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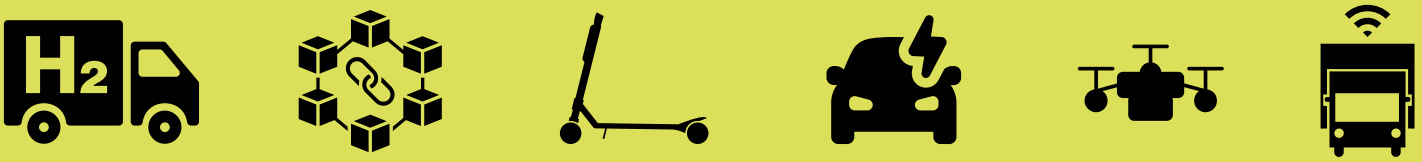
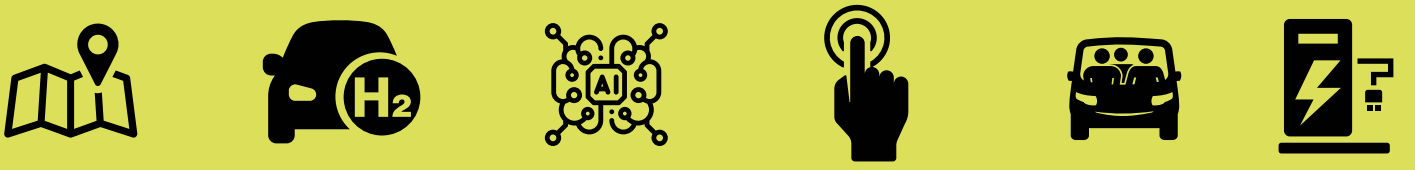


The 2020s: a new era of mobility?



Trevor Milton on Nikola's future strategy | **China's EV market** to hit critical mass in 2021, says Xpeng president | **Christophe Rauturier** on PSA's digital strategy | **Miles Mobility's** focus on selling shared kilometres | **Girish Wagh** outlines Tata's response to India's truck market downturn |

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Welcome to the new Automotive World Magazine

As the 2010s advanced, the potential for the next generation of vehicle technology and a new way of thinking about transportation morphed into the now widely established concept of mobility, not just within the automotive industry, but within the public consciousness. An evolution of the simple notion of transportation, 'mobility' incorporates–amongst other things–new business models, new technologies and the acceptance of a transition from vehicle ownership to usership. Mobility is a basic concept, but behind its simplicity lies vast complexity, from the burgeoning e-hailing market and connectivity to electrification and autonomous driving, all of which rely increasingly on artificial intelligence.

The 2020s became the milestone for those involved in mobility, held up as a turning point by start-ups and tech giants, established automotive suppliers and the automakers themselves who promised to deliver the solutions that would change mobility forever.

And now the Twenties are here.

What, then, will the 2020s deliver in terms of mobility? We've heard much about mobility's next inflection point, and the start of a new decade is as good an inflection point as any. Will the 2020s be the decade of evolution or revolution for mobility? Just how quickly EVs will become a mainstream consideration; how soon we can expect the commercialisation of autonomous drive technology; how firmly new mobility business models can take hold; whether trucking makes the switch away from diesel; how soon people will be prepared to give up their cars and switch to shared mobility and e-hailing...will reveal whether or not the 2020s will be remembered as the decade of mobility, or whether it's all put on hold until the 2030s.

A perfect moment, then, to launch an all-new monthly publication: welcome to *Automotive World Magazine*, which features the best and sharpest *Automotive World* content, and launches–appropriately–with a close look at what to expect from mobility in the 2020s.

Martin Kahl
Editor-in-Chief, Automotive World

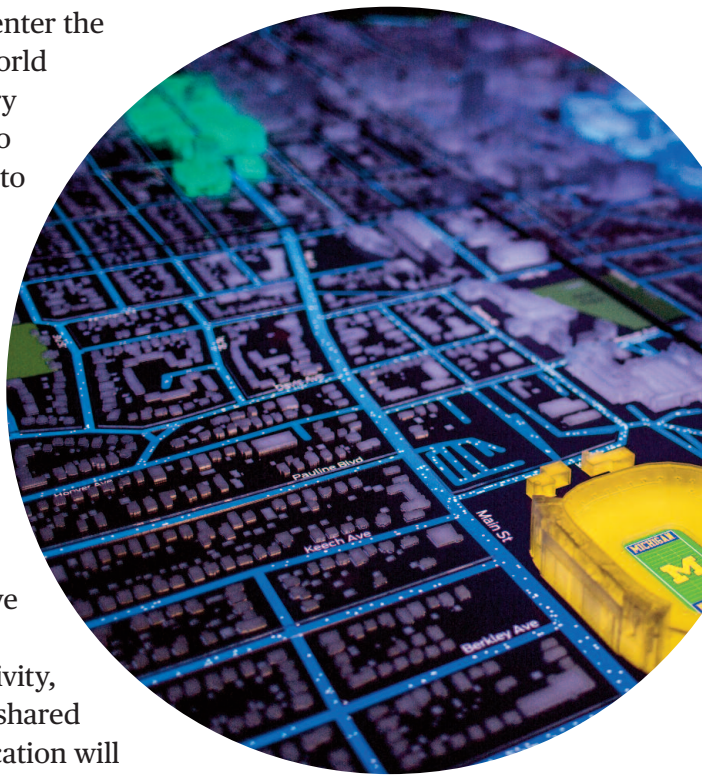
IN THIS ISSUE

The 2020s: a game-changing decade for mobility?

The new Roaring Twenties promise exciting advances in mobility, with trucking and passenger car stakeholders bracing for a decade of change as CASE technology evolves. By Megan Lampinen

There is no shortage of vision in the automotive industry. Going by some of the pledges from today's players, the coming decade heralds a step change in the way people move about. Ford promises to launch a fully autonomous vehicle (AV) by 2021, while Mitsubishi Fuso aims to offer a truck with SAE Level 4 capabilities by about 2025. By then, there could be nearly 100 million electric vehicles (EVs) on the road, charging at extensive motorway and city centre networks. EV-only and car-free zones could rewrite the urban landscape as private ownership all but disappears. Already more than half of consumers in Asia and Europe say they are prepared to give up their car, provided there are convenient alternatives available.

That's the promise, but what's the potential of all these trends playing out as planned? As the industry prepares to enter the 2020s, Automotive World reaches out to industry experts for insight into how mobility is likely to evolve over the next decade.



C is for Cities

CASE is a popular acronym to describe the megatrends at work in the automotive industry, and undoubtedly connectivity, autonomous driving, shared mobility and electrification will prove major influencers. However, with consumers opting for the familiar interfaces of

Apple CarPlay and Android Auto, bypassing the need for high-end automaker connectivity systems, many investors are instead approaching the 'C' of CASE from the perspective of the connected city.

The mobility transformation will be felt most acutely in urban environments, where increased population density and congestion challenge traditional transport systems. Growing urbanisation is anticipated around the world. Oliver Wyman estimates that by 2030, around 60% of the global population will live in cities. The United Nations predicts that by this time, there could be up to 43 megacities, each home to 10 million or more residents.

"CASE technologies will emerge the most quickly in dense urban areas. This is only natural," observes John Cleveland, President of Innovation Network for Communities and a co-author of the book *Life After Carbon: The Next Global Transformation of Cities*. "To get the economies of scale and impact you need to justify the cost of the technologies, you need a high density of use, and you only find this in urban areas. As cities become more and more popular places to live, these urban areas also have an acute need to address the issues of air pollution and congestion that come with populations growth. So cities will be the test beds for CASE systems. And the leading test beds will be those cities with the strongest commitments to greenhouse gas reductions."

However, Cleveland points out that smart city technologies tend to operate "behind the curtain", changing the way residents interact with the environment, but not necessarily changing the shape of that environment. "The two biggest things that will change the actual shape of cities are mobility transformation and adaptation to climate change," he tells Automotive World. "Mobility systems will fundamentally change how we move around our urban spaces. We will see more car-free zones, much more pedestrian and biking space and far fewer parking spaces. On the adaptation side, we will see large infrastructure designed to protect from rising sea levels and coastal flooding; extensive expansion of green infrastructure to control flooding, and 're-naturing' of cities to help control extreme heat."

The next ten years will witness notable evolutions within urban environments, but Cleveland doesn't think cities will necessarily become unrecognisable from today. Rather, they will be quieter, cooler, greener and easier to get around.

> "Fully autonomous technology is further away than people realise

Shared mobility will eat away at private ownership

That vision is based in part on the assumption that shared mobility usage rates will rise, be that via public buses, ride-hailing apps, electric scooters, or others. Even car dealers could become involved in this trend. "We see considerable potential

from the dealer side to adopt a shared mobility model to improve customer service," says James Carter, Principle Analyst for Vision Mobility. "Some of their customers may only require a vehicle occasionally. They will need to get a business model that is both profitable and offers a good customer experience, but there is certainly potential there."

Growth in shared mobility schemes could start to eat away at private ownership in the next few years. A recent study by Avis found that just 31% of European and Asian consumers believe that car ownership will be the most popular way to access a car in the next decade. This could prove particularly applicable for young urbanites. "Shared schemes might push back the point at which people start owning their first vehicle. If you are a young 20-year old in the city, you might think it's easier to simply use a sharing service," surmises Sean O'Flynn, Director at AlixPartners.

Others anticipate much greater momentum over the coming decade. ABI Research believes that by 2030, several cities will ban all personally owned vehicles. "By this time, some cities will only offer access to shared mobility," predicts Dominique Bonte, Managing Director and Vice President at ABI Research. He envisions city centres where most residents

have flat-fee subscription services which allow them to pay for and access all forms of mobility, from shuttles and buses to taxis and scooters. Such unlimited access to mobility will lead many to abandon private car ownership.

Lynk & Co, a joint venture between Volvo and Geely, is positioning itself for just such a future. "The car is a component in the customer journey, but it's not even half of what we do," explains David Green, Chief Digital Officer at Lynk & Co. Part of Green's role involves exploring new ways in which Lynk & Co cars can be used, including sharing or access through subscription.

Expect to see EV-only cities...

With growing concerns around air quality and the environment, increased uptake of EVs seems inevitable. By 2022, Renault wants EVs to account for 10% of its sales. At Volkswagen Group, the target is more than 20% by 2025. Others are similarly bullish in their outlook. Vision Mobility believes battery EVs will account for 30% of all new vehicle sales by 2030. "We will see steady growth in hybrid systems early on in the 2020s and during the middle of the decade, things like 48-volt and Toyota-type hybrid systems," says Carter. "However, towards the end of the decade, there will be a strong increase in battery electric as cities become much more focused on reducing emissions and start ruling out any ICE vehicles."

ABI Research expects to see over 100 million EVs on the road by 2029. "One of the biggest problems for cities is air quality, which continues to degrade," observes Bonte. "At certain times, air pollution levels exceed the internationally accepted

> By 2030, I assume that we will not be talking anymore about if we can charge the vehicles, but whether we can generate electricity sustainably

thresholds set by the World Health Organization (WHO). Some cities, particularly in Asia, are desperate. As the problem is caused mainly by traffic, the only way to reduce that is to push electrification."

Electric-only cities are increasingly looking like a real possibility. "If we are serious about CO2, we have to expect EV-only cities in the next decade," states Michael Hajesch, Chief Executive of charging infrastructure provider Ionity. As networks like those provided by Ionity expand across the world's highways, range anxiety will decrease. At the same time, charging technology is improving. "We will see charging times decrease as fast charging gets faster," predicts Chris D'Souza, Shell Programme Lead for eMobility Technology.

Charging should also become more sustainable. "By 2030, I assume that we will not be talking anymore about if we can charge the vehicles, but whether we can generate electricity sustainably," asserts Volkswagen's Head of e-Mobility Services, Martin Roemheld. "We want to reduce the carbon footprint of mobility as much as possible, so it's vital to have green energy in the cars."

...but battery supply will remain a challenge

Automakers are responding with plans for numerous new electric and electrified vehicles. AlixPartners estimates that €255bn (US$284bn) will be spent globally between 2018 and 2022, during which time more than 200 new electric models will arrive on the market. However, there are some concerns around the supply of cobalt, a key raw material in most of today's battery systems. AlixPartners has warned that demand for cobalt from the automotive industry will very likely outstrip global cobalt production by 2022, leading to a supply gap by 2025 if no new sources are found.

"With constraints in the marketplace around the supply of the raw materials, there's a large focus on identifying low cobalt technologies for electric powertrains," says O'Flynn. "Cost remains one of the primary barriers to the wider adoption of EVs. Increasing prices of cobalt and battery-grade nickel present a challenge to bring down the total cost of ownership on par with ICE vehicles." He believes the coming decade will see considerable investment by automakers and suppliers to identify ways to create lower cobalt technologies that offer the same power and energy density ratios that are achieved with more cobalt-rich technologies.

Renault is actively exploring a range of technologies, including solid-state batteries. “According to our engineers, this technology is not likely to reach maturity before 2025 but we are pushing hard in order to try to improve it,” explains Gilles Normand, Senior Vice President, Electric Vehicles, Group Renault.

