in a better position to convince the American public that EVs are both a viable and reliable alternative.

AN URBAN VERSUS RURAL STRATEGY

While Ford's F150 pick-up truck is America's best-selling vehicle, smaller cars are gaining popularity in more densely populated cities, particularly on the coasts. This gives a potential market for EVs from younger city-based consumers who use cars to commute to work and prefer to fly for longer trans-America journeys. With only 80% of America's 327 million population living in urban areas it makes sense for OEMs to have a specific urban-focused sustainable mobility strategy. This also opens the door for building partnerships that give access to shared mobility options such as ride-hailing and car sharing which has more traction in more densely populated areas. Whereas in rural areas hybrid vehicles offer an interim solution to current consumer reluctance for EVs.

THE CHALLENGE OF SECOND GUESSING INNOVATION

While advances in technology, particularly in the area of automated driving, are disrupting OEMs, it's equally as hard to envisage what the end game is for those in the US supply chain. As a result, some players are hedging their bets and investing heavily in technology to cope with life without combustion engines or traditional car materials. While it's a gamble to invest in expertise and capabilities 5-10 years before the landscape becomes readable, companies that delay plans to acquire the right skills and expertise could potentially fall too far behind the curve.

Of course, the ultimate winners and losers in the US automotive industry will not only be decided by national considerations, but also what happens on the global stage. As players in the industry jockey for position, an increase in investment and research into sustainable mobility solutions, collaboration and acquisitions will become the strategic norm.

CASE STUDY: New York City

~8.5 Mn
POPULATION (2015)

~3.1 Mn
HOUSEHOLDS

~2.0 Mn
CAR OWNERS

~2.4 Mn
BUS DAILY RIDERSHIP

~302.6
NYC AREA (SQ. MILES)

USD 55,752
AVERAGE ANNUAL PER CAPITA INCOME (2015)

~5.6 Mn
SUBWAY DAILY RIDERSHIP

~2.0 Mn.
CAR OWNERSHIP

~5700
BUSES

~13,600
YELLOW CABS

~14,100
UBER CABS

CASE ASSUMPTIONS

PERSONAL OWNERSHIP MODEL

Currently 63% of 3,128,246 households own a car in NYC. It is assumed that this ratio will stay the same, with the population of NYC (and therefore number of households) growing at a CAGR of 5% between 2016-30. According to this, 63% of 3,354,484 households will own a car, bringing the number of cars in 2030 to 2,113,325.

The average distance covered by each car is assumed to = the average vehicle miles travelled by cars in 2014-15 (~11,300 miles), converted to ~18,095 km.

The ICE-EV ratio is taken to = the amount of electric car stock outstanding in the US in 2015-16 (as by International Energy Agency) to the total number of cars (as by OICA).

RIDE SHARING

It is assumed that each ride sharing car will carry a total of **4 passengers** across.

In each case, it is assumed that **100%** ride shared cars and **50%** of personal cars will be electric

Each ride-sharing vehicle is assumed to cover an average distance of 36,191 km/year.

VEHICLE ECONOMICS

- ✔ Cost for a Private 4-wheeler Petrol ICE car is assumed to be the average of the 5 top selling sedan, SUV and van models in 2017, as selected by the American Automobile Association. Cost of EV is based on the operating costs listed by the American Automobile Association.
- ✔ Cost of public transit is taken to be USD 0.34/km, given that the Operating Cost per mile for electric buses are presumed to be 0.55 USD, as per HART Government District.

ELECTRIFICATION SCENARIO:
80% EV PENETRATION REDUCES RUNNING COSTS BY 33.6%

20 % EVS

20% ELECTRIC VEHICLE + 80% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	18,095 km
Cars in 2016	1,970,795
Cars in 2030	2,113,325
Estimated EVs 2030	422,665
Estimated ICEs (Petrol) 2030	1,690,660
Avg Distance Covered by EVs	7,648,300,630 km
Avg Distance Covered by ICEs	30,593,202,521 km
Private 4w EV (USD/km)	0.06
Private 4w Petrol (RMB/km)	0.11

TOTAL RUNNING COST: USD 3.85 BN

50 % EVS

50 % ELECTRIC VEHICLE + 50% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	18,095 km
Cars in 2016	1,970,795
Cars in 2030	2,113,325
Estimated EVs 2030	1,056,663
Estimated ICEs (Petrol) 2030	1,056,663
Avg Distance Covered by EVs	19,120,751,576 km
Avg Distance Covered by ICEs	19,120,751,576 km
Private 4w EV (GBP/km)	0.06
Private 4w Petrol (GBP/km)	0.11

TOTAL RUNNING COST: USD 3.32 BN

80 % EVS

80% ELECTRIC VEHICLE + 20% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	18,095 km
Cars in 2016	1,970,795
Cars in 2030	2,113,325
Estimated EVs 2030	1,690,660
Estimated ICEs (Petrol) 2030	422,665
Avg Distance Covered by EVs	30,593,202,521 km
Avg Distance Covered by ICEs	7,648,300,630 km
Private 4w EV (USD/km)	0.06
Private 4w EV (USD/km)	0.11

TOTAL RUNNING COST: USD 2.79 BN

Source: Mazars Global Knowledge Center Analysis; American Automobile Association Federal Highway Administration; United States Census Bureau; Press Articles

RIDE SHARING SCENARIO:
Greater Ride Sharing Cuts Down on Number of Vehicles and Cost

