



THE OLIVER WYMAN

AUTOMOTIVE MANAGER

DISRUPTION IS THE NEW NORMAL

Dear Readers,

Upheavals and innovations have become a constant feature of the automotive world, as new ways of selling, an explosion of digital gadgets, and new powertrain systems transform the industry. These changes will remake the way automakers design, manufacture, and sell automobiles – as well as how they operate as corporations.

But one thing remains unchanged: People want to travel more. So, a good place to start this edition of Automotive Manager is by addressing the expanding – and fast-evolving – demand for mobility and connectivity, the theme of our Cover Story. In many large cities, people only need a car occasionally, and car-sharing services have taken off. A new generation of startups is helping to manage journeys from end to end through “smart mobility” solutions. And digital technology is enhancing the traditional dealership sales model by providing customers with more information, backing up sales representatives, and increasing the transparency of products and prices.

Another revolution is taking place in the making of cars, resulting in new kinds of supplier relations. In electric vehicles, the most expensive part of the drivetrain is the battery, often made in China by a supplier separated by both geographical distance and a different business culture. Electronic gadgets are vastly increasing the number of sensors and microchips in every vehicle, with a growing share of such parts made by only a small number of suppliers. That makes car manufacturers more vulnerable than ever to supply chain disruptions.

Nearly all these changes depend heavily on IT and digital capabilities. To execute this digital transformation, automakers will need to develop expertise such as data analytics and digital project management. That means nurturing a talent ecosystem that provides access to new skillsets from multiple talent pools, including both partners and the on-demand workforce.

While these transformations may be referred to as “disruption,” they also represent a range of new opportunities, all arriving at once. At the same time, however, they also open the door to new digital players beyond the traditional automotive industry – both global giants and startups. Automakers will therefore need to figure out which tasks to carry out themselves, and which they can best pursue through alliances and partnerships. People want to keep moving. The industry needs to keep moving too, faster than ever.

Yours sincerely,



AUGUST JOAS
Partner, Head of Automotive Sector

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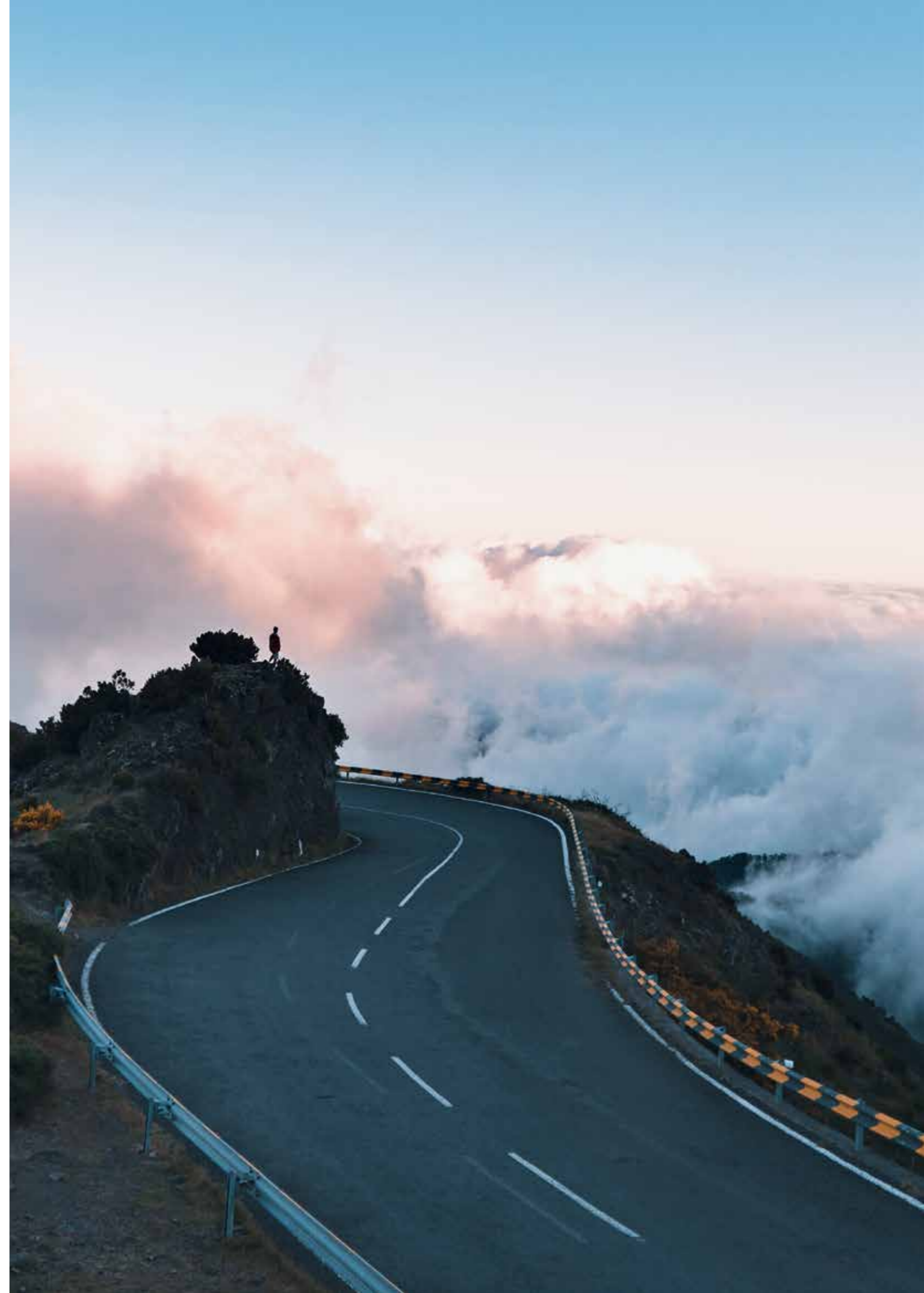
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AUTOMAKERS' CHOICE: DISRUPT OR BE DISRUPTED

An unprecedented range
of challenges arrives

Change is affecting the auto industry from many different angles, and in recent years it has been accelerating. Some governments are trying to phase out diesel engines initially and then internal combustion engines in general. There is growing global pressure to reduce the use of fossil fuels in order to cut carbon emissions. And a growing number of municipalities are restricting cars to reduce traffic jams and pollution.

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While the auto industry has some promising solutions, these too are potentially disruptive. Battery-powered electric drivetrains will mean that cars use a completely different propulsion system, which incumbent manufacturers may not have a lead in. Autonomous cars may offer effective solutions for urban transport challenges such as congestion and parking – but they might also alter the way cars are used and decrease ownership.

The industry has reacted successfully to challenges throughout its 100-plus year history. But these tests generally arrived one at a time – such as the oil shock, which forced an increase in fuel efficiency – or gradually, as with increasing safety and anti-pollution regulation, which led to widespread adoption of seatbelts and catalytic converters over relatively short periods. Today, digital advances, changing customer needs, and environmental regulations are generating a perfect storm with multiple, simultaneous challenges.

NEW MOBILITY SOLUTIONS

To address these disruptive impacts, automakers need to rethink their business models through a holistic strategic agenda. It is important that they defend traditional profit pools as much as possible – for example, those provided by well-designed cars and original parts, high-margin options, and vehicle financing. These will help weather the big changes coming.

But for the future they must also develop new sources of income. Firms need to ensure they do not get trapped in a sunk-cost fallacy: just because something has always been done in a certain way, does not mean that it should continue. Now, more than ever, they must focus on customer needs and experiences; pose fundamental questions about their businesses; and reexamine all current decisions and processes. The responses will then inform fundamental decisions, such as where to invest financial and human resources.

The crucial question is: What do people want cars for? In the 21st century, mobility patterns have begun to change rapidly, often to the benefit of alternative modes of transport. However, people's mobility needs are increasing, not declining, so automakers should examine new potential areas of growth. For example, in many large cities, people go to work by public transport and only need a car occasionally. For them, sharing a vehicle might make more sense than owning one, and car-sharing services such as Zipcar have been taking off. German automakers in cooperation with car rental/leasing firms have developed DriveNow and car2go, which offer free-floating car-sharing services. Corporate fleets, too, are becoming more widespread. And advanced connectivity in new cars offers rich opportunities for other mobility services and data-based business models.

Some of the new services help to manage journeys from end to end through “smart mobility” solutions, which are expected to be a major trend over the next 20 years. Current examples include mobile apps for ridesharing, city parking, and real-time public transport. In the future, smart mobility will also mean integration of transport modes, creating demand for one-click book-and-pay travel services. (See Exhibit 1.)

Overall, mobility startups – covering areas such as autonomous vehicles, e-mobility, smart city controls, and multimodal hubs – attracted over \$40 billion of investment between 2011 and 2016, with the amount of investment roughly doubling each year. The market share of innovative mobility services is projected to quintuple to 20 percent by 2040, while the share of private cars will shrink by roughly a quarter to some 55 percent. We think the smart-mobility market could generate up to \$270 billion in revenue by 2040, as well as profits above \$100 billion. Automotive mobility services could account for more than half of these revenues and profit pools.

As smart mobility solutions spread, such services will become the norm to swap transport modes. In our Mobility 2040 survey, a clear majority of the 7,500 participants said they would consider abandoning their current preferred mode of travel if an alternative offered enhanced smart-mobility services. Of consumers aged between 18 and 35, 94 percent said they would consider switching, as did three-quarters of those over the age of 65. In another recent online survey, 48 percent of respondents aged between 18 and 34 said they used mobility services, such as Lyft, Uber, Zipcar, and MyTaxi.

DIGITAL TOOLS FOR DIGITAL PRODUCTS

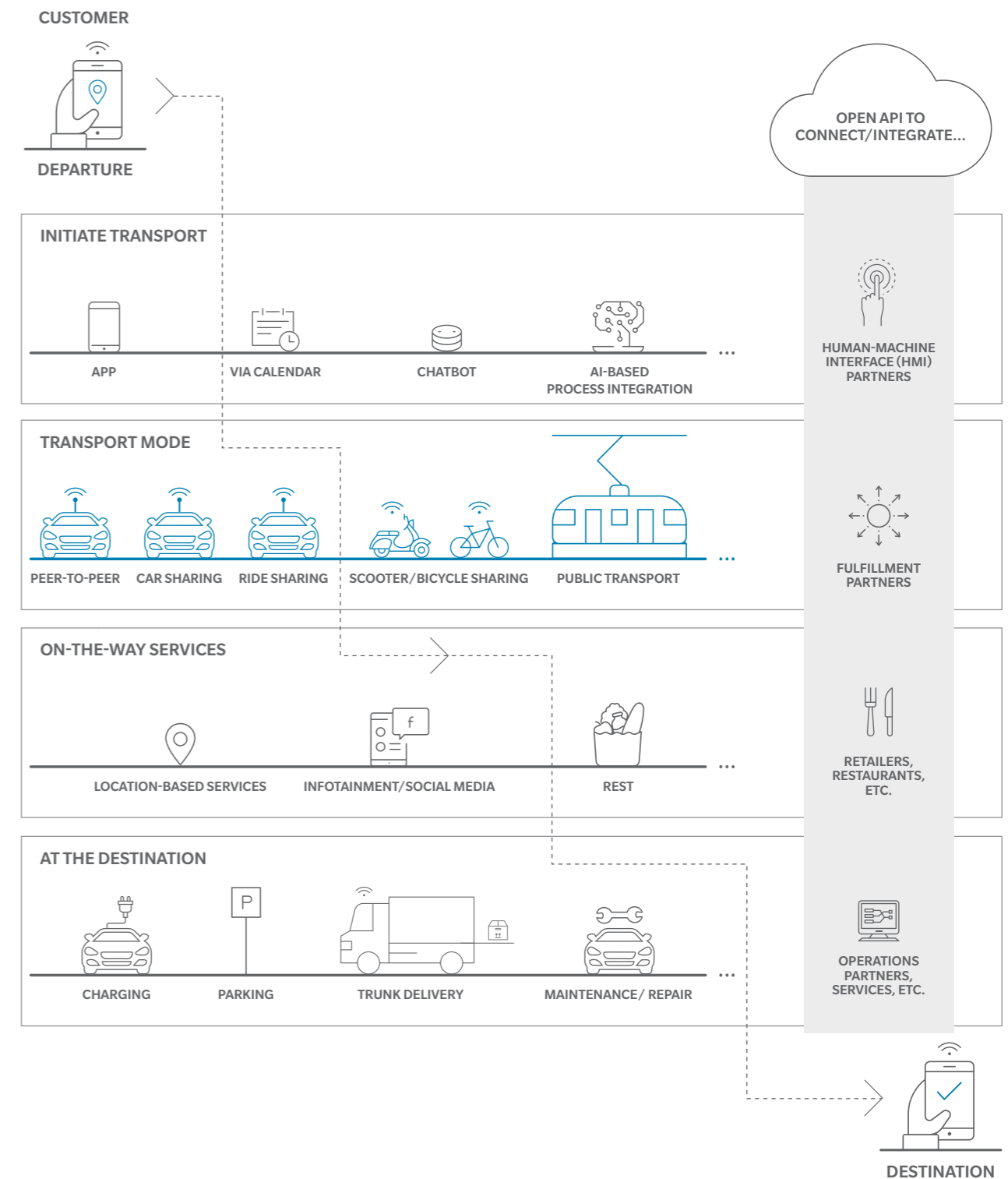
Product disruptions such as autonomous driving and mobility services represent only the outward manifestations of change. Automakers will need to invest heavily to develop new electric and digital technologies, putting firms under pressure to create economies in other areas. One way to boost effectiveness and get better value is to digitize and virtualize R&D, for example by systematically gathering data and using it to inform the design and development process.

In manufacturing, automakers achieved average productivity improvements of 20 percent in each of the past three decades, mainly thanks to automation, outsourcing, and standardization. Over the next five to 10 years, the automation and outsourcing of white-collar jobs could drive even greater gains, perhaps enabling workforce reductions of up to 30 percent in selected functions.

But instead of simply reducing workers, companies need to pursue the scarce supply of high-tech workers and either replace

EXHIBIT 1: TARGET PICTURE MOBILITY 2025

Fulfilling customer mobility needs by using AI, collaborating with partners, and offering a complete service portfolio



Source: Oliver Wyman analysis

or retrain current staff. It will not be sufficient simply to automate more processes and replace line workers with robots. Instead, factories will use increasing numbers of “cobots” – collaborative robots – and workers will have to be retrained to work with them. So, automakers will have to make their workforce planning and recruitment processes more dynamic and agile. Some are already retraining workers for digital roles, as well as hiring professionals fluent in robotics and app development.

Auto sales are mostly still done in a very traditional manner – through TV advertising and dealerships. Digital tools and solutions could help to radically cut the costs of sales and reaching target customers. They could also create new ways to retain customers and new opportunities to offer them services. If an automaker knows when someone has been looking at an online configurator, it can send follow-up ideas and proposals. If it knows that a sports-car owner has started a family, it can guess that the driver might be ready to move to a larger, more practical car, such as an SUV. The automaker can then send suggestions for a new model, set up a test drive, and offer financing.

Online auto sales have yet to catch on. Cars are far more expensive than almost all other consumer goods, and the decision-making process takes longer – often because people first want to visit a showroom and talk to a sales rep. However, the move to small, frequent transactions like rentals and car sharing could lead the average car buyer to be more digitally savvy and become comfortable with the online experience. So, car

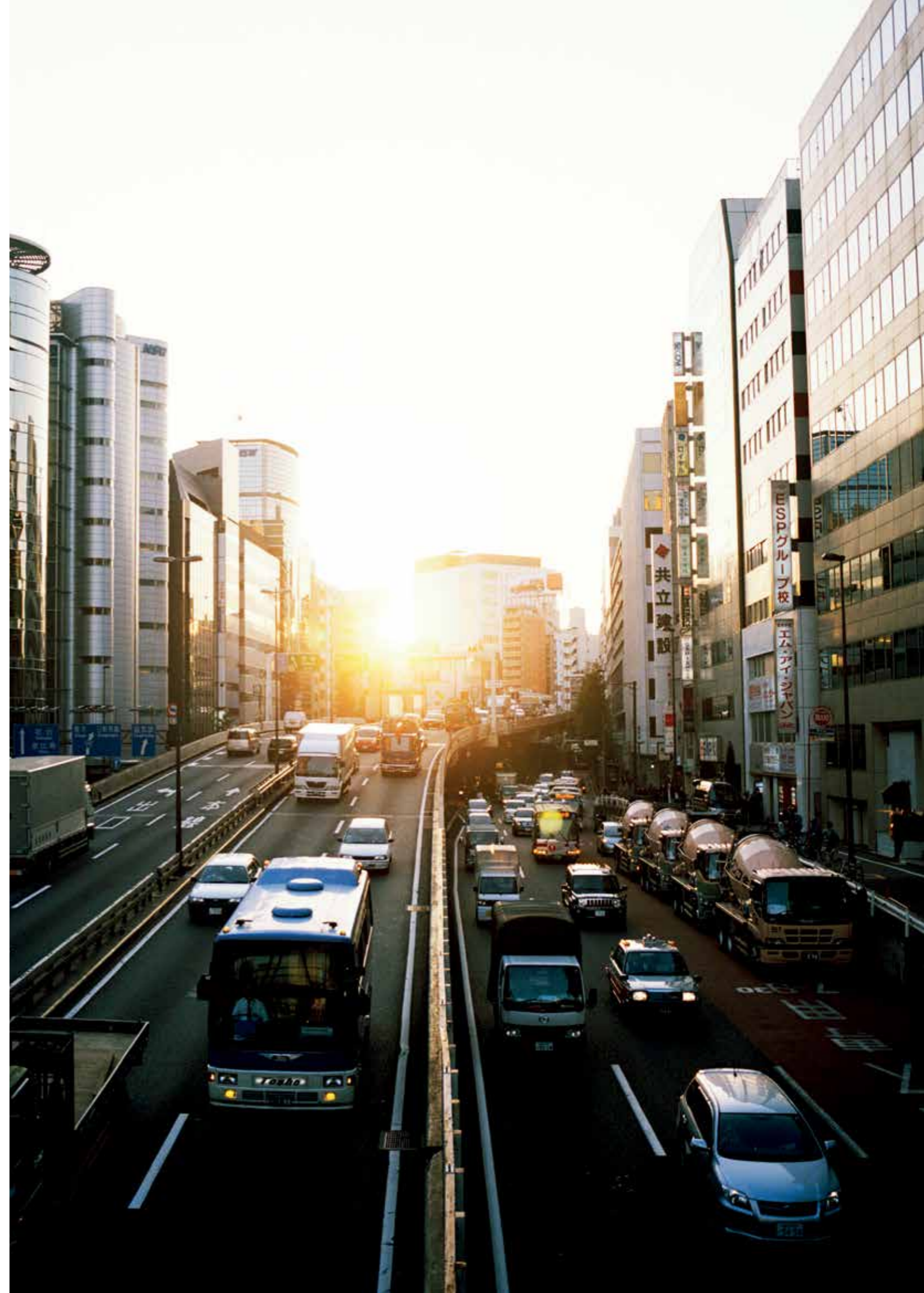
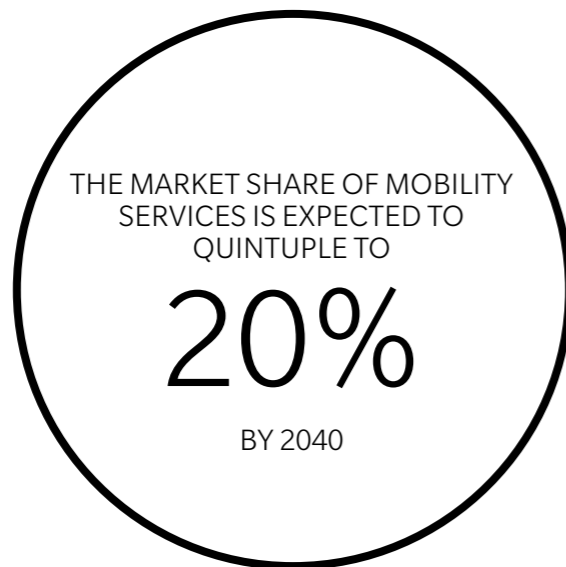
manufacturers’ sales executives will need to develop innovative offerings and channels.

Artificial intelligence (AI) has great potential to improve sales planning. Instead of relying on experience and gut feel to plan and allocate volumes, automakers can now leverage smart, data-driven tools, which will help them better meet customer demand. Experience suggests that AI-based planning and sales excellence could raise profitability per vehicle by between 15 percent and 20 percent.

THE FUTURE STARTS NOW

While automakers have probably never faced more challenges than now, the global population is growing and increasingly prosperous, and the demand for mobility is great. The new emerging customer is one who can be satisfied by the more traditional mobility products, but also by new ones as well. The successful companies will be those that figure out how to fulfill the needs of this new customer. That will likely mean embracing the very technologies that threaten to disrupt the existing business model.

However, smart mobility solutions are likely to follow the patterns of other digital platforms, such as search engines and social networks. These tend to be dominated by single players, such as Google and Facebook, which manage to turn early leads into market domination. Automakers will need to move fast. •



MAKING CAR SALES DIGITALLY PERSONAL

Five misconceptions regarding online car sales

Most car buyers begin online but end up in dealerships. Currently, the share of online vehicle transactions – actual car sales – remains small; in Germany, for example, it represents about 15 percent of the total, according to the *DAT-Report 2018*. Conventional wisdom now suggests online sales will replace those made offline, making retail dealers redundant. On closer inspection, however, several myths emerge regarding this perception.

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A version of this article first appeared in Forbes on May 23, 2018.