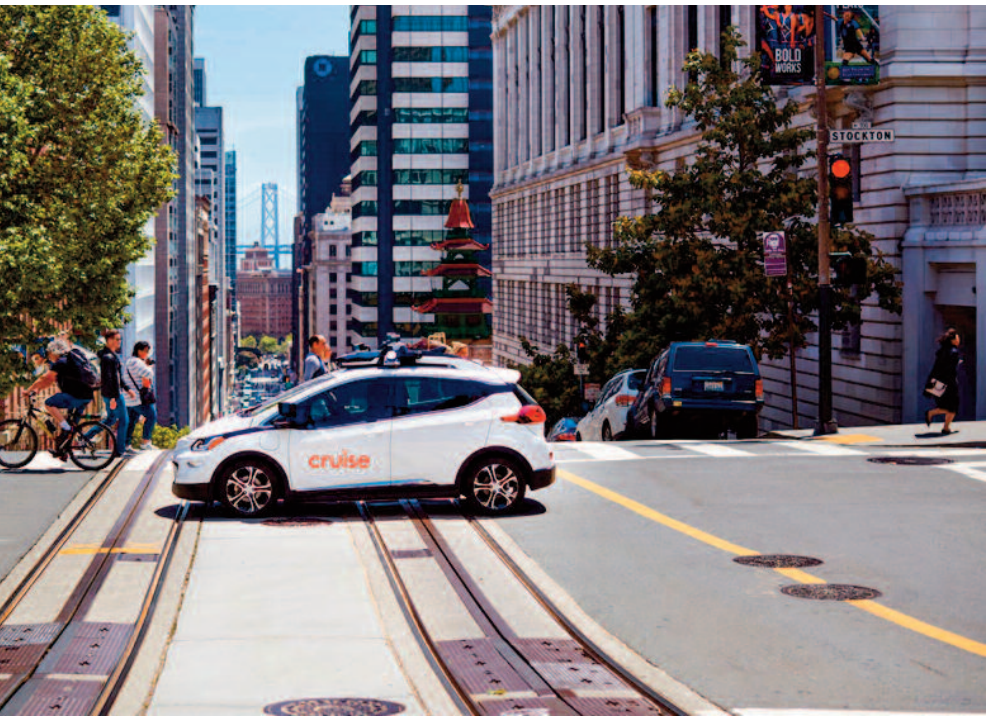
The autonomous car tech race

Just a few years ago General Motors promised a commercial fleet of autonomous taxis by the end of 2019. That turned out to be overly optimistic and the company recently backed away from that target. Meanwhile, Ford is sticking to its 2021 launch date for a fully autonomous vehicle (AV). But what do the industry forecasters think of these estimates?

“Autonomous is definitely something that’s going to roll out within the next decade, but we don’t see it as being quite as aggressive as some analysts have been forecasting,” says Carter. Vision Mobility expects that around 12% of new car sales will be equipped with Level 4 systems by the end of 2030. “12% is not really much, but to reach that 12%, plenty of work needs to be done,” he notes. This 12% will consist of a mix of high-end private vehicles and shared vehicles, both of which can better handle the initial cost of autonomous systems. By this time, Carter expects that Level 2 and possibly Level 2.5 or Level 3 will become “quite common”, even in the lower end of the market.

Offering a more cautious outlook, Huei Peng, Director of the Mcity AV test bed at the University of Michigan, points to the many technological developments that still need to be perfected: “The weakest link determines how successful you will be in the commercial deployment of any new system, like autonomous driving. As of today, there are many elements that need to be improved, the most important of which is the software and trying to figure out, reliably, what you see around you.”

O’Flynn expects it to take longer than a decade for mass commercial adoption. “We are starting to see Level 3 cars now coming to the market but the step between Level 3 and Level 4 technology is quite significant,” he explains. That jump to Level 4 will take a minimum of seven years, O’Flynn predicts. “Fully autonomous technology is further away than people realise.”



Automakers have dialled back earlier expectations for autonomous vehicle commercialisation. In 2019, GM's Cruise Automation division was forced to postpone plans to launch a driverless taxi service

> “Everyone is moving to zero emission

Supporting infrastructure could prove a significant obstacle, which is why some forecasters expect to see AVs limited to geo-fenced areas. Interacting with non-AVs will also prove a challenge. “We are already seeing in testing that AVs struggle to interact with human-driven cars,” says O’Flynn. “By their very nature they can’t mimic human behaviour, like that classic nudging into traffic and breaking small rules in order to efficiently operate the vehicle.”

Expect limited autonomous truck offerings

Automation may be slow to penetrate the passenger vehicle segment, but it could appear in trucks sooner. “Transport companies are extremely optimistic about the timescales for automation,” says Umberto de Pretto, Secretary General of The International Road Transport Union. He notes that 76% expect autonomous trucks to become a viable option within the next decade.

Autonomous trucks are already used successfully in restricted areas, such as mining. Peng sees considerable potential for driverless delivery in cities during off-peak hours: “If all supermarkets replenished their stocks between midnight and 5am, suddenly the trucks don’t need to encounter so many pedestrians or other cars.”

Avery Vise, Vice President of Trucking at FTR, is similarly optimistic for fully autonomous trucks in certain applications by the end of the 2020s. “The first common implementation likely will occur in controlled-access environments, such as construction worksites, manufacturing plants, warehouses, and distribution centres,” he notes. “On-highway applications logically will begin with autonomous operations on uncongested expressways.” As for fully autonomous driving in all traffic conditions and situations, FTR does not expect this to occur within the next decade. “Full automation beyond tightly controlled operating conditions will require too many advancements related to technology, security, and highway infrastructure to be achieved during the 2020s,” clarifies Vise.

The decade of the electric truck?

Meanwhile, like passenger cars, trucks are also poised to become cleaner, both through electrification and hydrogen technology. “As far as we are concerned, the future of urban freight transportation is electric,” asserts Frederik Zohm, Chief Technology Officer at MAN Truck & Bus. “The benefits are obvious: the vehicles produce no emissions locally and are very quiet.”

Scania’s Director of New Technologies, Anders Lampinen, believes that electrification will eventually transform all segments of trucking, but not necessarily in an all-electric setup: “Today, there is a limitation in that batteries are too heavy for certain applications. We need to have intermediate steps on this sustainable journey, and for certain customers, we see the plug-in hybrid as a solution.”

Vise expects “a big move toward electric powertrains during the 2020s and a growing emergence of hydrogen fuel cell technology,” but cautions: “A big wild card will be the ability of electric power grids to handle the charging requirements for large

commercial vehicles. However, that is a solvable problem, at least in many countries."

Trevor Milton, Chief Executive and co-founder of Nikola Motor Company, couldn't be any more bullish on the potential for his upcoming range of hydrogen electric trucks. "Diesel is going away, we all know that now. Suppliers are closing down shop, factories are closing all over Europe. Everyone is moving to zero emission," says Milton. However, this could cause a serious supply problem, as there are very few companies prepared to offer zero-emission trucks in high volumes. Because of the supply shortage of Nikola's zero emission models, Milton expects to see natural gas stick around as a fuel of choice for some time. "LNG can be a great bridge technology because it drives down CO2 and NOx emissions compared to diesel," he adds.

Welcome to the Roaring Twenties

This idea of bridge technology could thwart many of the more aggressive mobility targets currently on the table. Hybrids could stick around for longer than expected if consumers continue to struggle with range anxiety. A few more fatal accidents with test vehicles and AVs could stop at Level 3. While bridges offer a pragmatic approach to future mobility, reducing the shocks and stresses inevitable with radical change, they work much like fences; and the winners in any revolution are never found sitting on the fence.

The Scania AXL fully autonomous cab-less concept truck uses a combustion engine powered by renewable biofuel

In automotive circles, China has become synonymous with two things in particular: electric vehicles (EVs) and start-ups.

One of the contenders vying for a position in this heavily congested market is Xiaopeng Motors, a Guangzhou-based company that touts investors such as Alibaba and Xiaomi, a leading Chinese electronics company and one of the country's largest smartphone manufacturers. In November, it closed a US$400m investment round and garnered an estimated valuation of around US$4bn. It will compete directly with other start-ups such as Aiways, CHJ Automotive, Nio and WM Motor.

Interview: Brian Gu, Vice Chairman and President, Xpeng Motors

With so many EV start-ups pegged as the next big thing in e-mobility, why is Xiaopeng Motors valued so highly? Freddie Holmes speaks to its President, Brian Gu, to find out

> “Our vision is to provide a better mobility lifestyle for customers through smart manufacturing and by offering truly intelligent vehicles

Perhaps better known as ‘Xpeng’, the start-up has a raft of activities in store for 2020. Automotive World spoke to its Vice Chairman and President, Brian Gu, to find out more.

What does 2020 have in store for Xpeng?

2020 will remain a challenging year for the overall auto sector in China in terms of consumer sentiment and popularising the concept of intelligent vehicles in the mass market.

We are planning to launch our second-generation smart sedan–the Xpeng P7–in the spring of 2020, and will kick off customer delivery at the same time. It will be another milestone for Xpeng Motors after the launch of our smart SUV–the Xpeng G3–in December 2018. We will be focused on two production lines: the A-class platform for the G3 and B-class platform for the P7.

We think 2021 will be the year that the EV market in China really hits a critical mass. Right now, we are all trying to build this EV market, to make this ‘cake’ bigger.

How will Xpeng vehicles be distributed?

In terms of sales and servicing, optimising and upgrading our customer service model is a keen focus for us in 2020. In July 2019 we achieved mass production of 10,000 units and have delivered about 12,000 units of the G3 to customers across more than 200 cities in China. In 2020, our focus will be on accelerating sales growth and gaining market share in China.

Does the company have further funding rounds planned?

In November, we announced a US$400m capital fundraising round and introduced Xiaomi Corporation as a strategic investor. We’ve also successfully diversified our funding sources by securing several billions of RMB-denominated credit lines from leading Chinese and international banks including China

Merchants Bank, China CITIC Bank and HSBC, a powerful testament to the company's solid business model and its long-term growth prospects.

Fundraising is an ongoing target. We will continue to expand our capital base, securing more quality funding to support our business growth.

Xpeng has been highlighted as a 'unicorn' by some analysts– does the company see any benefit to this, or is it just a label in your eyes?

We celebrated our fifth anniversary in August this year. In the past five years, the company has achieved many milestones, including launching the first production model G3 and producing and delivering over 10,000 units to customers, establishing a nationwide sales, service and charging network and the debut of the second-generation sedan, the P7.

Our team has grown to about 4,000, including offices in Guangzhou, Beijing, Shanghai, Silicon Valley, San Diego and two production facilities in Zhengzhou and Zhaoqing. Most importantly, our customer base has grown to over 10,000 users with a much larger Xpeng fan base. From a funding perspective, we've raised multiple rounds of funds in the past five years and our shareholders are highly supportive of our strategy.

These are the things that are most meaningful to us. Whether the company is called a "unicorn" is purely a label. We care more about how customers value our products and services; investors see our strategy will bring long-term value. Our vision is to provide a better mobility lifestyle for customers through smart manufacturing and by offering truly intelligent vehicles.

The announcement of our Series-C funding is the best endorsement of shareholder and investor recognition, especially under the current difficult capital market conditions. We believe that validates our business model more than anything else.

Many start-ups in the EV space have come and gone in recent years. Do you see the company as being in a good position moving forward?

Xpeng Motors is currently the most well-funded EV start-up in China. Instead of targeting the premium market, we are focused on the largest middle-market segment where we see the highest growth potential in China.

Xpeng is not just an electric vehicle maker, but also a smart vehicle producer. We believe this segment will benefit most as consumers in China start to understand the user experience of smart vehicles and start to form their opinions. In the next two to three years, consumers of intelligent vehicles will form a critical mass. We believe Xpeng is best positioned to lead the market development with a very competitive portfolio of products, prudent strategy and a strong shareholder base.

The updated G3 '2020 edition' launched in July 2019

Alongside its electric powertrains, does Xpeng also have ambitions to develop autonomous driving technology?

Xpeng Motors in the only Chinese automaker that conducts end-to-end R&D, particularly for autonomous driving technology. Built on the SEPA platform (Smart Electric Platform Architecture), the P7 is equipped with NVIDIA DRIVE Xavier, NVIDIA's most advanced autonomous vehicle chip, and Qualcomm's top-line vehicle processor. It will be the only production model in the market that can perform Level 3 autonomous driving functions.

We are taking a bottom-up approach to autonomous driving by using relatively more economic ways to implement Level 3 or near-Level 4 functions in production vehicles. The key is how to implement technologies in production models. We think this is critically important and will continue to invest in R&D to beef up our capability.

> "We think 2021 will be the year that the EV market in China really hits a critical mass

How would you describe the push for vehicle automation in China?

We think the race of smart vehicles is just the beginning. If you look at it from a ten year point of view, China's autonomous vehicle market will be a Yuan 10tr (US$1.42tr) market.

We categorise the autonomous vehicle market development into two phases. The first phase will be dominated by driver assist autonomous technology, which is what we'd call "the first half of smart mobility", which will be over the next five to ten years. Many automakers and suppliers are focused on this phase of the market. The second phase will be the following five to ten years after that, and that is the market with enormous opportunity.

What does the next decade hold for EV charging?

Ionity CEO Michael Hajesch speaks to Megan Lampinen about the outlook for EVs and their supporting infrastructure

Charging infrastructure is pivotal to the success of electric vehicles (EVs), and that includes charging at home, within cities and on the highway. Joint venture Ionity is tackling the long-distance part of the equation by rolling out a network of chargers across Europe's motorways. The aim is to set up 400 stations, located roughly 120km (75 miles) apart, across 24 European countries by the end of 2020. When completed, it will mark the first pan-European, non-proprietary high-power charging network.

Ionity is a relative newcomer to the industry–it was founded by Ford, BMW, Daimler and Volkswagen Group (represented by Porsche) in 2017. But in today's industry, developments are advancing at breakneck speed and the infrastructure provider's first two years have been busy ones. A new decade is about to kick off, and things could look very different by the end of it. Infrastructure providers like Ionity are keeping a close eye on developments that could dramatically shape their segment.

The CO2 problem

The Global Carbon Project estimates that CO2 emissions from fossil fuels and industry rose to 37.1 gigatonnes last year. To meet the very demanding CO2 targets of the Paris Agreement, some big changes are needed. EVs could prove a pivotal tool. Already some cities are banning older diesel vehicles from entering; others are even considering banning all internal combustion engines (ICE). "If we are serious about CO2, we have to expect EV-only cities in the

> If we are serious about CO2, we have to expect EV-only cities in the next decade

next decade," states Ionity Chief Executive Michael Hajesch. "Ionity sees battery electric vehicles (BEVs) as a clear way forward in the decarbonisation of individual mobility."

