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McKinsey China Auto CEO Quarterly

Winning the race: China's auto market shifts gears

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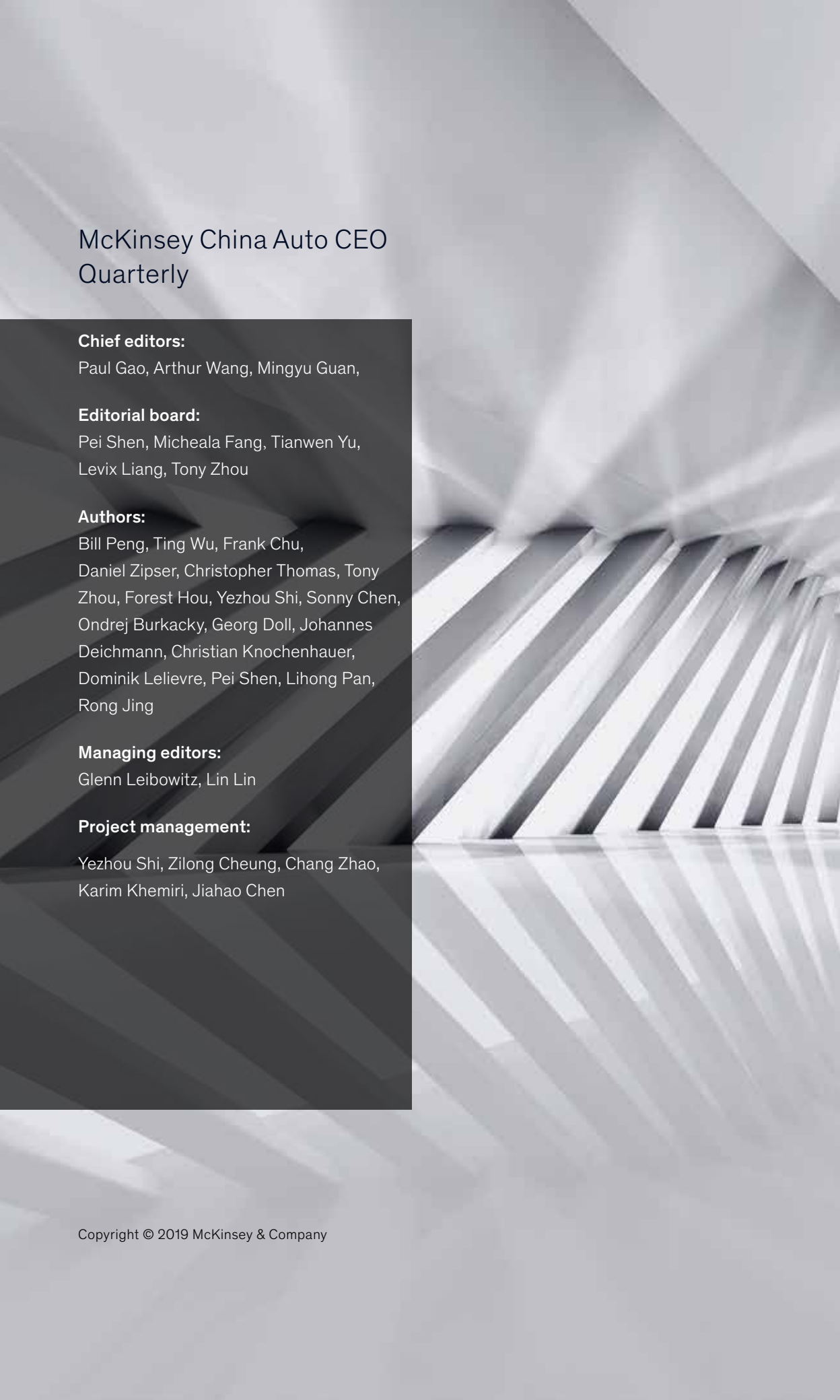

McKinsey China Auto CEO Quarterly

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Winning the race: China's auto market shifts gears

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Preface

Winning the race: China's auto market shifts gears

Paul Gao, Arthur Wang, Mingyu Guan, Bill Peng, Ting Wu, and Frank Chu

Over the last decade, China's automotive industry has been in overdrive, growing at an average 15 percent each year, and accounting for 70 percent of global growth during this period. By 2012, China surpassed the US as the world's largest auto market.

By 2018, however, China's cooling economy put the brakes on the auto market, pushing sales growth into negative territory, a trend that persisted through 2019. As China's auto market enters an entirely new phase of its development—which we call the "2.0 era" —automakers are faced with a host of new challenges as well opportunities.

In this article, we highlight the five main characteristics that define this new era, and pose a series of questions automakers must answer if they hope to thrive in a time of slower growth.

1. Competition is spurring consolidation

Many weaker players shielded by the sustained and rapid growth of the past decades simply won't survive the ongoing downturn. Already, the performance of automotive companies in China has splintered. In the last two years, a large profitability gap has opened between the leading players and their low-end rivals. Consider the case of a joint venture, which just two years ago enjoyed annual sales of one million units. In the first half of this year, it sold fewer than 100,000 cars. Over the next few years, brands like these are likely to exit the Chinese market if they do nothing to arrest their decline. Strong branding will be crucial. McKinsey research shows that Chinese consumers' automobile brand loyalty, measured by their willingness to buy their existing brand of car again,

increased from 12 percent two years ago to 31 percent this year. Companies selling cars in the mid-price range (100,000-200,000 RMB) will face particular challenges, with pressure coming from opposite ends of the price spectrum. At the top, premium brands are making their cars more affordable to appeal to consumers seeking to trade up. At the bottom, independent brands are launching increasingly appealing and competitive vehicles in the 100,000-plus RMB price range.

2. ACES investment needs are intensifying

Leading international automotive manufacturers typically spend as much as 50-100 billion RMB a year on research and development (R&D). In China's auto 2.0 era, much of this money, and more, will need to be redirected toward the four trends re-defining not just the automobile itself, but the whole experience of auto travel: Autonomous driving, Connected vehicles, Electric vehicles, and Shared mobility (ACES). In China, consumers' acceptance level for autonomous vehicles is 80 percent, double that of Germany and the US. With the Chinese government expected to double down on support for autonomous vehicles as part of the 14th Five-Year Plan, China is likely to be at the forefront of autonomous vehicle development. The considerable costs of keeping pace with these trends is forcing consolidation and collaboration among rivals. BMW and Mercedes-Benz, for instance, have forged a partnership focused on the next generation of mobility. Volkswagen and Ford have also teamed up to develop autonomous and electric vehicles, in a further example of a trend we expect to see more of in future..

3. New automotive retail models are emerging

The days of consumers purchasing their cars exclusively through dealers are numbered. For a start, China's dealership industry is highly fragmented, with the top 100 dealerships groups constituting only 30 percent of total sales, making them vulnerable to downturn pressure. Recently, dealers' profit margins have been feeling the squeeze, with 30 percent of dealers operating at a loss and new dealer inventory reaching an average of 1.5 months. Tesla, for example, has focused on selling cars online directly to the consumer, Chinese electric start-up NIO has succeeded with online-only sales, and Daimler launched Mercedes me, a system that allows drivers to track and control their vehicle.

4. Operational resilience is back in focus

During the global automotive industry's previous recession in the wake of the financial crisis, our research shows that the most resilient

companies adjusted their costs and reduced their breakeven point to 60 percent of revenue. Companies that performed poorly had a breakeven point of 84 percent of revenue, with negative earnings before interest and tax. Automotive companies must achieve efficiency gains on a par with the most resilient global performers if they are to survive the current downturn. This means rationalizing their major cost items, including promotion and marketing expenses, material costs, and fixed costs. It also means adjusting business models to account for digital innovations, and driving efficiency gains through organizational transformation.

5. Innovation and agility is paramount

Vehicle connectivity platforms, along with digital devices like smartphones and tablets, have made it easier for companies to interact directly with consumers. Automakers can now directly understand consumer needs and obtain precise product feedback. It is essential that automakers invest in talent, including data scientists and translators, that can interpret these insights and convert them into customer-driven product innovation. This requires an overhaul of talent management models, and a repositioning of human resources departments as drivers of organizational agility. It also requires that companies continue to move closer to the China market by building additional innovation and research centers in China itself.

In a market with decreasing tolerance for error, only companies that embark upon often painful transformations will succeed. It will fall to automotive company leaders to drive these transitions within their organizations. Before they begin, we suggest they address the following critical questions:

1. What can we do to put customers at the heart of our retail models, production, and marketing?
2. How do we best incentivize

the adoption and use of new technologies?

3. How can we reform across talent, culture, organization, and business model to capture the opportunities created by new mobility trends?
4. How can we build agile organizations with the flexibility to adapt to rapid changes in the China market?
5. How can we build efficient decision-making mechanisms to quickly and effectively respond to crises?