MYTH: ONLINE CAR SALES WILL SOON MATCH OFFLINE VOLUMES AND IMPORTANCE

In 2017, US online shopping of all types (including mail order) exceeded traditional department store shopping by a factor of three. Some say new and used car sales will follow the same trajectory, and online will become the dominant retail channel for the industry. Reality, however, suggests that online car sales will continue to lag other sectors, and appropriate online offerings – especially from automakers – will remain scarce.

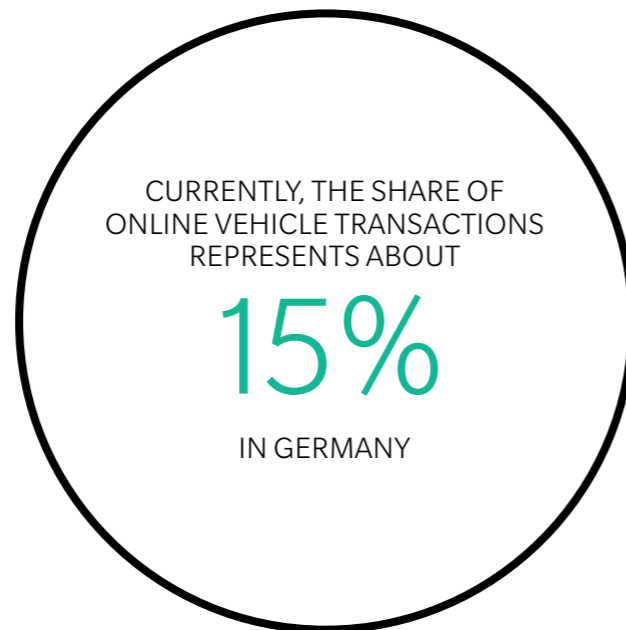
Several factors underlie this slow adoption. For one, cars are not commonplace consumer goods, given their expense (typically, they represent the second-largest household investment after housing). Where cars can cost tens of thousands of dollars, the average value of online shopping orders is currently \$82 in the US. The decision process surrounding automobiles is comparatively long, and service and maintenance needs continue long after the initial purchase. Consequently, customers prefer the advantages of online sales (convenience, transparency) coupled with the practical aspects of offline sales (trust, physical experience). Demographic mismatch may also play a role. The consumer group currently most comfortable with online purchases is from 35 to 44 years of age; the average German car buyer, on the other hand, is 52.8 years old.

Nevertheless, since the discussion continues to circle around online sales, automakers should take steps to enter the online market as soon as possible. They must stay competitive and prepare for the time online car sales do indeed make up a large portion of their sales volumes.

MYTH: ONLINE SALES PUT CAR DEALER NETWORKS AT RISK

Some argue online sales will make dealers redundant and that heavy automaker investments in online sales present a conflict with dealers and other network stakeholders. Instead, the integration of dealers is vital to the success of online sales. Much as they did with financial services products, car companies will take over direct customer interactions in car sales – negotiating and transacting deals. But automakers also need strong and local fulfillment partners. Even in the online car sales world, an efficient fulfillment process (one that includes test drives, showroom or direct car deliveries, logistics, and personal contact) is a necessity. Proximity to available dealers is frequently named among the top 10 criteria for car buyers when selecting their preferred brand and model.

With mobility-as-a-service (MAAS) concepts gathering more traction, competent retail organizations as fulfillment partners will shape the ownership lifecycle and customers' journeys. This constitutes a shift in the dealer's role, but not necessarily a dilution of it. Retailers might compensate for declining margins via lower working capital requirements and fewer financial risks.



MYTH: NEW CARS DO NOT QUALIFY FOR ONLINE SALES

Another argument makes automakers out as reluctant to pursue digital retailing because cars (especially new ones) are inappropriate products for online sales. For example, the right of withdrawal and extensive consumer rights concerning online shopping compel automakers in Europe and the US to take back vehicles without explanation within a certain timeframe. This stipulation opens them to two major risks. First, today's almost limitless vehicle individualization possibilities could make a customer-specific configuration difficult to resell; second, a returned car no longer qualifies as new, subjecting it to steep depreciation.

However, given the number of financed and leased vehicles (64 percent in the German new car segment) compared to those purchased via cash-payments, it seems unlikely that many customers would dishonestly go through this lengthy financing process just, for example, to secure a cheap holiday car for their next trip. What's more, customers who pursue the complex process of finance contracts or lease plans are more likely to be long-term planners, which should reduce the risk of contract withdrawals and vehicle returns.

To support online sales, automakers thus need to develop appropriate online offerings. This strategy includes focusing on optimized stock vehicles (with standardized options and lower complexity) and used cars initially and then expanding offerings over time.

MYTH: AGGREGATORS WILL DOMINATE, ELIMINATING AUTOMAKER RETAIL PLATFORMS

Automotive companies often see the risk of investing much in online sales, since other industries' online markets following a "winner take all" trend, dominated by a small number of aggregators like Amazon or Alibaba. The automotive sector, however, is unlike other such industries. Compared with white goods, for example, which relied heavily on aggregators prior to substantial online sales, cars – especially new cars – have always used brand-specific dealers because automakers focus on their brands rather than just the retail price and discounts to compete. Despite a slight decline recently, automotive brand loyalty still exists, enhanced by lock-in effects like aftersales service and warranties that make direct purchases via car dealers attractive. These effects will likely increase as the world becomes more digital and connected services enable automakers to create their own ecosystems and offer customized offerings and enhancements before, during, and after a car purchase.

MYTH: THE ONLINE CUSTOMER EXPERIENCE LACKS THE NEEDED PERSONAL CONTACT

Some observers believe online sales lack the personal contact needed to serve automotive customers, who approach car-buying with significant levels of emotion. The thinking goes that

such transactions require an empathetic human touch. However, a clear and structured online customer journey can generate the additional data required to understand customers and enable cross- and upselling. Ideally, retailers should combine digital contact points with personal contacts to deliver the best possible customer experience. (See Exhibit 1 in article "Getting Online Car Sales In Gear".)

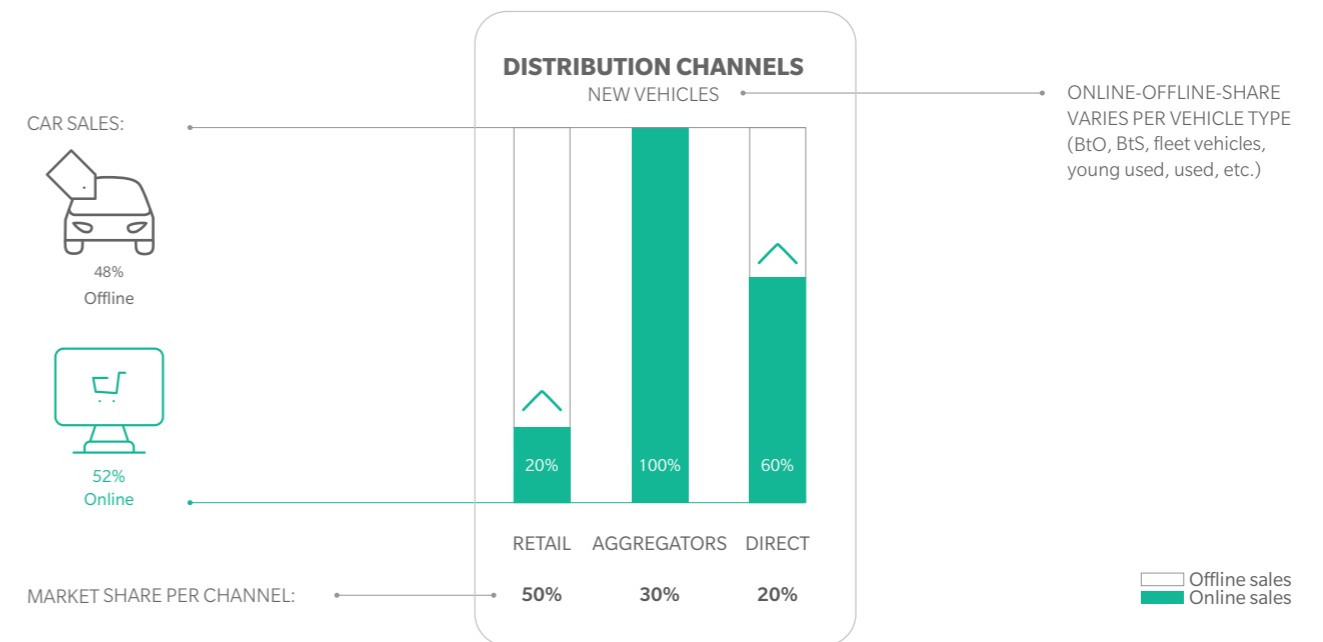
EXPANDING ONLINE HORIZONS

Compared with other industries, online automotive sales require more time to achieve a large-scale presence. While certain automotive sales channels (such as online aggregator vehicle platforms, especially in the used car segment in Europe and the US) can already rely on an existing online infrastructure and significant transaction volumes, others will probably remain offline. (See Exhibit 1.)

Younger car buyers expect a digital, hassle-free sales experience. To deliver it, automakers need to combine on- and offline sales points to offer a true omnichannel experience. This necessitates a new form of cooperation between car companies and dealers, one that emphasizes the right products, takes advantage of strong brands, and adopts a data-centered approach to meet the customer's ever-changing expectations. •

EXHIBIT 1: FUTURE AUTOMOTIVE SALES STRUCTURE (TARGET PICTURE 2025)

Online will grow in all three main channels in automotive sales



Source: Oliver Wyman analysis

GETTING ONLINE CAR SALES IN GEAR

Why connecting online and offline matters in optimizing the customer's journey

There are plenty of arguments against the online sale of cars. They are far more expensive than almost all other consumer goods, and the attendant decision-making process is lengthier. Choosing a car is often an emotional decision, so people like visiting a showroom and speaking with a sales rep.

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Moreover, the consumers most comfortable with online shopping are younger, while the average car buyer is relatively old – 53 in Germany, for example. In that country, online sales of cars represent about 15 percent of the total, according to the *DAT-Report 2018*, putting autos far behind most other consumer products apart from food. And the majority of online auto sales come from brokers and price comparison engines, not from automakers' own websites.

However, there are plenty of reasons why online sales could catch on. Over time, younger, digital-savvy consumers will gradually make up a larger proportion of car buyers. As the application of IT to sales becomes more sophisticated, customers are likely to appreciate the experience more. And, even if car sales in the future do not take place completely online, digital technology can still enhance the process in numerous ways: by providing customers with more information, backing up sales representatives, and increasing transparency. Thus, automakers need to start developing their expertise and online models now to be ready for when the market finally takes off. (See Exhibit 1.)

A DISCONNECT IN ONLINE PROCESS

Already, car buyers like researching online. For 87 percent, the internet is the most important research source, while 40 percent discover a new model through an online search. The website of one automaker recorded 1.2 million visits by potential customers over the course of a year, of whom a fifth completed a configurator and a calculator for financing or leasing rates.

However, less than 1 percent of these then used the online form to request a meeting with a dealer where they could have a test drive and proceed to a purchase, and possibly a financing or leasing contract. This represents a significant disconnect in the online process.

Such poor results might lead automakers to lose interest in online. But that would be a lost opportunity. As an example of the potential effectiveness of online channels, we identified a leasing firm that can land an online sale by spending just 500 euros on marketing at digital affiliates. For an automaker, the lifetime value of a customer including all car sales and financing activities is 10 times that amount.

Currently, few automakers are going to close on either an online sale or an online financing or leasing contract for just 500 euros of digital marketing spend. That is largely because they rely on costly search engine advertising. A better solution would be to analyze a customer's journey and make online interactions more attractive. (See Exhibit 2.)

One leading manufacturer of affordable cars has developed a system in the UK that lets people buy a car online at any time of day in as little as five minutes without speaking to anyone. However, if a customer does want to consult someone and go for a test drive, he or she can do so at a physical store. There, the approach differs from traditional dealerships: Prices are fixed for all customers regardless of channel; both the online and the physical store experience are appealing; and there are plenty of information and interaction options for the customer. In short, the system puts the buyer in control.

EXHIBIT 1: OPTIMIZING THE DIGITAL SALES FUNNEL

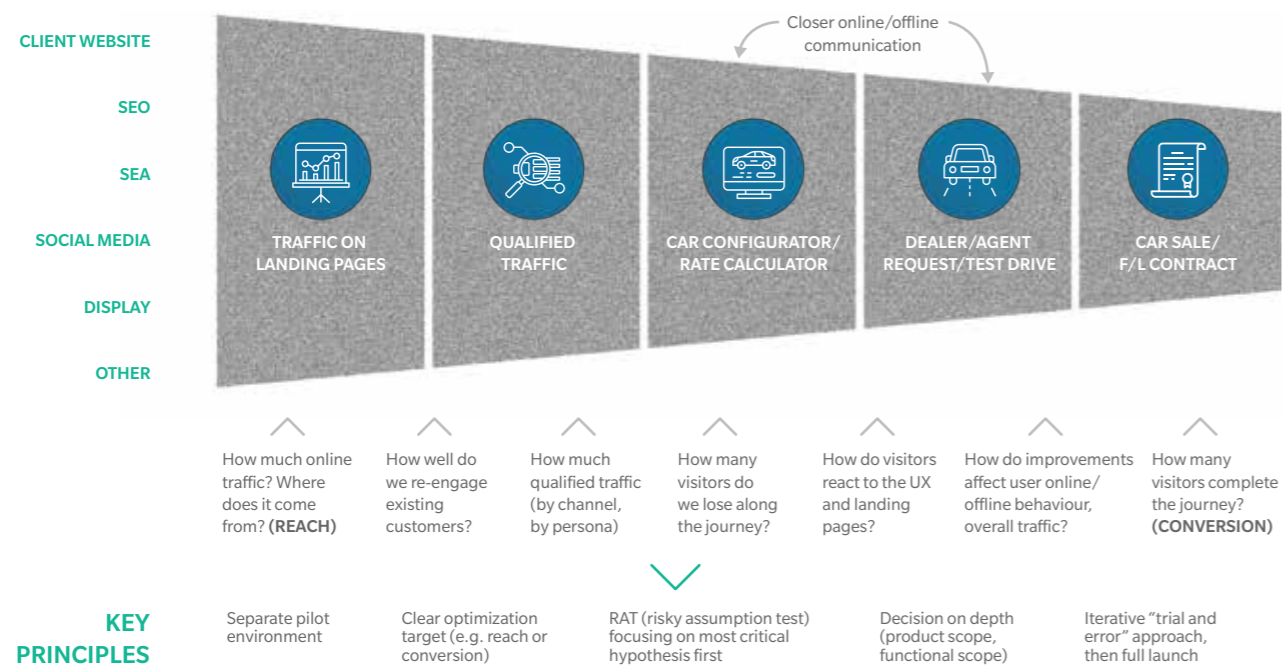
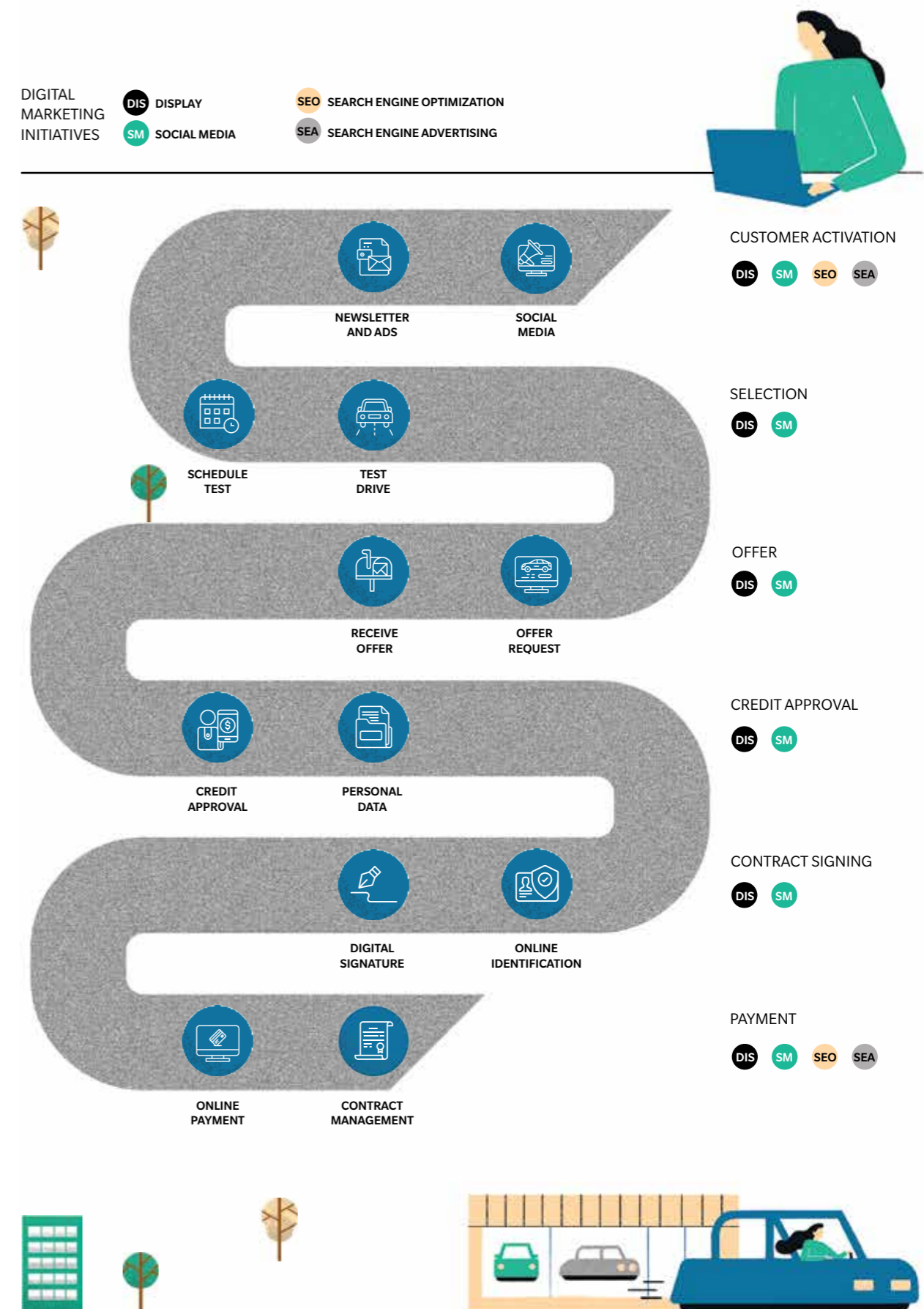


EXHIBIT 2: TAILORING DIGITAL MARKETING TO ENHANCE THE CUSTOMER JOURNEY



HOW DATA CAN INFORM DESIGN

Automakers are missing a chance to cut costs on product development by reducing reliance on trial-and-error

When automakers think about customer data, they usually focus on how it helps them market and sell a car – what features are most in demand or purchasing and pricing trends. Yet, as cars become increasingly crammed with sensors and digital devices that can collect information about how cars are used and perform under real driving conditions, data suddenly represents a potentially vital input for the research & development (R&D) and design teams – one that can have a dramatic impact on cutting operational and product costs much further upstream when cars are first being designed and new systems are being tested.

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This article first appeared in Forbes on August 13, 2018.

Today, many product development processes still tend to rely on prototypes and a trial-and-error approach to developing new models, technologies, and systems or even for improving on those already in use – a place where customer data can become particularly useful, especially as car systems become more electronic, connected, and digital.

For example, vehicle internal error codes are tracked and used by repair shops for diagnosis of problems, but then are often deleted after problems are solved. What if instead they were fed into an automaker database, so that engineers could track frequently recurring problems? Automakers could intervene earlier and perhaps redesign the problematic system. Understanding the circumstances under which navigation and infotainment systems freeze might help establish the root causes, which then could be addressed with countermeasures or a redesign.

EMULATING TECH

It's more the way technology providers like Microsoft and Apple work, where user input allows the companies to develop patches to fix glitches along the way and issue updates to make operating systems perform better and improve security. Admittedly, automotive product maturity at launch needs to be more advanced than for most consumer electronics, given what is potentially at stake if a car system fails while in use. That said, as we move into autonomous vehicles and electric cars,

customer data feedback will become even more useful – and more available.

Current production problems aside, Tesla has operated like this, issuing software updates that can be downloaded and installed while cars sit in the garage overnight. And after a car has been sold, data can provide the rationale to offer new services. Here again, Tesla has offered its customers access to new driver assistance systems through software updates.