Meanwhile, automakers are preparing to launch several new EV models, such as Volkswagen's ID.3, which will widen choices for consumers. Other manufacturers, such as Hyundai, are offering vehicles which could be considered 'affordable', opening up the segment to a much wider group of buyers. "Traditionally EVs were offered at a relatively high price point, which is simply not attractive to the majority of consumers," notes Hajesch. "Some do not want to spend more than €25,000 (US$28,000). The next two to three years will see a significant change in the number of vehicles being offered to consumers at a whole range of price points."

That's not to say that Ionity expects the industry to go all-electric in the next decade. As Hajesch points out, there is still plenty of patent activity going on around gasoline and diesel engine technology. However, the percentage of these patent applications is dropping, while interest in electric and hydrogen technology is gaining pace. "Electric is just one of a number of powertrain platforms being considered," he adds. "Some manufacturers are pursuing multi-solution platform strategies, while others are clearly focusing on a completely electric strategy."

Infrastructure

Ionity does not predict the market or make the models, but it does need to provide the infrastructure that its backers will require in the coming years. At least, the highway charging part of it. And it is generally working to a ten-year time frame. "The next decade is our business case." Hajesch tells Automotive World. "What happens beyond that is anyone's guess."

Forecasting is a tricky business, especially when it comes to consumer behaviour, and Norway is a case in point. The country has emerged as a leading market for EVs. Partly because of its population size and because of political incentives to support the introductions of BEVs, there are more EVs on Norwegian roads as a proportion of total vehicles than anywhere else. While exact sales figures vary month to month, EVs generally account for 60% of all new registrations. But the fuelling infrastructure is struggling to keep up.

There have been reports of long queues developing at charging points. Inconsiderate EV owners who leave their car plugged in too long while lingering over a coffee break have been beaten up by irate customers waiting behind them. Some station operators are now bringing in security personnel to manage crowd control and break up altercations. No wonder, then, that some are considering removing gasoline pumps from the forecourts to make more room for chargers.

The next decade could see a dramatic evolution of the forecourt experience. In fact, the journey has already begun, with notable improvements from the old stereotypes of fuel stations with dirty toilets and undrinkable coffee. Even fast charging an EV will take some time, and nobody wants to stand around for 20 minutes. A welcoming location for owners waiting could prove pivotal. "Station operators will have to provide more than just a fast charge. This gives the whole ancillary industry around EVs the opportunity to improve its act," suggests Hajesch. "If you spend more time charging, you are likely to spend more time at the facilities. I see that happening hand in hand." This, for example, is why Ionity chooses to work with site

operators who are willing to provide high-quality amenities on site. Exactly how station owners chose to develop their model remains to be seen, but the investment could prove lucrative if done right.

Power challenges

While global EV uptake is accelerating, overall volumes remain small. As numbers grow, they could pose a serious challenge for the distribution of power. "This is one of the reasons why we evaluate potential sites carefully to offer the highest available levels of power," says Hajesch.

The solution could boil down to cost. "Power is not cheap, and it will not be cheap down the line. This is especially true where Ionity is now establishing its network on long-distance routes, where time is of the essence," notes Hajesch. "Time will become a more relevant commodity." This could also be applicable for customers wishing to charge in urban areas but who do not have access to a wall box or similar charging facilities at the office, for example. Bidirectional charging systems connected to private vehicles at home could also make an interesting contribution to the power debate. "These systems would allow your parked car to play a fundamental role in the infrastructure of the house," he adds.

Exactly how this technology evolves and is incorporated into business models is just one of the many questions that is likely to be resolved in the coming decade. "If there is one thing the car industry is good at," says Hajesch, "it is coming up with surprises."

Trucking players move to help nations meet the Paris Agreement

A gargantuan shift across industry is required to limit global warming to two degrees, which will require more than simply putting electric trucks on the road. By Xavier Boucherat

The pressure to tackle climate change is more heavily felt than ever before, and manufacturers throughout the industry are putting their plans to reduce emissions and improve sustainability out into the open. Cummins is among the latest to do so: the engine manufacturer's 'Planet 2050' strategy sets both ten and 30-year goals, with the ultimate aim of achieving what it calls a 'net positive impact' in the communities in which it operates, and a 'near zero local environmental footprint'. The company says this meets the guidelines of a recent report from the intergovernmental panel on climate change, which says calls for carbon neutrality by 2050 to limit global warming to 2 degrees Celsius, as stated in the Paris Agreement.

The goals extend to emissions from facilities and operations. By 2030, it wants to cut greenhouse gas (GHG) by 50%, cut the scope 3 GHG emissions of new products by 25%, and partner with customers to reduce scope 3 GHG emissions from products already in the field by 55 million tonnes. Scope 3 emissions refer to indirect emissions occurring in a company's value chain, a holistic standard devised to help companies identify

The Cummins Planet 2050 environmental sustainability strategy calls for net-zero carbon emissions within 30 years

> Having CO2-neutral transport on the road by 2050 is our ultimate goal, but this can only be achieved if competitive conditions for CO2-neutral transport are created for our customers in terms of costs and infrastructure
>
> *Martin Daum,*
> *Daimler's head of trucks and buses*

opportunities to reduce emissions at a corporate level.

In addition to service-based targets, there are a number of circular economy-based goals, including a 50% reduction of organic compounds emissions from paint and coating operations by 2030, and the reuse or recycling of all packaging plastics. The twin sets of goals appear built to tackle an unfortunate truth facing the world and its societies: action on climate change is essential, but at the same time, the global population continues to rocket, as does the need for resources. By 2050, suggests Cummins, the world will consume twice the amount of electricity it does now, and material consumption is also likely to double.

A rock and a hard place

It puts the trucking industry in something of a bind: increased sustainability must be achieved whilst meeting the high levels of demand from the trucking sector, boosted by ever-creeping urbanisation and industrialisation.

"Our products have a large environmental footprint," said Chief Executive Tom Linebarger in a November press call. "They contribute significantly to climate change, and they also contribute significantly to economic goals and strong communities. We need to figure out ways to continue that contribution to growth in strong communities while reducing the environmental footprint."

The trucking sector's contribution to emissions cannot be denied. In 2017, the US Environmental Protection Agency (EPA) revealed that for the first time, the transportation sector–which includes all vehicles including planes and boats–was the biggest emitter of CO2, outpacing even the energy industry with 1.9 billion tonnes, or 28.9% of total emissions. In Europe, it is estimated that trucks, buses and coaches are responsible for around a quarter of road transport emissions, and 6% of the bloc's total emissions. The continent has since introduced the first ever CO2 emission standards for heavy-duty vehicles, with reduction targets set for 2025 and 2030.

Cummins has demonstrated a number of electrified powertrain concepts which will no doubt play a role in helping to meet targets, and has stressed partnerships with the major manufacturers and other industry players, but has also emphasised that the role of the internal combustion engine will play a role in bridging the gap to cleaner powertrain technologies. Cummins is the leading heavy-duty engine manufacturing in the US. Currently, says the company, there is no cost-effective alternative for many trucking applications, particularly long-haul.

Daimler Trucks agrees, and has stressed the importance of an

industry-wide effort to bring fleet operators around to the idea of going electric, as well as making the figures work. “We are clearly committed to the goals of the Paris Climate Protection Agreement,” said Martin Daum, Daimler’s head of trucks and buses. “Having CO2-neutral transport on the road by 2050 is our ultimate goal, but this can only be achieved if competitive conditions for CO2-neutral transport are created for our customers in terms of costs and infrastructure.”

True CO2-neutral transport, it argues, will only be possible via electrification, whether battery or fuel-cell. Even by 2040, he added, acquisition and total cost of ownership of electric trucks and buses could still prove higher than diesel trucks. He called for greater support from government, including targeted subsidiaries, nationwide infrastructure and tolls on heavy CO2-emitters.

The world’s largest truck manufacturer joins Cummins in believing that commitment to these long-term goals, if pursued in earnest, could help the developed nations of the world meet their obligations made at COP 21. By 2039, the company says it will only offer ‘tank-to-wheel’ carbon-neutral vehicles for sale in the major markets, including Europe, Japan and North America. It also shares Cummins’ ultimate goal of total CO2-neutral transport by 2050.

The truck maker wants battery-electric series production by 2022, and by 2030 wants fuel-cell models in operation, commonly thought to be the key to zero-emission long-haul transport.At the 2019 Tokyo Motor Show, it unveiled its ‘Vision F-Cell’ concept, a 7.5 tonne vehicle with a range of 300 km (186 miles).

Like Cummins, Daimler also wants to reduce its manufacturing footprint, and says it will power all German and European facilities by CO2 neutral means–in other words, renewable sources–by 2022. The company will presumably take advantage of Germany’s strong renewables sector, which delivered 44% of the country’s electricity consumption over the first half of 2019.

Of course, the question is whether these long-term goals will be pursued: after all, what accountability is there for a 30-year goal? Perhaps encouragingly, Cummins has pushed lawmakers in the US to introduce climate change legislation, as the US begins its own transition to a GHG-neutral economy by 2050. Wayne Eckerle, Vice President of Research and Technology, argued that long development cycles meant predictability was essential, as it drives investment.

However, he repeated the company’s assertion that diesel remains the best approach for zero-carbon goals. “In some applications, the best path forward is to focus on making diesel as clean and efficient as possible,” he told a panel at Capitol Hill in October 2019. It is thought there are 4.9 million diesel trucks in the US using the latest technology, and many of these will remain in service for years to come: another visible sign of the bind in which the sector finds itself.

Daimler's Fuso brand unveiled its ‘Vision F-Cell’ concept at the 2019 Tokyo Motor Show. A fuel cell range extender gives the truck a range of 300km

From disruptor to leader? Trevor Milton on Nikola's strategy for 2020 and beyond

Nikola visionary and founder Trevor Milton talks to *Automotive World* about its partnership with Iveco and outlook for the 2020s. By Jack Hunsley

Nikola has built quite a reputation over the last three years, but its recently announced partnership with Iveco is by far the biggest step the Arizona-based start-up has made to date. Together, the companies are firmly set on competing with the biggest players in the European trucking scene, an aim they intend to achieve by merging both companies' core competencies to create a potent force. No longer does Nikola need to rely on just its vision of a fuel cell future to sell its tech. Backed by Iveco, in just four years it hopes its hydrogen trucks will be out on the road in a meaningful way.

"Just like when we launched the truck in 2016 and started shaking up the industry, [the Nikola Tre launch] was like an absolute tidal wave hitting the market," said Trevor Milton, Nikola Founder and Chief Executive. "No one thought we would have a truck within three to four years, no other manufacturer thought it would be possible. We're showing the world that we're only a year away."

The Tre marks Nikola's first venture into the European market, with a battery version of the truck pencilled to go to market in 2021 and hydrogen fuel cell version in 2023. It's a short timeframe, especially considering no suitable hydrogen infrastructure is in place in Europe yet, but Milton and Nikola remain unphased. "The Tre will go into testing next year and into production in 2021. No other manufacturer can possibly even think about delivering a truck [like that] in a year anywhere in the world," Milton told Automotive World. "Right now they're laying off tens of thousands of people, and now they're going to be driving all their resources to react to what Nikola just did... We came from nowhere and we're the ones influencing the biggest companies in the world. That's pretty incredible."

> "We came from nowhere and we're the ones influencing the biggest companies in the world. That's pretty incredible

A perfect match?

With the bravado aside, one question for Nikola and Milton is, 'Why Iveco?' As one of the smallest of the global truck manufacturers, Iveco is probably not the first company to spring to mind when looking to a carbon-free trucking future. However, for Milton, partnering with the Italians was a no-brainer due to its arrogance-free approach.

"When we first met with Iveco, we had met with almost every other truck manufacturer," he said. "These other truck makers were incredibly arrogant. The first thing they'd say is 'we're the biggest, we're the best, we're the most powerful.' That's all they ever say, they do not even listen. We didn't want a partner like that."

Instead, as Milton detailed, Nikola was keen to partner with a company that was not only willing to engage but also understood where it needed to improve quickly. Once it was clear both Iveco and Nikola were on the same page, the partnership and joint venture fell into place.

"When Iveco came in, they said, 'Trevor, these are the areas where we really struggle'. It was the first time a truck maker told me they were struggling. Finally, someone was being honest," said Milton. "It was so nice to hear them tell me the

areas where they struggled and then say 'where can we help you?'"

Where Iveco can help, according to Milton, is in the core competencies required of a truck manufacturer, such as how to deal with supply chains, servicing, warranty and the very manufacturing of a truck. These elements combined with Nikola's tech outlook make for quite the pairing. "We're not good at those things, we're a tech company," he said. "Iveco is like a perfectly placed gear. The teeth do not conflict, they're just oiled and it goes together really well. Everything Iveco does badly, we do well. It is almost a perfect marriage."

The 2020s

A key success criterion of any marriage, however, is whether it can stand the test of time. With the next decade, which promises huge advances and obstacles, almost upon the industry, how well Nikola and Iveco can flourish and grow together remains to be seen. What can be assessed already is their plan for the 2020s. With diesel market share expected to slowly fade as the years pass, although not disappear completely just yet, Milton's main concern is not whether hydrogen can take up its mantle, but how easily Nikola can keep up with demand.

"What's happening now is that everyone is moving to zero emissions. They all want it, but there is going to be a supply problem," he said. "We will have a backlog of 10,000 to 40,000 trucks and we will not be able to build them fast enough. We're going to be fully focused on that right now with Iveco for a good five to ten years. That's a fantastic problem to have."