20% RIDE SHARING

20 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	36,191 km
Avg Distance – YR (Personal Car)	18,095 km
Ride Sharing (2030)	105,666
Personal Ownership (2030)	1,690,660
Estimated EVs 2030	950,996
Estimated ICEs (Petrol) 2030	845,330
Avg Distance Covered by EVs	19,120,751,576 km
Avg Distance Covered by ICEs	19,120,751,576 km
Shared 4w EV (USD/km)	0.05
Private 4w EV (USD/km)	0.06
Private 4w Petrol (USD/km)	0.11

TOTAL RUNNING COST: USD 2.84 BN

50% RIDE SHARING

50 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	36,191 km
Avg Distance – YR (Personal Car)	18,095 km
Ride Sharing (2030)	264,166
Personal Ownership (2030)	1,056,663
Estimated EVs 2030	792,497
Estimated ICEs (Petrol) 2030	528,331
Avg Distance Covered by EVs	19,120,751,576
Avg Distance Covered by ICEs	9,560,375,788
Shared 4w EV (USD/km)	0.05
Shared 4w EV (USD/km)	0.06
Private 4w Petrol (USD/km)	0.11

TOTAL RUNNING COST: USD 2.14 BN

80% RIDE SHARING

80 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	36,191 km
Avg Distance – YR (Personal Car)	36,191 km
Ride Sharing (2030)	422,665
Personal Ownership (2030)	422,665
Estimated EVs 2030	633,998
Estimated ICEs (Petrol) 2030	211,333
Avg Distance Covered by EVs	19,120,751,576
Avg Distance Covered by ICEs	3,824,150,315
Shared 4w EV (USD/km)	0.05
Private 4w EV (USD/km)	0.01
Private 4w Petrol (USD/km)	0.01

TOTAL RUNNING COST: USD 1.43 BN

Source: Mazars Global Knowledge Center Analysis; American Automobile Association Federal Highway Administration; United States Census Bureau; Press Articles

RELATED CASE STUDY: TORONTO

~2.93 Mn
POPULATION (2017)

~1.67 Mn
CAR OWNERSHIP (2016)

~538 Mn
ANNUAL TRANSIT COMMISSION (TTC) RIDES (2015)

~1.11 Mn
HOUSEHOLDS (2016)

~630
LAND AREA (SQ. KM)

~CAD 98,174
AVERAGE ANNUAL HOUSEHOLD INCOME (2015)

CASE ASSUMPTIONS

PERSONAL OWNERSHIP MODEL

The average Canadian household owns 1.5 cars. Currently, there are 1,112,930 households in the city of Toronto. Given that the population of ~2.88 Mn is projected to increase to ~3.89 Mn in 2041, the per year growth rate is derived, which is used to calculate the number of households in 2030, that = 1,316,976. At a rate of 1.5 this means there are 1,975,464 cars in 2030.

The average distance covered by each car is assumed to = the average distance travelled by a car in Ontario, which = 16,000 km.

The ICE-EV ratio is taken to = the amount of electric car stock outstanding in Canada in 2015 (as by International Energy Agency) to the total number of cars (as by OICA), which = 0.08%.

RIDE SHARING

It is assumed that each ride sharing car will carry a total of 4 passengers across each journey.

It is assumed that each ride sharing car will carry a total of 4 passengers across.

Each ridesharing vehicle is assumed to cover an average distance of 32,000 km/year.

VEHICLE ECONOMICS

- ✔ Cost for a Private 4-wheeler Petrol ICE car is assumed to be the average of Canada's top selling Honda Civic LX (2013 model) – with regards to the current fuel rate of CAD 1/liter and standard maintenance and tire cost.
- ✔ Cost for Private 4-wheeler EV is assumed to be the average for Nissan LEAF – using the current electricity rate at CAD 0.06/kwh and the average maintenance taken by users.
- ✔ Cost of Shared 4-wheeler EV is assumed to reduce to 50%, based on the current trend shared in Canada, where car pooling cuts costs by 50%.

ELECTRIFICATION SCENARIO:
80% EV PENETRATION REDUCES RUNNING COSTS BY 33.6%

20 % EVS

20% ELECTRIC VEHICLE + 80% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	16,000 km
Cars in 2016	1,669,395
Cars in 2030	1,975,464
Estimated EVs 2030	395,093
Estimated ICEs (Petrol) 2030	1,580,371
Avg Distance Covered by EVs	6,321,483,554 km
Avg Distance Covered by ICEs	25,285,934,217 km
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 3.34 BN

50 % EVS

50 % ELECTRIC VEHICLE + 50% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	16,000 km
Cars in 2016	1,669,395
Cars in 2030	1,975,464
Estimated EVs 2030	987,732
Estimated ICEs (Petrol) 2030	987,732
Avg Distance Covered by EVs	15,803,708,885 km
Avg Distance Covered by ICEs	15,803,708,885 km
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 2.32 BN

80 % EVS

80% ELECTRIC VEHICLE + 20% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	16,000 km
Cars in 2016	1,669,395
Cars in 2030	1,975,464
Estimated EVs 2030	1,580,371
Estimated ICEs (Petrol) 2030	395,093
Avg Distance Covered by EVs	25,285,934,217 km
Avg Distance Covered by ICEs	6,321,483,554 km
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 1.29 BN