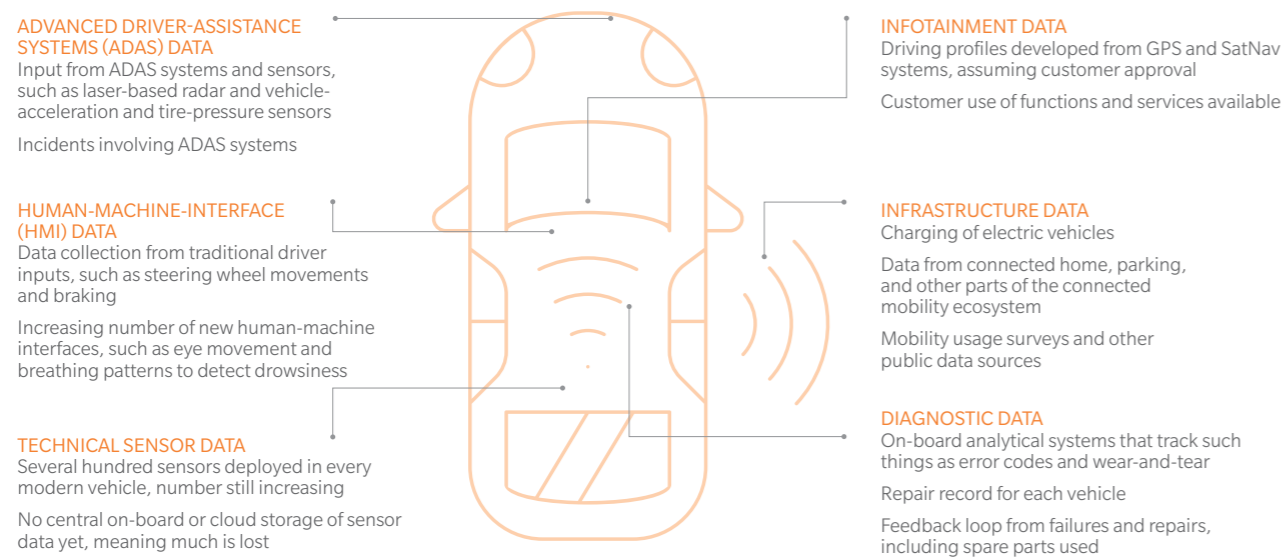
Given the wide array of sources for customer data, we calculate that the automotive industry, as a whole, could be looking at as much as a 10 percent saving from data-driven engineering on its cumulative R&D budget. However, most automakers are not yet prepared to make the best of this opportunity. Internal silos mean that a lot of customer data never makes it beyond the walls of the sales and marketing departments or is never used at all – and engineering and R&D do not benefit.

REPOSITORIES OF DATA

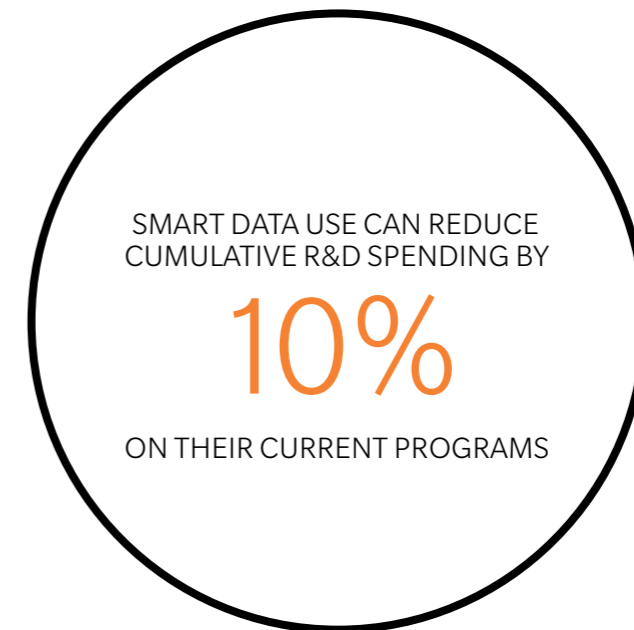
Moreover, much of the information is not even gathered by automakers. Historically, dealers have played an active intermediary role with customers and have often become a repository of information on vehicle usage patterns and common mechanical problems – data that rarely makes it back to the car companies.

EXHIBIT 1: POTENTIAL SOURCES OF DATA FOR DATA-DRIVEN ENGINEERING

Sensors throughout the vehicle are collecting insights into system performance that could help designers



Source: Oliver Wyman analysis



Historic shifts in the industry – notably to electric power and autonomous driving – make data deployment and optimal utilization especially important. The new technologies will bring with them a whole range of functions and systems that have been only tested on a limited basis, including those related to autonomous driving systems, mobile office applications for use while the vehicle is in autonomous mode, and automated battery recharging programs.

The testing of such complicated systems produces a slow development process and puts pressure on development spending. Customers and shareholders who have been hearing for years about these new functionalities are getting impatient to see them on the road and in top-line sales figures. Under market pressure, automakers are working to cut the current three- to four-year process in half. Ultimately, the only way to cope with these new demands is through extensive use of field data.

SMART DATA USE

Moreover, the new technologies will not pay for themselves for several years, so many car manufacturers are also trying to reduce costs. Larger automakers, with R&D costs typically running up to six to eight percent of revenue, are aiming to reduce spending on their current programs by between 20 and 30 percent. Better use of data could help reach these efficiency targets. (See Exhibit 1.)

The good news for automakers: Most of the new technologies afford far more opportunities to collect data because they tend to be electronic, digital and often connected to the cloud. Mimicking insurers' little black boxes, which collect data on driving

behaviors, car companies could also look to gather more info on how their cars are driven, and compare these patterns against their own testing programs and results.

For instance, certain driving patterns might be found to cause higher emissions, in which case those systems could be adjusted by changing their control algorithms. In other areas, the typical automotive standards might go beyond typical customer usage patterns and could be lowered. In electric vehicles, where batteries last longer when slowly charged, drivers that need to travel long distances and fast-charge a lot on the motorway might be offered a battery with components that can be more easily serviced or with an adjusted chemistry and structure.

CREATING NEW CHANNELS

None of this can happen unless automakers create channels to gather data systematically and then distribute the information throughout their organizations, including to their engineers. They also will have to convince customers to share data, just as Microsoft and Apple have had to do. Like all information, data is most useful when it's in real time.

Automakers also face the danger of getting inundated with data that ends up complicating the development process. More data on customer preferences will tend to generate a greater number of variable requirements, so engineers early on must prioritize the information that truly moves the process forward, produces real savings, and fits their use case scenarios. But at this point, car companies have a long way to go before that's their biggest problem. •



EMBRACING AN ELECTRIC FUTURE

Automakers need a global timetable for phasing out internal-combustion engines

Western car manufacturers have been slow to move beyond the automobile's century-old, internal-combustion (IC) technology. One reason is the current lack of overwhelming consumer demand for wholly electric vehicles (EV). It's also hard to give up those highly lucrative margins on internal-combustion pickups and sport utility vehicles – especially in the United States. And then, there's the confusing jumble of globally inconsistent regulations and incentives that make it difficult for automakers to plan ahead.

One thing is clear: A transition to electric vehicles is inevitable, and the best thing that could happen to the industry is exactly what is starting to happen – governments are beginning to set timetables, deadlines against which car companies can plan a smooth conversion to an EV world.

While it is doubtful many automakers would readily agree, they should thank the judges of the high court in Germany who recently ruled that German cities can legally ban diesel-powered cars and trucks – even though that ban could affect up to half of the vehicles in Germany. They also should welcome bans on the sale of internal combustion-powered cars enacted by France, the United Kingdom, India, Norway, and the Netherlands – with the earliest of these prohibitions not taking effect until 2025. Several global cities, such as Mexico City and Paris, have banned either diesel or IC cars starting in the next several years or have proposed bans. (See Exhibit 1.)

THE 2040 OUTLOOK

And while no date has been set, China – the world’s largest automotive market – has put its automakers on notice that an IC ban is coming. The bottom line to recent regulations: By 2040, if not before, the majority of new car sales outside of the US will likely be electric – even though today Western car companies only have a few models in their offerings.

While on the surface the prohibitions seem harsh, they provide the industry with the opportunity to plan the transition to EVs. With bans in the biggest markets not starting before 2030 and some not until 2040, car manufacturers have been given much-needed time to switch over their current research and development budgets to EVs, retool their production plants for EVs, and launch more EV models – in the end probably a less expensive option than having to find enough precious financial and talent resources to sustain both IC and electric vehicles over the long-term. In response, several European-based car

companies – including Mercedes Benz, Jaguar Land Rover, and Volvo – have already pledged to go all electric over the next four years, and Japanese car maker Toyota dropped diesels, which will also free up resources for EV initiatives.

The one country that seems to be traveling in the opposite direction is the United States, although Germany has started backpedaling on the likelihood of diesel or IC bans. US government policies have been mixed over the last year: While the federal tax rebate is still in place for electric cars, the recent tax legislation limited it to the first 200,000 plug-in electric cars sold by a manufacturer. After that threshold is reached, the incentive goes away. The US also pulled out of the Paris Climate Accord, which would have elicited tough national commitments on carbon-dioxide emission reductions. In April, the Trump administration recommended weakening future fuel-efficiency standards for the first time since they were adopted in 1975, but have been stymied so far by threats from California, 13 other densely populated states, and the District of Columbia that they would make their own rules if the administration proceeds. Combine those moves with the abundance of cheap, minimally taxed gasoline, and it becomes easier to see why both American automakers and consumers remain reluctant to move away from IC-powered cars.

THE NEXT AUTO GIANTS

Foot-dragging by the big global automakers may leave the leadership role in EVs up for grabs over the next five to 10 years. Thanks to the bans, many European automakers appear ready to commit to the future, but will still have to play some catch-

up to develop a sufficient array of models to win the consumer. Japanese and South Korean producers are also likely to be running the same race. Of course, with the bans, they have at least a decade to forge forward in the biggest markets.

Already, ahead of the curve are Chinese car companies, which have developed literally dozens of reasonably priced models of EVs. China’s abundance of electric-car choices reflects the success of a government program, called Made in China 2025, which provided domestic automakers with generous subsidies and access to cheap capital to build production and make the necessary acquisitions to help them become global players in EV sales.

As the largest market for autos on the planet – 28.3 million sold in 2017 versus 17.1 million sold in the US – it is not surprising that China is also the biggest market in the world for electric vehicles, accounting for more than half of the 1.1 million sold worldwide in 2017. Of those, 90 percent were produced by Chinese car companies. (See Exhibit 2.)

But Chinese automakers are no longer content with dominating their own market. Their sights are set on selling globally, and by next year several of the largest will begin marketing cars, including EVs, in the US and Europe.

The big uncertainty is how America and US-based carmakers will respond. General Motors and Tesla are certainly contenders with EV models that are selling. Yet, without a clearer timetable on transitioning to electric, the US may find itself in the position of having other nations set standards for the next generation of vehicles.

They are the ones producing and consuming them – and gaining fundamental experience that will move the technology forward.

POTENTIALLY EV-FRIENDLY

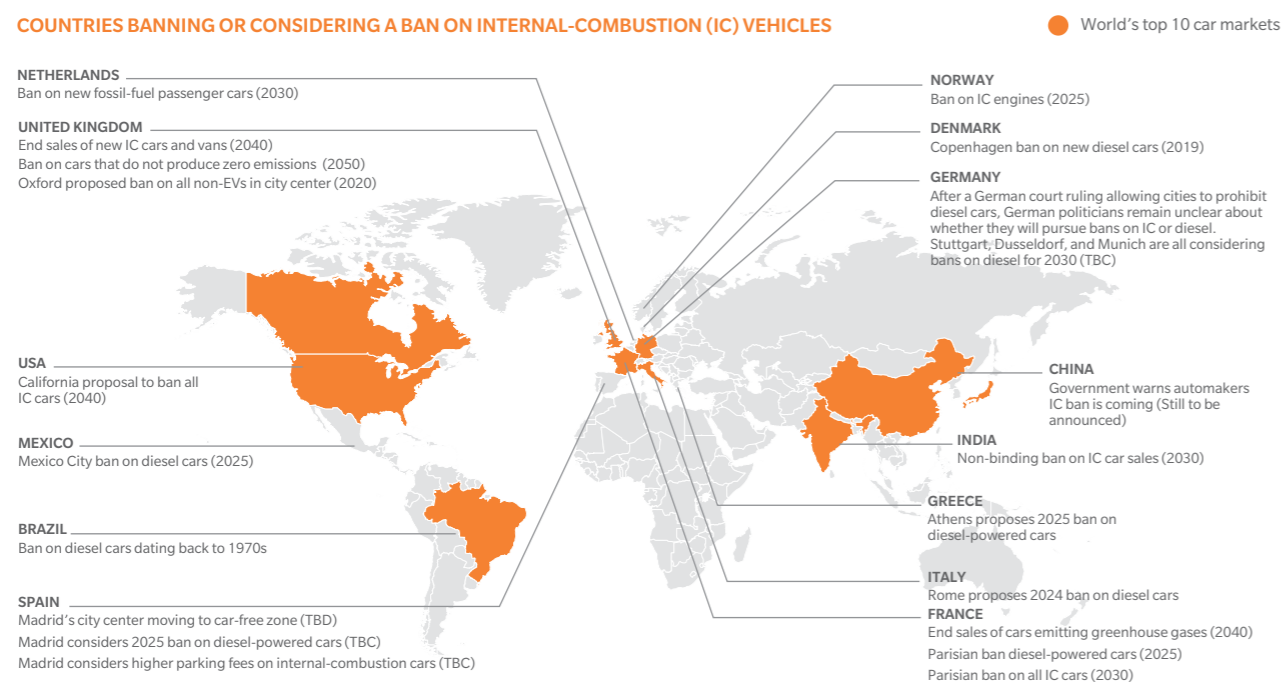
It does not have to be this way. The United States – with its abundance of single-family homes with garages providing perfect charging stations – is better suited to accommodating electric vehicles than many other countries. And it is not like US automakers lack the technological know-how or ingenuity to make EVs successful. After all, the next biggest supplier of EVs in China is Tesla.

Once at the vanguard of automotive innovation, US automakers need to rekindle that kind of determination to move beyond the insular and short-term thinking that is putting them behind in the race to dominate EVs. Even before electric cars, US producers have watched their global vehicle market share fall, currently expected to dip to a mere 15 percent by 2020 after being 40-plus percent as recently as the 1980s.

US automakers need to embrace EVs and the inevitable change, so they can elicit support from policymakers in the form of dependable incentives and a solid timetable. They should apply the same aggressive playbook that let US innovations like the SUV and certain vehicle safety features become standards of excellence around the world. With that kind of intense focus, EVs could turn into an American success story for the next generation. •

EXHIBIT 1: GOVERNMENTAL BANS THAT STEER CAR OWNERS TO ELECTRIC VEHICLES

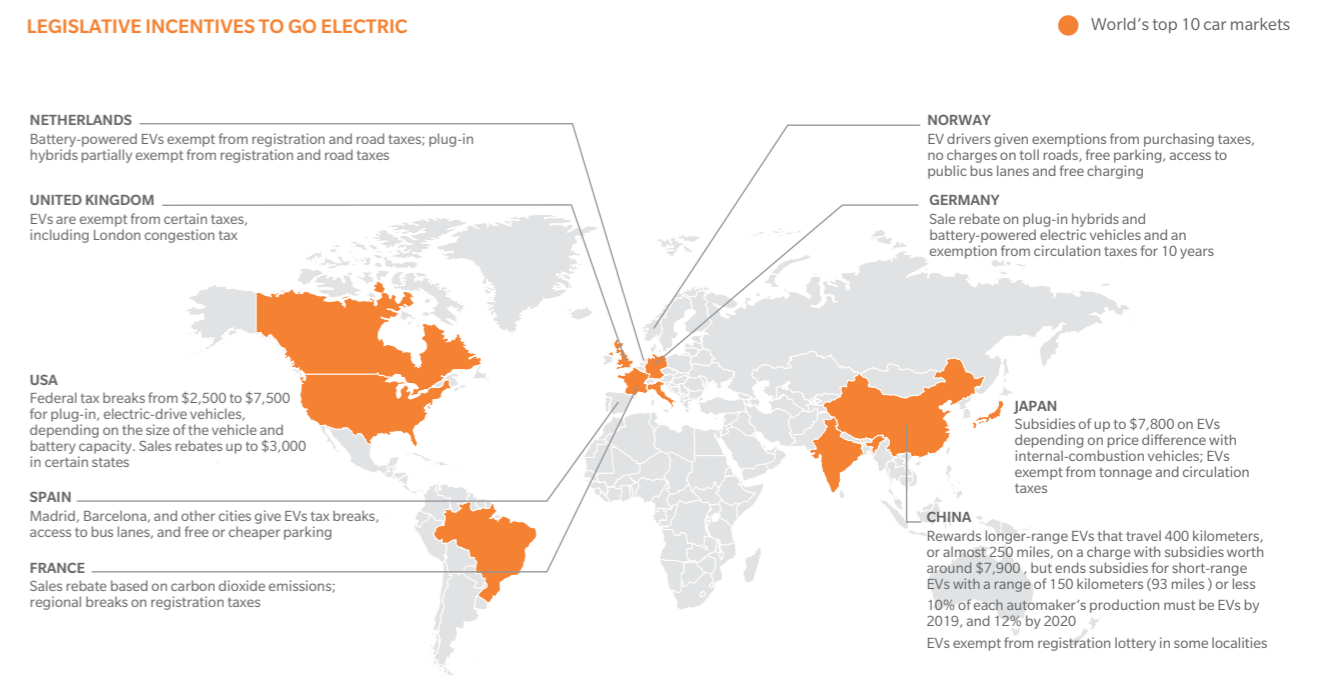
A snapshot of restrictions enacted or being considered to prohibit internal combustion-powered cars entirely or the sale of new ones



Source: Oliver Wyman analysis

EXHIBIT 2: GOVERNMENTAL INCENTIVES TO ENCOURAGE ELECTRIC-VEHICLE SALES AND USE

A snapshot of current national and local sweeteners adopted by countries and cities to encourage car owners to switch to EVs



Source: Oliver Wyman analysis



SUPPLY CHAIN RISK IN THE DIGITAL AGE

Reducing automakers' vulnerability
to supply chain disruptions

Automakers are loading a growing number of electronic devices into their increasingly electrified cars, covering everything from infotainment to semi-autonomous driving. This has vastly increased the number of sensors, microchips, and other electronic components in every vehicle. An increasing share of such electronic components – both high-end and commodities – is made only by a small number of suppliers, which often deliver them to the entire automotive industry – along with several other industries, such as consumer electronics, “smart” home automation, and appliances, too.

LARS STOLZ
HENDRIK VEDDER
MICHAEL LIEROW

At the same time, cost pressures and a desire to manage fewer supplier relationships has led to a further consolidation of the automotive supply chain. Just-in-time delivery and inventory levels along the supply chain are continuously being optimized to reduce cost. As a result of these changes, car manufacturers are more vulnerable than ever to unexpected disruptions in their supply chain.

Automakers thus need to think about supplier risk in whole new ways. They need to develop management approaches employing both preventive and reactive levers. This should include identifying risk-fraught components, training employees in risk management, and developing tools such as big-data analysis to penetrate their complex supply chains.

One reason for the growth in risk has been the competitive pressure on suppliers. Many have reduced inventory levels and outsourced non-core activities – the production of basic parts such as injection mouldings or actuators, for example – reducing their control over their own supply chains. Moreover, suppliers – in an effort to build economies of scale – have consolidated or else exited less profitable businesses.

Increasingly, fewer and fewer suppliers produce the standard parts and materials automakers need. But also sophisticated components and systems, such as engine management, electric vehicle batteries, and advanced chassis electronics, are also coming from just a few large suppliers.

Automakers also face stiff competition from other industries such as consumer electronics and high-tech in securing production capacity for key raw materials and electronic components. That applies to commodities such as polymeric materials, which are used to make engine hoods and interior fittings. It also applies to

key components for electrified vehicles such as batteries, where there is a global, inter-industry struggle for rare raw materials like lithium and cobalt.

GROWING AWARENESS

The 2011 earthquake and tsunami that hit the area of Japan around Fukushima was a wake-up call. It produced month-long waits for semiconductor components that would normally be delivered on order. Automakers then became aware of the danger of buying a high concentration of these from a single region. Most of the affected automakers realized they would need to manage their supply chains more dynamically.

Few, however, have taken all the necessary actions, and automakers are still being caught off-guard by a variety of supply chain problems. In the past few years, natural disasters, planning errors, or disagreements about contractual terms have made the regular supply of diverse components such as braking pipes, electronics modules, or gear boxes a constant struggle, caused by disruptions at tier-2 or tier-3 suppliers or even farther down the supply chain, where visibility of automotive OEMs is limited.

Supply chain risk affects other industries too. In 2017, 65 percent of companies had at least one supply chain disruption, according to the Business Continuity Institute Supply Chain Resilience Report 2017. Of these, 55 percent reported lost productivity, and 12 percent put their cumulative losses from supply chain disruption at more than \$10 million. In 2016, the insolvency of the seventh largest maritime carrier, Hanjin, resulted in supply issues for companies around the globe: goods and materials-carrying containers worth 12 billion euro remained stranded at sea and in ports for weeks. In 2017, Samsung was in the press several times after problems in a battery maker's supply chain led to a recall of smartphone batteries.