In this McKinsey China Auto CEO Quarterly, we will explore the five major characteristics of the new era of China's automotive market, and analyze the major choices the industry faces across five chapters: Market Insights, The Future of ACES, Commercial excellence, Operational Excellence, and Agility and Transformation.

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Market insights

Finding the road to growth in China's auto industry

Paul Gao, Arthur Wang, Mingyu Guan

After more than 30 years of rapid and continuous growth, China's automobile market has reached a historic inflection point. Auto manufacturers are staring at a new reality in which sales are on the decline and market fundamentals are shifting from the manufacture and sale of internal combustion engine cars to the pioneering of next generation mobility experiences and technologies.

Despite the downturn, however, there is substantial growth potential in China, albeit at a slower rate. Auto sales enjoy better margins in China than elsewhere. The country also represents 30-40 percent of sales and a higher share of profits for major multinational brands. In other words, China is still the golden goose.

However, the ongoing slowdown in vehicle sales is cause for concern, not only for auto industry stakeholders, but global consumers and policymakers, who rely on a strong Chinese auto market to provide millions of people with direct and indirect employment, and the income to sustain consumption spending in the world's second-largest economy. Auto capacity left idle by contracting sales, coupled with ongoing investments in new auto production facilities, should also perplex financial institutions bankrolling local governments and the auto ventures they support, many of which might not survive a forthcoming industry shake-out.

Meanwhile, the global auto industry is wrestling with a game-changing transition to Autonomous, Connected, Electric, and Shared (ACES) vehicles and solutions. These proffer significant potential for future revenue growth, but the path to profit is as yet unclear, and both Chinese and foreign automakers face significant performance pressure in the race to keep pace with investment and innovation.

As the world's largest auto manufacturer and consumer, China will be a major battleground as we move into a new phase of automotive innovation. To thrive, automakers will need the courage to make bold changes, and the strategic insights to develop a long-term vision. In the following three-part analysis, we provide a detailed view of the current status of China's auto market, an in-depth exploration of its future, and suggestions for how both domestic and multinational auto companies can capture market opportunities, and build a bright, sustainable future.

The status quo: China's prolonged automotive market downturn is driving market consolidation

The China Association of Automobile Manufacturers (CAAM) has forecast China's annual vehicle sales to fall 5 percent this year to 26.7 million units, compounding weak performance in 2018 that saw annual vehicle sales contract for the first time in more than two decades.

There are few signs the market will beat this dour prediction. Overall auto sales in China fell 4.3 percent in July, marking a 13th straight month of declines in the world's largest vehicle market, according to CAAM. New-energy vehicle (NEV) sales were down 4.7 percent in the same month, marking a first fall in two years in the segment as a withdrawal of subsidies sapped market sentiment.

This once-in-a-generation downturn continues despite manufacturers and dealers offering interest-free loans, non-price incentives, and price reductions equivalent to more than 10 percent of list prices. Media reports suggest a down payment of just $149 is sufficient to drive home a new sedan, yet consumers remain reluctant to return to showrooms: The China Automobile Dealers' Association's inventory index stood at 1.73 months at the end of December, up 92 percent compared with the same period a year earlier.

There are a number of factors at play in this scenario. On the macroeconomic side, confidence is languishing amid International Monetary Fund projections that the US-China trade war will see China's economic growth moderate to 6.2 percent this year, slowing from a near-three-decade low of 6.6 percent in 2018. Moreover, a withdrawal of a major auto tax incentive scheme in China has undermined market demand. Between 2015 and 2017, many consumers purchased new cars to take advantage of a tax break on smaller engine vehicles. McKinsey estimates the additional demand created by the policy ran to about 7 million units. When the incentive was rolled back in 2018, demand dropped away, leaving the market searching in vain for a substitute catalyst.

Ongoing reform of China's peer-to-peer (P2P) lending industry has also contributed to lower demand. Stricter licensing requirements are expected to decimate the number of P2P companies in business by the end of this year. This has hampered Chinese mass-market OEM brands, which rely on customers in less developed regions, who in turn are often reliant on P2P financing to buy cars. The new car insurance data for the Jan-May 2019 period reflect this, with Chinese OEM brand sales falling 8.5 percent on year. By comparison, imported car sales declined 1.5 percent, even as purchases of joint venture units were up 0.2 percent. Chinese brands have been hit the hardest by the ongoing market malaise.

In this sluggish macro environment, market consolidation has proceeded apace, compressing sales of both Chinese and multinational brands into the hands of a shrinking pool of major brands. Data from our recent McKinsey China Auto Consumer Insights report show that the top nine brands now account for 54 percent of new car sales, up from 48 percent in 2016.

Perhaps the most significant reason for this squeeze is the increasing sophistication of the Chinese auto consumer, in part driven by a rise in the proportion of non-first-time buyers. Our research shows that Chinese consumer brand loyalty, measured by willingness to purchase the same brand of car again, has increased from 12 percent two years ago to 31 percent this

year. Armed with more information, and no longer incentivized by tax breaks, auto buyers are becoming more discerning when it comes to researching and purchasing a vehicle.

Auto manufacturers unable to upgrade their governance, marketing, and technology in line with the evolving needs of these consumers have found it hard to survive. Many are struggling to enhance brand experience across the diverse range of online and offline touchpoints consumers engage with on their path to buying a car. McKinsey research shows that Chinese consumers begin the journey to purchase a car with just two or three brands in mind, and 60 percent end up selecting one of these brands when it comes to making a purchase. This puts huge pressure on brands to be upmost in consumers' minds if they are to secure sales.

Meanwhile, China's NEV industry, which includes battery-powered, plug-in hybrids and fuel-cell electric cars, is under particular pressure as the government winds down financial support. Central government subsidies of about 31 billion RMB – equivalent to 25,000 RMB per vehicle – helped propel Chinese electric vehicle NEV sales to about 1.25 million units last year, three-quarters of which were pure EVs and the remainder hybrids, in turn attracting both local government and private investor support for a cluster of EV startups.

These companies are experiencing difficulties after the Ministry of Finance announced it would make deep cuts to EV subsidies from June onwards to encourage innovation. For example, the subsidy for pure battery electric cars with a range of 250 kilometers and above was cut by half to $3,700 per vehicle, while subsidies for cars with a range of less than 250 km were removed entirely. For some major companies, these subsidies accounted for almost two-thirds of their profits.

The subsidy cuts come at an inopportune time for several EV companies struggling to get to their feet. Nine major startups in the space, which together have attracted multi-billion-dollar investments in recent years, sold just 30,000

units between them in the first half of 2019, accounting for 5-7 percent of global sales of EVs and hybrids. Domestic NEV players also face stiff competition from global auto companies. Despite the current downturn, numerous multinational automakers have set their sights on China's NEV market, investing billions of dollars to develop new products and expand their capacities.

The path ahead: Sustained demand, ACES innovation, and evolving business models

In the mid- to long-term, we believe the demand profile for vehicle sales in China is encouraging, and that the country will remain the world's largest market for cars. There is still vast potential for growth as hundreds of millions of people still do not own a vehicle. Moreover, the vehicle penetration rate is low compared to developed countries: China's car parc, or the number of cars per 1,000 people, is only about 150, compared with 850 in the US, 600 in Germany, 500 in Japan, and 420 in Korea.

But China-based automakers are negotiating a paradigm shift in consumer attitudes as increasing numbers of urban Chinese choose mobility as a service over car ownership. Government data suggests Chinese passengers took more than 20 million ride-hailed trips every day in 2018, the majority of them with Didi Chuxing. The Chinese ride-hailing leader announced in January that its platform counts 550 million global users, and hosted 10 billion trips last year – almost 10 times the number in 2015 – and roughly double Uber's 5.2 billion journeys in 2018.

Consumer choice is proliferating as at least 20 companies, including Chinese OEMs and foreign brands such as BWM, vie against Didi to take a share of a domestic mobility services market that McKinsey research estimates will be worth $1.1 trillion by 2040. For example, T3 Chuxing, a shared mobility platform backed by Chinese state-owned automakers FAW, Dongfeng Motor, and Changan, in July launched services in Nanjing with plans to extend to six major Chinese cities by year-end. The alliance is backed by Alibaba Group and Tencent Holdings, and aims to expand into a shared electric vehicles services platform that will lead the domestic smart mobility market by 2025.

Evidence suggests this is just the beginning of a seismic shift toward a shared mobility future. The McKinsey Future of Mobility consumer survey 2018 showed Chinese customers are more than twice as inclined (81 percent) as US and German peers to trade in their cars and use a shared autonomous chauffeur service instead. Cost and convenience are major motivations.

When it comes to EVs, our research suggests that there is light at the end of the tunnel. Chinese consumers are increasingly open to the idea of buying a NEV, and pure EVs in particular. This acceptance towards EVs, which incorporates easing fears over safety and vehicle range, has yet to translate into market share. The reason could be that there is a dearth of appealing NEV products on

the market, providing incentive for companies in the space to up their game.