Source: Mazars' Global Knowledge Center Analysis; Canadian Automotive Association; Statistics Canada; Ontario Ministry of Finance; City of Toronto Government Data; Press Articles

RIDE SHARING SCENARIO:
Greater Ride Sharing Cuts Down on Number of Vehicles and Cost

20% RIDE SHARING

20 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	32,000 km
Avg Distance – YR (Personal Car)	16,000 km
Ride Sharing (2030)	98,773
Personal Ownership (2030)	1,580,731
Estimated EVs 2030	888,959
Estimated ICEs (Petrol) 2030	790,185
Avg Distance Covered by EVs	15,803,708,885 km
Avg Distance Covered by ICEs	12,642,967,108 km
Shared 4w EV (CAD/km)	0.063553
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 2.05 BN

50% RIDE SHARING

50 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	32,000 km
Avg Distance – YR (Personal Car)	16,000 km
Ride Sharing (2030)	246,933
Personal Ownership (2030)	987,732
Estimated EVs 2030	740,799
Estimated ICEs (Petrol) 2030	493,866
Avg Distance Covered by EVs	15,803,708,885 km
Avg Distance Covered by ICEs	7,901,854,443 km
Shared 4w EV (CAD/km)	0.063553
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 1.66 BN

80% RIDE SHARING

80 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	32,000 km
Avg Distance – YR (Personal Car)	16,000 km
Ride Sharing (2030)	395,093
Personal Ownership (2030)	395,093
Estimated EVs 2030	592,639
Estimated ICEs (Petrol) 2030	197,546
Avg Distance Covered by EVs	15,803,708,885 km
Avg Distance Covered by ICEs	3,160,741,777 km
Shared 4w EV (CAD/km)	0.063553
Private 4w EV (CAD/km)	0.0194
Private 4w Petrol (CAD/km)	0.127106

TOTAL RUNNING COST: CAD 1.27 BN

Source: Mazars' Global Knowledge Center Analysis; Canadian Automotive Association; Statistics Canada; Ontario Ministry of Finance; City of Toronto Government Data; Press Articles

FRANCE

POPULATION 2016
66 896 110

URBAN POPULATION %
80 %

NUMBER OF PASSENGER CARS IN USE
32 326 000

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
580

TOTAL PASSENGER TRAVEL DISTANCE 2016
838 397

ROAD INFRASTRUCTURE INVESTMENT 2017 €
8 293 899 173

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
LESS THAN 5%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/Population Division; Statistics from Departments of Transport

Jerome de Pastors
Partner, Mazars France

France on the front foot of sustainable mobility

With French consumers showing a healthy appetite for sustainable mobility solutions, Jerome de Pastors, Partner, Mazars France explores some of the key developments that are driving growth and what players should be considering going forward.

While still a small percentage of overall car sales, EV take up in France has been relatively high compared with other European countries. In 2017, EV sales reached 36,835, which is a 26.2% increase on the previous year and now makes France one of the top four countries for EV sales alongside Norway, Germany and the UK. The challenge now is how the automotive industry can strategises this demand and plan for the future.

In terms of government involvement, innovation is certainly a key plank of President Macron's parliament. The recent announcement of the creation of the Prairie Institute as a centre of excellence dedicated to artificial intelligence (AI) in Paris is a clear sign of intent that France plans to be at the forefront of technological development. While the institute will be a collaboration of the academic world and industry to research solutions across a wide range of areas, the involvement of Faurecia, PSA Group and Valeo highlight that mobility will be a beneficiary.

How the automotive industry as a whole reacts to such developments will set the tone for the factors considered important in shaping what the industry will look like in the future.

MEGA-PARTNERSHIP REPLICATION

Recent mega-partnership developments in France have seen PSA Group acquire Opel/Vauxhall from General Motors, as well as rumours of a merger between Renault and Nissan who between them produce France's top two selling EVs - the Renault Zoe and Nissan Leaf. As the pace of change in the sustainable mobility space moves up a notch, best of breed mergers between OEMs and within the supply chain will continue to be attractive Certainly, identifying individual strengths in the sustainable mobility space and brokering a marriage with a complementary partner is a game plan not just open to big players, but can be replicated by a wide range of companies across the automotive industry to gain market momentum.

HOW SUSTAINABLE IS SUSTAINABLE?

In terms of an environmental footprint, the focus so far has been on combustion engines. But it will not take long before consideration is given to having a more accurate measure of the environmental impact of EVs. We already know that while EVs reduce emissions overall, batteries use large amounts of nickel, lithium and cobalt. The mining of these elements has big environmental consequences. A further concern is whether the electricity being used to power EVs is from a renewable source. As sustainable mobility choices develop, key performance indicators (KPIs) on sustainable objectives are set to become more common across the wider supply chain.

SUPPLY CHAIN CHALLENGE

While OEMs are finding themselves at the sharp end of sustainable mobility disruption, it's players in the automotive industry supply chain that potentially face the biggest challenges at business level. With EVs requiring fewer traditional components and materials, Tier 2 and 3 companies who currently focus on a small number of product lines that have limited EV cross over potential going forward will need to spend time developing their future strategy, particularly if they do not have the support of a Tier 1 player.