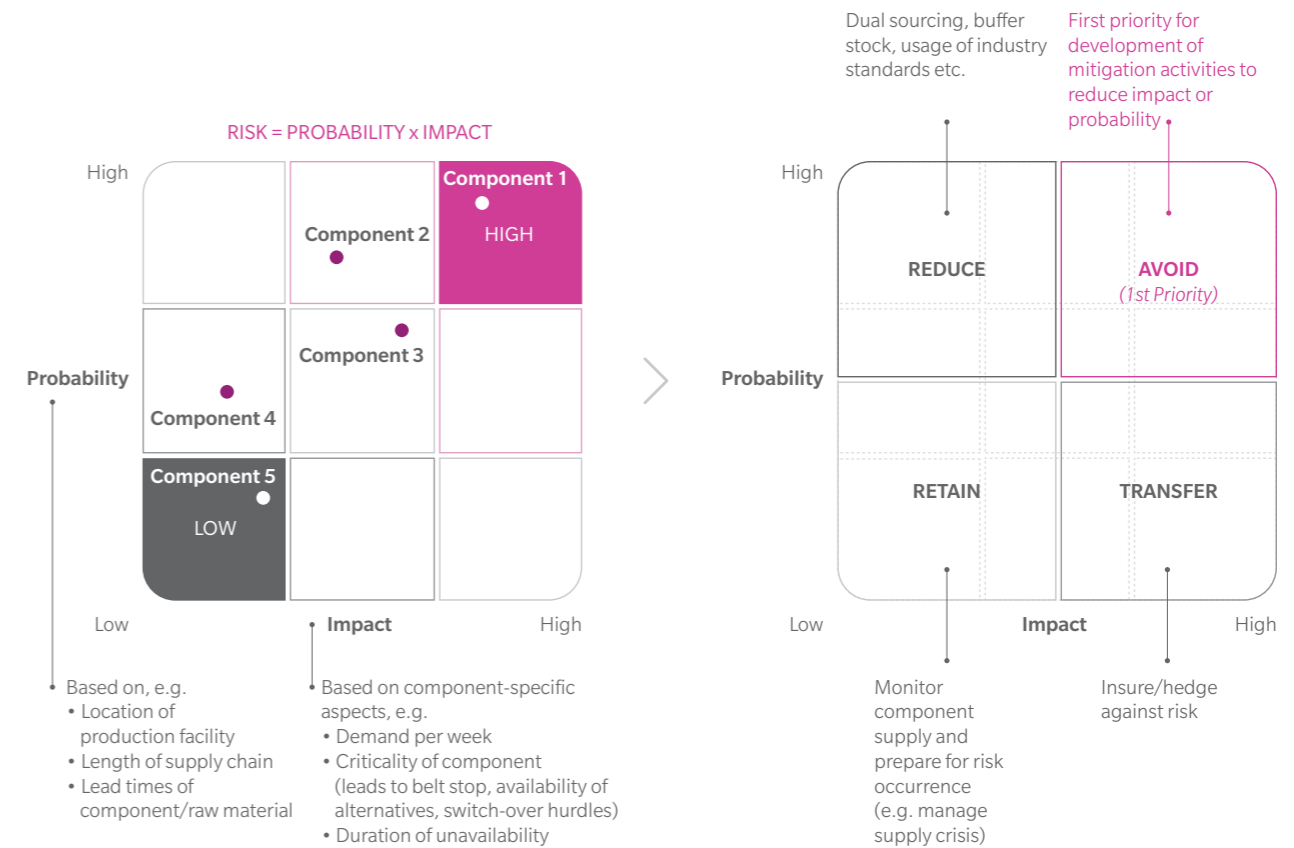
NEW WAYS TO MANAGE RISK

So far, automakers' supply risk actions are often focused on tier-1 suppliers – those that they deal with directly. However, further down the chain, smaller suppliers have often not identified, let alone managed, their own risks. This might include, for example, dependence on the financial stability or quality controls of a small raw materials supplier. Automakers thus often overlook the risks that one of its tier-1 suppliers faces further down the value chain.

Traditional approaches include building buffer stock or switching to the once-standard practice of dual sourcing. Several supply crisis situations demonstrated how suppliers with dual or multiple sourcing agreements can successfully mitigate the risks posed by, for example, natural disasters. Counting in the likelihood and impact of earthquakes into the risk profile of certain components such as semiconductors eventually triggers the need to identify suppliers with a different footprint for highly critical parts. (See Exhibit 1.)

EXHIBIT 1: EVALUATING AND MITIGATING RISK OF COMPONENTS

Developing an evaluation of component risk as a basis for defining mitigation measures



Source: Oliver Wyman analysis

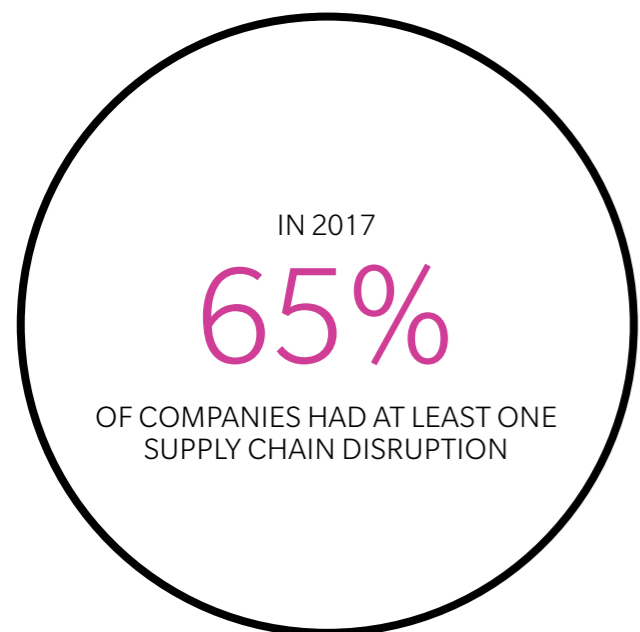
Automakers might also review their company's component specifications in the early stages of product design: if the supplier of a customized part can no longer deliver for some reason, it would be hard to find a replacement; but if an automaker uses industry-standard parts, new sources are more easily found.

Big data and artificial intelligence as well as digital tools could make it easier for automakers to screen several layers of their supply chains. Early warning indicators might include: price developments for certain raw materials; logistics hubs and materials data for identifying potential disruption; weather forecasts and environmental data; market penetration forecasts; and financial data and social media postings for information on a company's financial stability. Applying artificial intelligence and real-time data analytics can then improve monitoring and forecasting. An appropriately developed supply chain risk management function using a risk monitor system based on big data and warning indicators will help an automaker stay one step ahead of its competitors if the supply of a raw material or sub-component is interrupted.

Still, it is neither possible nor economically feasible to eliminate supply chain risk completely, so automakers need to be able to react effectively. Different functions – from engineering to purchasing – require processes, tools, and structures for managing supply crises. They should also train personnel in these functions to respond quickly to unexpected problems.

In essence, automakers and their suppliers need to take a proactive approach towards managing their supply chain risk: identifying and evaluating risks early, based on increased transparency of the materials they require along the entire supply chain; devising mitigating actions that strike a balance between cost and risk mitigation and increase their ability to respond to crisis; and installing advanced monitoring tools that look deep into their supply chains' most critical links. In addition, they need to raise the awareness of their suppliers to follow suit.

Acting in such a way will help them keep their supply chain lean and optimized for cost while allowing them to produce the cars their customers want in the required quantity, the ultimate goal of any healthy supply chain. •



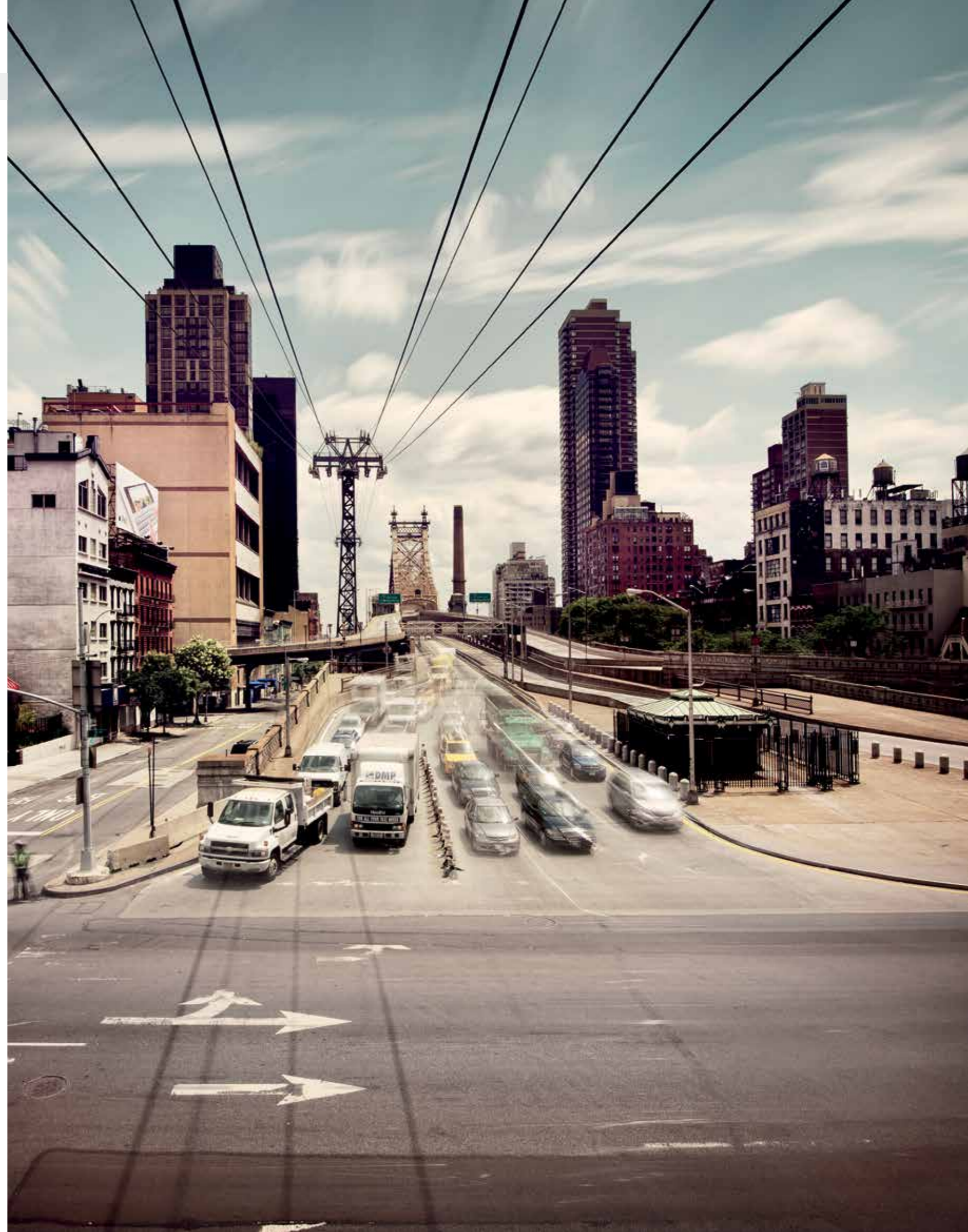
GETTING AHEAD OF SEVEN SUPPLIER DISRUPTIONS

The new FAST 2030 report highlights the digital disruptions automotive suppliers face

The automotive world is shifting into overdrive. Automakers and suppliers can no longer count on predictable changes and the occasional, isolated disruption. Instead, they must prepare for a cascade of transformative technologies and digitally driven customer behaviors that will end-up much of the industry's conventional wisdom. Underestimating the urgency of this challenge will leave suppliers in the digital dust.

JOERN A. BUSS
JOHANNES BERKING
KEVIN REBBEREH

A version of this article first appeared on Automotive World on July 9, 2018.



A new report by Oliver Wyman and the German Association of the Automotive Industry (VDA), Future Automotive Industry Structure – FAST 2030, assesses the impact this transformation will have on automotive value creation through 2030 based on seven major trends. (See Exhibit 1.) It suggests several clearly defined ways suppliers can ensure their future competitiveness.

The seven trends will drastically change cars themselves, how companies create them, and the ways that customers use them between now and 2030. Unlike in the past, when industry players might face one or two major disruptions at once, now, organizations must deal with all seven simultaneously.

VALUE-LADEN HOTSPOTS WILL SHIFT

Over the next decade or so, these trends will drive major changes in automotive value creation. Markets will experience horizontal and vertical value shifts, along with increasing regional variations.

The most obvious horizontal shift will involve the substitution of e-mobility systems for internal-combustion engines (ICEs). This should eliminate entire value chains while creating a competitive edge for new players, such as those in Asia, which have a headstart in adopting the new technological requirements. However, other vehicle systems could also see significant changes. While the chassis will increase in value through the addition of active and intelligent systems, the industry's strong focus on costs will prevent such positive developments in the body-in-white despite the regulation-influenced need for weight reduction.

Value could also shift within individual systems. Take the interior, for example: The cockpit and seats should rise in value with the

addition of sophisticated electronics and greater functionality as the industry pivots toward autonomous cars, while areas such as interior trim and roof and door elements remain largely the same.

Vertical shifts involve the transfer of value between the automaker and its suppliers. Auto companies will become increasingly involved in e-drives and batteries, and will rely more on their suppliers for advanced driver assistance systems (ADAS) and autonomous vehicle technologies.

On a regional basis, new technologies will erase many historical competitive advantages, thus shifting value creation opportunities into the "best benefit" countries, which stand out not only because of low costs, but also in terms of predictable long-term regulatory frameworks and other considerations.

SUPPLIERS: SURVIVING AT GROUND ZERO

The strengths that have traditionally benefited suppliers could leave them short as the seven trends take hold and value chain hotspots continue to shift. To remain competitive, many suppliers will need to develop new business and operating models and achieve holistic improvements in performance. Success will require greater flexibility, new capabilities and talent, and innovative partnerships; for some, significant portfolio adjustments will be in order, along with the need to secure the capital for financing change. It will also require superb timing as companies build up new offerings while simultaneously abandoning obsolete ones.

Our report identifies nine new business models across the automotive value chain that suppliers might employ to set themselves up for success. (See Exhibit 2.)

Of the nine supplier business models, five warrant greater attention, given their potential to create substantial value.

E-drive and battery specialist. Suppliers offering integrated power systems for EVs, as well as control software and subsystems, face high upfront capital requirements and will need tier-1 and tier-2 supplier relationships, a solid grounding in the pros and cons of the latest technologies, and a comprehensive understanding of e-powertrain design. The supplier must proactively manage R&D and co-development efforts, understand material economics and tracking for rare materials, and fully understand new manufacturing methods and equipment requirements.

Tier 0.5 supplier. A tier-0.5 supplier is an automaker's "wingman," taking over responsibility for major systems and modules from a vehicle value-creation perspective. Often co-located at automaker facilities, it offers system-level R&D, integrating the ecosystem of suppliers and partners, and providing system integration and program management expertise. Such companies will need to have ready access to capital markets, understand end-customer dynamics, and excel at high capacity production flexibility.

"White label" vehicle manufacturer. Essentially contract vehicle manufacturers, these players build unbranded vehicles for automakers to sell under their own brand names. Doing so requires manufacturing and engineering expertise, along with available manufacturing capacity located near the major components suppliers, lean manufacturing capabilities, access to strategic partnerships, and flexible manufacturing abilities. Players need strong manufacturing expertise and design capabilities, close ties with the R&D organizations of their automaker customers, and high degrees of production flexibility.

Ramp-down of fading technologies. These companies actively manage the ramp-down of fading technologies, such as ICEs and associated drivetrain components as EVs gain market share. This is a consolidation play, requiring economies of scale, sophisticated capacity management, and pricing and negotiation skills. To succeed, companies must embed a proactive ramp-down process in the organization and plan to reap long-term profits on declining volumes by capturing late-stage oligopolistic profits.

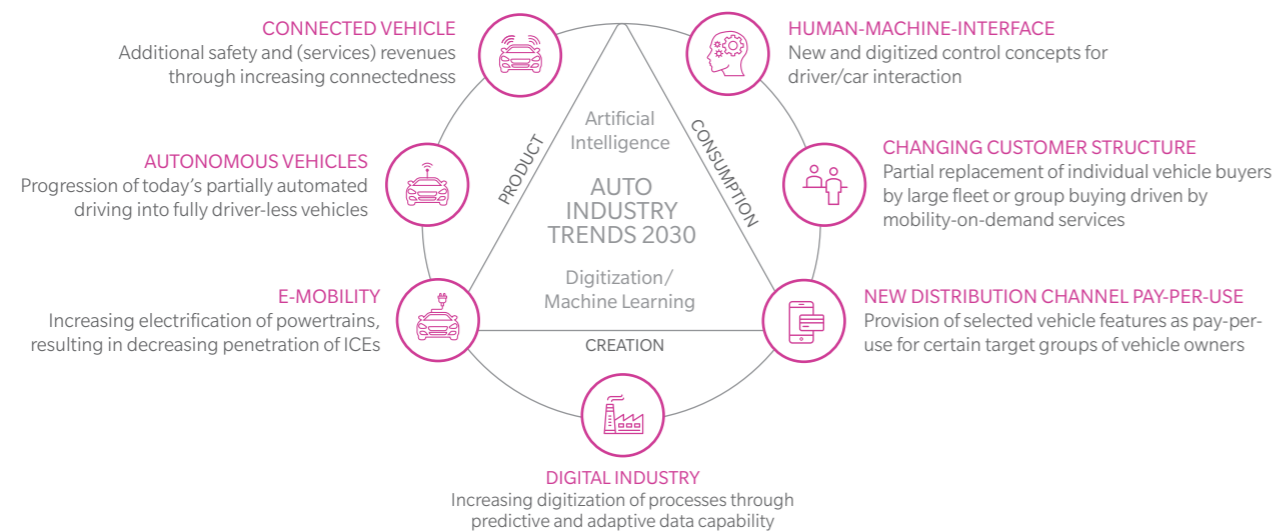
Direct channel aftersales. Suppliers in this category make direct sales of aftersales products to end customers, third-party repair shops, and large fleet operations. They tend to have strong brands and marketing apparatus, understand shifts in customer behavior, and control distribution systems. They offer value pricing (made possible by distribution efficiencies and strong delivery-performance), thus resulting in customer satisfaction and loyalty.

TOUGH DECISIONS NEEDED NOW

Suppliers need to act now to lock in future industry value. Smaller and midsize suppliers that fail to adapt to the new business models will fall behind. Existing multinational suppliers have an opening to expand their roles, reshaping the industry and offering complex systems, such as complete chassis "skateboards" for electric cars or entire systems for driverless cars. At the opposite end of the value chain, online and direct aftermarket businesses could develop substantially and challenge incumbents. To manage risk while striving to capture emerging opportunities will require both toughness and vision on the part of firms. •

EXHIBIT 1: SEVEN TRANSFORMATIVE AUTOMOTIVE TRENDS THROUGH 2030

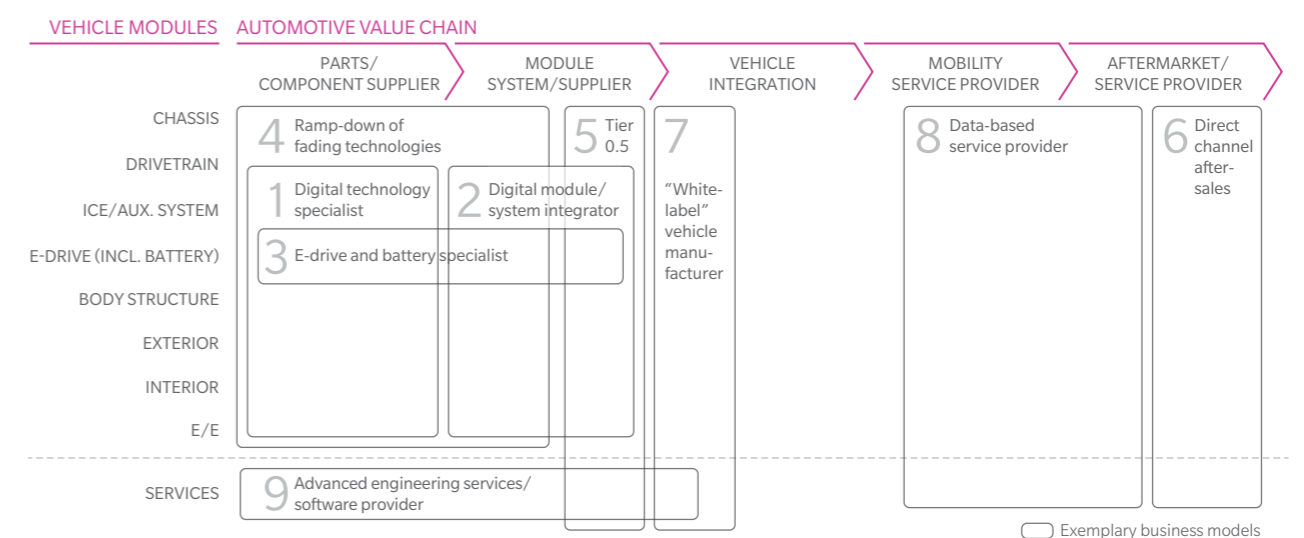
Seven fundamental trends drive the automotive industry, enabled and accelerated by digitization, AI and machine learning



Source: Oliver Wyman analysis

EXHIBIT 2: SUPPLIER BUSINESS MODELS THROUGH 2030

Driven by the current and emerging trends, new supplier business models are being established along the automotive value chain



Source: Oliver Wyman analysis



FUTURE AUTOMOTIVE MANUFACTURE

Tomorrow's factories will need better processes, not just better robots

When people think of the automotive Factory of the Future, the first word that comes to mind is automation. They think of the "lights-out" factory that General Motors Chief Executive Roger Smith fantasized about in 1982 and Elon Musk talks about building today - plants so dominated by robots and machines that they do not need lights to work.

RON HARBOUR
JIM SCHMIDT
JOHANNES BERKING

This article first appeared in Harvard Business Review on May 11, 2018, and a version of it on BRINK on June 13, 2018.

There is no doubt that the auto industry will continue to vigorously pursue automation solutions to lower the cost of producing cars. But the reality is that any major leap forward on cost and efficiency will no longer be possible through automation alone, since most of the tasks that can be automated in an automotive factory have already been tackled. (See Exhibit 1.)

FACTORY OF THE FUTURE REQUIRES NEW PROCESSES

When a real Factory of the Future finally arrives, it will not look different because we have automated the processes we use today. It will look different because we will have invented entirely new processes and designs for building cars requiring entirely new manufacturing techniques.