In this transition phase, Milton sees natural gas playing a key

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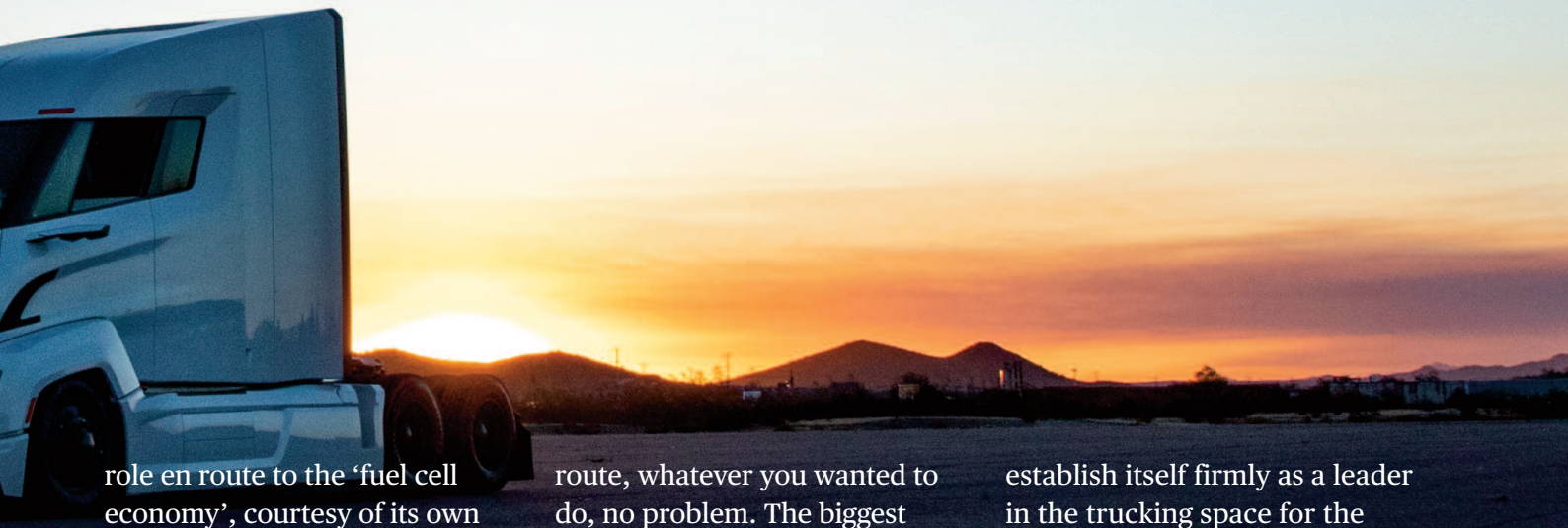


role en route to the 'fuel cell economy', courtesy of its own potential to cut CO2 and NOx emissions by displacing diesel trucks. However, while it may have a role to play, unsurprisingly Nikola's long-term outlook rests on hydrogen and batteries.

"Diesels are going. People are going to stop buying them because the emission regulations are too strict now. With what has to happen over the next ten years, they're dead. That leaves hydrogen, battery electric and natural gas," Milton told this publication. "Hydrogen and electric could fill the whole market, no problem. It could handle every edge case, truck route, whatever you wanted to do, no problem. The biggest problem is, we cannot build enough trucks for the next 20 years. Liquefied natural gas (LNG) can be a great bridge technology because it drives down those CO2 and NOx emissions, it is a great way to clean up the environment while the infrastructure of battery and hydrogen is being developed."

Technology aside, Milton has his eyes firmly set on putting Nikola alongside the biggest names in trucking. Powered by fuel cell technology, the hope is that by 2030 Nikola can do for trucking not only what Tesla has done for battery electric passenger vehicles, but also establish itself firmly as a leader in the trucking space for the long term.

"Nikola will become one of the top three truck manufacturers in the world, and I think the next ten years will be the brightest ten years we'll ever have in our future," said Milton. "I'm just so excited about it as we guessed it perfectly. We were the first to do it and we have been criticised for it, but now [the industry] finally respects us. It was a great feeling for me to be able to finally show off what all the other truck makers said could not be done. It was a 'drop the mic' moment. We do not have to prove anything any more."

‘Russia’s Silicon Valley’ jockeys for robotaxi leadership

Megan Lampinen speaks to Yandex, the Russian technology giant, about its advances in autonomous ride-hailing

Russian technology giant Yandex is emerging as a serious contender on the autonomous driving front. The company has spent the past 20 years building a reputation in the IT segment, where it is perhaps best known for its popular search engine. In fact, as of July this year it was bigger–just slightly–than Google in its home market. More recently it began expanding into adjacent segments, including Internet commerce, ride-sharing and autonomous driving.

“Sometimes Yandex is called the Google of Russia, but that’s misleading,” says Artem Fokin, head of business development at the Yandex self-driving cars project. “We are more like the Silicon Valley of Russia. Our portfolio covers anything you can think of that is related to the Internet.”

A late arrival

Self-driving is the latest addition and developments have been rapid. Yandex unveiled its first robotaxi prototype in 2017. At this time, Google had already been working with its own self-driving projects for eight years. “We were relatively late to the game, but it was easy for us to catch up,” Fokin tells Automotive World. “That’s because we have a good understanding how self-driving cars should look and what ideas work and what do not work.”

To move quickly, Yandex started with a production vehicle that it could customise. It settled on the Toyota Prius, as other companies had already used this as a base

A Yandex self-driving car safely navigated the streets of Las Vegas during CES 2019

model and had successfully connected their self-driving systems to it. “If someone could do it with this car, we would be able to do the same,” he states. Working with no assistance from Toyota, Yandex simply bought the cars on the open market and retrofitted them.

By August 2018, a fleet of its self-driving taxis entered commercial service in the Russian university city of Innopolis. Two months later, a second service kicked off in Moscow’s Skolkovo district. Users hail a taxi using the Yandex.Taxi app. When the vehicle pulls up, they will not find a driver behind the wheel, just an engineer in the front passenger seat.

Racking up the miles

Outside of Russia, tests have also been conducted in Tel Aviv and Las Vegas. In total, the company’s autonomous fleet has covered more than one million miles, and this figure is growing by 150,000 km (93,000 miles) every week. The aim is to cover one million km per week. “There’s a reason behind that number,” explains Fokin. “It brings a certain assurance about the changes to the code and the behaviour of the system. Driving that much would give us statistical proof that the many changes we’re constantly making to our software are changing things for the better. At the moment, when you make some improvements, you need to make sure that they didn’t inadvertently break anything somewhere else. We also need to understand that the metrics are getting better, and for that you need to have a statistically valuable number of kilometres driven on every new code improvement.”

Virtual testing plays a big role in validation as well, and engineers test more than 40,000 simulated scenarios every hour. But Fokin sees limits to this approach: “The simulator can recreate behaviour of other objects on the road, but it’s basically one computer testing the other computer, one programme testing the other programme. It definitely helps to improve things but you cannot be 100% sure that something validated only in the simulator will behave the same in the real world.”

The feedback from early users of the robotaxi service has been overwhelmingly positive. That said, the user group was predisposed to a more favourable response. “It’s very a specific audience,” notes Fokin. “They are primarily young people and they work in technology areas like IT, which is very close to what we do. They tend to be excited about the technology already.”

The data offers a more objective view, and that too is promising. So far the vehicles have avoided any accidents. “The only thing which prevents us from going faster are the regulators, because they’re still in a conservative mind-set and are very cautious about dangerous situations.

Usually, once a regulator rides in one of our cars, his attitude changes for the better."

Human intervention

Despite its confidence, Yandex is prepared in case something does go wrong. In Russia, the cars are insured under a Rouble 10m (US$156,000) liability policy, but Yandex has never had to use it. That's not to say that test drivers have never had to intervene, though. "In most of the cases where a driver had to intervene, it wasn't as if an accident was imminent, more that the system was confused," he notes.

Imagine a two-lane road, in which the lanes are separated only by a painted line. If one lane is blocked by an illegally parked car, a human driver would realise that the only way to move forward would be to violate the road rules and overtake the vehicle by passing into the other lane. That's what humans would do. Robots don't, not yet. "Robots don't break rules, so they can become confused," he points out. "It is this sort of case where the human driver has had to take over."

> "Sometimes Yandex is called the Google of Russia, but that's misleading. We are more like the Silicon Valley of Russia

Notably, this isn't the only sort of situation in which humans may need to intervene in an otherwise autonomous ecosystem. Fokin envisions a future in which fleets of driverless vehicles ply the roadways, watched over by

> The only thing which prevents us from going faster are the regulators... Usually, once a regulator rides in one of our cars, his attitude changes for the better

remote operators who could step in and help. This remote operator would be called on to analyse potentially unusual situations and then personally validate that a divergence from the official road rules was required. If the authorities later have questions about why a vehicle violated the road rules, there would be a specific human to whom they can address their questions.

This is not to be confused with remote operation of autonomous vehicles, which Fokin believes is difficult. It is simply a case of a human authorising certain manoeuvres which the car can execute while relying on all the other safety protocols it has in place. And Yandex could have a role to play here, at least initially. "We see our future as an organisation that operates a fleet, and that includes maintaining and monitoring all the vehicles. When we have millions of self-driving cars, those functions can be outsourced, and third parties might be trained and could operate the system on our behalf."

Hardest ones first

Urban applications of autonomous driving are among the most challenging, due in part to the vast number of variables at play in city streets. Other companies are looking to simpler environments in which to refine their self-driving technology, such as bus depots, warehouses or even motorways.

"We have often been asked why we don't try something simpler like autopilot for trucks on the highway," notes Fokin. "It is easier to do highway driving, because there are fewer things to predict. However, because we focus on city driving, it means that once we solve this problem, all others will be solved as well. A robodriver that is capable of handling all kinds of central metropolitan areas will be able to handle anything."

This is also part of the logic behind the choice of Russia as an early test bed. "The harsh winter weather creates additional challenges for everything driver related," concedes Fokin. So far, the vehicles have managed it well. Yandex released a video in February 2018 of a test vehicle safely navigating a host of obstacles as it drives along a Moscow street shortly after a snowstorm.

It is also tackling urban challenges head on with its testing in Tel Aviv. While the city's winters are mild, there are many narrow streets, numerous two-wheelers and plenty of passionate drivers on the road. "This all makes it hard to predict behaviour," he adds.

The next few months will see Yandex continue to accumulate additional miles of experience, with the launch of a temporary robotaxi service at CES in January and later the North America International Auto Show in June 2020.

Cooperation and a new mindset vital for AI success, says Ford

Artificial intelligence holds huge potential to improve efficiency in the automotive industry. Reaching this potential relies on cooperation with, not against, AI. By Jack Hunsley

Artificial intelligence (AI) has grown over the past years from a neat addition to a core requirement. From autonomous driving to more effective sales and marketing strategies, the transition to an AI-driven industry is well on its way.

However, one curious element is how AI-adoption has allowed new tech giants into the industry. From Microsoft to Amazon, almost every established computer tech company has now invested in automotive solutions to some degree. For such players, these

moves were a natural progression, based on decades of expertise in computing. For the automotive industry's incumbents, however, that adjustment has been slightly more challenging.

One such player affected is Ford. With more than a century's worth of expertise in vehicle development and manufacturing, the move to a CASE (connected, autonomous, shared, electric) dominated industry has instigated profound change throughout the company, most notably the way it now considers itself the 'Ford Mobility Company'. However, as the company continues its public CASE and AI endeavours, how has greater AI-capability changed its work behind the scenes?

> "In the past, workers worried that automation could threaten their jobs, but now we need to carry out more maintenance tasks if machines can run 24/7

More than just AVs

AI has many uses in automotive outside of autonous driving. Popular focus areas include logistics, sales, marketing and customer experiences. However, perhaps the most valuable opportunity is in manufacturing. Automation has been used for decades now to increase time and efficiency savings on manufacturing lines. However, integrating AI into such processes is yielding even bigger results.

For example, one area on which Ford is currently focused is generative design—an iterative design process which leverages AI capabilities to explore a multitude of structural permutations to find the most efficient solution for tools and components. "We are using biometric structures and the topological designs which we can develop and automatically optimise using a programme," detailed Ford's Seonhi Ro. "One area we use that is in designing tools. If we design tools that way we can build lighter tools much quicker," said Ro, Global Data Insight and Analytics Manager for Manufacturing at the automaker.

AI is also being used at Ford to aid its maintenance cycles. Just as how in-vehicle connectivity can be used to enable predictive maintenance services for personal vehicles, the same concept is being used for robots and cobots in Ford plants. Algorithms are used to monitor machine performance and estimate when maintenance will be required well in advance of any failures. AI can also be used to identify the best time slot to carry out repairs so as not to impact day-to-day operations.

In a similar vein, a recent development at Ford is its work in 360-degree sketching. The concept leverages AI and virtual reality (VR) functionality to allow Ford designers to automatically transform freehand design sketches into a 3D VR viewable model. "360-degree sketching makes it possible to see the dashboard, doors, seats and console altogether and to better understand how elements interact," said Nicolas Fourny, Interior Designer at Ford of Europe. "We can see how things flow, collaborate in real-time and work on different elements all at once. We can make the customer experience central to a vehicle's interior right from the start of design."

The concept, which was first unveiled in November 2019, allows Ford to identify potential improvements such as seat height and width adjustments, visibility for rear passengers and placement of roof console elements on the VR model. Alterations can then be made digitally, saving time and money on developing physical prototypes.

> With AI we have to work differently, so it is important to begin changing people's mindset to work with, not against, AI

Helping hands

An interesting aspect of 360-degree sketching is the fact that it has its roots in the gaming industry, a point which Fourny himself highlighted. As the automotive industry continues to embrace VR and AI in

The most prominent example is Nvidia's success over the previous decade. Having built much of its reputation since 1993 developing solutions for video games, over the last few years it has also developed a reputation as one of the go-to partners for autonomous driving development. Since unveiling its Nvidia Drive platform for the first time at CES 2015, today it counts Toyota, Volkswagen, Daimler, Audi, Volvo, ZF, Bosch and Continental among its many automotive partners. While not a partner of Ford's, Nvidia's success does show that traditional players are increasingly looking to leverage external computing expertise to aid such development.