INCENTIVES VERSUS INFRASTRUCTURE

Environmental regulation aside, governments are taking two main approaches to increasing EV take up - creating incentives and providing necessary infrastructure. Some such as Norway have focused on consumer incentives to great success. Whereas countries where traditional car manufacturing accounts for a large percentage of the economy, have to take a more balanced approach. In France's case, getting the infrastructure in place has been the preferred route. Indeed, in 2017 France installed more than a third more electric vehicle charging points (11,987) than anywhere else in the world, according to OSV's Electric Car Index. With lack of infrastructure a major reason for low EV take up, France's approach removes a major disincentive, while at the same time leaving open the door for financial incentives further down the line.

GERMANY

POPULATION 2016
82 667 680

URBAN POPULATION %
76 %

NUMBER OF PASSENGER CARS IN USE
46 474 594

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
593

TOTAL PASSENGER TRAVEL DISTANCE 2016
1 027 629

ROAD INFRASTRUCTURE INVESTMENT 2017 €
11 690 000 000

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
LESS THAN 5%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/Population Division; Statistics from Departments of Transport

Björn Franke
Partner

Can arriving late to the sustainable mobility party work to Germany's advantage?

Björn Franke, partner at Mazars in Berlin looks at how a more measured approach to sustainable mobility solutions may be of benefit to Germany's automotive sector in the long term.

Compared with some of its European cousins such as Norway and The Netherlands, Germany has not embraced alternative drive vehicles as quickly as others. This is not entirely surprising with car manufacturing giants such as BMW and Volkswagen earning their reputations on the expertise and knowledge of combustion engine technology and manufacturing excellence built up over the past 80 to 100 years. But with the political and regulatory landscape moving firmly in the direction of car electrification, the industry is having to seriously examine its future.

Accounting for 20% of total German industry revenue and employing approximately 808,500 people, the political will to meddle with an industry that is an integral part of Germany's social fabric is not yet at full throttle. However, a Federal Administrative Court ruling in February 2018 giving cities the right to ban diesel cars, together with a fall in diesel car sales and the lingering emissions scandal, are creating the perfect storm for the automotive industry to explore alternatives. So how can being a late adopter of sustainable mobility solutions work to Germany's advantage?

MONETIZING CURRENT EXPERTISE

Synonymous with reliability, safety and manufacturing excellence, the 'Made in Germany' brand still holds prestige. A large part of this reputation is based on the high priority placed on Research & Develop (R&D) that underpins the industry's technological capabilities and international competitiveness. The automotive industry is by far the biggest investor and employer in the R&D arena employing over 110,000 people.

According to German's automotive industry association, VDA, the industry accounts for more than one third of total global R&D spending in the automotive sector, putting it at the top of the league ahead of Japanese and American companies. It's a sector of the industry that is highly prized internationally, particularly in the field of optimizing production processes where non-auto players are weak. The ability to transfer such expertise and knowledge to the sustainable mobility sector is not to be underestimated. Certainly, adapting traditional knowledge and expertise already in place can help propel Germany forward and leapfrog countries that are still developing relevant skills.

EXPLOIT BATTERY INNOVATION

Battery-cell production for electrified powertrains is currently the biggest battleground in terms of getting alternative drive vehicles to be fully accepted by consumers. Elon Musk's Tesla has spent millions of dollar developing and testing EV batteries. But while investing money into new technology can shine a light on opportunities, it doesn't always equate to a mass-market ready product as quickly and effectively as anticipated. We are still on a learning curve if we take the impact of factors such as climate, chemical composition on battery performance and cost into account. Learning from pioneers such as Tesla and honing budgets to manufacture or identify partners to achieve a better and more revenue-certain product is certainly one late-mover advantage that Volkswagen and Daimler are currently exploiting in the EV sector.