Take the paint shop. Today, in most mature markets, it's more than 90 percent automated, yet it is still one of the most expensive and space-intensive sections of the factory. Robots, instead of humans, perform most tasks – applying protective corrosion coats, sealant, primer, basecoat, and clear coat to achieve the highly polished finishes we like on our cars – but the process itself is not that different than what it was 30 years ago. For instance, in the BMW plant in Spartanburg, South Carolina, processing a car through the paint shop is a 12-hour task, involving more than 100 robots, and requiring a vehicle in the paint assembly line to travel four miles within the factory before the process is complete.

Clearly, there has to be a better way to paint a car, but to make that operation more efficient and take cost out will require the development of a new process. Perhaps it will be the experimental approach of applying a single film over the car and then baking it on, like in a pottery kiln – currently being tested in automotive research labs. Or 3-D printing of the entire car body in the color a customer orders, completely eliminating the need for a traditional paint shop and body shop. Whatever it is, it will have to be more than adding a few more robots into the mix to make a significant difference in the cost of producing an auto.

Today, two-thirds of automotive workers – the human ones – are in the general assembly section. Automating this section has proved to be more difficult because the customization and complexity of today's autos requires the flexibility humans provide. Most factories are producing several models of cars simultaneously, and the mix of those models often changes depending on demand. It would be expensive, if even possible, to reprogram robots and machines to be able to accommodate daily changes in factory production schedules.

There are also some tasks on the assembly line for which humans are better suited, such as handling all of the intricacies of installing and connecting a car's wire harnesses – the nervous system of a vehicle. With a future market expected to consist of electric and autonomous vehicles, the electrical systems will need to transmit more data faster and unfailingly, compared to today's car. The consequence to the assembly plant: more wires and connectors leading to longer, heavier wire harnesses.

For this operation to be automated would again require a new process – perhaps going wireless, with the electrical systems operating via electronic modules or connecting via the cloud.

A new process will also need to be developed to assemble electric vehicles since they involve the relatively uncomplicated installation of the battery pack and an electric motor. Simpler tasks may lend themselves better to robots, but several steps on the line will also be bypassed. The leap forward will be accomplished through the development of a new process – in this case, electrifying the auto – not automating an old one.

COBOTS AS VALUABLE AND VERSATILE HELPERS

New collaborative robots, or cobots, are also adding a new twist: Instead of threatening the survival of humans on the assembly line by replacing them, cobots enhance their native abilities. Ranging in size from two- to four-feet high, these automated assistants work with humans to perform tasks that perhaps are slightly dangerous or repetitive, or that require a special agility to work in tight or hard to reach places, such as working underneath autos. For instance, Renault has deployed cobots in a few plants to help build the powertrain – torquing bolts to a certain tolerance, a task that can be tedious for humans to do consistently and efficiently.

Making these small helpers attractive to companies, cobots can be relatively inexpensive, often costing under \$50,000 each. They are simple to reprogram – workers on the assembly line can often handle the reprogramming on their own. This allows them to be re-tasked quickly, again adding to their value and versatility.

Unlike much of the current robotic automation that must be kept fenced in, with safety signs warning employees to keep their distance, cobots perform tasks in factories without hurting humans as they are programmed to stop when there is an object in front of them. With their swing arms, they can retrieve certain small parts from bins for their human partners.

Another example of automation that enhances humans' native abilities is the exoskeleton. Workers wear these cyborg-esque contraptions to make them strong enough to lift heavy truck tires or ease the stress on their bodies when performing repetitive overhead assembly tasks. This wearable automation becomes particularly important as the average age of production workers rises above 40, as it has in many industrialized economies, such as the United States, Western Europe, and Japan.

Roger Smith's dream of a lights-out factory has only been realized in a very few operations – robots building robots, for instance – and not in the automotive world. But there are other roads to the automotive Factory of the Future that will likely be paved with human invention, and while robots and automation will be part of the picture, the lights will still be on. •

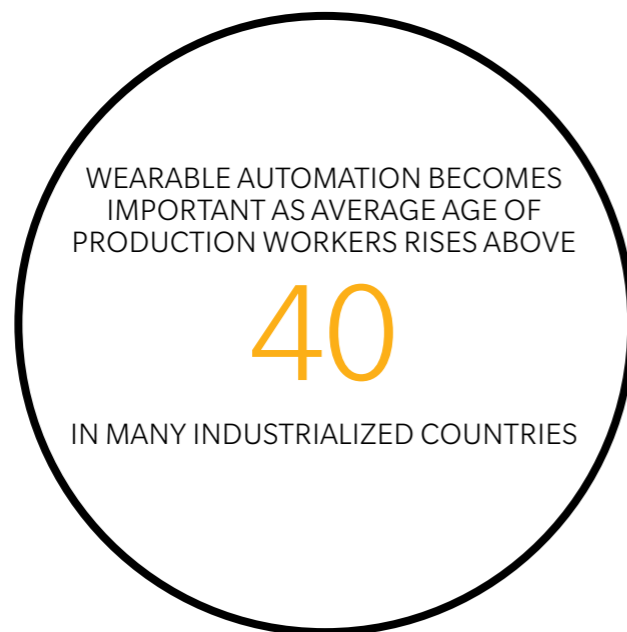
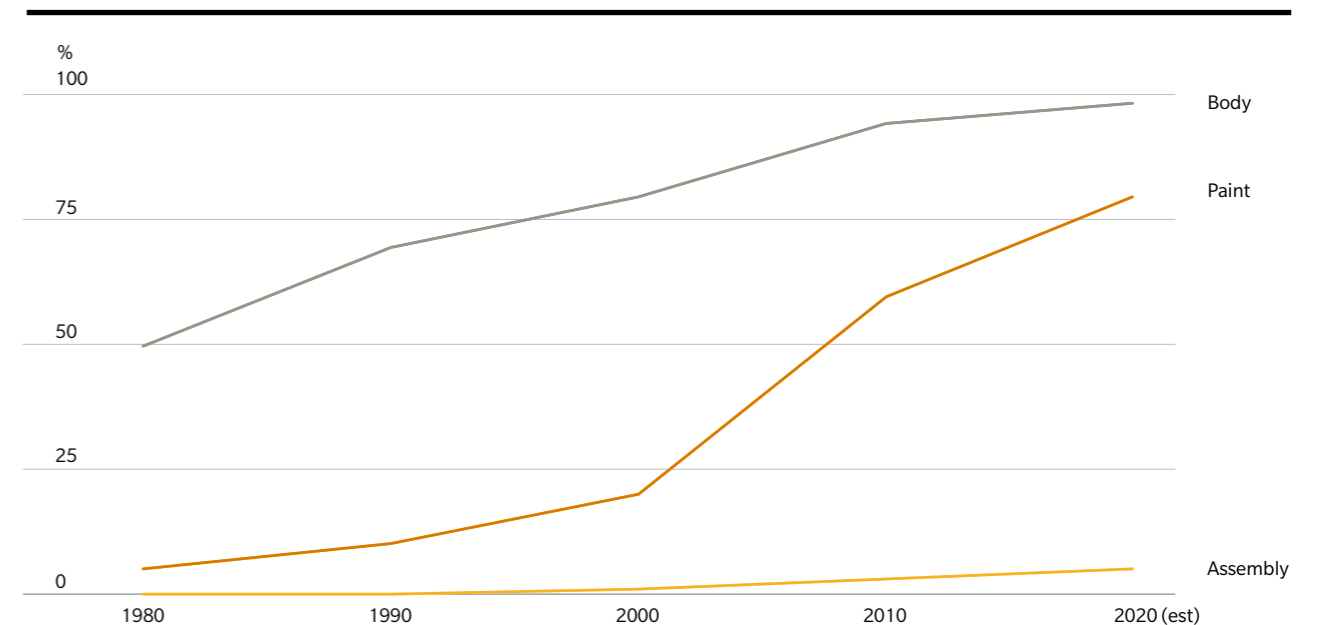


EXHIBIT 1: WHAT CAN BE AUTOMATED HAS BEEN AUTOMATED: ASSEMBLY LINES NEED THE HUMAN TOUCH

Automated workstations in automotive factories



Note: Typical automated workstations in assembly: body/chassis marriage; urethane application and installation of windshield glass

Source: Oliver Wyman analysis

FUTURE BUMPS IN TRANSITIONING TO ELECTRIC POWERTRAINS

The “e-shift” to battery-driven powertrains may prove challenging, complex, and costly to automakers

The shift from gasoline to electricity could blow fuses throughout the vehicle powertrain world. Known as the “e-shift,” the transition from conventional internal-combustion engines (ICEs) to battery-driven electric motors will produce significant new quality and reliability challenges for the automotive industry.

RICHARD HELL
DANIEL PARTSCH
DANIEL RUPPERT



Without question, the e-shift will fundamentally change the supplier ecosystem, but automaker powertrain departments themselves will be entering unknown territory. Where in the past both groups relied on experience-based capabilities to deal with ICE issues, now, they must understand new functional interdependencies during the early stages of product development processes. (See Exhibit 1.)

BATTERIES WILL SPARK MAJOR CHANGES

Automakers traditionally produce major ICE elements internally; with electric vehicles (EVs), the battery represents the most expensive part of the drivetrain. However, only a limited group of specialized suppliers, often located across the globe (in China, for instance), currently produce them (although recent developments suggest an emerging willingness to relocate closer to Western customers). A second hurdle involves the different business cultures and competitive behaviors of EV battery suppliers and automakers. Such differences may cause delays and trigger reliability and quality problems.

Research suggests that most recurring technical problems result from product development weaknesses, which in turn stem from a lack of experience in the integration, testing, and validation stages. Likewise, problems associated with product launch, production, or vehicle operation often relate to an incomplete understanding of the technical aspects of a product or system.

While few outsiders understand ICEs as well as industry incumbents, most automakers lack the expertise to optimize EV technologies in the automotive environment.

Take temperature management, for example. The automotive industry has perfected the archetype for ICE temperature management over the past 130 years, which typically includes a radiator, thermostat, engine coolant jacket, pump, and so on. The technologies involved are known commodities; car engineers and technicians know how to design, develop, and produce them

for specific engine and drivetrain configurations. With EVs, the battery requires the most attention, and overheating occurs due to the way it interacts with the rest of the powertrain and other parts of the car. Consequently, battery suppliers often cannot remedy overheating problems before automakers install the batteries in specific cars and observe them operating with the rest of the vehicle. At the same time, automakers cannot work on overheating problems before they mate the battery with the vehicle. At this point, optimal temperature management solutions could require a battery redesign along with changes regarding how it integrates with the rest of the powertrain (and vehicle). EV packaging and integration priorities will differ as well, requiring automakers to rethink the entire powertrain system. One EV maker adopted an integrated electronics architecture, for example, dramatically reducing the number of microprocessors it required.

The entire process of mating battery to car to prevent overheating depends on a comprehensive functional analysis. This approach focuses on functions and overcomes system limitations by assessing the machines' building blocks and executing a risk assessment (for example, an enhanced form of failure mode effects analysis, or FMEA). Based on the outlined risks, engineers can design and execute targeted verification tests.

Vehicle crash-worthiness is another area prime for functional analysis. The status quo is the result of decades of testing and the analysis of millions of accidents involving ICE-powered cars. EVs, with massive batteries and small electric motors, will require engineers to rethink the entire crash paradigm, from crumple zones to areas requiring reinforcement via high-strength steel.

THE E-SHIFT REQUIRES NEW WAYS OF WORKING WITH SUPPLIERS

Ensuring the functional behavior of a powertrain system requires that engineers understand and model cause-and-

effect relationships within an EV's system. Many times, interactions among sub-functions or parameters will affect the main function, which is why the physical behavior of a system and the interactions between measurable sub-functions drive Oliver Wyman's functional approach, not hardware components.

Automakers (or their suppliers) may fail to understand the interactions that occur in new powertrain technologies due to torque, temperature, power, or vibration issues. To identify and fix such problems effectively, automakers need know-how and experience. Involving suppliers early in the powertrain product development process can help prevent quality, reliability, and NVH (noise, vibration, and harshness) problems before they impact customer satisfaction. For instance, lacking the covering noise and vibration of an ICE, EVs can emit a host of sounds that engineers struggle to manage.

Consequently, this approach requires much stronger and deeper functional-level collaboration between EV makers and their technology suppliers, as they establish tailored processes. That means much earlier involvement of suppliers in quality issues through the creation of fast response and process improvement approaches. It also requires stronger functional behavior analysis on reliability and risk reduction in the product development process.

At the same time, demand for predictive and transparent tools and methods will increase, as these can identify and control the

risks associated with powertrain systems and components in the early development phases. These techniques will prevent critical failures from occurring later in the field, with the end customer.

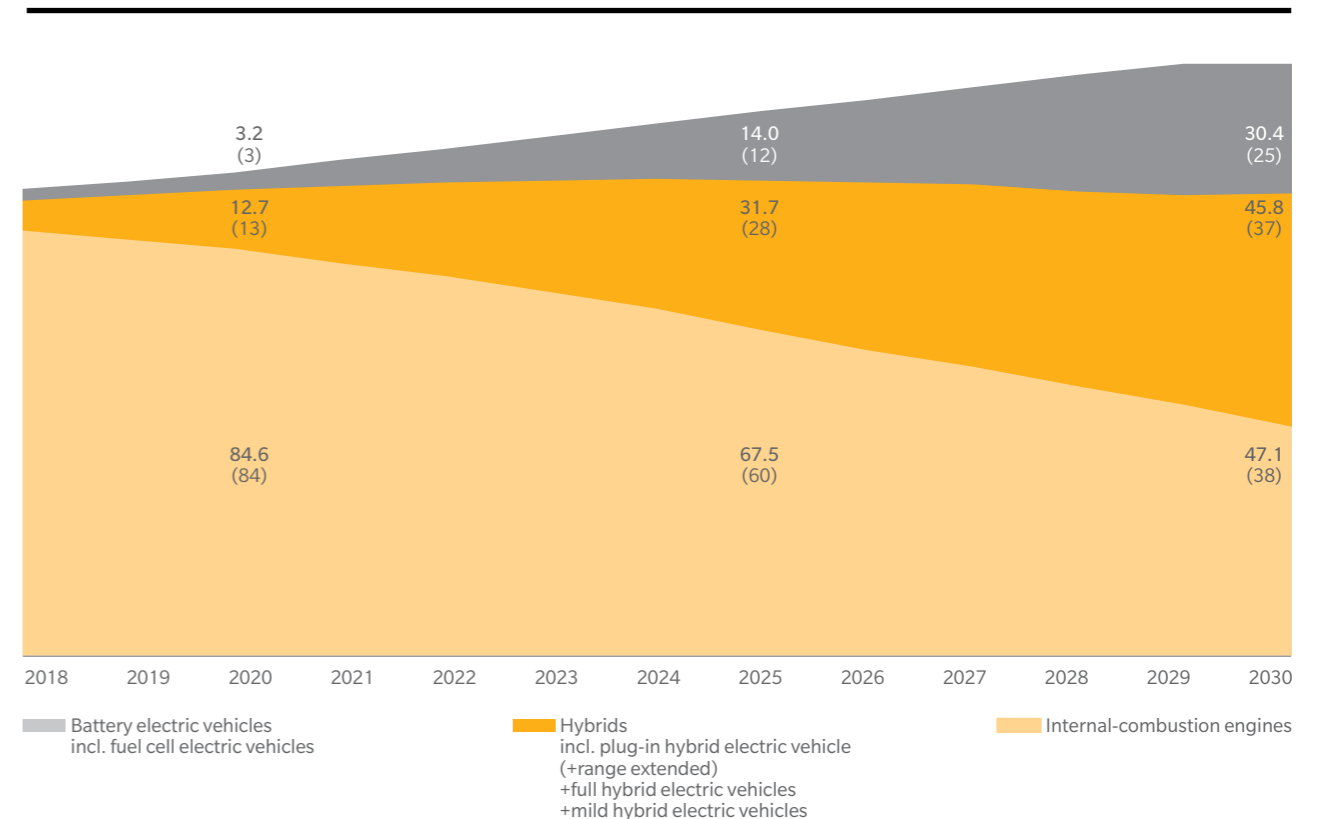
Some of these collaborative links between automakers and suppliers already exist. For example, many suppliers now operate on or in very close proximity to automaker sites and may assume the role of "resident engineers." Expanding and reinforcing these links can support the improved processes and relationships needed, thus enabling the more effective exchange of data between automakers and suppliers regarding engineering change orders or supplier shifts. Likewise, the use of combined automaker and supplier teams can promote more robust functional requirements and specifications resulting in fewer recalls, quality defects, and reliability issues down the road. Some companies are already making headway in this area: one Chinese battery producer for a European premium automaker is building a plant in Europe to be closer to its customer.

GEARING UP FOR E-SHIFT

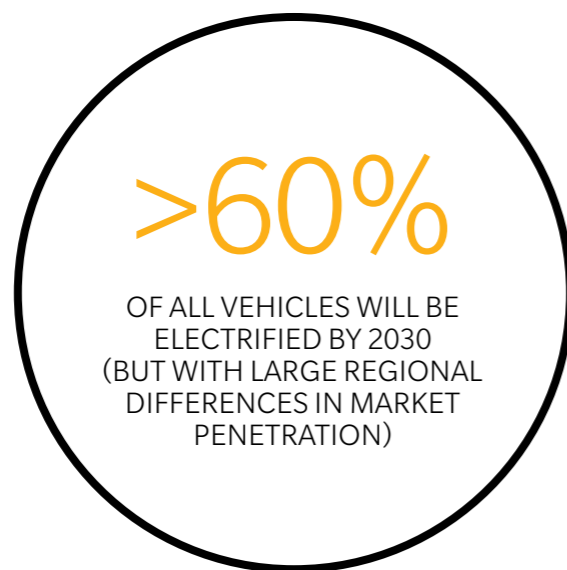
Most automakers have dabbled in EVs, but may be unprepared for the challenges associated with shifting major parts of their product portfolios to these powertrain technologies. By adopting a functional approach to the issue, and by collaborating more closely with key suppliers, automakers can position themselves to make the e-shift seamlessly. •

EXHIBIT 1: GLOBAL RAMP-UP SCENARIO FOR ALTERNATIVE POWERTRAIN TECHNOLOGIES

Production volume in million units (% share of total)



Source: Oliver Wyman analysis





SUPERCHARGING CAR SALES PLANNING WITH AI

How AI can boost profitability through optimized sales planning and vehicle allocation

The goal is complex: deliver the right vehicle to the right dealer in the right country at the right time to make the most profitable sale. Automotive players across the globe strive to make it happen every day, but several trends are making it more challenging than ever.

AUGUST JOAS
ANDREAS NIENHAUS
CHRISTOPH TIRL

First, inadequate sales volume planning creates inefficiencies. Second, ineffective allocation of vehicles across markets, customer segments, and channels results in major margin losses. And third, automakers sometimes struggle to follow an integrated approach across the sales value chain and to utilize all of the available information effectively.

Instead of relying on experience and gut feel to plan and allocate volumes, automakers now can leverage smart, data-driven tools based on artificial intelligence (AI), better meeting customer demand and boosting profitability across the downstream value chain. Experience suggests that establishing AI-based planning and sales excellence could improve total profitability per vehicle between 15 percent and 20 percent.

NEW CHALLENGES INCREASE COMPLEXITY

Several new issues have emerged in vehicle volume planning and allocation that can dramatically affect a car company's bottom line, making an already difficult job even harder. For instance, as new CO₂ regulations or the Worldwide Light Vehicle Testing Procedure (WLTP) take effect in various regions, automakers must ensure adequate supplies of appropriately configured vehicles or face major penalties. In 2020, these regulations will limit the average CO₂ emission per vehicle to 95 grams per kilometer across automakers' fleets. Based on current projections, not all automakers will reach that target. In total, joint penalties for automakers thus could add up to €3.6 billion. Car companies must also balance the growing demand for electric vehicles (EVs) against their lower overall profitability to ensure competitiveness and regulatory compliance without incurring unnecessary losses. With several carmakers targeting 50 percent EV market shares by 2025 – and with sales of their more profitable diesel cars likely to plunge – the challenge to sustain healthy margins will be enormous.

In this new environment, the traditional planning and allocation processes currently used by most automakers are likely to produce three types of shortages: across markets, if planners do not recognize shrinking demand in time; between models, as car volumes rise or fall; and between customer segments or channels, if marketers overlook profitable niches.

Automakers thus need to improve their processes to better satisfy customer demand, to react dynamically to market changes, and to increase overall profitability. An array of AI and advanced data analytics applications – including random forest analyses, deep learning, and neural networks – can help overcome these challenges, attract new customers, and foster excellence in sales planning and volume allocation.

ACHIEVING SALES PLANNING EXCELLENCE

To optimize midterm sales planning using AI, players must migrate away from legacy “gut feel” and static planning approaches and embrace forward-looking, dynamic forecasts

based on intelligent algorithms. Satisfying customer demand is the primary goal, following the question, “How many vehicles could we sell without current limitations and restrictions?”

Several proven AI applications to enhance sales planning already exist. For example, machine-learning technologies like “random forest” analyses combine multiple regression analyses to forecast vehicle volumes across various dimensions. The analysis relies on a limited number of external market variables (such as competitive intensity, market shares, GDP, and income distribution), along with internal company data (concerning product lifecycles, marketing spending, expiring leasing contracts, and web configurator data).

Companies often find that employing AI not only improves planning quality, it also increases flexibility, offering the opportunity of real-time adjustments. Ultimately, it is a better way to meet customer demand.

ATTAINING ALLOCATION SUPERIORITY

Advanced analytics can also help automakers optimize vehicle volume allocation in day-to-day operations. This can significantly boost profitability, either at the market level (within an attractive customer segment) or across sales channels. It brings new clarity to legacy allocation processes that more typically respond to pressure from market players that “shout the loudest.” Advanced analytics focuses on where the greatest value truly lies.