"The basic principle is that many of these algorithms were first developed in the gaming industry and now we are benefiting from that work," said Ro. "The key difference lies in identifying how we can leverage outside knowledge and the areas where we need internal knowledge. For example, if you are building a solution for one of our plants you need to understand the processes and how best to support the people that work there. If you plan to use AI to help make that decision, it is difficult for an outsider to develop that capability."

This why Ford, among many other automakers, has made great strides in recruiting and training its own AI specialists. Ford currently has a team of around 1,000 specialists working on data analytics including application and development of AI across its entire business. By keeping these elements in-house for specific core areas, the belief

is that this will produce more effective AI solutions. “It is vital to keep things internal if you want to use AI to help humans interact with technology effectively and make the right decisions,” Ro added.

AI for the greater good

However, connectivity need not only benefit individual lines and plants. With CASE mobility encouraging cooperation across almost all new mobility trends, the use of AI behind the scenes is no exception. For Ford, one area that could hugely benefit from AI is supply chain organisation.

“We are not alone in manufacturing. We need to get parts from many different suppliers and so it is hugely beneficial to know of any changes in advance,” explained Ro. “If we know early enough that a supplier has a quality issue, we can adjust for this in our plants. At the moment, we sometimes get that information too late. If we can leverage real-time data we can make our production processes more robust.”

It sounds great on paper, but in practice, it is much trickier to organise. Even though unwavering cooperation would technically benefit all involved in the supply chain, concerns swell around not wanting to divulge more than necessary about internal processes. “The big discussion there is how we can exchange our data confidentially and securely. We are already discussing this with some suppliers, but the problem is that some do not want to give their information away,” said Ro. “It is a huge challenge to make sure that only the parties that really need that data can access that information.”

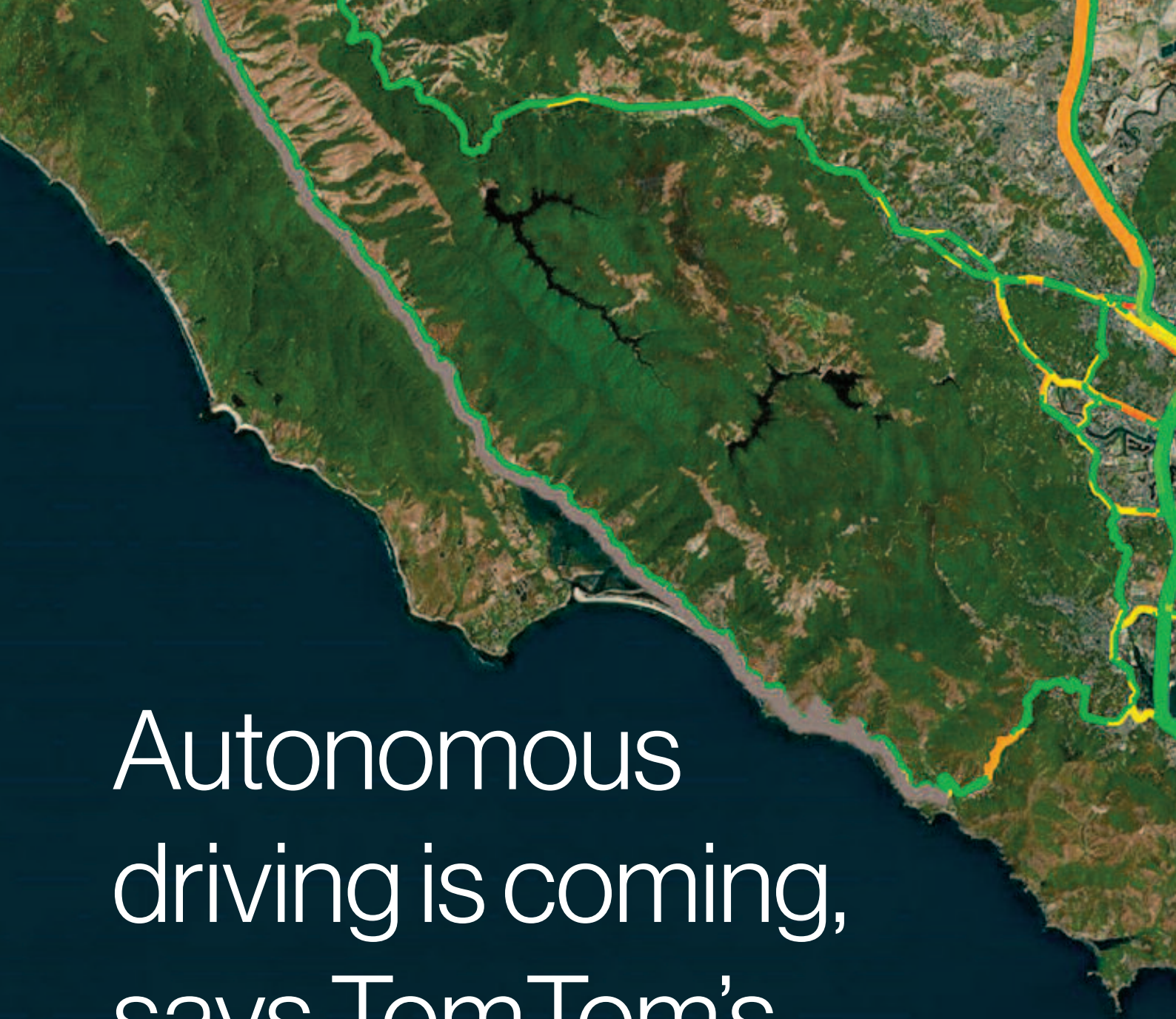
A new mindset

The potential benefits of leveraging AI are fairly straightforward. However, quantifying exactly what results AI can achieve is tricky. Across the board, it should yield significant time and cost savings, but the speed at which it is being deployed, its reliance on other tech developments, and the need to firmly understand how best to use it makes its overall potential difficult to realise.

“Looking ahead to 2030, while AI is very dependent on what other technology is developing, I would not be surprised if we’re already exploring concepts such as wireless production and smart manufacturing,” said Ro. “The potential to create digital twins, integrated supply chains, smarter cobots, predictive maintenance, etc., should result in a big efficiency jump.”

Even if the exact results are not yet predictable, one element that will remain is the role of human workers. While some may equate greater connectivity and AI usage to a move away from a traditional workforce, the way AI is being used and developed is keeping the human touch very much in mind.

“AI has allowed us to do many things automatically, but there are still plenty of verification steps that we need to go through,” said Ro. “In the past, workers have worried that more automation could threaten their jobs, but now we have a need to carry out more maintenance tasks if machines can run 24/7. With AI we have to work differently, so it is important to begin changing people’s mindset to work with, not against, AI.”



Autonomous driving is coming, says TomTom's 'Godfather of mapping'

Megan Lampinen speaks to one of the pioneers of digital mapping, Alain De Taeye, about the rise of real-time maps and the evolution of autonomous driving

TomTom has established itself as one of the leading players in the world of digital navigation technology. It has expanded its expertise from the traditional navigation map for turn-by-turn navigation to ADAS maps that improve the functionality of popular driver assistance systems and High Definition (HD) maps for autonomous vehicles (AVs). And none of this would be possible without the mapping groundwork laid by Alain De Taeye.

De Taeye has spent his career pursuing advances in map digitisation and routing, leading Dutch company Tele Atlas until it was acquired by TomTom in 2008. Today he serves as a Member of TomTom's Management Board, tasked with steering the company's geospatial content strategy and innovations towards an autonomous future. "I am a mapmaker," he states–but he's not just any mapmaker.

Early days

Within the industry, De Taeye is commonly referred to as the 'Godfather of mapping'–a sobriquet which seems to make him slightly uneasy. "I don't know if it's that accurate, especially if you think of The Godfather movies, but I was certainly one of the first to make digital maps for navigation," he tells Automotive World. "I started working on this in the 1980s, when it was considered to be science fiction. The first time it hit the newspapers it was compared to KITT, the car in the television series Knight Rider. KITT did indeed have one of the first navigation systems, even if it didn't work in reality."

But De Taeye's technology did work. The idea behind Tele Atlas was to help trucking and delivery companies better understand the distances between cities. "In the old days, you had to figure that out with a paper map, using a little tool to calculate distance between towns in kilometres," he explains. "It was very labour intensive. We thought, why not digitise the map and from that we can calculate a wide range of things." The idea fit in with the wider digital advances emerging at the time with personal computers. "It was not that spectacular, it was just the next step in digitisation," he adds.

Many advancements soon followed. From simply calculating distances between cities they began to look

"I like making maps" - TomTom's Alain De Taeye, the so-called 'Godfather of mapping'

into car navigation. A few pioneering companies like Etak were also exploring this. The US company launched its aftermarket Navigator product in 1985, making the cover of Popular Science magazine in June that year. The Navigator read mapping data stored on a cassette drive, with individual tapes for certain sections within a city. Tele Atlas acquired that company in 2000, the same year it went public on the Frankfurt stock exchange.

And all this time it was building up stores of mobile mapping (MoMa) data. The first mapping vehicle used by De Taeye and his team was a Mercedes-Benz van, which hit the roads in the late 1980s. In the back, it carried around about 1,000kg worth of electronics equipment, storing pictures captured as it drove. It's a far cry from the small MoMa passenger vehicles, usually Kia or Volkswagen models, that TomTom uses today, where the technical kit takes up just half of a small back seat. But at the time it was breaking new ground.

From small things... The first Tele Atlas road mapping vehicle was a Mercedes-Benz van loaded with 1,000kg worth of electronics equipment to capture and store pictures

Tie ups

TomTom was also making waves at the time with its navigation device, which relied on maps from Tele Atlas. These devices were pivotal in bringing navigation to the masses. Until then, this sort of functionality would cost drivers anything from €3,000 to €4,000 (US$3,320 to US$4,430). "It was a revolution," notes De Taeye. "Instead of selling hundreds of thousands of devices you could start selling millions."

In 2008, Tele Atlas fell into TomTom's hands after the latter emerged victorious from a bidding war with rival Garmin. Due to that bidding war, TomTom's Chief Executive Harold Goddijn ended up paying €2.9bn for the company, and despite the hefty price tag, he later insisted he had no regrets. Neither, apparently, does De Taeye. "There was a clear rationale for the sale to TomTom," he says. "We were a B2B company. We did not have access directly to the community input that TomTom, with all its devices, did. It had a massive amount of community input and probe data."

TomTom is able to collect vast amounts of data on aspects such as traffic and road changes from both

its users and its many connected devices. Today, it harnesses input from more than 600 million devices. While ten years ago the number was considerably smaller, it was still significant. “At that time, it was still very early in the game, when almost nobody had probe data,” notes De Taeye. “We wanted to tap probe and community data to improve maps and make new services available like traffic information. Traffic is very close to a map; it’s a layer on top.”

A good map

The definition of a good map has evolved in line with technological advances and user needs. In the early days of digital mapping, a good map was one that had no gaps in its coverage. “One of the problems in those days was topology,” he states. “If you draw lines on a piece of paper, which is essentially what you do when you digitise, you have to make sure all the connections are made. You cannot have gaps. For an accurate model, you must have quality rules and be able to detect a mistake.”

The past three decades have witnessed tremendous progress on many fronts, particularly in terms of automation and quality. As De Taeye points out: “Where we used to have tens of quality rules, we now have thousands and thousands. With greater automation, the speed by which you update the map has become faster, and both accuracy and quality have gone up. We are also bringing more content into the map. In the early days is was just a road map but now we include all kinds of features. As the content features increase, the update cycle reduces. We are getting closer and closer to real time maps.”