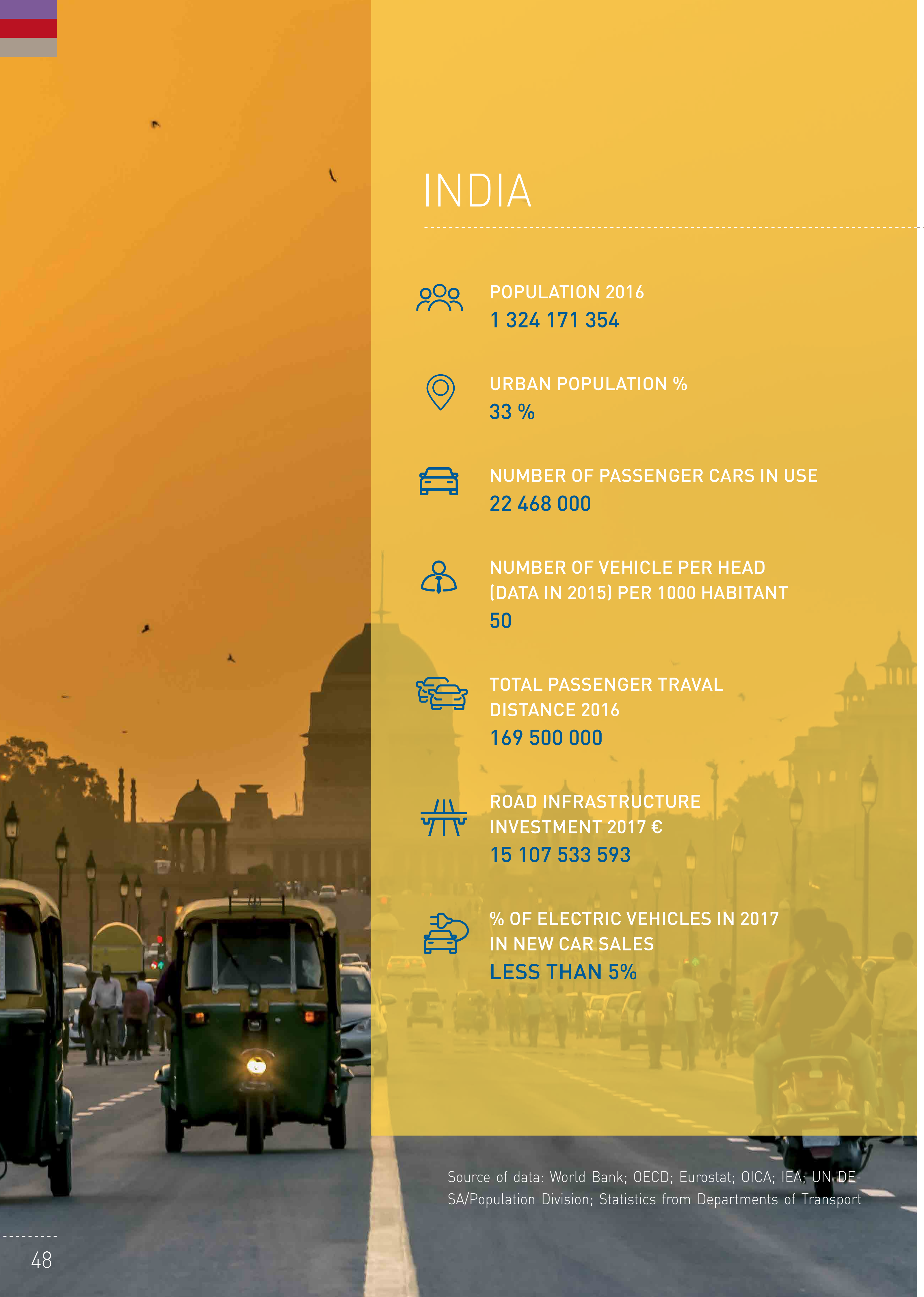
INFRASTRUCTURE ADVANTAGE

Again, charging station infrastructure to accommodate EVs is key to gaining consumer traction. The complexity of changing established infrastructure to propel EV popularity is slower than expected resulting in bottle necks as governments struggle to accommodate consumer charging needs. However, Germany's recent move to convert 12,000 distribution boxes into charging stations is a great example of how to leverage existing infrastructure to create more EV charging points without infrastructure displacement. Certainly stepping in at a timeframe when EV growth is more quantifiable opens the door to how best to develop, install or adapt infrastructure.

On a practical level, there's no denying that a move to a more sustainable mobility solution is well and truly in motion, and that German CEOs, CFOs and marketers alike are acutely aware that developing finance, investment and marketing strategies to cope with changes that are driven by disruption is not simplistic and at risk to market pressure. However, German auto manufacturers seem to be intent on finding their own way.

Despite the fact that Volkswagen has recently pledged 34 billion euros towards the development of battery-powered and autonomous vehicle technology, and has also partnered-up with Silicon Valley start-up, Aurora, headed by ex-Google innovator Chris Urmson to bring self-driving taxis, cars and trucks to the roads, Volkswagen and other German OEMs are still working to improve traditional engine powertrain development, which is indicative that a more measured approach to the challenges ahead is favoured by Germany's automotive industry.

It's an approach that has its advantages in terms of formulating strategies and budgets in the sustainable mobility arena, particularly in terms of identifying the right partners, adapting business models, as well as assessing the impact on the country's social and economic make-up. Indeed, it is a strategy that is paying dividends with Germany now overtaking France for EV sales and second only to Norway, acording to the European Automobile Manufacturers Association (AECEA). It certainly highlights the fact that when knowledge and expertise are at the very heart of an industry, being a late mover need not always be a disadvantage.



INDIA

POPULATION 2016
1 324 171 354

URBAN POPULATION %
33 %

NUMBER OF PASSENGER CARS IN USE
22 468 000

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
50

TOTAL PASSENGER TRAVAL DISTANCE 2016
169 500 000

ROAD INFRASTRUCTURE INVESTMENT 2017 €
15 107 533 593

% OF ELECTRIC VEHICLES IN 2017 IN NEW CAR SALES
LESS THAN 5%

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/Population Division; Statistics from Departments of Transport

Bharat Dhawan
Managing Partner, Mazars India

Unlocking India's sustainable mobility potential

With India's transition to a more sustainable mobility model unclear following the withdrawal of ambitious electric vehicle targets, Bharat Dhawan, Managing Director at Mazars India looks at the key themes behind India's sustainable mobility aspirations and asks whether industry collaboration is the answer?

With a population of over 1.3 billion people, rising urban incomes and low car ownership per capita, India is seen as a growth market for the automotive industry. But as a global push for more sustainable mobility solutions gains environmental approval, whether India can keep pace will be determined by three themes.

1. PARALLEL DEVELOPMENT

Vehicle congestion is a major problem for India's cities. While banning diesel vehicles more than 10 years old from the likes of Delhi city centre is a step in the right direction in terms of reducing pollution, the sheer numbers of two and four wheeled vehicles on the streets of India's major cities and growing urban areas requires a more joined up approach than simply banning fuel-powered vehicles in favour of electric. Digital development of shared mobility solutions, including ride sharing and public transport have key roles to play in India's transition to a sustainable mobility solution. Connected mobility solutions at B2B (business to business), B2C (business to customer) or P2P (peer to peer) level from the likes of Door2Door, Uber, Ola and Via as well as a focus on more electric public transport vehicles are already helping to make Indian city's smarter and reducing individual travel needs.