Based on results from the above planning approach, AI allocation optimizes vehicle volume distribution. Here, the core question is, “How do we allocate vehicles under given constraints to maximize overall profits?”

Essentially, this value-driven approach is a mathematical optimization problem, solved by advanced analytics and statistical methods that take into account multiple, potentially interfering constraints. These might include production capacities, market share targets, competitive behaviors, price levels, logistics, and the like. Other potential impediments range from strategic and legal considerations, to CO₂ targets. Furthermore, automotive players should consider four elements when optimizing vehicle volume allocation:

Markets. Profit per vehicle varies widely across markets. (See Exhibit 1.) Within given restrictions such as market share targets, logistics, and production capacities, companies should allocate vehicle volumes to markets with higher profit potential.

Customer segments. Automakers need to optimize the profitability of customer segments within markets. A shift from large fleets and rental car sales with significant discount levels to a stronger focus on private customers can unlock significant profit potential (but will require strong brand power and potentially greater individual sales efforts).

Sales channels. In the future, the automotive industry will likely shift to an omnichannel sales and distribution ecosystem with varying vehicle volumes and profitability-per-channel performance. Steering this transformation successfully will require automakers to capture currently untapped margin potential.

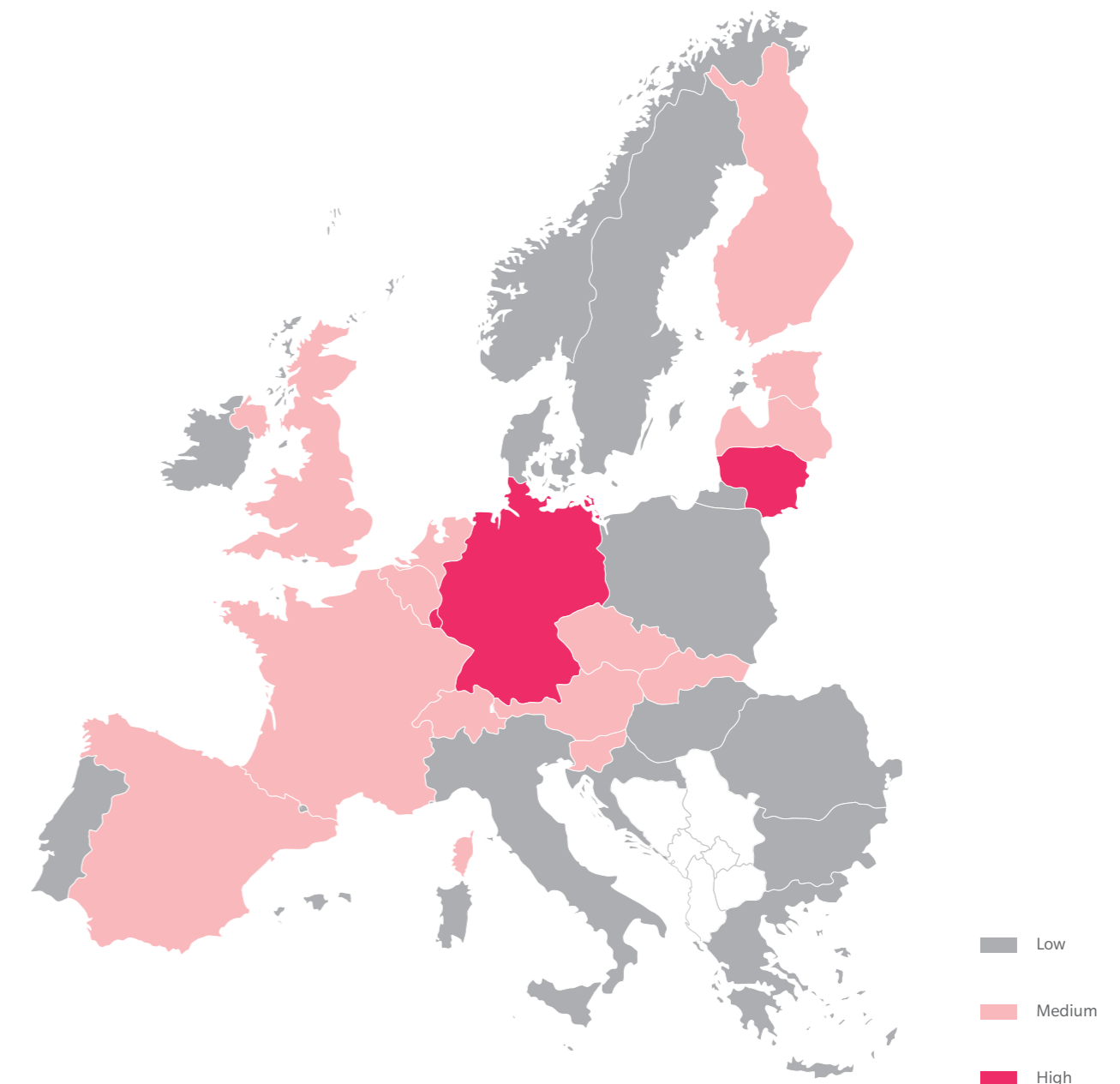
CO₂ management. As carbon dioxide regulations tighten, automakers must prioritize vehicle volume allocation strategies that can minimize or avoid high fleet emission levels.

SMARTER TOOLS FOR BETTER RESULTS

By using AI and advanced analytics, automakers can develop a sophisticated market planning and allocation approach that improves planning quality and flexibility, delivers the cars customers want, and increases total profitability in a range of 15 percent to 20 percent across models, markets, segments, and channels. With new planning and allocation challenges on the horizon, leaders should view this need not merely as a productivity boost but as an important way to enhance profitability and manage growing risk. •

EXHIBIT 1: AVERAGE PROFIT CONTRIBUTION PER VEHICLE ACROSS EUROPEAN MARKETS¹

Varying profit per vehicle across markets offers additional potential for car makers in case of profit-orientated volume allocation



1. Gross profit per vehicle minus cost of sales tacticals and incentives. Source: Oliver Wyman analysis

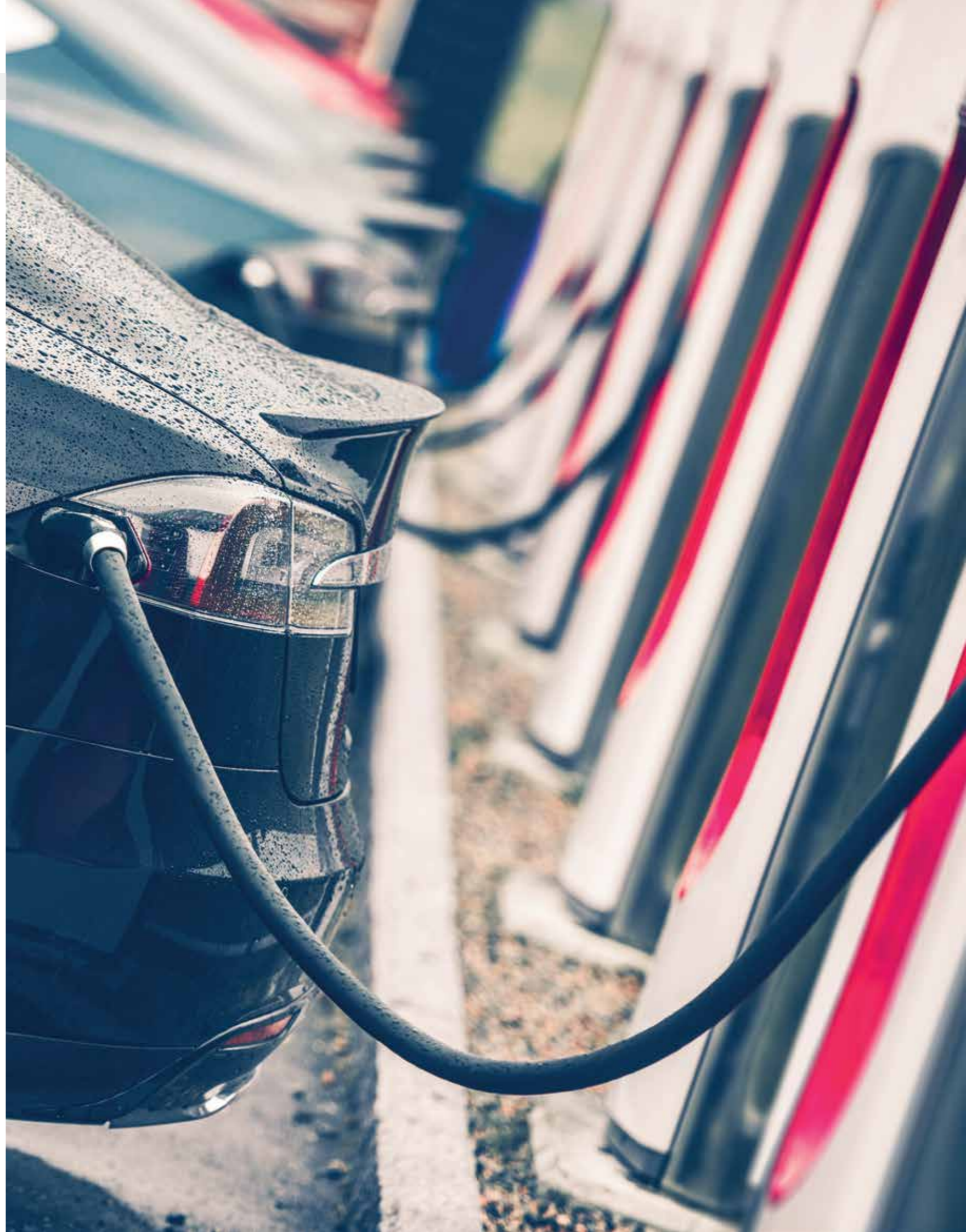
MADE-IN-CHINA CARS GO GLOBAL

Get ready for a Chinese electric-vehicle offensive

For years, Chinese startups unveiled concept vehicles at Western auto shows, but when it came to sales, the cars never made it into the export market. But get ready for that to change as China contemplates the creation of a global auto brand.

MICHELLE HILL

This article first appeared on BRINK on February 22, 2018, a version of it on Automotive News on February 12, 2018.



Chinese-branded electric vehicles (EVs) are slated to go on sale in the United States (US) in less than two years. In January 2018, Chinese automaker GAC Motor, a division of Guangzhou Automobile Group, unveiled an ambitious all-electric concept car – the En Verge – at the North American International Auto Show in Detroit, announcing that its autos would be entering the US market in 2019.

The same month, at the Consumer Electronics Show in Las Vegas, a two-year-old Chinese startup – with executives lured from Tesla, BMW, and Google, among others – wowed with the Byton, a slick electric car with a 49-inch screen dominating its dashboard. Future Mobility Corp., the maker of the Byton, is also aiming for a US debut in the near future as it ramps up its production.

WHAT DOES THIS MEAN FOR US AUTOMAKERS?

China is already the biggest electric vehicle producer in the world, and accounts for half of the EVs sold annually, with more than nine out of 10 of those produced by Chinese-owned manufacturers. While US car companies have been investing in the development of hybrids and EVs for years, they still lag their rivals and remain perhaps too fully committed to internal-combustion trucks and sport-utility vehicles. With China entering the market, their ability to assume leadership in EVs will become even more challenging.

Most Americans would be hard-pressed to name a Chinese automaker, but there are literally dozens of them. The sheer size of the Chinese market has helped its automakers dominate the fledgling EV technology, providing them scale early on in their production. Demand for EVs is rapidly expanding in China, where leaders have talked about outlawing the sale of internal-combustion engines within the next decade. (See Exhibit 1.)

And Chinese automakers have another advantage – an initiative called Made in China 2025 (MiC2025).

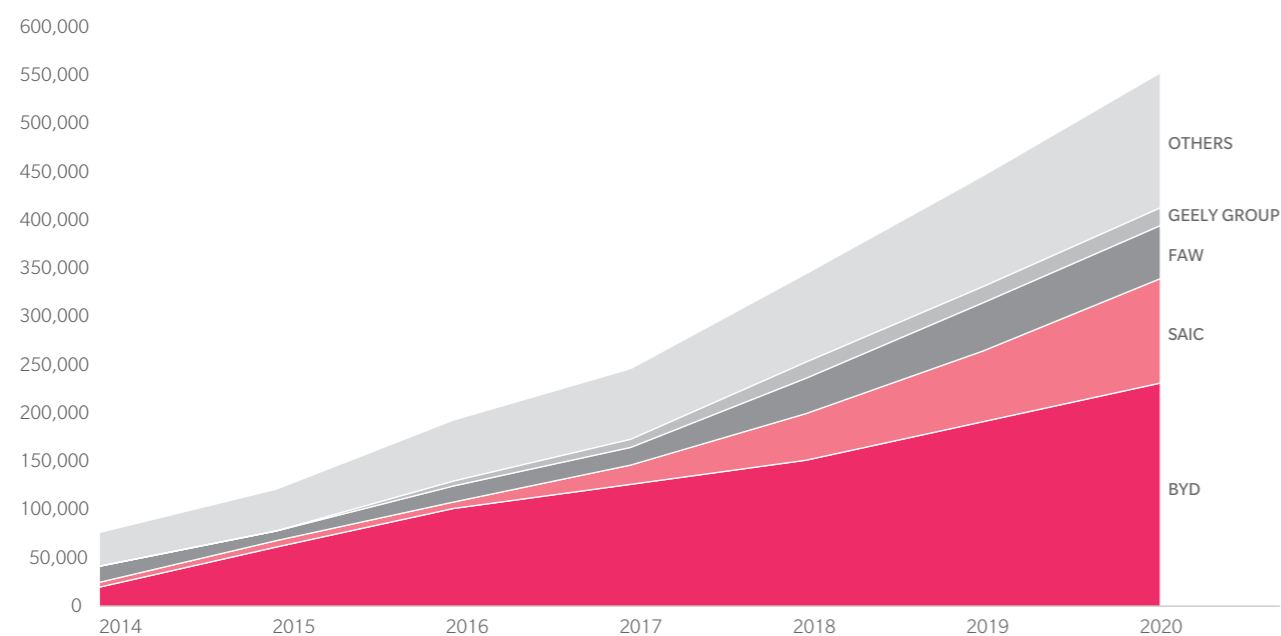
MADE IN CHINA 2025

MiC2025 is an aggressive economic development campaign, started by the government in 2015 to help domestic startups become global brands in a whole host of manufacturing marketplaces, including aerospace, robotics, rail equipment, biopharma, power generation, and – of course – electric vehicles. These are industries that were once considered too technologically sophisticated for the low-cost, mass production for which China became known over the past two decades.

That’s where the Made in China initiative comes into play. The program helps Chinese manufacturers and startups take on top-tier producers in the US, Europe, and Japan by tapping cheap capital, searching out mergers and acquisitions, and attracting foreign investment.

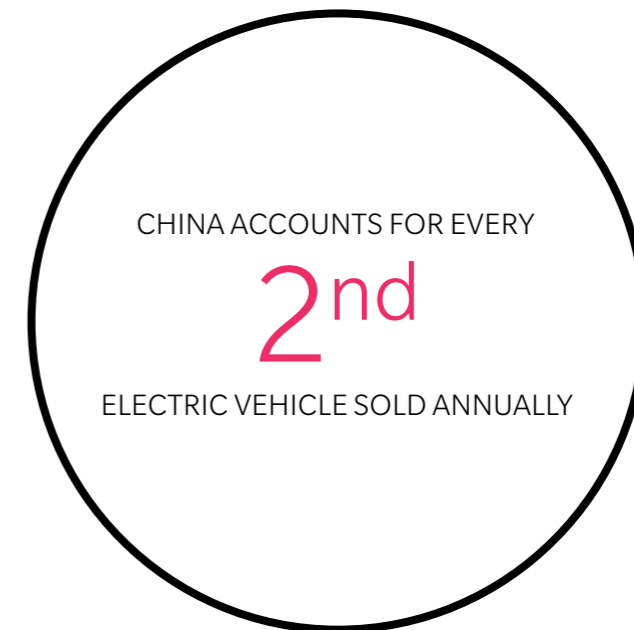
EXHIBIT 1: CHARGING AHEAD

China’s domestic automakers are forecast to boost light electric vehicles production by 2020^{1,2}



¹ Includes hybrids and fuel cell vehicles ² Includes Chinese-foreign joint ventures

Source: LMCA Q4/2015, Oliver Wyman analysis



THE SOLAR PLAYBOOK

The success China has had in the solar panel market may provide a clue to what could happen with electric cars. Beginning in 2007, China provided as much as \$18 billion in cheap capital to kick-start solar panel companies. By 2012, major European and US solar panel manufacturers began filing anti-dumping challenges to the burgeoning Chinese industry. By 2015, seven of the top 10 solar panel manufacturers in the world were Chinese.

Globally, the sale of electric vehicles surpassed the three-million mark last year – albeit less than 4 percent of the total automotive market worldwide. Still, researchers from Georgetown University and the International Monetary Fund have reckoned that, based on how quickly horses and buggies disappeared in the early 1900s, 90 percent of vehicles in the major car markets of the world could be electric by 2040.

Bloomberg New Energy Finance’s estimate of the EV market share in 2040 puts it at 54 percent of all new car sales. Even if US automakers do not believe the two-year timeline for China’s entry into the US market, the fact that their Chinese rivals are so dominant in sales of the technology of the future should give them pause.

THE JAPANESE MODEL

US government officials are accusing China of trade violations, noting that tariffs on Chinese vehicles coming into the US are one-tenth of what American automakers face when exporting cars to China. Of course, the lower tariff also helps US automakers who have opened production in China. In 2017, General Motors sold more than 40,000 of the Buick Envision, a small luxury SUV

that was made in China. After moving production from Mexico to China, Ford also said it would start selling a China-made Ford Focus in the US in 2019.

China’s push with EVs into global markets is reminiscent of Japan’s efforts to break into the US auto market with fuel-efficient compact cars in the 1960s and 1970s. The initial reaction of the Big Three was to assume Americans would never buy them because they liked big cars. Then, gasoline prices rose, and the Organization of the Petroleum Exporting Countries imposed an oil embargo. Detroit kept making big cars, and inevitably the US auto industry took a hit.

MOVING STRATEGICALLY

Today, US automakers are more prepared and have a deeper awareness when it comes to China and electric vehicles through their joint ventures with some of the largest Chinese car manufacturers. Even so, there should be no doubt that China is planning to be a leader in EVs in the US.

Strategic responses by US manufacturers could include moves like investing in a national network of charging stations to stimulate demand. They could also increase their promotion of electric vehicles – borrowing from their success with trucks and SUVs.

Bottom line: China can no longer be ignored as an automaker, particularly as electric vehicles gain popularity. While EVs are still a small percentage of cars on the road, they represent one of the fastest growing industry segments. US automakers must keep in mind how quickly technology catches on these days, and how easy it is to lose market share by not offering the right car at the right time. Moving too cautiously could be a perilous option. •



THE WORLD WANTS SMART MOBILITY

Survey says: Consumers would pay more and even switch modes of transportation to get seamless digital services

The future of efficient, seamless, and personalized transportation gets closer to reality each year. Right now, it is seen in apps that order rides or book travel with a click or smartphone alerts that tell passengers how long until the next subway arrives. It is the apps that show drivers where to find parking spaces.

JORIS D'INCÀ
PATRICK LORTIE
ANNE PRUVOT

This article first appeared in Forbes on August 28, 2018.

Not too many years from now, the same kind of centralized databases and platforms that make today's apps possible will give people access to driverless cars on demand and adjust the flow of city traffic, based on real-time data feeds. Commuters will be able to swap travel options on the fly, jumping from driverless ride-sharing to autonomous bus-train connections to avoid delay.

All this will be part of "smart mobility" – the future's digitally connected approach to today's travel problems. With smart mobility, digital platforms will be designed to manage the travel experience from end-to-end and allow consumers to plan, book, and pay for their trips through one outlet – even if several providers are required to complete the journey. Only a few clicks away, integrated travel services like route maps, real-time travel information, real-time seating choices, and advanced porter booking will be available.

THE REWARDS OF BEING SMART

Right now, businesses are rushing to develop smart-mobility platforms and services, including travel operators like airlines and rail companies, digital giants such as Google and Amazon, and savvy technology startups. The rewards of unlocking smart mobility could be vast: Innovative mobility services are projected to see a fivefold increase in their share of travel spending by 2040 and generate an estimated \$270 billion in revenue and up to \$150 billion in profit for providers.

But are consumers ready to embrace smart mobility? Oliver Wyman conducted a survey of 7,500 consumers across Germany, France, Italy, China, and the United States, and it turns out the majority are ready to change their preferred mode of transportation and pay more to get access to these kinds of services. (See Exhibit 1.)

The percentages of consumers who consider smart mobility important are overwhelming: In China, a stunning 98 percent of those surveyed ranked it as important or very important; in Europe, 93 percent; and in the United States, 83 percent. Among respondents 18 to 35 years old whose principal transportation is a private car, 97 percent said they would consider switching to public transportation to gain access to smart-mobility services. Even among those 65 and older, 76 percent said they would consider a change. For those who use public transportation, similar percentages would move to automobiles for smart-mobility advantages.

CONSUMERS READY TO SPEND MORE

The survey also found that 84 percent of respondents said they would shell out an additional fee to use integrated smart-mobility solutions. That includes 89 percent of millennials and Generation Z travelers and 75 percent of senior travelers.