Moreover, a separate McKinsey survey of industry respondents indicates expectations that autonomous passenger vehicles used for mobility services such as “robo-taxis” will become predominant in China, seeing a peak adoption rate of 62 percent, beating private premium vehicles (51 percent), and private mass-market cars (38 percent). As parking and fuel become increasingly expensive in major cities, where potential car buyers are already forced to compete in license plate lotteries to drive ICE cars, these dynamics set the stage for an ACES-based future in China.

Whether or not that future and the models of auto consumption it demands will be sufficient to absorb China's forecast industry production capacity is an open question. IHS Markit analysis projects China's auto production capacity to rise from 38.3 million units in 2018 to 43.5 million next year, and 45.9 million in 2025. Such heavy output relative to 2018 sales (28.1 million units) demands the industry raise its competitiveness in order to provide both domestic and potential overseas buyers with greater value. Automakers must also figure out how ACES innovations can help lift their bottom line, as our research suggests Chinese consumers are as yet unwilling to pay a significant premium for them.

Hitting the road: Nurturing new growth in China's auto industry

Six steps to revitalize Chinese automakers

Chinese OEMs must look inward if they are to galvanize reform, and lay the groundwork for long-term growth. Our analysis indicates most major Chinese auto brands could benefit from five simple steps:

1. Fix the basics
   We see significant opportunities for sales and margin improvement through systematic and disciplined implementation of proven industry best practices. For example, refinements to incentive and dealer

performance management structures can lead to higher sales, topics we address in detail elsewhere in this edition of McKinsey China Auto CEO Quarterly. On the production side, re-assessment of product features, target costing, and design-to-value modeling, can optimize model desirability at lower material cost. There is also ample room to adopt variable marketing expense (VME) management regimes to rationalize dealer pricing behavior, leading to improved profitability for both OEMs and their dealer partners.

2. Prioritize and focus

Many Chinese OEMs took an early lead investing in ACES only to see their advantage disappear due to an inability to maintain investment across a fragmented scope of commitments. Going forward, they will need to proactively review their portfolio and exit non-core businesses. They must also decide which future technologies and key areas they want to control. There will be scope to bring in missing links via collaboration with other OEMs, technology partners, and suppliers.

3. Innovate on customer experience

The automotive industry has been product-centric for more than a century. Third-party dealers have played the key role in managing customer interactions, and overall brand experience. However, this indirect model of customer relationship management is being challenged by digital commerce, and customers' increasing preference to bypass intermediaries. OEMs must adapt by leveraging customer data through artificial intelligence and data analytics to provide more proactive customer service, and enhance brand experience. The digital ecosystem in China is arguably the most advanced in the world, and Chinese OEMs should develop this leadership into a competitive advantage over global peers.

4. Consolidate and collaborate

Chinese OEMs remain sub-scale by global standards in terms of production volume. For example, the largest Chinese OEM sells about 1.5 million vehicles each year, compared to more than 10 million units for the likes of Volkswagen and the Renault-Nissan-Mitsubishi alliance. This puts Chinese brands at a significant disadvantage not only for cost competitiveness in existing technologies, but also the ability to match investment in future technologies. For instance, Volkswagen Group is investing more in R&D than the top 10 domestic Chinese auto companies combined. Local players should team up to invest and share core technologies that will determine their future competitiveness, instead of fighting an uphill battle by going it alone.

5. Strategic thinking and repositioning
   In light of overcapacity issues within China's auto industry, and rising demand for ACES investments, an asset-light business model is emerging. China's auto companies have the opportunity to transform into the "Foxconn of the auto industry" by producing cars and solutions for other OEMs without necessarily managing their own branded products, much like Foxconn does for Apple.

6. Transform corporate culture
   China's auto industry is shifting from a long-running focus on vehicle production to a dual focus on both production and mobility services. This will require a corresponding overhaul in talent management and corporate culture. Perhaps the biggest shift for traditional OEMs will be from a business-to-business product-oriented culture to a business-to-consumer service culture. The question is no longer how to compete with traditional OEMs for mechanical engineers, but how to win the loyalty of the best software engineers in a more widely competitive market that includes every technology company, and every digital business.

Multinational auto companies: Five key areas worthy of a rethink

For multinational OEMs operating in China, the years of reliable double-digit volume and profit growth are likely gone forever. We have identified five key areas where a rethink is required to maximize the contribution of a multinational brand's China operations to its global business:

1. From ‘made in China for China' to ‘innovate in China for the world'
   There is a substantial opportunity for multinational carmakers to position China as an auto innovation hub. The country is already the world's largest and most diversified market for EVs, and the government intends to foster global leadership in smart car development and production by 2035. China is also likely to become the world's largest market for autonomous vehicles, and we believe that fully autonomous cars (SAE Level 4 and above) will see mass deployment in China within the next 20 years. Global, non-China-specific autonomous driving solutions will likely struggle in China, which presents a unique set of road conditions and driving behaviors, demanding that multinationals maintain a deep developmental commitment to the China market. Moreover, Chinese consumers are more sophisticated and demanding than global peers when it comes to digital technology. Automakers and their technology partners have the potential to leverage China's advanced digital ecosystem to drive market-leading innovations in vehicle connectivity. To boost global competitiveness, multinationals should position their China R&D as a driver of cost-competitive solutions for international

markets, rather than just China itself.

2. From 'one-size-fits-all' to 'tailored for China'
Alibaba Group's revolutionary innovations in the retail industry helped China become a world leader in the creation of new retail experiences. Global automakers operating in China could do the same. By leveraging both digital and data analytics to suit the relatively fluid regulatory environment in China, innovative retail business models could help change the current practice of directly adopting the 4S (sales, service, spare parts, and surveys) distribution model that is prevalent overseas, which is one-size-fits-all and costly, and create a retail business model tailored to Chinese consumers' needs.

3. From a single Chinese market to multiple sub-markets
China is an enormous country with many regional differences. Multinational auto companies could benefit from adopting a more granular approach to managing their China operations given the differences in consumer preferences and market conditions around the country. Local factors, including differing attitudes to media consumption, purchase channel, and brand choice, should be considered in product development and network planning. Creating differentiated marketing campaigns, and giving local sales and service organizations greater autonomy, also has the potential to raise sales.

4. From cost-plus to market-back
Foreign cars have historically sold for higher prices in China compared with other markets as a result of import tariffs, strong consumer interest, and weak domestic competition allowing them to command premium positioning. Multinational OEMs have consequently had the freedom to price models by summing component costs and adding margin, but this approach is coming under strain in the current environment of falling transaction prices. Looking ahead, OEMs should shift towards setting competitive prices, deducting margin, and working towards achieving the required cost savings. This would entail a reassessment of their China organizational model, including a review of products and administrative cost structures. This should ensure that cost competitiveness does not suffer in the event of Chinese rivals launching high-quality, lower-priced challenger models onto the market.

5. From joint venture to wholly owned enterprise
In 2022, China will eliminate its caps on foreign ownership of car companies, allowing automakers to own their Chinese operations outright instead of partnering with domestic companies. Foreign auto companies should review their existing collaborations and modify their joint ventures in accordance with their strategic goals. Options on the

table include exploring new models of collaboration, including contract production, as well as joint development or sourcing partnerships, instead of traditional equity joint ventures.

The global auto industry is going through a difficult period, and China is no different. However, as we have shown, China's market potential remains largely unfulfilled. There is no reason why both domestic and foreign automotive companies cannot use this transitional period as an opportunity to reposition, and benefit from what we believe will be a second phase of sustained growth. Chinese OEMs face significant challenges in strategic planning, moving closer to their customers, and improving brand experience. For multinationals, the key will be making astute changes to organizational structures, while sharpening their commitment to the China market. The rewards for those who succeed will surely be substantial.