Parallel policies that develop shared mobility solutions alongside encouraging environmentally-friendly vehicle ownership are likely to improve India's sustainable mobility transition.

2. COMPETITIVE AMBITIONS

Ambitions by Indian and Indian-based companies in the automotive sector and wider supply chain should not be underestimated. While the slow speed of electric vehicle (EV) take up in India due to cost of ownership, the government's backtracking on its goal to fully switch to electric vehicles by 2030 and a lack of infrastructure is conspiring to put India behind the race to reach a sustainable mobility solution, companies are not prepared to remain at a competitive disadvantage. In February 2018, India's Mahindra Electric announced a partnership with Korean company, LG Chem, to develop new lithium-ion cells and battery packs exclusively for the Indian EV market. Similarly, Tata Motors has also developed a long range battery pack for the Indian market with a range of over 300 kilometres per charge to match the popular Nissan Leaf. The development of sustainable mobility solutions by companies such as Tata and Mahindra independently of government policy will ensure that India's ambitions in the sector remain on track nationally and internationally.

3. WIDER INDUSTRY COLLABORATION

For many countries the lack of charging station infrastructure is a main deterrent to EV take-up. However, in India the lack of basic infrastructure per se requires a different approach. In order for sustainable mobility needs to be met requires road transport facilities to be improved and utilities infrastructure such as electricity and telecommunications to be strengthened, not only in urban cities but also rural areas.

The synergies between the need for improved transport infrastructure and a more software and technology focused automotive sector are increasing rapidly. While there are government plans in motion to improve basic infrastructure, there's a case for wider collaboration between infrastructure industries and the automotive sector in order to fast-track ideas to ensure sustainable mobility plans are met.

Nicolas Ribollet
Partner, Mazars France

What clues does the current automotive landscape in India hold in helping companies to identify a suitable sustainable mobility strategy? **Nicolas Ribollet,** Partner, Mazars in India and France explores potential options.

India's opportunistic approach and ability to adapt quickly alongside strong IT skills are highly prized attributes in today's technology-focused business environment. So can India's automotive sector use such capabilities to develop the market for sustainable mobility solutions? What's becoming clear is that progress will not simply depend on having the appropriate skills or mindset. Equally important to unlocking India's sustainable mobility potential will be understanding what works in the current market and how companies can embed those ideas into an appropriate strategy going forward.

COMBINING TECHNOLOGY AND SOLUTION-BASED SKILLS

There are two aspects to India's automotive industry, one based on strong IT capabilities and the other based on an ability to find dynamic yet cost-effective solutions. While cost is an important factor for Indian car ownership, throw into the mix India's aspirational and growing middle class and solutions become more complex to define. You need look no further than Tata Motor's Nano car launched in 2009 costing approximately $2,000. Billed as the cheapest car in the world, the Nano provided a solution on cost, but could not initially live up to consumer expectations.Tata is using the experience to develop an EV version, but it provides a valuable lesson in that an approach which can dovetail India's technical knowhow with solution-based capabilities more in tune with consumer demands will be key to achieving sustainable mobility success.

TRANSACTION TRENDS

Just four OEMs account for 75% of car sales in India - Maruti Suzuki, Hyundai, Mahindra & Mahindra and Tata Motors. Maruti Suzuki alone has more than a 40% market share. Such high market concentration means for many companies looking to gain a foothold in India's booming automotive market, buying into the market through OEMs and suppliers that are either based in India or have a business relationship in India is the preferred approach. A rapidly growing economy means transaction activity continues to be strong in most automotive segments, including two wheelers and commercial vehicles, not only from international OEM-s,but also vertical transaction activity between Indian companies looking to consolidate or grow their market presence. In the other direction, Indian companies are looking to acquire international expertise that will give them an edge in the market, either through techno-logy or smart component expertise. While a similar transaction pattern of buying in expertise in order to meet sustainable mobility needs is expected, start-ups focusing on technology will challenge the status quo, particularly in the shared economy sector.

SPEED OF TRANSITION

Despite a huge and growing automotive market, India's take up of electric vehicles (EVs) is slow mainly due to lack of infrastructure to support growth. However, India's de-carbonisation policy has seen an increase in renewable energy infrastructure, particularly in solar, hydro and wind power, which may be the push needed to give EVs a much needed boost in popularity. Indeed, legislation introduced to tackle pollution provides a good benchmark on how quickly changes can happen, with Government implementation requirements typically taking months rather than years. Once better infrastructure is in place and incentives and legislation to promote sustainable mobility solutions are introduced, the transition to hybrid, electric and autonomous cars in India is likely to be quicker than seen in many other countries.

THE IMPORTANCE OF PRODUCT ADAPTATION

Cost, small size, reliability and good resale value are the main reasons why consumers continue to buy the 800cc Maruti Alto, which is India's best-selling car. With its extraordinary market share, Maruti is also bucking the trend in anticipating future needs. It is one of the few companies, alongside Tata and Hyundai that produces vehicles with factory-fitted Compressed Natural Gas (CNG) engines as India's move away from diesel engines on pollution grounds gather's pace. The main reason for companies failing to succeed in India's competitive automotive market is often due to not adapting products to fit market requirements. Once sustainable mobility options such as hybrids and EVs tick the boxes on size, cost, reliability and resale value they will have gone a long way to fulfilling Indian market requirements.