Among commuters, many said they were willing to add a flat fee on top of their current transit bill each month for a bundle of smart-mobility services, similar to the way they opt to add premium channels to monthly cable charges. On average, commuters said they would pay 4.1 percent above their monthly commuting cost for multimodal, door-to-door journey planning and 2.9 percent more for real-time travel information and rerouting to avoid delays.

People also are willing to pay more for long-distance travel that involves smart-mobility services. Long distance, in this case, is defined as a trip of more than 100 kilometers. With these trips, consumers indicated they would pay on average 3.3 percent more, and as much as 5.8 percent more, for multimodal, door-to-door journey planning, and 2.4 percent more on average for real-time information and rerouting.

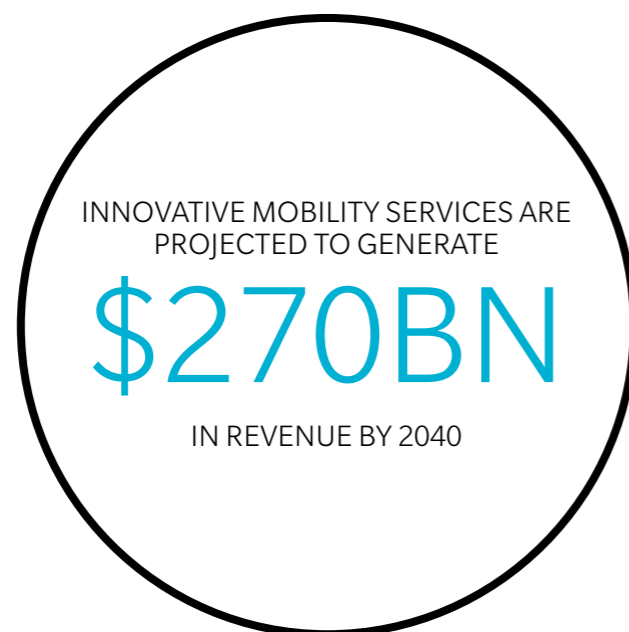
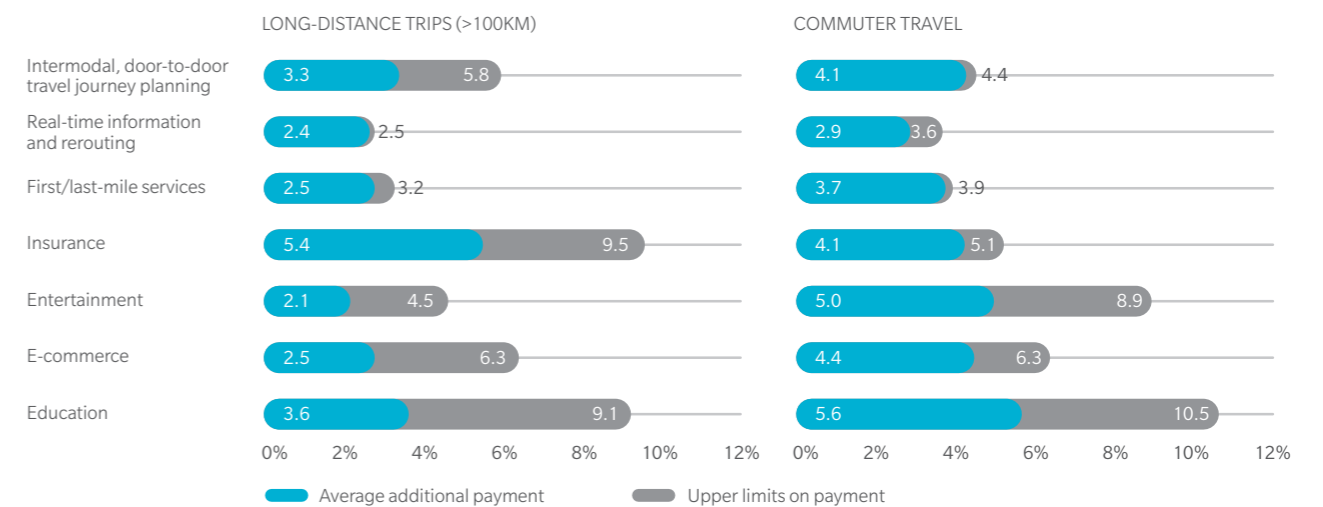


EXHIBIT 1: CONSUMERS ARE WILLING TO PAY EXTRA FOR SERVICES

Percentage above basic ticket price for long distance travel and monthly commuting



Source: Oliver Wyman Mobility 2040: Smart Mobility survey

SEAMLESS CONNECTIONS

An example of a personalized, flexible, end-to-end travel service consumers say they want is the digitally connected multimodal hub that allows passengers to seamlessly transfer from one mode of transport to another. This could be created at a train station or airport where, using an app, a traveler can arrange a ride-share home but quickly switch to a subway if real-time data shows traffic delays. Another example would be the smart sensors and analytical tools that can help a city ease traffic congestion.

Beyond travel services, smart mobility includes activities that can keep passengers occupied during a trip – browsing shopping sites, taking online courses, and enjoying movies or music, for example – as well as those that offer options for the end of the trip, such as sightseeing or dining. It also can tie in related services, such as purchasing theft, casualty, and travel insurance. Like travel services, these would be provided via a digital platform that completes transactions with a click or two.

Here again, survey respondents showed considerable interest in improved access, with the addition of insurance services being the most popular. On average, respondents said that for long-distance trips, they would spend 5.4 percent more for the opportunity to buy travel, theft, and casualty coverage as part of the end-to-end journey and 2.5 percent more to access e-commerce sites. Daily commuters said they would pay an additional 5 percent for entertainment and 5.6 percent for educational offerings.

GETTING THERE FIRST

As autonomous and artificial intelligence technologies are increasingly incorporated into the daily lives of travelers, the

race is on among travel operators, digital giants, and innovative startups to establish the first foothold and gain the advantage in smart mobility. The challenge will be to see which will develop more dynamic, personalized offerings and seize a competitive edge by controlling smart-mobility portals that seamlessly connect transportation options.

No doubt, access to personal data and the ability to analyze it are necessary elements for building customized smart-mobility options. Despite recent breaches and tighter regulation on data, consumers still show a willingness to share personal information for a quid pro quo: More than half of the consumers surveyed in the five countries – and 80 percent in China alone – said they would give providers their personal data and travel preferences in return for services.

Currently, travel providers hold a slight edge with consumers, according to our survey. But smart mobility is a fast-moving target, with some data-savvy digital giants already entering parts of the market and successfully dominating many of the services not exclusively linked to travel. To stay ahead, travel operators may opt to partner with digital giants and startups to access the data and technical expertise needed to power the next round of travel innovation. Meanwhile, agile smart-mobility startups attracted \$40 billion in investments from 2011 to 2016, with the funding roughly doubling year over year.

To be sure, not even smart mobility will eliminate urban congestion and all travel delays. But a transformation in travel is inevitable. The challenge for travelers and travel providers alike will be keeping up with the ever-shifting landscape of transportation and technology options reshaping long distance and local travel. •



INJECTING DIGITAL INTO AUTOMAKERS' ORGANIZATIONS

IT to spread beyond products and back office

Cars are now crammed with sensors and electronic devices. Some of these digital additions improve performance on traditional tasks, making engines and brakes more efficient and safe. Other tools, such as autonomous driving systems, are fundamentally transforming the way cars are used. The next digital revolution, however, will fundamentally change how automakers use IT in every aspect of the organization. The use of robotics in production is the most obvious step, but still-greater benefits will come from employing digital technology in white-collar areas such as customer interaction and product design. These functions are ripe for transformation by cloud computing, machine learning, and data analytics.

KAI BENDER
FLORIAN DETER
SASCHA COCCORULLO



Digital transformation is a huge task. One complication is automakers' legacy systems: While these old systems are adequate for traditional back-office work, a companywide IT transformation could result in a disruption to the normal workflow. Moreover, digital tends to operate best on nimble, daily decisions and frequent releases and updates to technology. These decisions reflect continuous changes with regard to competitors and markets. Wide-ranging change may be outdated by the time it is completed.

Automakers will have to decouple their front- and back-end systems to allow for digital implementation at different speeds. Different areas should be freed up to develop new systems and agile processes. Alliances with digital startups will be necessary, as will new types of staff.

Here are four ways in which IT can transform automakers' businesses: (See Exhibit 1.)

DIGITAL CUSTOMER RELATIONS

Smart use of IT in customer interactions could radically cut marketing costs and yield new ways to retain customers and new opportunities to offer them services. Traditionally, automakers have spent heavily on everything from advertisements to test rides, with mixed results. Digital marketing can be more precisely targeted. At the most basic level, a Google search may prompt an ad for an automaker's financing arm. Alternatively, a carmaker may send tailored, follow-up proposals to people who have been using a configurator.

But a detailed knowledge of customers can take digital marketing further. A vast amount of customer data enters the wider auto industry, making a kind of golden customer record theoretically possible. An automaker could run advanced analytics on the data and come up with recommendations for products and services.

No major automaker has fully succeeded in doing this yet. Most sales go through dealer networks, which are separate organizations. Dealers lack full access to all the data that would be of use to them, preventing them from playing a greater role. For instance, a potential customer might first configure a model online before visiting a dealer, but the dealer typically has no way of knowing this. Automakers have direct contact with customers through their financial services departments, but these often outsource their data management, and so the data is hard to obtain. As a result, neither automakers nor dealers know all that much about their customers and so they cannot effectively predict what products or services to offer and when.

A first step towards getting hold of more data is to keep in better touch with the customer: remind them to have regular inspections and engage them on social media. Automakers should also involve dealers and financing arms to develop a centralized "golden" record of customer interactions. This can be implemented by creating a multichannel digital customer experience, involving online and offline touch points. Link website front ends, such as configuration and financing pages, to connect online and offline worlds. In this way, a dealer will have automatic access to the car models and features a customer has been considering.

Effective data management could be the trigger for digital marketing to take off in the auto industry. And the payoff could be huge: Currently, it costs more than 3,000 euros on average to get a customer to buy a new car. We think digital marketing will reduce this to 1,000 euros.

TIME TO MARKET

Upgrading an infotainment or navigation system typically takes more than six months from conception to launch, limiting the number of updates to two per year. That is no longer good enough: Drivers are smartphone users, and are conditioned to

expecting frequent software updates to fix glitches and improve performance. Automakers need to develop a structure that promotes agile development so they can get new products to market faster.

Ceaseless experimentation will allow innovations to be turned rapidly into pilots and to be improved through iterative, incremental processes. Participants from multiple functions should be encouraged to work with agile development methods and speed feedback cycles: Continuous integration of different components will mean testing can be done on a daily basis.

By building and maintaining the right organizational ecosystem, automakers could reduce the digital product release cycle sharply: Small-scale improvements could be done in under a week, incremental changes within a day or even faster.

SCALABLE EFFICIENCY

IT should bring about scalable efficiency, where the scale of operations can be increased at little cost. Advanced data analytics can lead to streamlined decision making, while automation holds great promise for processing tasks. As a result, staffing could be trimmed. Automakers typically spend more than 40 euros "cost to serve" for each online service interaction with a client. They should be able to reduce this to fewer than 12 euros – something other industries have achieved.

The auto industry is constrained by its costly legacy IT systems, which are needed to run current operations yet leave little budget to invest in new IT infrastructure. Typically, the ratio of spending on running IT to that of changing IT is around 80 to 20. We think automakers should push this to more like 40 to 60, shifting the IT budget away from running current systems towards investment in new solutions and applications.

A separate, greenfield IT platform is one way to let new IT capabilities evolve without the constraints of the legacy system. It would feature a simpler decision-making process, with less consultation and sign-off and more room for experimentation and failure. Cloud and server-less systems would reduce costs, allow access to the latest technology, and free up resources for implementing change. The new digital tools – such as customer services – will run on this greenfield platform from the start. Additional functionalities from the legacy applications will be developed incrementally in the new platform or transferred when it is ready to take them over.

THE SKILLS TO DO ALL THIS

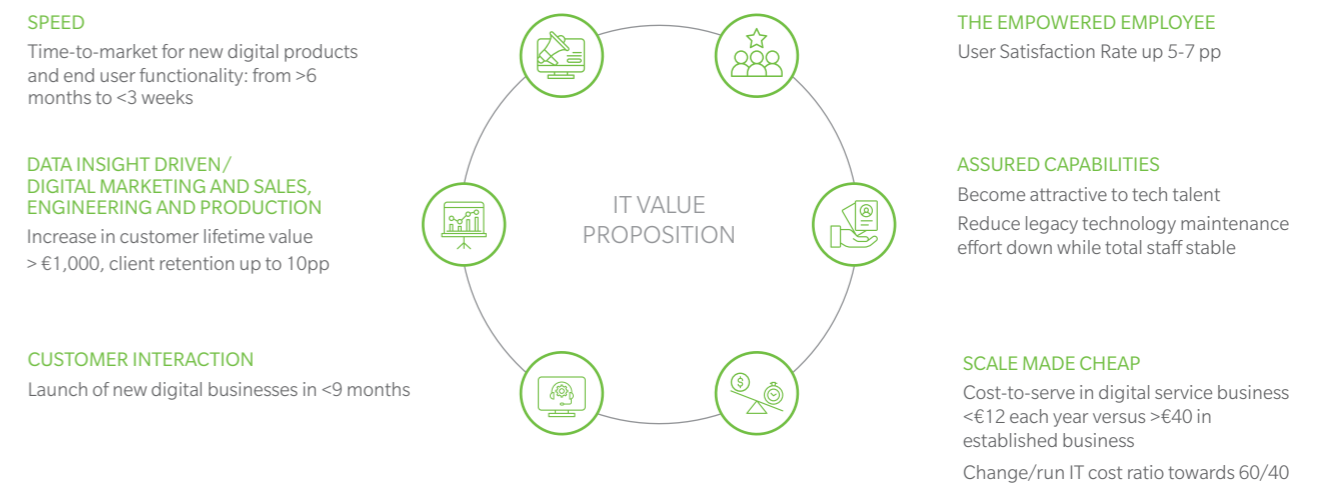
Making these changes will reduce workforce needs, particularly in data processing. At the same time, new expertise in data analytics and digital project management will be needed to execute the digital transformation. Automakers will also need to change their organizations to work in new, more-agile ways, which place a premium on relationship building and problem solving.

To cope with this shift, traditional workforce planning should be replaced by a more dynamic approach. Automakers will need a talent ecosystem to provide access to the new skillsets from multiple talent pools.

This will be a challenge, particularly as digital talent tends not to be less attracted to traditional manufacturing. New models for IT careers and talent development in manufacturing will be needed, as will a new learning culture. Digital talent needs to be persuaded that the work will focus on attractive, next-generation products and applications – developed in agile, cross-functional teams – and not just back-office systems. •

EXHIBIT 1: HOW IT CAN TRANSFORM AUTOMAKERS' BUSINESS

An IT strategy needs to create tangible value in at least six dimensions



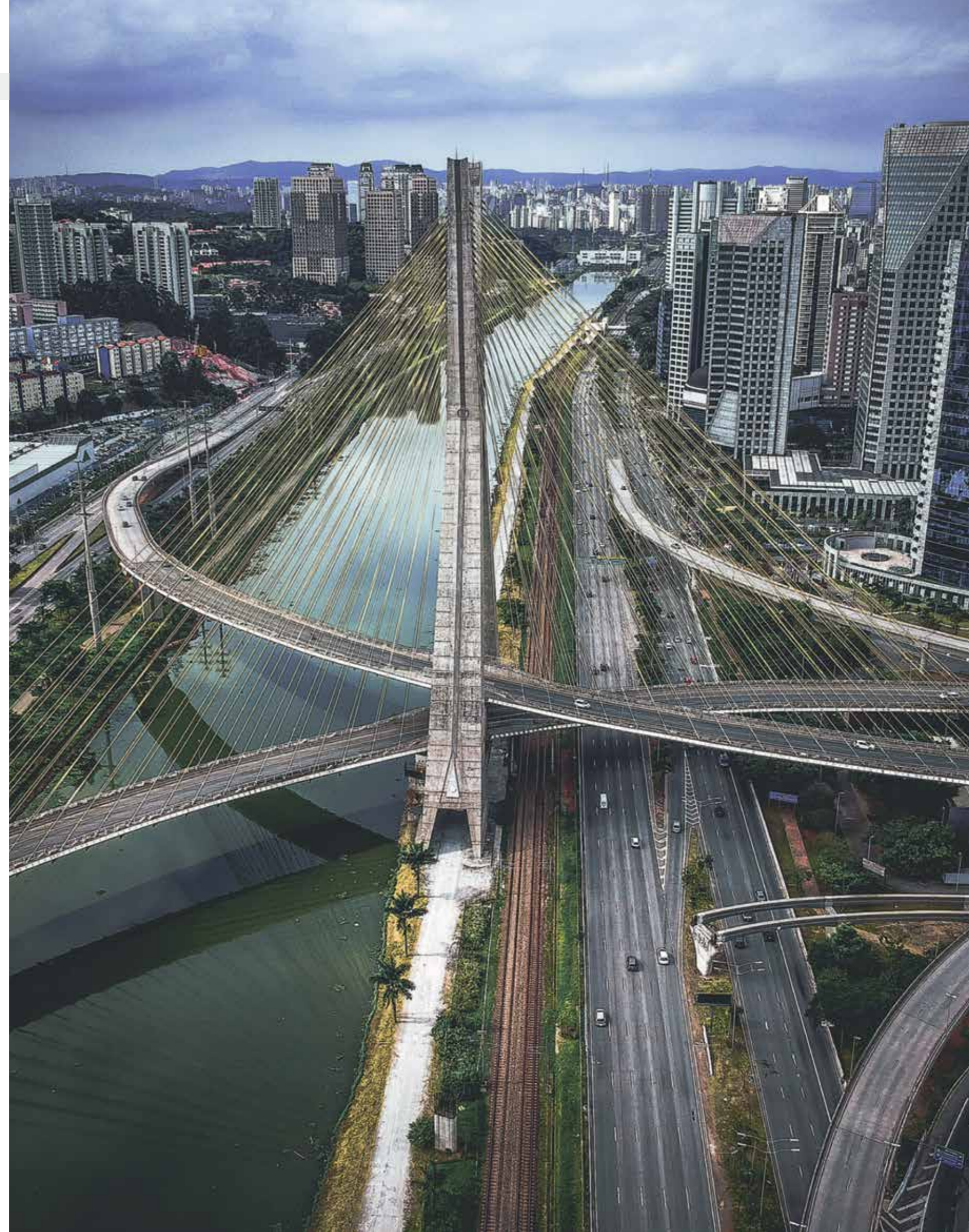
Source: Oliver Wyman analysis

BUILDING THE AUTOMOTIVE WORKFORCE FOR THE FUTURE

Tomorrow's workforce will be lean
and digitally adept

Automakers are investing heavily to bring their professional and managerial staffs up to digital speed. According to Reuters, in 2017, Audi pledged half a billion euros over several years to retrain workers for digital and hire professionals fluent in robotics and app development. Likewise, CNN reported General Motors' intention to hire 1,100 new employees for its self-driving car R&D startup in San Francisco.

ROMED KELP
AXEL MILLER
BO KAUNITZ



Where previous tech transformations in the auto industry were companywide (such as installing personal computers) or focused on improving front-line operations, the digital revolution is pushing automakers to up their game. Instead of simply replacing line workers with robots, companies need to upgrade their existing workforces to perform new digital tasks.

Product disruptions such as autonomous driving and mobility services only represent the outward manifestations of change. Underneath the surface are the innovations that will power the industry going forward: big data, advanced analytics, artificial intelligence (AI), automated back-office processes, and service robots. To succeed, automakers need to pursue a scarce supply of high-tech workers and replace and/or retrain current staff.

THE AUTOMOTIVE WORKFORCE WILL SHIFT IN SIZE, SHAPE, AND REQUIRED SKILLS

In each of the past three decades, automakers captured 20 percent productivity improvements on average, mainly due to automation, outsourcing, and standardization. In the next five to 10 years, automation and outsourcing of white-collar jobs could drive even greater gains. Expressed in terms of full-time employees (FTEs), this change could equal a reduction in an automaker's workforce of up to 30 percent in selected functions and cause a significant recalibration in the type of tasks the workers will perform. (See Exhibit 1.)

In this context, automation and machine learning will affect white-collar processing tasks the most. With regards to functionality, digitization could affect vehicle financing in contract origination and management processes; and in purchasing, companies may be able to use web crawlers to increase efficiency and machine learning to plot category strategies.

Different white-collar functions will have their own specific staffing challenges. For example, functions like R&D, aftersales, financing, and sales and marketing need to maintain important elements of their traditional core competencies while integrating more digitally fluent workers. By contrast, in purchasing, buyers will greatly benefit from an automation-driven reduction in administrative work, freeing them to work with suppliers to reduce product costs, manage complexity, and improve reliability. While cuts in headcount in this area will be significant, the need to replace current staff with digital experts should be less extensive (although some retraining may be needed). The same should hold true for production, which has the largest pool of workers combined with few reskilling needs.

Beyond the needs of the various functions, automakers will need better analytics skills companywide. For instance, advanced analytics will play a bigger role in understanding customer behaviors and developing market-winning offerings. Better communications, made possible by seamless online data exchanges and video-call systems, will enhance collaboration and co-creation activities between automakers and suppliers. This approach will also help automakers compensate for those skills they lack in-house. Consequently, companies must decide how best to manage this shift: which workers can be retrained, which ones need to be brought in from outside, and which laborers can be replaced through outsourcing. This last option differs from the industry's current outsourcing approach: finding tomorrow's specific competences (such as data scientists) may be more difficult and could carry additional risk. Success may require automakers to develop "digital talent ecosystems" that include both internal and external resources.