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Unleashing value in China's slowing auto market

Mingyu Guan, Tony Zhou and Micheala Fang

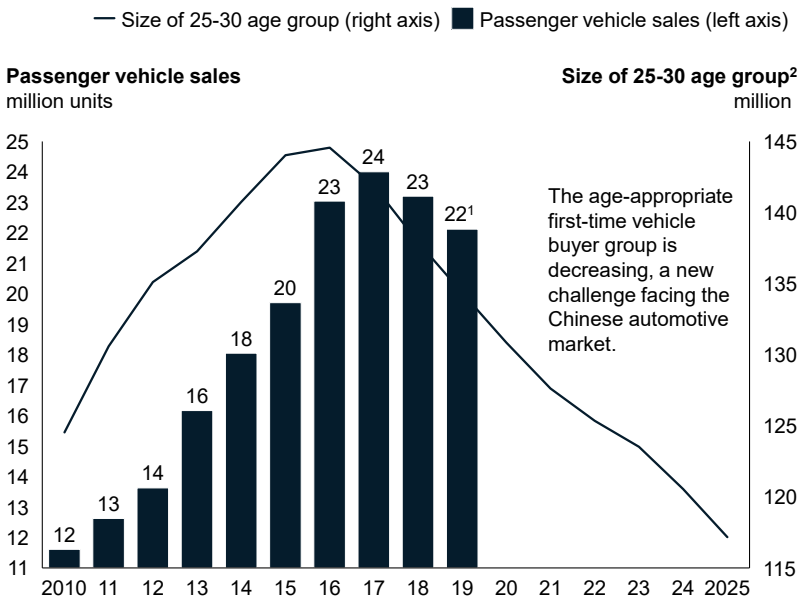
China's automotive market is negotiating a tricky period after decades of rapid and unbroken growth. We believe the stalled market presents significant opportunities alongside the obvious challenges. In an environment characterized by falling profits, intense competition, and increasing diversification as brands search for growth, automakers must carefully hone their advantages, and adopt a more rational approach to planning that will see them through the tough times ahead. In the article below, we analyze critical factors at play in the current market downturn.

The market has reached an inflection point as demand from young, first-time buyers weakens

Demand from first-time buyers in China has softened, and consumer willingness to purchase replacement vehicles has also weakened. Moreover, the market is still adjusting after the withdrawal of a preferential vehicle purchase tax rate in the first quarter of 2018, which our research suggests likely triggered a rush to buy millions of cars. As the ripple effect of this policy switch recedes, China's auto market has increasingly moved in step with China's slowing economy.

First-time buyers, comprised predominantly of young consumers, drive passenger car sales in China. Assuming an average age for this group of 25-30, and correlating this with the number of newborns in previous years, the size of this pool of potential first-time buyers began to shrink from 2017 onwards (see Exhibit 1). This trend is likely to continue given China's population policies,

Exhibit 1: The age-appropriate first-time buyer population has decreased, contributing to the contraction in vehicle sales



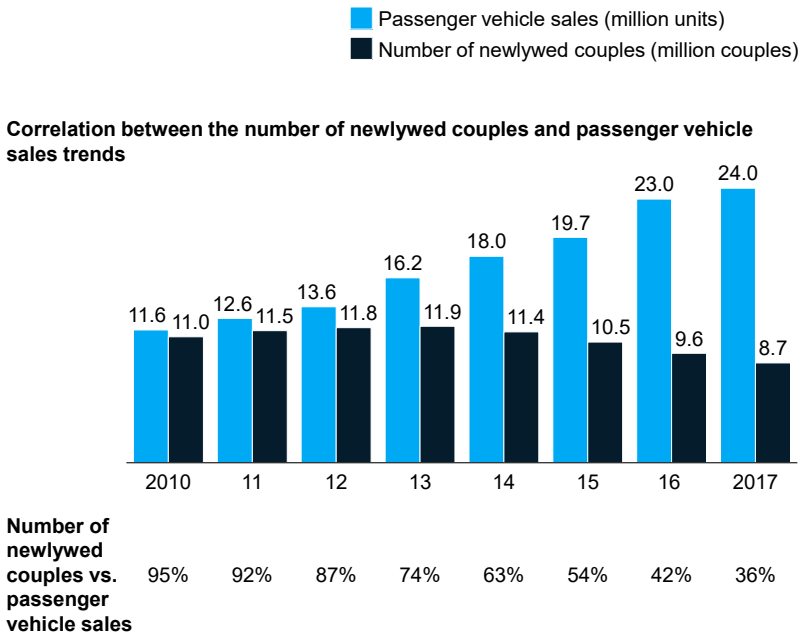
1 IHS projected data (June 2019)
2 Based on newborn data in the corresponding years; mortality factor is not accounted for

Sources: IHS; China Statistical Yearbook; McKinsey

creating an unprecedented challenge for China's automotive market.

In China, buying a vehicle is deemed a necessity for newlyweds. Since 2014, the number of couples tying the knot has declined – from close to 12 million couples in 2013 to less than 9 million in 2017. Overlap between newlyweds and the first-time buyer group offers further indication as to why market demand is weakening (see Exhibit 2).

Exhibit 2: Marriage registrations data offer insight into the size of the age-appropriate, first-time vehicle buyer group



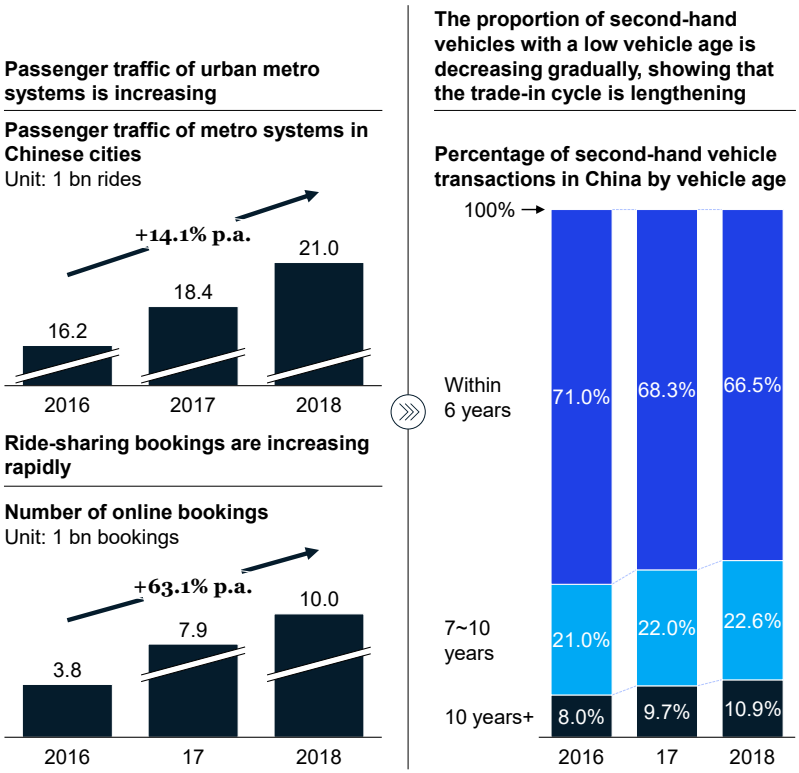
Source: IHS; China Statistical Yearbook; McKinsey

Vehicle owners are less inclined to trade in their vehicles

In light of the dwindling first-time buyer market, experienced buyers will eventually take over as the driving force supporting sales. However, influenced by the boom in shared mobility, and increasingly advanced public transport systems, the utilization rate of passenger vehicles is falling, and the trade-in cycle is lengthening (see Exhibit 3).

Assuming consumers wait for an average one additional month before buying a new car, we estimate annual trade-in volume will shrink by 8.3 percent. This lengthening of the trade-in cycle, coupled with the drop in the pool of young would-be first-time buyers, pose significant issues for the industry.

Exhibit 3: Urban public transport and shared mobility is sapping willingness to trade in vehicles; the trade-in cycle is lengthening