CASE STUDY: New Delhi

~26 Mn
POPULATION (2016)

~2,8 Mn
CAR OWNERS (2014-15)

~2,4 Mn
METRO RIDESHIP (2014-15)

3,3 Mn
HOUSEHOLDS (2014-15)

1 483
DELHI AREA (SQ.KM)

INR 0,24 Mn
AVERAGE ANNUAL PER CAPITAL INCOME (2014-15)

2.8 Mn
CAR OWNERSHIP (2014-15)

5.5 Mn
BIKE OWNERSHIP (2014-15)

4,700
DTC BUS REGISTERED (2014-15)

81,269
AUTO RICKSHAW (2014-15)

CASE ASSUMPTIONS

PERSONAL OWNERSHIP MODEL

There are 2.8 Mn Cars for 3.3 Mn Households in 2014-15. The penetration of cars per households stands at 85%. We assume that households of Delhi grow at 2% , hence in 2030, households stand at 4.5 Mn. To cater 4.5 Mn households let there be car penetration of 90%. Hence Cars in 2030 stands at 4.07 Mn.

We assume that, in a year a personal owned car covers an average of 12,000 Km in a Year.

RIDE SHARING

It is assumed that each ride sharing car will carry a total of 4 passengers across each journey.

In each case, it is assumed that 100% ride shared cars and 50% of personal cars will be electric

Each ridesharing vehicle is assumed to cover an average distance of 24,000 km/year.

VEHICLE ECONOMICS

- ✔ Operating costs for a Private 4w EV, Private 4w Petrol and Shared 4w EV are assumed to be 0.20, 0.27 and 0.09 USD/km respectively,.
- ✔ Operating cost for a Public Transit EV is assumed to be 0.27 USD/km, as per the expenditure undertaken from the DTC Report.

EVS CAN HELP REDUCE
the burden of rising gas pricing by 26.2%

20 % EVS

20% ELECTRIC VEHICLE + 80% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	12,000 Km
Cars in 2014-15	28,00,000
Cars in 2030	40,77,174
Estimated Electric Vehicles 2030	8,15,435
Estimated ICE's (Petrol) 2030	32,61,739
Avg Distance covered by EV's	9,78,52,16,506 km
Avg Distance covered by ICE's	39,14,08,66,024 km
Personal 4w EV (USD/KM)	0.20
Personal 4w Petrol (USD/KM)	0.27

TOTAL RUNNING COST: $ 12.5 BN.

50 % EVS

50 % ELECTRIC VEHICLE + 50% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	12,000 Km
Cars in 2014-15	28,00,000
Cars in 2030	40,77,174
Estimated Electric Vehicles 2030	20,38,587
Estimated ICE's (Petrol) 2030	20,38,587
Avg Distance covered by EV's	24,46,30,41,265 km
Avg Distance covered by ICE's	24,46,30,41,265 km
Personal 4w EV (USD/KM)	0.20
Personal 4w Petrol (USD/KM)	0.27

TOTAL RUNNING COST: RMB 28.9 BN

80 % EVS

80% ELECTRIC VEHICLE + 20% INTERNAL COMBUSTION ENGINE

Data Points	Size
Avg Distance Covered - Year	12,000 Km
Cars in 2014-15	28,00,000
Cars in 2030	40,77,174
Estimated Electric Vehicles 2030	32,61,739
Estimated ICE's (Petrol) 2030	8,15,435
Avg Distance covered by EV's	39,14,08,66,024 km
Avg Distance covered by ICE's	9,78,52,16,506 km
Personal 4w EV (USD/KM)	0.20
Personal 4w Petrol (USD/KM)	0.27

TOTAL RUNNING COST: $ 10.4 BN.

Source: Mazars' Global Knowledge Center Analysis; Research paper (Congestion cost incurred on Indian Roads); Travel Behavior and Society; Press articles

RIDE SHARING CAN HELP REDUCE
the ownership cost by 69.3%, congestion by 60% and Pollution

20% RIDE SHARING

20 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	24,000 Km
Avg Distance – YR (Personal Car)	12,000 Km
Ride Sharing (2030)	2,03,859
Personal Ownership (2030)	32,61,739
Estimated EVs 2030	18,34,728
Estimated ICEs (Petrol) 2030	16,30,869
Avg Distance Covered by EVs	24,46,30,41,265 km
Avg Distance Covered by ICEs	19,57,04,33,012 km
Shared 4w EV (USD/KM)	0.09
Private 4w EV (USD/KM)	0.20
Personal 4w Petrol (USD/KM)	0.27

TOTAL RUNNING COST: $ 9.6 BN.

50% RIDE SHARING

50 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	24,000 Km
Avg Distance – YR (Personal Car)	12,000 Km
Ride Sharing (2030)	5,09,647
Personal Ownership (2030)	20,38,587
Estimated EVs 2030	15,28,940
Estimated ICEs (Petrol) 2030	10,19,293
Avg Distance Covered by EVs	24,46,30,41,265 km
Avg Distance Covered by ICEs	12,23,15,20,632 km
Shared 4w EV (GBP/km)	0.09
Private 4w EV (GBP/km)	0.20
Private 4w Petrol (GBP/km)	0.09

TOTAL RUNNING COST: $ 6.8 BN.