Given the scale of the reduction and the necessity of new, digitally fluent staff in many departments, automakers should update their workforce planning and recruitment processes to

be more dynamic and agile. Planning horizons should shift from simply filling empty jobs and slashing unneeded positions, to developing flexible strategies for renewal and enhancement as needed. Instead of concentrating on existing career structures and pay grades, HR managers should identify recruitment priorities for the future, finding the right people with the right skill sets, whether a job currently exists for them or not.

FOUR STEPS TO A DIGITALLY SAVVY ENTERPRISE

Automakers should begin preparing now for the digital talent ecosystem, following a four-phase workforce for the future framework. (See Exhibit 2.)

Set the vision and prepare for change. Automakers need to determine the changes affecting their workforces and what those changes mean. A solid starting point involves identifying the impact of different trends on the workforce – not just digital trends but demographic, organizational, and environmental ones, too. Companies should evaluate several workforce scenarios via research on their peers and their industry's disruptors. They should then review the impact of identified trends, qualitatively and quantitatively assessing the changes across the value chain. The next steps involve building alignment within the leadership team regarding their future workforce and determining the organization's readiness.

Map the current workforce and forecast future needs. Company leaders need to define the future workforce's profile. That entails mapping the size, shape, and skill sets of today's workforce, using a standardized approach with company specific adaptations, to gain a clear picture.

Determine and design workforce strategies. While great aspirations stir people to quick action, automotive players need to understand the road ahead concretely. To start with, they should design workforce strategies for optimizing relevant talent pools, identifying the best ways to engage them while developing compelling employee "brand" and value propositions. Then, use technology to gain seamless access to relevant talent pools, expanding the availability of critical skill sets and enabling a more flexible organization. For example, to maintain a strong pool of freelance talent, Bosch established an internal database that collects the skills and knowledge of former employees as possible resources for future projects.

In a next step, automakers should build an integrated transformation plan to bring together new workforce strategies and the associated organizational changes. Succeeding here will require strong stakeholder buy-in.

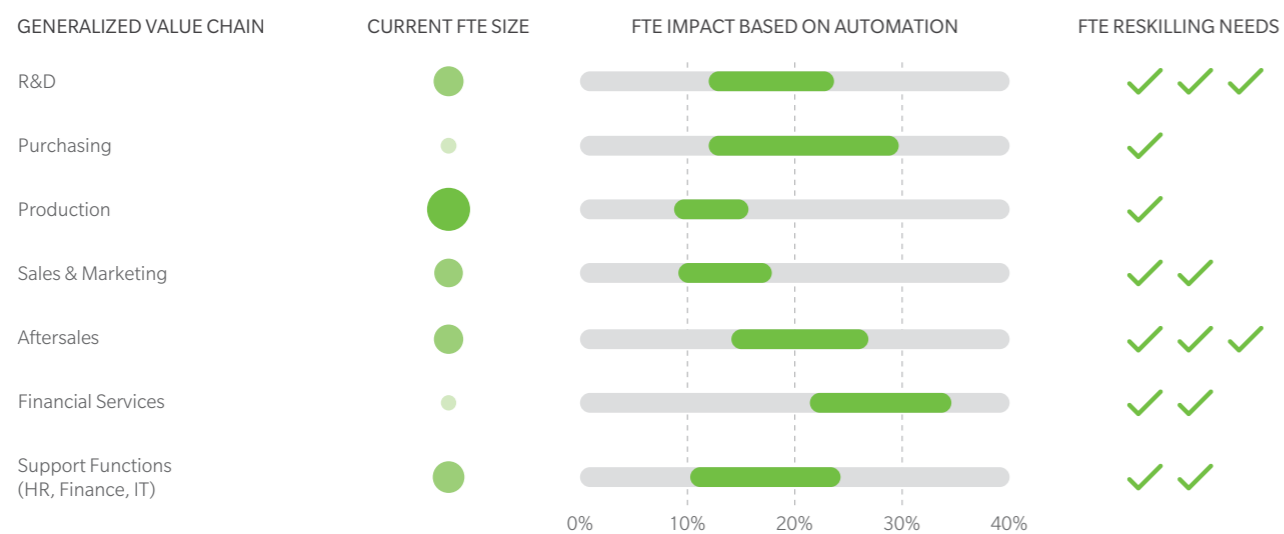
Deliver the transformation. Driving transformation is the goal, and this requires a company's personnel to get behind it. But that will only happen if company leaders themselves buy in to the change. A transformation management office will play a substantial role in implementing the roadmap; however, automakers will need good communication strategies that target affected employee groups and offer training on new technology platforms.

LEARNING THE DIGITAL ROPES

Automotive players must get ready to fire up their engines if they want to gain a competitive edge. By starting today, automakers can get a jump on the competition in mastering – and benefiting – from the disruptive digital forces ahead.

EXHIBIT 1: WORKFORCE REDUCTIONS DRIVEN BY AUTOMATION

Activity-based analysis specific to the organization's distribution of employees across the value chain is required for specific projections



Source: Oliver Wyman analysis

EXHIBIT 2: FOUR-PHASE WORKFORCE FOR THE FUTURE FRAMEWORK

A dynamic framework for defining and delivering the workforce for the future



Source: Oliver Wyman analysis



BLUE-COLLAR TURNS WHITE-COLLAR

Automakers and other manufacturers may need to offer traditional white-collar perks if they want to attract and retain assembly-line workers

Manufacturing executives in the United States and other developed economies – whether involved in the production of automobiles, aircraft, trucks, or combines – agree: The single biggest threat to their operations over the next decade is a shortage of labor. The reason behind the gap relates to demographics; an oversized generation – baby boomers – is starting to retire, and not enough of the next three generations are interested in taking their place.

MICHELLE HILL
JOE BERISH

This article first appeared in Forbes on July 10, 2018.

Most people think this deficit is concentrated in skilled labor categories, and there is no doubt that finding candidates with the right training for certain jobs is part of the problem. But the shortfall is affecting many employment categories – skilled and unskilled labor. Rather than a skills gap, the manufacturing world is facing a numbers gap – literally there are not enough eligible candidates applying for most job openings.

This means any solution aimed at shrinking the gap must go beyond offers of more training and focus on retention as much as recruiting. Companies must figuratively begin to build a “moat” around the current workforce, making it difficult for other employers to lure workers away with more attractive compensation offers. Retention is just as important as recruitment, given the cost of hiring and training a new worker, which can run anywhere from \$500 to \$5,000 per worker – a number which does not include the negative impact to quality and efficiency from the incorporation of new workers who are less familiar with the product and processes.

is fierce. Rivals include growing sectors, such as technology and healthcare, that are currently less prone to layoffs than manufacturing has been. Job security may not be something manufacturers can promise, so they need to be more creative.

Automakers and other manufacturers are also battling a rising rate of absenteeism, with some plants reaching as high as 20 percent. (See Exhibit 1.) That means that employers must look for candidates willing to both accept jobs and show up every day. Add to all that, the reality of a record-low 3.8 percent unemployment rate, and manufacturers can begin to appreciate the daunting nature of their challenge.

So where to begin? Automakers and other manufacturers can look to some of the same strategies their engineers and marketing and sales departments use to design and sell products: Find pain points and design products that help prospective customers fix them.



COMPETITION FOR WORKERS

A necessary step in making manufacturing jobs more attractive and building that protective barrier around your workforce is recognizing that the competition for dependable employees

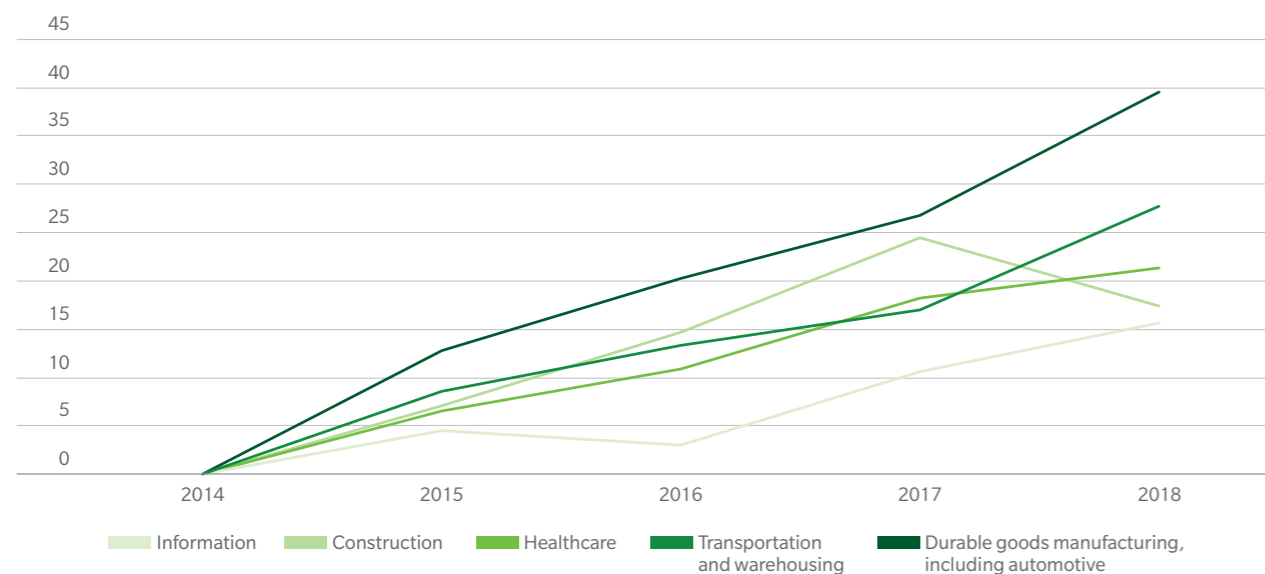
DESIGN-THINKING IN HR

Human capital departments should consider this same kind of design-thinking approach, which involves creating different personas – in this case, of their workers – and mapping their journeys. Employers can set themselves apart from rivals by

EXHIBIT 1: WHY THE AUTOMOTIVE INDUSTRY HAS TO KEEP LOOKING FOR NEW WORKERS

The rate of employee turnover in durable goods, including autos, significantly outpaces other industries

CHANGE IN EMPLOYEE TURNOVER BY INDUSTRY SINCE 2014 [%]



Source: U.S. Bureau of Labor Statistics, Oliver Wyman analysis

mapping these journeys beyond the walls of factories and into their employees’ homes, providing ways to reduce both the complications and stress in their lives.

To do this effectively, human capital must recognize what drives employees when looking for, accepting, and changing jobs. There are basic minimums – the “must haves” – which include competitive wages and benefits. But there are other factors that involve lifestyle and convenience, and building that moat starts with taking a more empathetic approach to workers on the assembly line who sometimes feel like they are treated like the robots they fear will replace them one day.

Offering perks and services is something we see more often with the treatment of professionals, but today it is a strategy widely used by tech companies to entice prospective employees and then build a moat around them. In addition to a paycheck and benefits, tech companies acknowledge that employees value flexibility in scheduling; being offered healthy, free or inexpensive meals so they do not have to leave the work site; and free or discounted transportation solutions to commuting headaches. These kinds of perks make leaving companies harder because it means those pains would return in the next job.

WHITE-COLLAR PERKS

The result of this exercise is a more individualized understanding of the workforce and what they go through each day. For example, maybe the most stressful part of the day is leaving work, picking up children and trying to cobble something together for dinner. If the factory offered pre-portioned meal kits to pick up on the way out the door, they just helped the employee’s life be a little easier and, perhaps, healthier. “How can I live without this?”, an employee may think if approached by another company to change jobs.

But family responsibilities also bring with it other headaches. Consider on-site emergency daycare or urgent care to help employees handle problems without missing a full day of work. One audacious solution could be to issue smartphones for everyone as a method to roll out company policy, handle absenteeism, scan quick-response QR codes for training modules, share rides to the plant, and learn about daily work schedules or corporate announcements. It may seem extravagant, but for workers who do not normally get such perks it may be a deal-clincher.

These solutions no doubt come with a price tag – and one some manufacturers may think short-term is not worth it, hoping the problem will go away. But they need to remember – the status-quo is not a cost-free option either. •

THREE DIGITAL UPHEAVALS

BY JUERGEN REINER AND KEVIN REBBEREH

An industry that has long avoided a major revolution is now being rattled by digital technologies. Automotive manufacturers have thrived for decades by producing a succession of new versions of their cars, each one better than the last. But the new technologies will require different strategies, ranging from alliances with digital innovators to new approaches to the role of cars in consumers' lives. We take a look at three areas where digital advances could mean radical change.



BLOCKCHAIN CAN INCREASE TRUST – AND VALUE

TRANSPARENCY IS KEY TO NEW BUSINESS OPPORTUNITIES

A car is, after a home, the biggest purchase many people make – and maintaining it adds significant additional cost throughout the vehicle's lifetime.

Given the high financial impact, trust-based relationships are important. However, car ownership is fraught with uncertainties. Widespread odometer tampering undermines trust in the second-hand market. Car servicing is often an opaque process, with the diagnosis of problems being made by the very people who will offer costly fixes. The growth of digital services has led to an increasing number of transactions and exchanges of personal data, which are hard to keep track of.

Blockchain technology could reduce many of these anxieties. It can record changes to an asset – such as ownership or alterations in status – in multiple locations, so that they cannot be altered without permission but can be consulted by authorized parties. That means it provides an immutable record that all parties trust.

For a car, the record can include ownership, as well as driving, accident, and maintenance history. To prevent odometer tampering, mileage and GPS data could be continuously registered in a vehicle's digital logbook. A potential buyer could then easily verify the state of the vehicle: its service history and how far – and smoothly – it has been driven.

Blockchain technology has further potential benefits throughout a car's lifecycle. Taking a car for maintenance, the owner would know more about the state of the car and so be better able to assess the kind of work being proposed. An automaker could buy back and resell its cars in the second-hand market with all parties aware of a vehicle's condition through transparent records.

Blockchain could also provide automakers with more information on drivers while still complying with increasingly strict privacy laws. They will then be better able to anticipate customers' needs, keeping contact with them long after purchase. For example, a customer's driving patterns can indicate when they will be open to a proposal to buy a new car, as well as the most appropriate model – perhaps an electric vehicle for someone that makes short, frequent journeys. And if an automaker can access a customer's blockchain financial records, it will also be able to tailor corresponding financing plans for the new purchase.

As the range of connected vehicle and transport services mushrooms over the coming years, so too will the need to track these, the opportunities to add new revenue streams – and the demand for blockchain solutions. •

STRATEGIES NEEDED FOR THE AUTONOMOUS ERA

NEW TECH THREATENS AUTOMAKERS' TRADITIONAL MODEL

To see why different industries in the transportation world might have contrasting feelings about autonomous driving, consider the business potential.

For a mobility provider or logistics company, autonomous driving could knock out the cost of human drivers – some 65,000 euros to 90,000 euros a year each in Western Europe. This could yield substantial profitability gains within service businesses that have limited options for diversification.

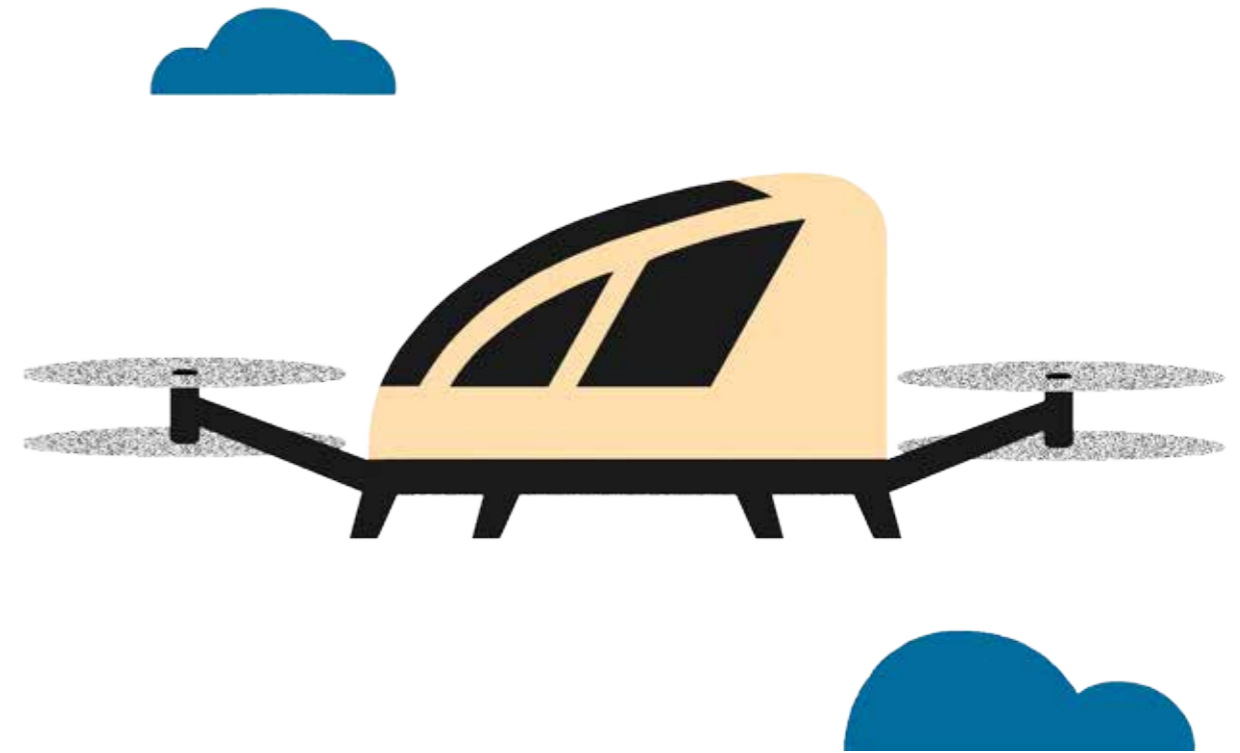
For a manufacturer of private cars, there's no such upside. However, fitting the systems will be costly: around 8,000 euros to 10,000 euros at present. And it will be impossible to pass this price increase on to customers, resulting in a substantial net negative for business. Moreover, any accidents are more likely to be blamed on the manufacturer rather than the driver, so automakers could face an added risk to their reputations.

Autonomous vehicles are the future, however. Automakers should therefore broaden their outlook, anticipating shifts in consumer spending so that they can provide what is demanded. Robot-guided cars could turn up at someone's door when needed, so consumers might spend their money on mobility rather than on vehicles. In addition, car use will increasingly

be combined with other modes of transport, such as trains and bicycles, which will also shift spending away from automakers' core business.

To participate in this widening mobility market, car manufacturers need to build up diverse networks of partnerships. These should include software specialists that can improve cars' autonomous capabilities, suppliers of cloud-based digital infrastructure, and providers of new mobility services such as car-sharing and driverless taxis. The new services will make it all the more important to optimize the utilization of transport networks – and by participating, automakers will continue to benefit as mobility evolves.

These partnerships will distribute risk and reduce costs, while letting an automaker remain flexible so that it can respond to changes in mobility needs. Boundaries with direct competitors should fall – especially in traditional hardware, where currently only half the innovations lead to a differentiation in brand perception, a proportion that is expected to shrink even further. In the future, software will represent an increasing share of a car's value, but here brand differentiation exists only in limited cases when affecting the customer interface. Car manufacturers must act wisely and fast – and be prepared to do so continuously. •



DRONES AND THE AUTOMOTIVE FUTURE

WHAT IF FLYING CARS TURN OUT TO BE DRONES ON WHEELS?

The dream of cars that can fly – above traffic jams, over water, and off the road network – has long been a staple of science fiction and driver fantasy. But before automakers get their acts together, technology companies have already started making drones that have a lot in common with flying cars. Alphabet is testing package-delivery drones, and its “Project Wing” team is developing a tracking and control system to enable thousands of drones to operate safely at the same time. Other drones aim to carry people, such as German-based Volocopter’s driverless hover-taxi, which made its first concept flight in Dubai in September 2017. Uber, too, is working on air taxis.

To be sure, these are not cars, and in many aspects, such as energy efficiency and practicability, are inferior to cars. But a sign of the crossover potential comes from MIT’s Computer Service and Artificial Intelligence Laboratory, which is building an autonomous drone that can both fly and run on wheels. On the ground, it will use less power than when flying and save its batteries – but it will have the option of taking off to avoid traffic jams.

Among automakers, Daimler is experimenting with vans as rolling distribution hubs for aerial delivery drones. And Ford has an idea for an electric, self-driving delivery van that launches

drones to access hard-to-reach places. However, aviation efforts are still rare from the auto industry, which is mature and traditionally operates through incremental improvements.

Non-automotive innovators could benefit from early-mover advantage as they experiment with new possibilities. Drones could soon transport critical supplies, such as blood and medicines, to outlying areas. Other applications might include firefighting, rescue missions, and surveillance systems.

Drone makers could also get a boost from new technologies developed for the road. The regulation and public acceptance of autonomous vehicles might foster drone penetration. Ride-hailing apps could help get around the bottleneck of limited battery capacity: A passenger or parcel could keep moving by using up one drone’s battery and then swapping to another drone that had been recharged.

In reality, delivery drones and flying taxis may not operate in major cities anytime soon. But their use for special purposes will disrupt our concepts of vehicles and of how transport can function. If automakers do not want to be left behind, they need to start developing these new possibilities, rather than watching as others take the lead. •

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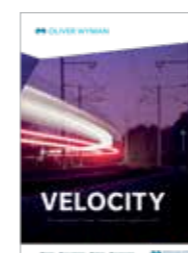
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