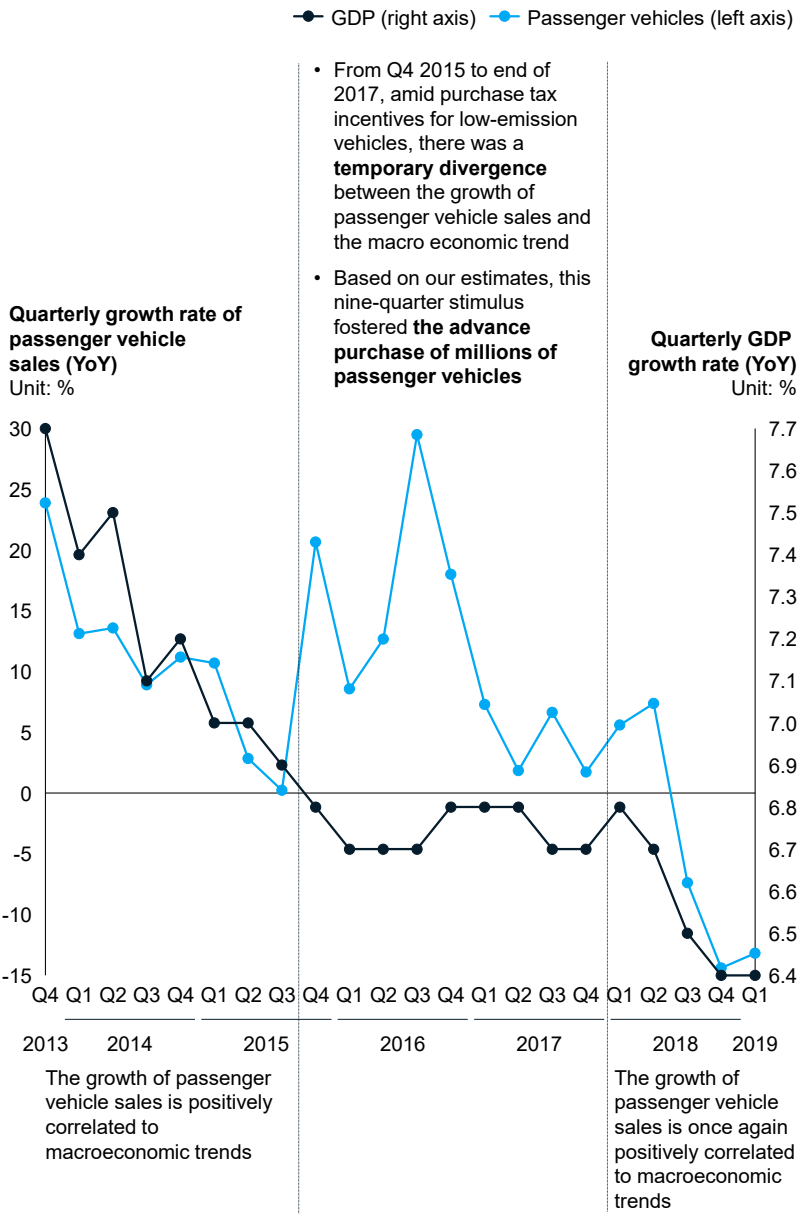


Source: China Automobile Dealers Association, China Urban Railway Transport Association, Development of China's Sharing Economy Annual Report (2019), McKinsey

Macroeconomic growth is slowing and the market is normalizing

Prior to Q4 2015, the growth of passenger vehicle sales was tightly correlated to GDP growth (see Exhibit 4). However, in the two years to end-2017, the two temporarily diverged. Preferential policies supporting sales of small displacement cars spurred a significant change in consumer behavior. We estimate that the nine-quarter period during which these tax incentives were on offer may have triggered the advance purchase of millions of passenger vehicles. After the withdrawal of the preferential tax policy at the start of 2018, the correlation between passenger vehicle consumption and the economy resurfaced.

Exhibit 4: After eliminating impact of the preferential tax policy, growth of passenger vehicle consumption is positively correlated to the macro-economy

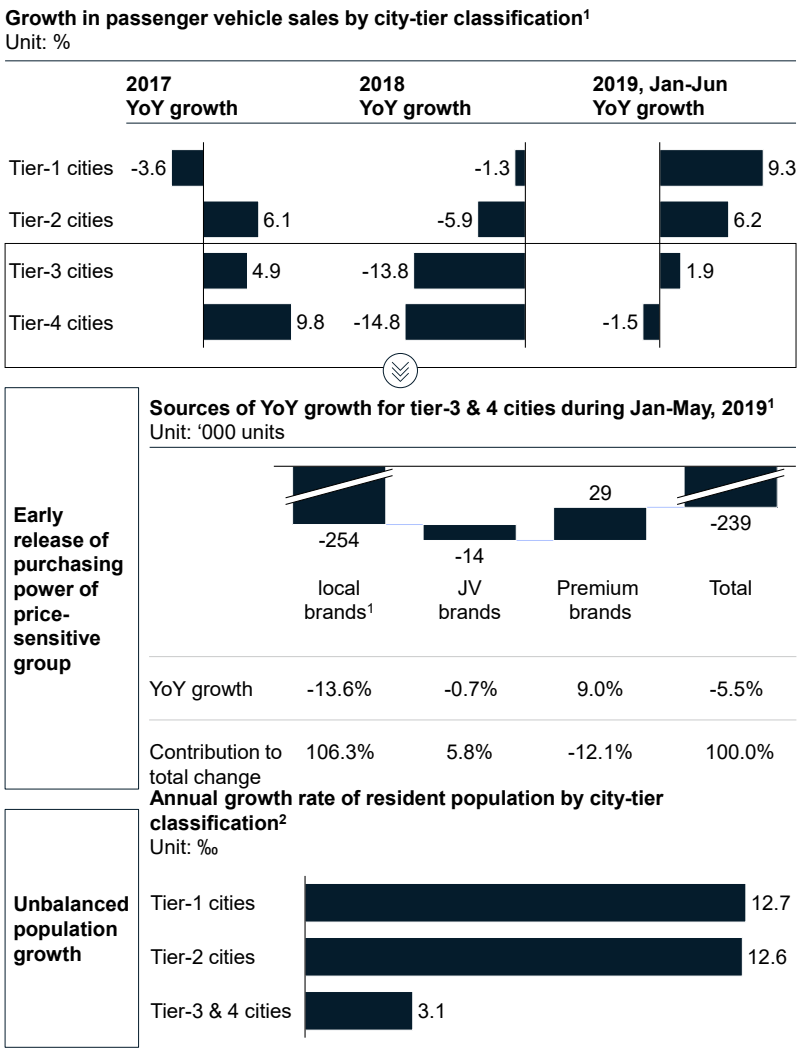


Source: IHS; China Statistical Yearbook; McKinsey

Big city consumers, and premium brand demand, will provide impetus for growth

Lower vehicle penetration rates, and local consumers' relatively strong desire for vehicle ownership, has traditionally spurred more rapid sales growth in lower-tier cities. However, this trend reversed in 2018. Sales growth in higher-tier cities started to lead the market, while lower-tier cities lagged behind (see Exhibit 5). We believe that the preferential tax policy unlocked the early

Exhibit 5: From 2018, higher-tier cities outperformed lower-tier cities driven by vehicle purchase tax incentive withdraw and unbalanced population growth



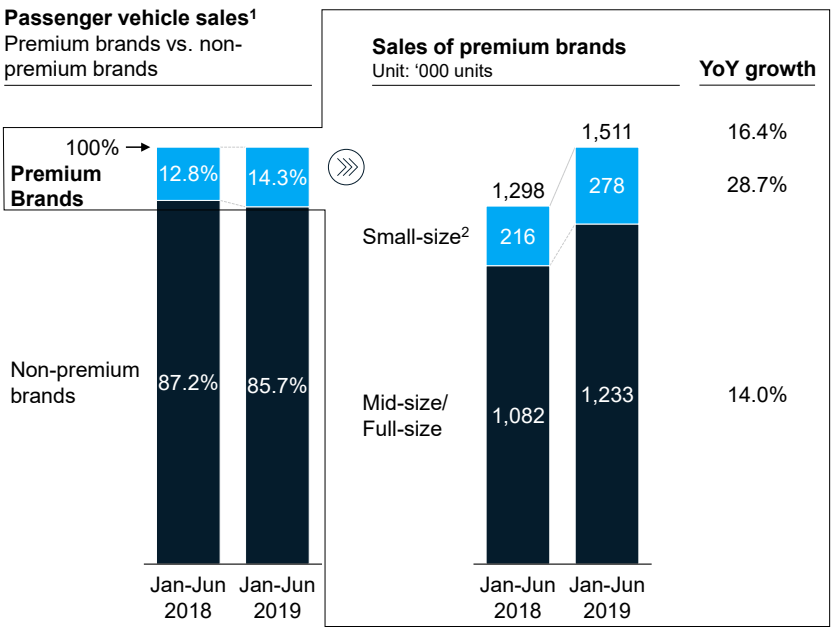
1 Based on the number of insured vehicles
2 Based on resident population data in 241 cities

Source: Data on China's newly sold vehicles with insurance coverage; statistical yearbooks at different city levels and the National Bureau of Statistics website

release of purchasing power among price-sensitive groups in lower-tier cities. This, coupled with unbalanced population growth that has seen the number of residents in China's bigger cities increase more rapidly than in smaller urban areas, is the main reason for the marked drop in sales in lower-tier cities over the last 18 months.

Although the overall automotive market is currently experiencing a downturn, sales of premium brand vehicles have rebounded (see Exhibit 6). Premium brands' market share was 12.8 percent in the first half of 2018, and rose to 14.3 percent in the same period this year. This growth momentum comes mainly from small-size vehicles (that is, A/A0-class passenger vehicles), rather than their B- and C-class counterparts. In recent years, many premium brands have launched A/A0-class cars, including the Audi Q3, Audi Q2L, BMW 1 series, BMW X1, and Mercedes-Benz A-Class. These smaller vehicles have lowered the entry threshold for premium brand vehicles, and enjoyed great success among consumers. We believe that Chinese consumers will continue to aspire to own premium cars, and that as the prices of these vehicles come down, the segment will enjoy further sales growth.