This is the Holy Grail of mapping–the concept that any change in the map is picked up immediately, enters into a database and then finds its way onto the application. ‘Immediately’ is the big challenge here: about 85-90% of the changes made in TomTom’s database are automated, but it still takes a little time to process. “We are not at real time just yet, but we come close to it,” says De Taeye. “At the moment, there is a delay for traffic information of just minutes. We will reduce that to seconds. If you can do that to traffic information, you can do it to all sorts of things. ”

More than mapping

TomTom has emerged from strong mapping roots, but it is much more than that today. The company

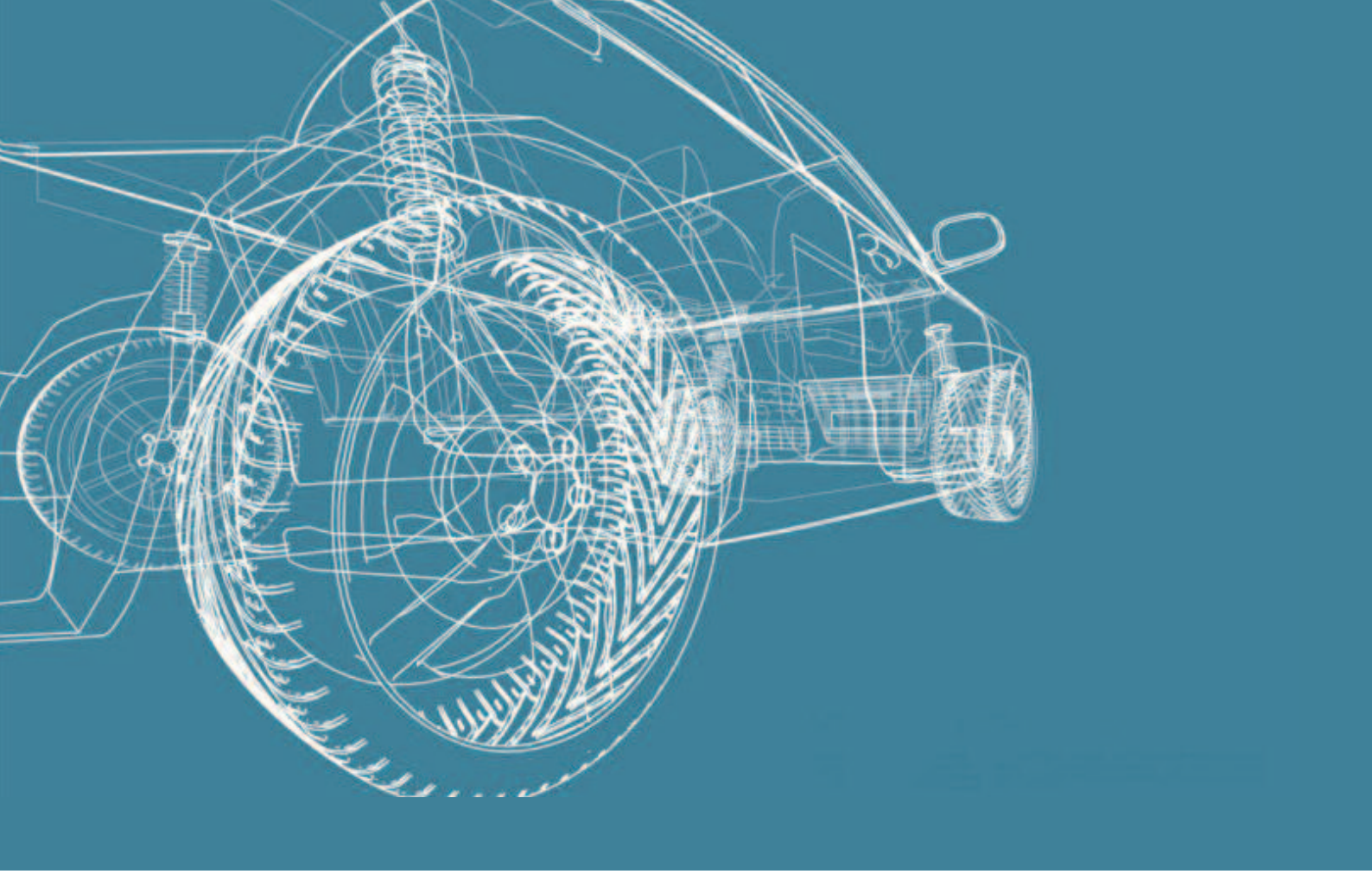
likes to refer to itself as an independent location technology company. “Maps are the foundation of location technology but we do much more on top of that,” he states, pointing to its partnership with Microsoft, under which the latter’s Azure Location-Based Services (LBS) use TomTom’s mapping data. “This puts us into the world of the Internet of Things (IoT), where there are many ‘things’. For almost all of them you need to know where they are. You need a map. Geocoding, reverse geocoding, the software layer on top of that–the map is the foundation.”

> “TomTom believes its HD maps can help reshape not just the driving experience, but the entire mobility ecosystem

Similarly, its technology promises to help reshape not just the driving experience, but the entire mobility ecosystem. HD maps are widely regarded as one of the four pillars of autonomous driving, along with sensing, driving policy and actuators. Made for machines rather than humans, HD maps allow an AV to understand its location on the road and in relation to other objects. Importantly, they complement input from vehicle sensors to ensure high reliability in instances of poor visibility, snow, rain, etc. Today, TomTom’s HD maps are currently used by nine of the top ten global automakers, helping to pave the route towards a world of autonomous driving.

“I am 100% sure autonomous driving will happen,” asserts De Taeye. “What is less clear is when, and to what extent.” Looking long term, he anticipates cities in which fleets of shared AVs pick up and drop off riders, summoned on demand by app. In this scenario, there is no private ownership, and no need for urban parking spots, freeing up land for green spaces in today’s crowded, congested urban centres. It’s a safer, cleaner, more convenient world of mobility. And it is made possible, in part, by mapping advances.

Looking back over his eventful career, De Taeye concedes that he was one of the lucky ones: “You need a bit of luck. I had the luck to do what I like to do most, and that is making maps. I was able to do that from the very start and see all the different phases, and hopefully another couple yet to come. I’ve seen a lot of new people come in and a lot of new focus on software and platforms, but I’m still the mapmaker.”



Interview: Christophe Rauturier, Chief Digital Officer, PSA Group

Freddie Holmes finds out how artificial intelligence can play a role in a growing number of areas of the car business

The automotive industry is in the height of a digitalisation phase, and new sources of data are enabling automakers to optimise the way various departments are run.

In particular, artificial intelligence (AI) is being leveraged in more ways than ever before, and not only when it comes to autonomous vehicle software. Indeed, algorithms are being trained to optimise back office operations, marketing campaigns, supplier quality optimisation and even customer retention.

Christophe Rauturier, Chief Digital Officer at PSA Group, spoke to Automotive World about how AI has made an impact at the automaker, from its use in traditional areas of the business to deployment in new ventures such as mobility services.

Besides autonomous driving software, in which ways can AI be useful for an automaker?

I'm glad this point is being raised, because AI does not only have a role in autonomous driving. In general, we believe AI is not only about creating efficiency, but also about gaining more knowledge and understanding. We really see AI as a key contributor to our efficiency improvements across the organisation.

It is also worth noting that this is not a new approach, it is just a question of the kind of algorithms that are being used and the volume of data we have available. For example, for crash simulation we have been sending digital cars into digital walls for years. We can also learn more about our customers, of course taking GDPR into account.

In which ways can AI improve efficiency– reduced cost, time to market or a reduction in the amount of human effort?

It is a mix of all of the above. For example, AI can make a positive impact on quality. To achieve this, we have equipped our supplier development teams with a predictive dashboard that can monitor the quality from supplier factories on a day-to-day basis. This can highlight situations

> "Marketing campaigns that have been powered by these kinds of algorithms are around four or five times lower in cost

> We really see AI as a key contributor to our efficiency improvements across the organisation

where it is likely that the supplier needs to improve quality. AI allows us to warn supplier development teams that the suppliers they monitor may be heading toward a problem, and also help the supplier's plant managers to focus on the right areas.

We can save time through robotic process automation, which allows you to automate things such as sales administration. This can reduce the time required of a human to perform fastidious tasks, such as copying things from one system to another or building an Excel spread sheet. This is not necessarily machine learning, but as long as it augments the capacity of a human being we can call it artificial intelligence.

AI can also increase efficiency during a marketing campaign, where we try to understand the probability of someone coming to one of our garages. AI can ensure we take the appropriate marketing action to ensure that customers remain loyal to our dealers, and for this we learn from the data that we obtain in terms of the number of visits or how far the customer is to a garage. Where AI comes into action is the fact that we can target relevant customers who are likely to accept the offer.

Marketing campaigns that have been powered by these kinds of algorithms are around four or five times lower in cost, so it is really impressive what you can do when you use data to improve the efficiency of marketing. AI can clearly help with cost avoidance.

How can AI help automakers run on-demand mobility services?

Mobility on demand is a completely different business model, and its operations rely heavily on digital platforms and data. We have seen in Paris with our Free2Move car-sharing operations, for example, that AI can help to ensure that cars are in the right place depending on where prospective users will be. We can see where there are 'hot' areas of activity, and if we ever have cars that are sitting in 'cold' areas, we can move them. This is where we use data and trained algorithms to provide assistance for the operation of Free2Move car-sharing.

What about more traditional areas of the business?

We have some use for mathematical algorithms when it comes to computer vision. For example, using digital images to detect defects in our factories during certain processes, such as exterior painting. There are now suppliers of industry equipment that feature an 'automatic control portal', which combines image recognition, machine learning and deep learning. Recently, we have also used computer vision with deep learning algorithms to recognise ID numbers from documentation we receive for supplier's spare parts and that we wanted to reference in our own documentation.

Has the workforce expanded in certain areas as the use of AI grows across the business?

We did not just hire hundreds of people; we are growing progressively. As we demonstrate the value of AI, we are bound to invest further. The way we tackle the issue is to have a central expertise team. We have a number of very high-level data scientists, who rely on data from project managers across different parts of the company: sales, marketing, R&D, etc. One of the characteristics of AI in data projects is that you need extremely short cycles of interaction between the person who knows the problem to be solved, and the person that knows what kind of algorithm you should use.

Even the most highly skilled algorithm developer needs to know how that algorithm relates to the business, so there is nothing more important than having continuous interaction between teams. For this, we created a Fablab, which is dedicated to data and allows the relevant teams to work together and share data from the different parts of the business on a daily basis. If you do not do this, your AI strategy will not work.

AI, deep learning, machine learning—is it all just 'marketing speak' to describe the use of algorithms?

All of these phrases have become very popular thanks to the tech giants, but generally speaking, there are other kinds of algorithms that can help you understand a problem.

Is PSA working with players outside of the automotive industry to assist with the introduction of AI in its operations?

We are part of a French initiative called PRAIRIE, a consortium of companies within our space but also those from the digital world, such as Amazon, Microsoft or Google, to perform research in an open manner and test proposals through research initiatives. The focus will mainly be on autonomous vehicles, but also on manufacturing issues and other areas.

US policy update to secure autonomous tech competitiveness

US Senate Commerce Committee convenes to hear experts on autonomous vehicle testing and deployment. By Megan Lampinen

The US is keen to push ahead with autonomous vehicles (AVs), both for safety and for the economic benefits they promise. However, in terms of supporting legislation, it has a long way to go. KPMG ranks the US as ninth in the world in terms of legislation and policy governing AVs, and the concern among US politicians is that without a strong national approach, other countries will emerge as leaders in this field.

The US Department of Transportation (DOT) has been working to update its processes and regulations through such measures as guidance documents, requests for information, grants, and proposed rulemakings. The question now is how Congress might further support the DOT's efforts on this front. This was the focus of a recent meeting of the Senate Committee on Commerce, Science, and Transportation (generally known as the Commerce Committee), which has jurisdiction over AV policy along with the House Energy and Commerce Committee. The two are working together to draft bipartisan, bicameral legislation to set a federal regulatory framework governing the safety of AVs.

"Recent efforts are a step in the right direction. But, with AVs already being tested on our roads in more than 34 states, strong federal leadership is required to govern the successful implementation of this technology," stated Senator Roger Wicker, Chairman of the Commerce Committee, in his opening remarks at the hearing.

Safety in the spotlight

AVs could dramatically reduce the number of crashes by eliminating human error, but some industry watchers and safety advocates are concerned that vehicles with automated features could pose a real risk if they are pushed onto the market too quickly, or tested in a reckless manner. The fatal crash of Uber's test AV in Tempe, Arizona is frequently held up as an example of the dangers this poses. "It is imperative that manufacturers learn from this incident and prevent similar tragedies from happening again," emphasised Wicker.

> "With AVs already being tested on our roads in more than 34 states, strong federal leadership is required to govern the successful implementation of this technology

Partially automated vehicles are also a big concern, and Tesla's Autopilot has been linked to several fatal crashes. US Senator Maria Cantwell raised her concerns around human engagement in these SAE Level 2 vehicles: "Research consistently shows that drivers disengage from a task of driving when using automated tools. I believe the interaction between humans and technology, particularly this whole area of automation, is one that will be very much part of the future, but needs a lot more attention. Over the past three years, more companies have been putting AVs out on the road, and sometimes ending in fatal consequences. In several of these accidents, the drivers were not paying attention to the roadway and unable to intervene to avoid the crash."

People are also worried about the cyber security risks posed by these vehicles, whose connected features open them up to potential hacking. Senator Edward Markey raised this point at the hearing: "These new vehicles are just computers on wheels. They can be cyber hacked and taken over. It's a very dangerous situation." He

Partially automated functions like Tesla's Autopilot have attracted both high praise as well as serious safety concerns

flagged the recent 'Kill Switch' report by Consumer Watchdog, which noted how automakers had disclosed the risks of connected cars to investors and shareholders. The concern here is that they have not disclosed those same cyber risks to the public at large. While Markey and his colleague Senator Richard Blumenthal sent a letter to the National Highway Traffic Safety Administration (NHTSA) asking it to share the actions it is taking to protect consumers from cyber threats, NHTSA has so far not responded.

NHTSA: We're on it

NHTSA Acting Administrator James Owens was also at the hearing, both to answer concerns like those voiced by Markey and to present an update on the agency's AV efforts. As for the cyber risk, he explained that NHTSA addressed this through safety recalls. In 2015, for instance, NHTSA recalled 1.4 million vehicles for cyber vulnerabilities.

In theory, NHTSA is a big backer of AVs for their ability to eliminate human error, the primary cause of serious road incidents. One of its focus areas at the moment is driver engagement with partially automated features–the very problem raised by Senator Cantwell. "As we transition from traditional vehicles and those with limited ADAS features to ever increasing levels of automation, we will address the ability of drivers to assume control when necessary,"

said Owens. “In all but fully automated vehicles, which are not commercially available yet, driver readiness to resume control is critical to safety. NHTSA is currently engaged in human factors research to evaluate various methods for notifying and engaging the human driver as needed to maintain safe operation of the vehicle.”

Owens also made assurances that the agency is tackling concerns around cyber security. It is currently updating the existing ‘Cybersecurity Best Practices for Modern Vehicles’ document. NHTSA has also been conducting workshops on the topic in partnership with the Society of Automotive Engineers (SAE). In 2018, it participated in the Department of Homeland Security’s Cyber Storm exercise, which will be held again next year.

More than voluntary

At the moment, all guidance and regulations around AVs are voluntary, which has some players worried. “NHTSA has voluntary safety assessments as a way for companies to communicate how they prioritise safety, but some of these self-assessments read more like a marketing brochure than a critical assessment,” noted Markey. Also, not everyone files these. Most notably, neither Tesla nor Uber has, and both companies have had fatal crashes linked to their vehicles. “We need to make sure these safety safeguards are not just voluntary,” insisted Markey.