80% RIDE SHARING

80 % RIDE SHARING + 80% PERSONAL CARS (WITH 50% EV)

Data Points	Size
Avg Distance – YR (Ride Sharing)	24,000 Km
Avg Distance – YR (Personal Car)	12,000 Km
Ride Sharing (2030)	8,15,435
Personal Ownership (2030)	8,15,435
Estimated EVs 2030	12,23,152
Estimated ICEs (Petrol) 2030	4,07,717
Avg Distance Covered by EVs	24,46,30,41,265 km
Avg Distance Covered by ICEs	4,89,26,08,253 km
Shared 4w EV (GBP/km)	0.09
Private 4w EV (GBP/km)	0.20
Private 4w Petrol (GBP/km)	0.09

TOTAL RUNNING COST: $ 4.06 BN.

Source: Mazars' Global Knowledge Center Analysis; Research paper (Congestion cost incurred on Indian Roads); Travel Behavior and Society; Press articles

POLAND

POPULATION 2016
37 948 020

URBAN POPULATION %
61%

NUMBER OF PASSENGER CARS IN USE
20 723 423

NUMBER OF VEHICLE PER HEAD (DATA IN 2015) PER 1000 HABITANT
537

TOTAL PASSENGER TRAVAL DISTANCE 2016
238 150

ROAD INFRASTRUCTURE INVESTMENT 2017 €
2 170 794 683

Source of data: World Bank; OECD; Eurostat; OICA; IEA; UN-DESA/Population Division; Statistics from Departments of Transport

Jaroslaw Bochenek
Partner, Mazars Poland

How deep thinking can drive Poland's sustainable mobility aspirations?

Poland's reputation as a supply chain hub is underpinned by an educated and cost-effective workforce built up over many years. Can the sector now push on to take advantage of the move towards a more sustainable mobility future? Jaroslaw Bochenek, Partner, Mazars Poland examines the challenges.

Poland's strategic location giving access to the east-west corridor alongside a well-developed road infrastructure has proven to be a winning combination for its automotive industry. A further draw is access to a skilled workforce that remains cost-effective at the Tier 1 and Tier 2 supply chain end. It's why companies such as Toyota, Volkswagen and Fiat Chrysler have chosen Poland as a base for powertrain production, alongside companies producing a wide range of vehicle systems and car components. Importantly, many are longstanding relationships that have been based in Poland for many years.

So can these relationships now be developed into ones which can benefit the move to sustainable mobility solutions in the electric vehicle (EV), smart connectivity and autonomous driving fields? Certainly, recent activity suggests there's an appetite with German global electronics group, ZF, announcing it was to expand its 10-year old manufacturing footprint in Poland with a new engineering centre to support its growth in the advanced safety and automated driving fields.

While such strong relationships are key to developing new investment opportunities in sustainable mobility solutions, other factors supporting such growth rely on government policy, having a thriving research and development (R&D) sector and a workforce that accommodates the new skills required.

ECONOMIC ZONE MAKEOVER

The success of economic zones set up by the government in the 1990s has certainly played a role in Poland's strength in the automotive industry. While initially set up to help bring employment to towns and cities, legislation was most recently updated in 2014 when an emphasis was placed on companies getting tax breaks to set up clusters with schools and universities to improve and develop technical knowledge for the future workforce. However, the most recent government announcement shows a more mature approach to social and economic development in Poland linking tax incentives for companies wishing to set up operations in Poland with a wider range of factors such as the quality of jobs, including salaries, job specialization and number of jobs created, as well as how sustainable the investment project actually is.

EXPANDING R&D OPPORTUNITIES

With its status as a supply chain hub, it makes sense for companies such as Delphi, Faurecia, Valeo, Wabco and Eaton to have R&D facilities also located in Poland. Embedding R&D into the supply chain ecosystem at the product conceptualization stage is seen as a way to develop a market leading product and simultaneously control costs. As the move to explore more sustainable mobility solutions gains traction, the ability for the supply chain and R&D to work closely together will be a key differentiator in a highly competitive market. In particular, as the high cost of research into new automotive technologies sees more companies seeking opportunities to collaborate and share platforms in order to decrease costs, Poland's ability to fulfill both location and skills' requirements will be increasingly attractive

BRAIN DRAIN REVERSAL

Poland's previous reputation as a cheap labour base has moved on. Now seen as a location for more complex automotive manufacturing and supply chain functions, the new government emphasis on awarding tax breaks linked to quality of work and salaries paid offers the opportunity to attract higher skilled Polish workers who have migrated abroad for better employment opportunities and higher wages. This will help to give strength and depth to Poland's ability to provide the new skills needed to meet the automotive industry's sustainable mobility requirements.

Of course, challenges remain. Managing the transition from a traditional automotive framework that relies less on the production of vehicle parts and more on software and technical output will continue to have social and economic consequences. Equally, despite showing clear potential as a location for developing and manufacturing state-of-the-art sustainable mobility systems, Poland is way behind other European countries in terms of electric vehicle take-up by consumers. While the car remains a strong status symbol in Poland, it's expected that the take-up for electric vehicles will continue to be slow, with an initial move to a hybrid solution more likely. However, as the government begins to put in place strategies to make electric vehicles more attractive to consumers, we may yet see Poland as not only a location for companies looking to develop sustainable mobility solutions, but a location where such ideals are also shared by the people who live there.