Exhibit 6: Premium brands' market share is increasing, with growth mainly driven by smaller vehicles



1 Based on the number of insured vehicles
2 Compact or small-size passenger vehicles

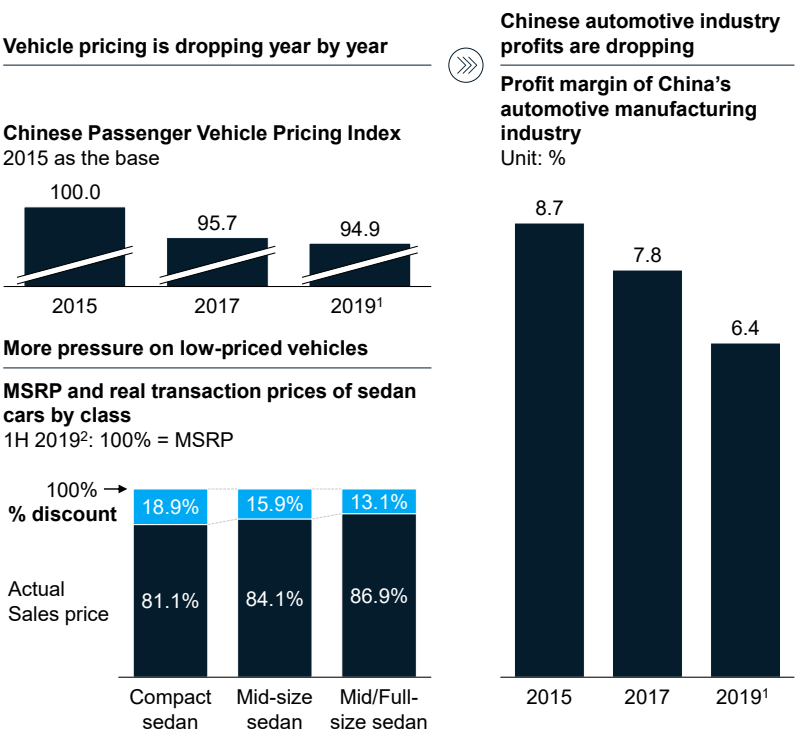
Source: Data on China's newly sold vehicles with insurance coverage; Autohome

Automakers at home and overseas are battling significant earnings pressure

Price reductions designed to boost sales are commonplace in China's automotive market, and price-cutting behavior continues in 2019. At the same time, pressure on brands to further reduce prices of cheaper models, such as compact passenger vehicles, is much higher than that on high-priced models, including mid-size and full-size passenger vehicles. Persistent price wars aimed at low-priced models with large market share are driving steady declines in the domestic industry's profit margin (see Exhibit 7). Likewise, the global financial performance of international automotive companies is also subject to tremendous pressure (see Exhibit 8).

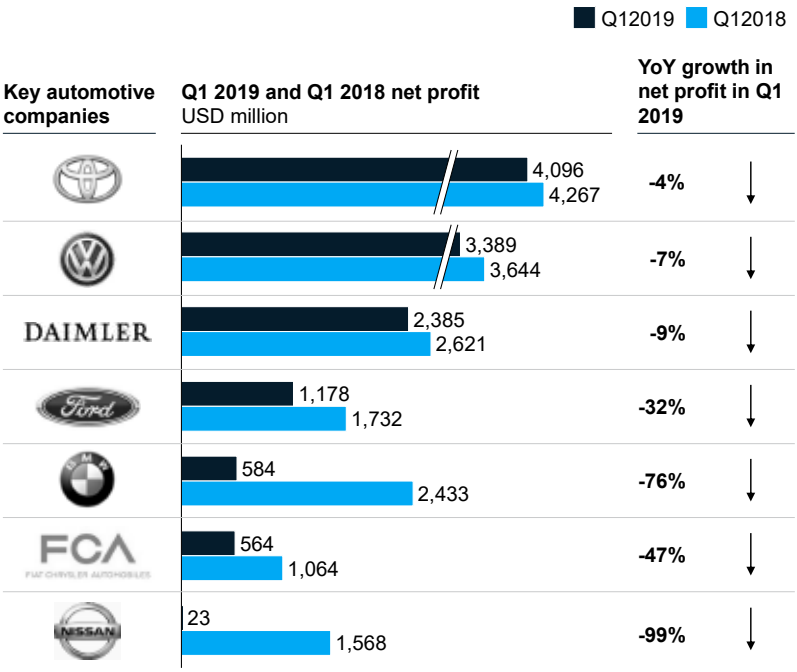
Many international automotive companies have enjoyed rich returns in China, but the days of easy sales growth are over. The proliferation of ACES (autonomous, connected, electric, and shared) offerings is forcing automotive

Exhibit 7: Prices continue to drop, pressuring low-price vehicles. The automotive industry's profit margin is also on the decline



1 Jan-Jun, 2019;
2 Based on the arithmetic average of the monthly data during Jan-Jun 2019
Source: National Bureau of Statistics; CAAM; JD Power; ISE; McKinsey

Exhibit 8: Global auto companies are also under significant performance pressure



Source: McKinsey analysis; IHS statistical data; companies' financial reports

companies to expand investment in new products and technologies. However, facing the reality of declining profit margins, both international and domestic automotive companies have no choice but to more carefully plan their capital expenditures.

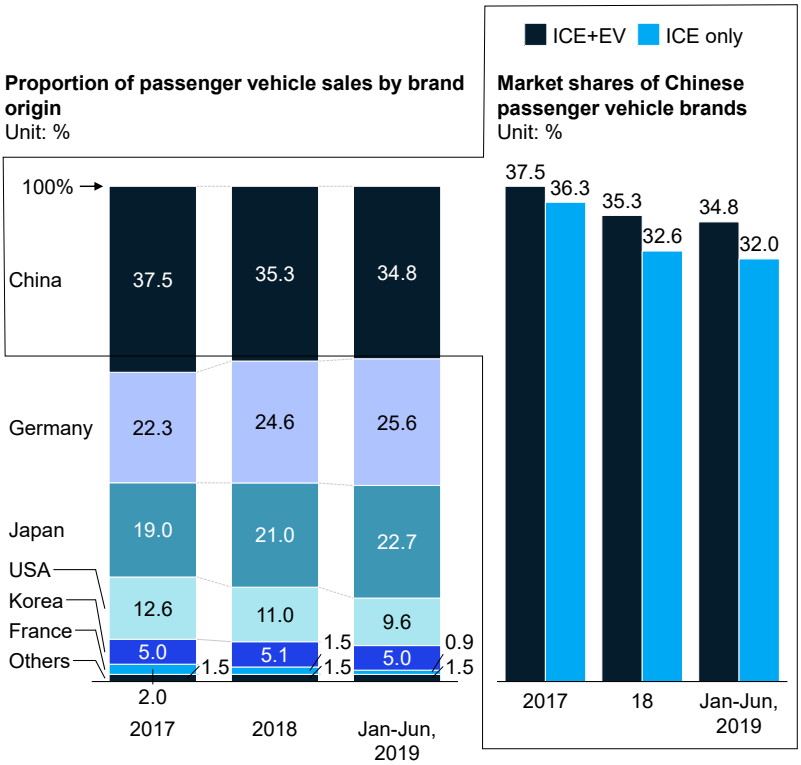
Branding is becoming more important as competition heats up

Over the past few years, the rapid rise of Chinese brands has been a bright spot in the passenger vehicle market. However, since 2018, these brands have started to lose their shine, and their combined market share has dropped by close to 3 percentage points from its peak in 2017. Excluding the electric vehicle market, in which Chinese brands are predominant, the share of Chinese brands has fallen to less than a third of the market (see Exhibit 9).

Meanwhile, Japanese auto brands have enjoyed particular success. Chinese consumers have rewarded Japanese companies' long-term commitment to improving reliability, fuel efficiency, and powertrain technologies.

Despite the overall decline in their market share, leading Chinese companies

Exhibit 9: Chinese brands are losing out, particularly in the ICE market



Source: Data on China's newly sold vehicles with insurance coverage; McKinsey

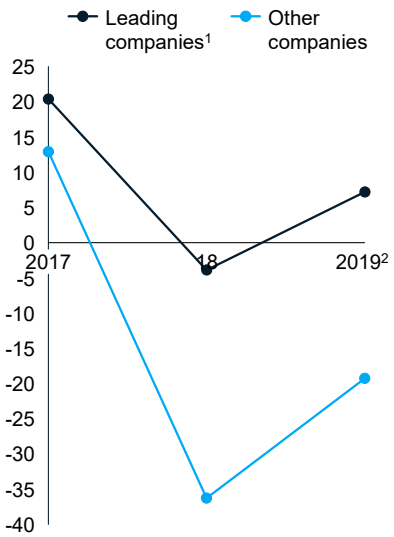
(Geely, SGMW, Great Wall, Changan, SAIC Motor, GAC Motor, BYD, and Chery) are starting to wield their economies of scale, reflecting the current "survival of the fittest" market situation (see Exhibit 10). The ratio of the combined market share of these eight companies to the total market share of Chinese brands increased by 14 percentage points in just three years, reaching 78 percent in the first half of 2019. Other weaker Chinese brands with monthly sales in thousands of units must somehow counter this onslaught from the big players.