That is the focus of the work being carried out by the National Transportation Safety Board (NTSB), which had met a day earlier to discuss the March 2018 Uber crash that killed Elaine Herzberg. It has recommended that NHTSA make self-assessment reports mandatory for anyone intending to test AVs on public roads. “While NHTSA has published three iterations of AV guidance, it provides insufficient instructions on how automated driving developers should accomplish the safety goals of the 12 automated driving system safety elements,” explained NTSB Chairman Robert Sumwalt in his testimony before the Senate. These 12 priority areas were flagged by NHTSA in previous AV guidance.

“If the process of submission of safety self-assessment reports were mandatory and included a process for the ongoing evaluation by NHTSA, it could serve as a criterion for judging whether a manufacturer’s approach to development and testing met the minimal intent of the 12 automated driving system safety elements,” he added. “NHTSA’s evaluation of a safety plan could also provide a minimum level of assessment that would aid states with AV testing.”

Don’t stymie developments

Safety is pivotal, but government is keen to ensure that it does not stymie technology development at the same time. NHTSA believes a big boost to innovation could come if it modified the reporting and submission requirements for exemptions to the Federal Motor Vehicle Safety Standards (FMVSS). At the moment, if a vehicle, even an AV, does not comply with the FMVSS, developers must apply for an exemption based on novel vehicle design.

For example, in March this year, General Motors applied for a temporary exemption for its driverless Zero-Emission Autonomous Vehicle (ZEAV), as the models do not have a steering wheel. They also do not have any manually-operated gear selection mechanism or foot pedals for braking and accelerating. GM intends to use the ZEAVs to provide on-demand mobility services.

NHTSA only has authority to grant exemptions on up to 2,500 vehicles for any automaker per year. “That’s fairly small for automakers,” noted Owens. “We have heard from many that this number may not be enough to help them pay for the R&D they incur to develop these novel vehicle designs. If we have more flexibility to grant more exemptions, it would allow the agency to make case by case determination on which vehicles and designs have a greater likelihood of safety. We could then make a risk-based decision on the number of vehicles that may be exempted. That may be helpful.”

This potential change would, however, also be gated by safety. As Owens was careful to add: “We must proceed carefully when determining which standards we can amend to ensure they remain consistent with safety.”

Scania gives new meaning to electric over the road trucking

The plug-in hybrid truck and the electric road are both solutions which could be deployed today, says the truck maker, but a long-term focus is also important. By Xavier Boucherat

This year in Stockholm, a number of plug-in hybrid trucks were deployed to make night-time deliveries to McDonalds restaurants. This normally would not be possible: after-hours deliveries are banned in the Swedish capital, thanks to strict laws around noise. "Ask Stockholmers what they think is the biggest environmental problem in the city, and they will nearly always say noise," said Eva Sunnerstedt, who leads the Clean Vehicles and Fuels Programme for the city's Environment and Health Administration. It's a sensitive issue, and one which the truck's pure electric range of 10 kilometres tackles well, allowing


SCHANZ
SCANIA
R 450
hybrid
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Scania believes its quiet, near-zero emissions hybrid trucks are ideal for off-peak city centre deliveries

the logistics firm HAVI to dodge the morning rush-hour of deliveries.

The truck itself is a Scania. Unveiled in 2018 at the Hannover IAA, the plug-in truck–which was also accompanied by a standard hybrid variation–is powered by a five-cylinder engine working in parallel with a lithium-ion system. It represents improvements made on the company's first hybrid truck, launched in 2014. The industry, says Scania, is in a transitional phase. Infrastructure has yet to be put fully in place, and batteries remain pricey. For longer range requirements, hybridised solutions, in combination with alternative fuels, are the best chance of offering fleets greener vehicles which can be run at a reasonable total cost of ownership (TCO) in the short term.

"The reasoning behind the plug-in, range extended truck is that we still see a lot of customers transporting goods from outside the city to the inside," says Anders Lampinen, Scania's Director of New Technologies. "This test, done in collaboration with HAVI, the City of Stockholm and the Royal Institute of Technology, is to understand the benefit of off-peak delivery. What reports show clearly so far is that it can free up a lot of congestion, and from an operator perspective, increase productivity."

Lampinen believes that eventually, all segments of trucking will be transformed by electrification. Urban applications have proliferated, covering everything from garbage disposal to city distribution. Battery technology, he says, is reaching a stage where payloads can be handled, and overnight charging can provide sufficient range for a day's work. One of the next sectors likely to adopt en masse will be the industrial markets, such as mining, which work with heavy loads over relatively short distances. "For these types of jobs, you don't need much battery

capacity," he says, "unlike in long-haulage where a truck would need at least 500 kilometres in range before needing a rest."

Hybridisation presents a smaller capex investment, he says, when compared with full battery electric. It could be the key to driving the long-haul segment in the right direction. "We need to make sure our portfolio is broad, as there is no silver bullet when it comes to electrification," says Lampinen. "Today, there is a limitation in that batteries are too heavy for certain applications. We need to have intermediate steps on this sustainable journey, and for certain customers, we see the plug-in hybrid as a solution."

> "We need to make sure our portfolio is broad, as there is no silver bullet when it comes to electrification. Today, there is a limitation in that batteries are too heavy for certain applications

The infrastructure question

Magnus Hoglund, Head of Electric Road System at Scania, says that whilst the confidence is present, the challenge in reaching electric long-haul hinges on the emergence of infrastructure. This infrastructure could take a couple of forms. "Scania sees a possibility for positive total cost operation across all segments within ten to 15 years," he says, "but when we get to long-haul, it's not simply a case of having a lower TCO. The right infrastructure is also required, and so whilst we work to launch products that will work short-term, we also want to be a part of electrifying the whole business."

One project which Scania is involved in is the Electric Road. Using pantographs mounted on trucks, and pylons built along the right lane of a highway, the vehicle can connect to an electric contact line which powers the electric motor. At the same time, it charges the electric battery, allowing for further zero-emission driving once the end of the pantograph line has been reached.

Hoglund sees it as a solution for the entire truck industry, including long-haul applications. It would specifically tackle greenhouse gas emissions produced on the highway, which account for a sizeable portion of Europe's total emissions. Any application could potentially use

the power lines, from coaches, to distribution, to long-haul.

But thus far, only a small number of electric roads have gone into effect. The first opened in Sweden, a two kilometre 'e-highway' in Gavle in collaboration with Siemens. This year, Germany followed suit with a 10km (6.2 miles) system near Frankfurt airport, along a stretch of highway that leads to an industrial zone and sees considerable heavy-duty diesel traffic. A project in Italy hopes to build a 62.1km stretch to connect the northern region cities of Bergamo, Milan and Brescia, and will begin with a 6km trial. A mile-long demo was also put into use at the twin ports of Los Angeles and Long Beach in 2017.

"From a system point of view, Scania sees that electrification is the most cost-efficient, and over time it will surpass fossil fuel systems. And so we don't see infrastructure as a cost," says Hoglund, "however it is certainly a big investment, and a complex system. The question is whether electric roads or mega-chargers will prevail."

Part of this, he adds, will depend on the will of authorities and governments, and how quickly they want to decarbonise their transport industries. For those who want to do so quickly, says Hoglund, the electric road is a solution which can be deployed immediately: compatible trucks are already on the market, and fewer batteries are needed. "Delivering something that's working could drive electrification in Europe.

In the Electric Road project, Scania trucks with roof-mounted pantographs draw electricity from overhead cables for driving, and for charging their batteries

Consider the telecoms industry as an example: they've successfully built from 1G to 5G. At some point, a decision must be made."

Based on that decision, truck makers will adapt and evolve. Like its competitors, Scania is also investigating fuel cell solutions and alternative fuels, recognising different applications across markets. Ultimately, however, electrification boils down to the cost on the system level. In comparing electric road systems with mega-chargers, there are a number of considerations, says Hoglund.

"One is the vehicle itself, and its battery size," he explains. "Electric roads do not require such big batteries, enabling savings or bigger payloads. Furthermore, it could accelerate the introduction of autonomous trucks as no stopping is required to charge between certain routes. The mega charger business case is connected to driving time legislation, requiring stops of 45 minutes every four and half hours. During that time, a truck needs 800 kilowatts of power or more for four and a half hours of driving."

This would put enormous strain on a grid, in scenarios where 100 trucks every hour may require power. They would also require standardised solutions. However, adds Hoglund, they remain an easier option in terms of set-up: erecting two mega-chargers between important cities could be done far quicker than an electric road system. The electric vehicle infrastructure project involves hundreds of players, some capable of making decisions beyond the influence of truck makers. Those that want to see success in the electric truck segment must move with the times.

Independent business models are miles better for car-sharing

Megan Lampinen speaks to the new CEO of Miles Mobility about the need for transparency in selling mobility

Miles Mobility's CEO Oliver Mackprang previously worked at VW's Moia, and before that founded Carjump, which later became PSA Group's Free2Move

Mobility as a Service (MaaS) is revolutionising the automotive industry. It has opened the door for new entrants while sending incumbents scrambling to keep up with evolving concepts of ownership and usage. Car-sharing is a big part of the wider MaaS movement, and only expected to grow bigger. ING, for instance, expects there to be more than 7.5 million shared cars on Europe's road by 2035.

Plenty of players are keen to gain a share of the pie, including some of today's leading car manufacturers. German start-up Miles Mobility is making a name for itself as one of the largest car-sharing providers without any automaker involvement. Founded in 2016, the scheme currently operates in Berlin, Hamburg, Munich, Cologne, Düsseldorf and the island of Sylt. Miles offers a pricing model based on distance travelled, rather than the time it takes, promising users that they pay only for the ride, not the traffic.

Steering the company is Oliver Mackprang, the recently installed Chief Executive. Mackprang is no stranger to the mobility industry, and spent the past two years at Volkswagen's mobility subsidiary Moia. Before that, he founded his own start-up Carjump, which was later acquired by PSA Group and now operates under the name Free2Move.

While Mackprang originally hails from Canada, he has lived for many years in Germany, kick-starting his career in the start-up friendly city of Berlin. It was a proving ground that trained him well for the emerging mobility revolution, in which he now finds himself a starring player.

You have been very busy on the mobility front over the past few years. What were some of the highlights?

I began in mobile application consulting around the time that the first iPhone came out, helping with the development of apps for

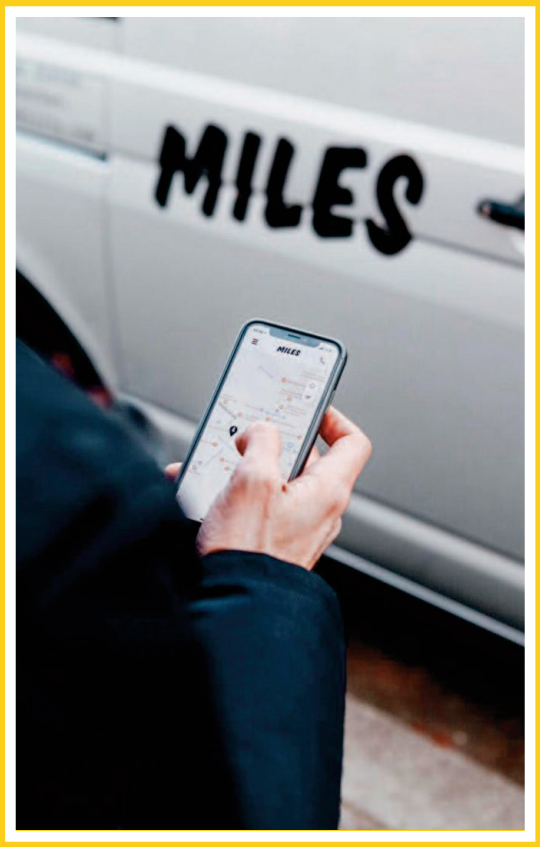
corporate customers. Out of this I founded my first start-up, the car-sharing aggregation platform Carjump. The idea was to have a single platform to combine all the different developing car-share companies, such as DriveNow and car2go. After I sold the company to PSA, I spent some time consulting with AT Kearney in the digital strategy department, but I have always been mobility focussed. I then joined Moia.

And how did you eventually end up at Miles?

I have known the founders of Miles for several years, as well as one of the main investors. I generally stayed in touch with the start-up and the wider mobility scene. The company mentioned it was looking to expand its management.

You've founded your own start-up and you've worked at one of the largest automakers in the world. Looking at both these experiences, what are the strengths and drawbacks of each?

Ideally, these corporate start-ups would be the best of both worlds. In theory, the fast environment of a start-up is great, but the drawback is that you are keeping that rapid pace in order to survive. There is also a higher scarcity of people to deal with. You may want to hire a consultancy for every decision you make versus simply taking a leap of faith, but you can't afford to. It all comes down to pace and resources.



Although Miles is a relatively new company, would you say it is an industry disruptor?

In its category, yes. We all are. Mobility has become the belle of the ball. It is a start-up category on its own. It is recession proof, in the sense that people will always have a need for it. Nobody is arguing the need of the market or need of mobility.

What is Miles doing particularly well at the moment? Where is there room for improvement?

We have very lean operations, and are proving that this can be done at an economically sustainable level. We could probably improve on the technological aspects of delivering the service.

In your new role at Miles, what will the primary focus be for 2020?

Expansion, both of capabilities and footprint. By footprint, I don't necessarily mean geographic expansion; it is more a matter of having a higher impact where we are already active. The urban context is very important. In mobility, every market is its own. You can win or lose in a city, irrespective of the overall business model.

Where do you see the wider shared mobility evolution heading in the long term?