Chinese car companies have been prone to launching new brands in response to several issues, including difficulty in raising the value of the primary brand, the need to break into a new market segment, or desire to reach a new demographic. When overall sales growth in China was powering along in the double-digits, there was adequate space for these new brands to survive, but precious few were able to carve a niche in the high-end market. Now, as the market moves through a period of stagnation, several such sub- brands are under serious threat.

Exhibit 10: Market concentration is increasing among Chinese brands, reflecting a 'survival of the fittest' situation

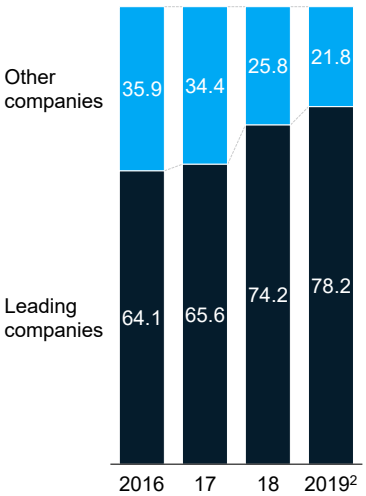
Leading Chinese brands are growing much faster than SMEs

YoY growth in sales of Chinese brands
Unit: %



Leading companies' market share is increasing, while companies at the bottom find it increasingly hard to survive

Proportion of market share among Chinese brands
Unit: %



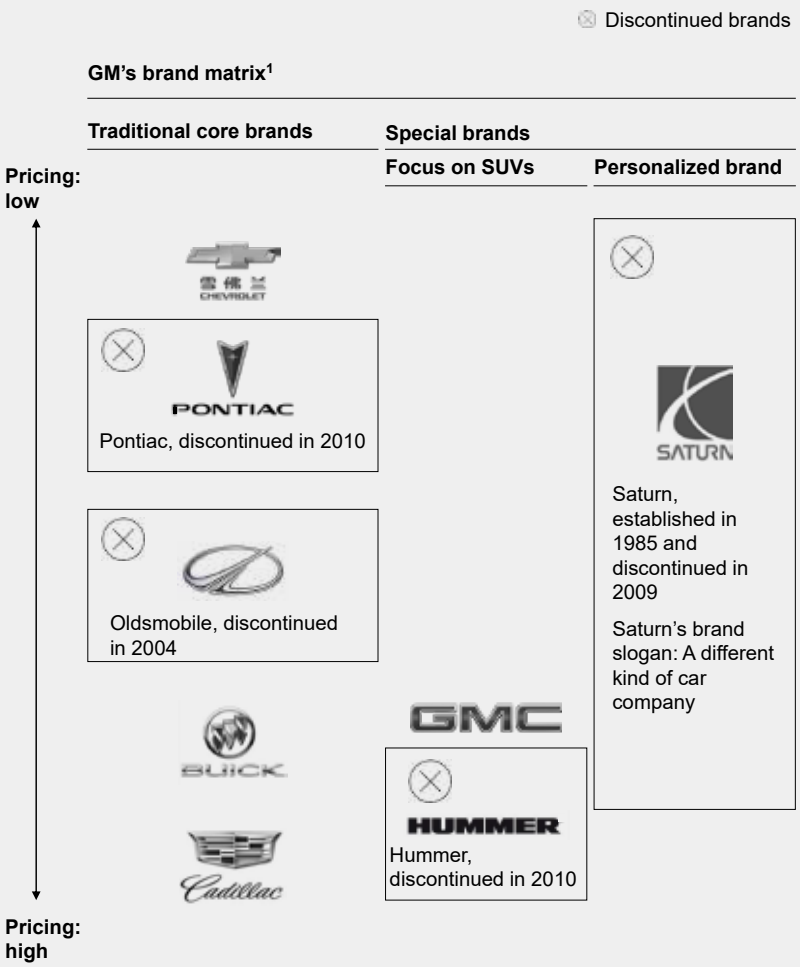
1 Geely, SGMW, Great Wall, Changan, SAIC, GAC, BYD, and Chery; selection criteria: top 8 homegrown brands in sales over the past 3 years and business bigger than other domestic brands (Chery in 8th place on the sales ranking from January to May 2019 has twice as many sales as the automaker in 9th place)
2 Jan-Jun, 2019

Source: Data on China's newly sold vehicles with insurance coverage

Lessons for China's independent auto companies from GM's brand transition

China's independent auto brands can learn much from the evolution of General Motors (GM)'s brand matrix (Exhibit 11). There remains some overlap in the pricing of Chevrolet and Buick, but there was a time when GM's brand mix was complicated by two other similarly positioned marques: Pontiac and Oldsmobile. It is not hard to imagine the resulting contradictions in product positioning, pricing, design, production, and marketing with four brands squeezed into a similar price range. In the end, GM acted decisively to eliminate both historic brands.

Exhibit 11: lessons learned for GM's multi-brand strategy: A complex brand matrix is extremely difficult to manage, and a broad-brush, streamlined approach to branding may be the ultimate way out



1 Only includes brands established locally within the US; excluding regional brands outside of the US, such as Vauxhall and Holden

Source: Retrieved documents; McKinsey

In the mid-1980s, GM launched the Saturn brand to counter the encroachment of Japanese vehicles into the US market. Saturn took an innovative approach, as reflected in their slogan, "A different kind of car company". However, GM found it hard to allocate sufficient resources to maintain Saturn's unique and independent brand image. As a result, Saturn was unable to fulfill its mission of defending GM against Japanese vehicles, only serving to cannibalize other brands under the GM umbrella

(such as Chevrolet). In the end, GM had no choice but to abandon Saturn, leading to the product matrix we know today.

We believe that the strain GM faced when managing its complex product matrix is particularly relevant to independent Chinese automotive brands striving to build their own brands today. Like GM, they face hard decisions as regards streamlining their product portfolio if they wish to enjoy similar longevity.

Chinese brands are not alone when it comes to the need to move beyond their comfort zone and aggressively confront challenges – the entire industry is on the cusp of momentous change. Based on our analysis and experience working with leading global automakers, we recommend automotive companies working in China act now to implement the following measures:

1. **Target setting:** While we are cautiously optimistic about the market's medium-to-long term development, automotive companies need to adapt to current market conditions by drawing up realistic production and marketing plans. The time for spur of the moment or poorly considered initiatives has passed. A new paradigm should be established in which actions are meticulously planned across the organization.
2. **Dealer network planning:** With increasing differentiation in regional sales trends, particularly the shift in sales momentum in urban areas, automotive OEMs need to re-evaluate the layout of their dealership networks, and formulate new standards for their brick-and-mortar dealership partners.
3. **Rational brand development:** When it comes to brand, blind expansion or indiscriminate shifts have done more harm than good. A rational, forward-thinking approach to brand, one that doubles down on reflecting a company's internal capabilities, will provide the touchstone for success over the next 3-5 years.

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The authors would like to thank Stella Zhang for her contribution.

China Auto Consumer Insights Survey 2019: What it takes to win

Mingyu Guan, Pei Shen, Daniel Zipser

Navigating historic change in China's automotive environment

After years of strong growth, China's passenger vehicle market is slowing down, posting negative growth in 2018 for the first time in decades. Several factors have conspired to precipitate this historic inflection point in China's automotive market. For a start, the cancellation of purchase tax incentives in early 2018 sapped automotive consumption. Meanwhile, slowing GDP growth and US-China trade conflicts have also hit the market hard.

Behind the downturn, a transition is occurring in the wider automotive market in China. Over the past 20 years, benefiting from favorable macro environment factors, such as a growing population and surging economic growth, automotive market performance has been near miraculous. In this environment, manufacturers could achieve acceptable results simply by identifying and targeting gaps in the market. However, China's passenger vehicle market is no longer driven solely by incremental demand from first-time vehicle buyers; existing owners seeking to trade in their vehicles are fast becoming the new growth engine. Auto brands are consequently embroiled in a once-in-a-generation shake-up that will define the profile of China's maturing automotive market

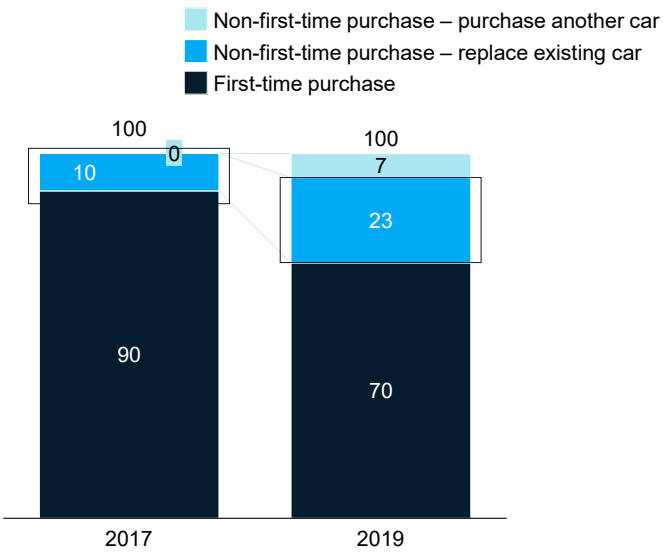
Against this backdrop, the McKinsey China Auto Consumer Insights Survey 2019 polled 2,500 auto buyers representing a diverse range of demographics in more than 20 major cities across China. This article picks out trends in these consumers' purchase behavior, and their attitude towards autos, while analyzing how the market has evolved in the two years since our previous in-depth study. The results provide invaluable insights and guidance for auto industry decision-makers in China as they embark on the road ahead.