The bottom line is that the car is here to stay, despite all the disruption and everything that's coming. The car will be part of the mobility sector for the foreseeable future. The modal share of the car for overall of passenger kilometres travelled is high and will always be high. What's changing is the way people consume the vehicle. Car-share and ride-hail are basically grabbing market share from the incumbents and changing the way people consume automotive mobility.

How would you describe your overall aim on this front?

We are trying to cannibalise passenger kilometres on four wheels. Our objective at Miles is to make every driven kilometre a shared kilometre. Even if that's by yourself in a car, it's progress if the vehicle or the platform is shared.

What does it mean to you to be independent from a specific automaker?

We have no ulterior motives. We are pure in vision and mission. Our focus is on selling mobility. It is not as if we regard a trip in one of our vehicles as a test drive for a potential future owner. We source our vehicles through tenders. While we want the experience to be right for the use case, we are not married to a supplier for vehicles. We are extremely open. We have integrated with public transport authorities and are featured in multiple platforms.

Does that mean you might miss out on the customer interaction side of things?

We don't feel the need to own the customer interaction. If you are on the street looking for a car, you have made the decision that you want to use a car. Our scheme has a car for you. We don't feel you should be penalised simply because you've gone through a different acquisition channel or a different platform. It is part of our belief that mobility should be accessible to everyone.

Interview: Girish Wagh, President, Commercial Vehicle Business Unit, Tata Motors

Megan Lampinen hears how Tata Motors is weathering the Indian market downturn

India's commercial vehicle (CV) industry is a volatile one. Over the past 18 years, annual demand has fluctuated on average 21%, either up or down. For the past few years, the medium-heavy CV (M&HCV) segment has been gaining steadily. In 2017 it jumped 13%, followed by a 15.3% rise in 2018. This year, though, could buck the trend. The country's overall CV segment plunged 22.95% in the April-September 2019 period compared to the same time last year. M&HCV demand dropped by 35.79%, while light CVs were down 14.69%.

Historically, downturns rarely last more than two years, but just how serious a trough could the market be heading towards? Girish Wagh, President of Tata Motors' Commercial Vehicle Business Unit, speaks to Automotive World about the market's latest developments and how Tata is weathering the storm.

The CV segment is down considerably from this time last year. What are the biggest factors impacting sales at the moment?

There are various cyclical and non-cyclical factors shaping the market at the moment. One of the main ones is the slowdown in the execution of infrastructure projects over the past few quarters. On top of that there has been a drop in discretionary consumption, along with poor

liquidity conditions in a tight financing environment. We also see excess capacity created on account of the Increased Axle Load (IAL) regulation–last year the Ministry of Road Transport and Highways increased the maximum allowed axle loads by about 15%, boosting truck tonnage. All of this has led to a severe contraction in total industry volumes across segments.

Are there any promising signs out there just now?

While some customers are postponing purchases, recently we've seen an increase in customer enquiries for light, medium and heavy CVs. Many of these are fleet owners initiating discussions for the replacement of older vehicles. Overall system stocks are now at a multi-quarter low, which, coupled with increasing enquiries, will help sales going forward.

How closely is the industry slowdown tied to the wider economic slowdown?

The Indian automotive industry contributes significantly to Gross Domestic Product (GDP). The CV segment is closely linked to the Indian economy and any change in the general economy has a substantial impact across different segments. Economic slowdown due to a consumption pause, weak rural activity, and a slowdown in infrastructure are all cyclical factors impacting the CV industry, so in that sense the wider economic slowdown has indeed had an impact on the industry.

Have you seen any notable impact on demand from the implementation of the goods and service tax (GST)?

After the GST implementation in July 2017, the overall economy picked up gradually and the improving environment had a significantly positive impact on CV industry volumes in FY2018 and FY19. In addition, GST implementation has brought efficiencies to the logistics sector by reducing the turnaround time for journeys.

What do some of the more recent developments on the regulatory front, such as the move to Bharat Stage VI (BS VI), mean for Tata Motors?

For us, regulations such BS VI or IAL are not merely about compliance. We do not believe in offering vehicles which barely meet the regulations; instead, we take it as an opportunity to improve our end customer's overall business. Tata Motors' IAL range of M&HCV vehicles, introduced after the IAL regulation, are offering substantial improvements in our customers' total cost of

ownership and hence overall business case. Similarly, during development of vehicles compliant with the BS VI emission regulation, our focus has been on delivering better value to the end customer.

How are these regulatory changes impacting demand?

It is likely that the transition to BS VI will see some pre-buying in Q3 and early Q4 as customers seek to save on higher acquisition costs from April 2020, as has been the experience in developed markets during similar emission regulation transitions. However, the extent of such a pre-buy should be subdued due to the wider demand slowdown. With regard to BS VI transition readiness, we are well on track in the areas of product development, certification and production.

In terms of production, what adjustments have you made in response to the slowdown in demand?

In light of the significant contraction in demand, and the need to get through the entire BS IV stock before the impending transition to BS VI towards the end of the year, we have focussed on reducing stocks in the entire value chain. We are cautiously monitoring the market and working very closely with our dealers and other relevant stakeholders to respond to the situation appropriately. We have brought down our inventory by continuously aligning production to the market demand. Our production

this year, for April through October, has been 32% lower than the same period last year.

Are there any other proactive steps you can take?

In this environment of subdued demand, we have been engaging with customers to understand their expectations and future plans to align our actions accordingly. We have also been communicating to our customers the economic rationale of replacing older vehicles with the current BS IV ones, especially in M&HCV and LCVs, to improve their overall profitability. We have also launched a few new products with a superior value proposition to better meet customer expectations.

How do you expect the market to develop over the coming months and through 2020?

We are looking forward to a positive impact from the government's recently announced relief package and a general economic recovery. The CV industry is largely reliant on strong economic activity, comprehensive growth in industrial production, mining and infrastructure projects and overall consumption. With some initial uptick in demand drivers such as increased enquiries in October, along with reduced system stocks and the economic rationale of replacing older vehicles with BS IV, we are looking forward to improving volumes in Q3 and Q4 compared to the first two quarters in this fiscal year.

> “We are looking forward to a positive impact from the government's recently announced relief package and a general economic recovery

Electrification—the truck industry's expensive path to profitability?

The stakes have never been higher, and the need for truck makers and fleets to develop coherent electrification strategies has arguably never been greater, writes Oliver Dixon, Senior Adviser at Roland Berger

Any analyst asserting that electrification will not play a major role in the automotive industry in coming years would look like King Canute attempting to turn back the tide. He was rewarded with a pair of wet feet for his trouble, and anyone downplaying the significance of vehicle electrification and its subsequent impact upon the automotive and broader mobility sectors would be left similarly damp and in a very small and lonely place.

We know electrification will change the shape of the truck industry. There's no debate about that; what is less clear at present is quite how that change will manifest itself. And given that the disruptive potential here is very significant–it's not unreasonable to draw parallels between the impact of electrification to automotive and that of mass internet adoption to retail–the ability to future proof strategy is of supreme importance to any and all industry stakeholders.

Truck makers face complex commercial and strategic challenges

While much analysis has focused understandably upon the technical challenges associated with electrification–vehicle range, charging infrastructure and the like–we argue that it is the impact upon the value chain that is both the more significant issue and the one that demands close attention today. While the technological challenges to widespread adoption of electrification are well-known, the strategic and commercial challenges to all participants within the value chain are complex.

The two accompanying charts illustrate the problem. Both refer to the most recent (Q3 2019) earnings of Paccar Inc and Rush Enterprises. We use these two organisations by way of illustration as they are respectively a pure-play truck maker (Paccar) and a dealership organisation focused solely on HD trucks (Rush). While the former has global footprint, the latter restricts its operations to North America but this notwithstanding, comparing segment revenues and segment gross margins show a very clear challenge.

Not unsurprisingly, sales of new trucks account for by far the greatest percentage of revenue both for manufacturer and dealer. In the case of Paccar, 78.2% of its top line accrues from making trucks and, in the case of Rush, 67% come from selling them. Aftermarket revenues represent 28.4% of Rush revenues and 15.7% of Paccar top line–in both cases a significantly smaller contribution to overall sales.

But if we consider this data in terms of gross margin, it's a different story. Truck sales return a gross margin of 6.8% for Rush and 12.3% for Paccar, whereas parts and aftermarket sales post 37.5% and 28% respectively. In simple dollar terms, Rush throws off 6.8 cents per dollar of trucks sold but 37.5c per dollar of parts sold, while Paccar gets 12.3c per dollar of truck sold and 28c per dollar of parts sold. In terms of absolute profitability, the parts and aftermarket segment is a clear winner and while verticalisation within the truck industry has been explained by many factors, the contribution to profit made by a captive parts and aftermarket revenue stream is arguably the most compelling driver.

What happens, then, if it goes away?

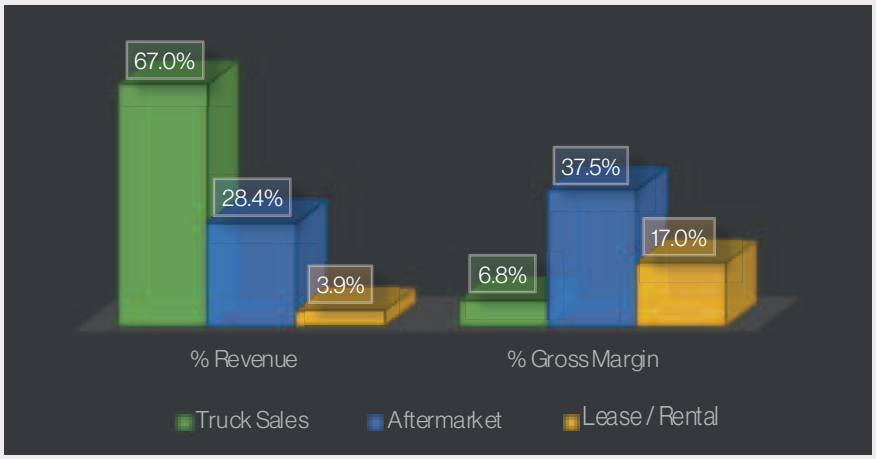
Demonstrably, a loss of parts and aftermarket margin would be a distinct negative both for truck maker and for dealer and, once again we should reiterate that neither Paccar nor Rush are unique here; this is an issue that, on the basis of current industry structure and revenue segmentation will apply to all stakeholders. Thus, the supplementary question here should be one that asks if this is a risk.

Here we find ourselves confronted by a combination of simple arithmetic and addressable markets. An electric truck–indeed, any electric vehicle–has fewer moving and wearing parts than one powered by a conventional internal combustion engine (ICE) driveline. Fewer parts wearing out means a concurrent reduction in demand for replacements which subsequently reduces organisational margin and, ultimately, profitability. With the industry structured as it is today–effectively vertically integrated–the revenue from parts and aftermarket is not merely a nice bonus, but a core contributor.

Electrification will change trucking – but how?

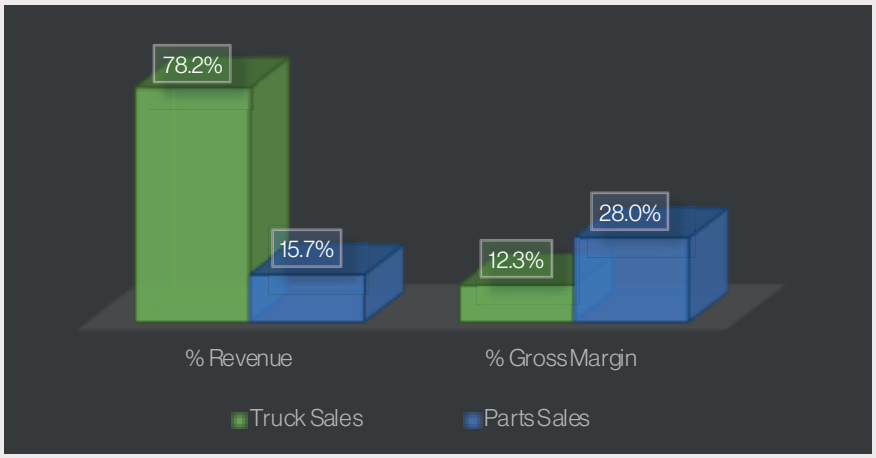
This loss of revenue and margin is problematic but, in isolation,

Rush Enterprises Q3 2019 revenue and margin by segment



Source: Roland Berger, company reports

Paccar Inc Q3 2019 revenue and margin by segment



Source: Roland Berger, company reports

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> If the shift towards electrification continues apace, then the strategic challenge faced by vehicle manufacturers and their networks is a considerable one

it should not prove insurmountable. Unfortunately, it is not occurring in isolation. It is perhaps supremely ironic that the very issue which is creating this profitability issue–the drive towards electrification–is, at the same time, one that is already proving to be expensive in terms of its development. Recent announcements by Daimler and Audi have indicated the earnings impact likely as a result of this shift in emphasis, and it seems only reasonable to assume that these two automakers are not alone in confronting this challenge.

For the truck dealer network, the challenge is arguably more brutal; not only will a reduction in parts and aftermarket revenue and margin impact organisational financial health directly, the attendant additional costs inherent in readying the network to maintain electric trucks will place further stress on the books.

This is an issue that lies at the very heart of the challenges facing the automotive industry as we head into the next decade. With both regulatory and societal pressures now very much at the fore, it seems entirely probable that the adoption rate for electric vehicles will continue to grow. If the shift towards electrification continues apace, then the strategic challenge faced by vehicle manufacturers and their networks is a considerable one.

No-one is in the automotive industry as a result of a vocational calling–they are here to get paid and, while it is an oft-quoted strategic cliché, it may well be that electrification is a Blockbuster moment. The widest range of DVDs proved of little value in the Netflix era, and the best margins on parts for ICEs look similarly peripheral as we move away from the diesel pump and embrace the power outlet. The stakes are very high, and the need for truck makers and fleets to develop coherent strategies accommodating electrification has arguably never been greater.