The size of China's first-time buyer group is shrinking, the demand for replacement cars is increasing, and securing loyalty of existing drivers is crucial to success

Although the first-time vehicle buyer group remains the driving force in China's automotive market, demand for replacement vehicles is gradually encroaching on the new vehicle market. We observe a corresponding shift in focus among automakers from tapping incremental demand to retaining existing business. In McKinsey's 2017 Automotive Consumer Survey, close to 90 percent of respondents were first-time buyers, while only 10 percent were second-time or multiple purchasers; almost all of whom were trading in their original private vehicles. In comparison, the recent McKinsey 2019 China Automotive Consumer Survey indicates that the proportion of non-first-time buyers has reached 30 percent, of which 23 percent were trading in their existing vehicles.

Exhibit 1: Automotive consumption in China is shifting from incremental to existing demand

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

(see Exhibit 1).

This shift towards retaining existing demand poses a serious challenge to all automotive manufacturers in China. It implies the competitive focus is shifting from fighting over untapped market space to seizing a larger portion of the existing pool. To excel, automotive manufacturers need to develop an in-depth understanding of the replacement requirements of mature consumers, and introduce products that will meet their evolving needs. Enhancing customer loyalty – to ensure consumers will become repeat buyers of the same brand – is a strategic issue that every brand manufacturer must address.

The second-hand market is booming, stimulating demand for existing inventory, and opening a new battlefield for automotive brands

The used car market continues its upward trajectory, even as new car sales decline. In the past three years, used car sales have grown at an annual rate of 15 percent, reaching 14 million units in 2018, in the process seizing the attention of automotive executives. Strong consumer demand is powering this growth, underpinned by greater willingness to consider buying secondhand vehicles,

according to our research.

In our 2017 survey, only 11 percent of new car owners said they had considered or would consider buying a used car, compared to more than 20 percent in 2019. In particular, female respondents (nearly 27 percent) were more willing to buy a used car; and the higher the household income, the more used cars appealed: 31 percent of the high-income group (monthly income household above 48,000 RMB) said they had considered buying used.

The biggest reason for consumers to buy used cars is their low price (49 percent). After all, an old car of the same model can be at least 30 percent cheaper than a new one. High cost efficiency is the second most-cited reason (45 percent): with the same money, consumers can enjoy better features, brand status, and model specifications from a used car than from a new one. Meanwhile, 41 percent of respondents said it is less nerve-wracking to drive a used car than a new car in case of bumps or scratches. More female respondents (57 percent) cited this as their main reason.

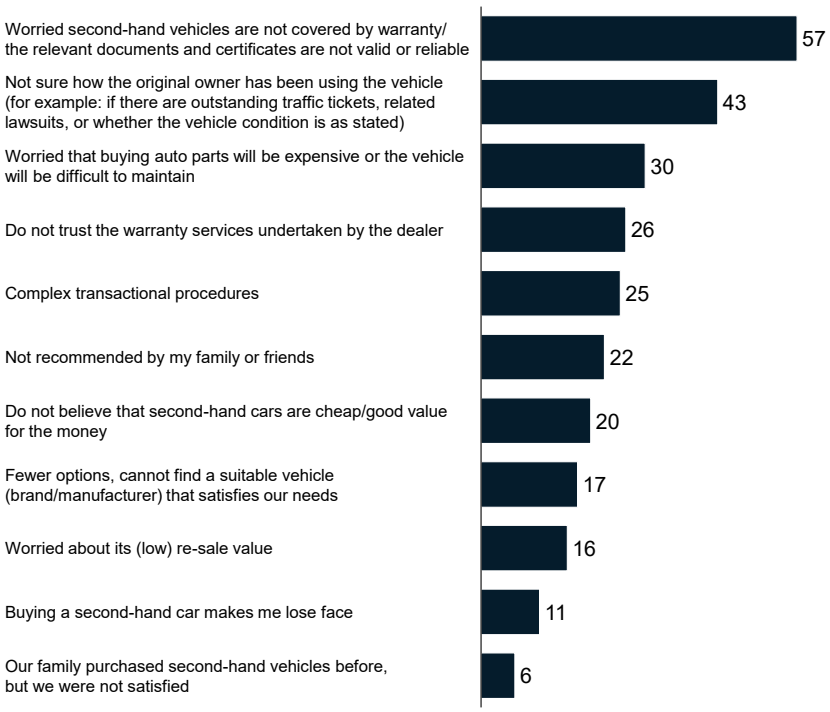
The take-off of the second-hand market further proves the rising importance of existing demand. However, despite growing acceptance of used cars, concerns remain over quality, safety, and post-sale services. We believe that automakers can seize significant market share and revenue by addressing these pain points.

For example, 57 percent of consumers believe that used cars have no safety guarantee; 43 percent believe that the previous owner's usage may present hidden risks; and 30 percent have fears about future maintenance. The complex trading process is another big concern (25 percent). These findings, which point to an overarching lack of trust in the market, were consistent across demographics. Certified pre-owned (CPO) programs can address all these concerns by providing assurances over product quality and provenance, as well as guarantees over safety, and in some cases, options to return vehicles, or redeem warranties, within certain timeframes. Our findings present considerable opportunity for manufacturers to win the trust of consumers by creating an efficient, fast, and convenient experience for owners to trade their cars, which will in turn serve to lift turnover (see Exhibit 2).

We also found that prices, often considered of utmost importance, are not consumers' primary consideration when seeking to sell a used car. On the contrary, car owners place more emphasis on a fast, convenient, safe, and reliable sales channel. Respondents who chose manufacturer-authorized physical stores were enticed by considerable trade-in subsidies (47 percent); those that chose used car dealers and used car websites, such as guazi.com and xin.com, did so for the one-stop service, as well as the speed and convenience of transactions; while those who traded their cars with friends did so because it allowed them to

Exhibit 2: Reasons vehicle buyers considered second-hand option but did not buy last year

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

quickly close the deal (74 percent).

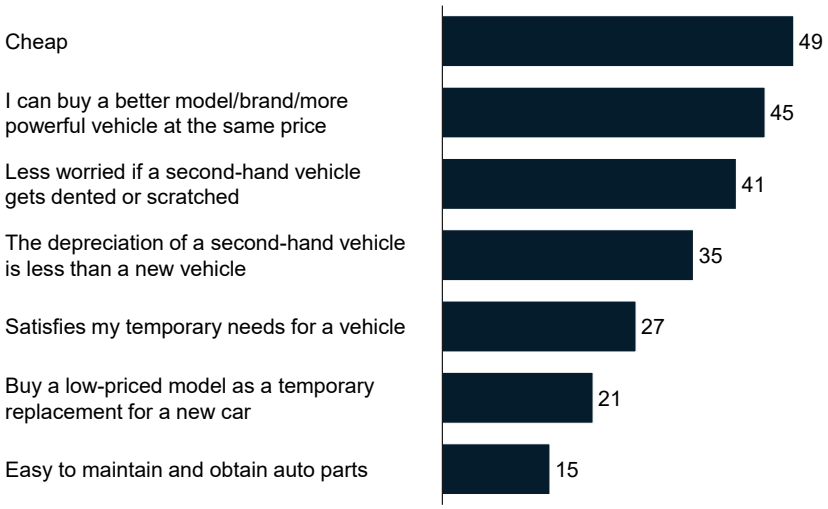
These findings were consistent across owners with vehicles in different price ranges, in different age groups, and in different regions. The message to manufacturers is clear: Enhancing the efficiency of second-hand vehicle transactions, and promoting key values, such as efficiency and speed, convenience and simplicity, can win consumer trust, and be more effective than increasing the trade-in value of the vehicle. (Exhibit 3).

Willingness to trade up is strong, and SUVs are the vehicle of choice

Against a backdrop of steadily increasing disposable income, consumers remain keen to trade up their vehicles. Nearly 60 percent of respondents told us they would trade up for their next car purchase. Most chose a price range

Exhibit 3: Reasons for buying second-hand vehicles

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

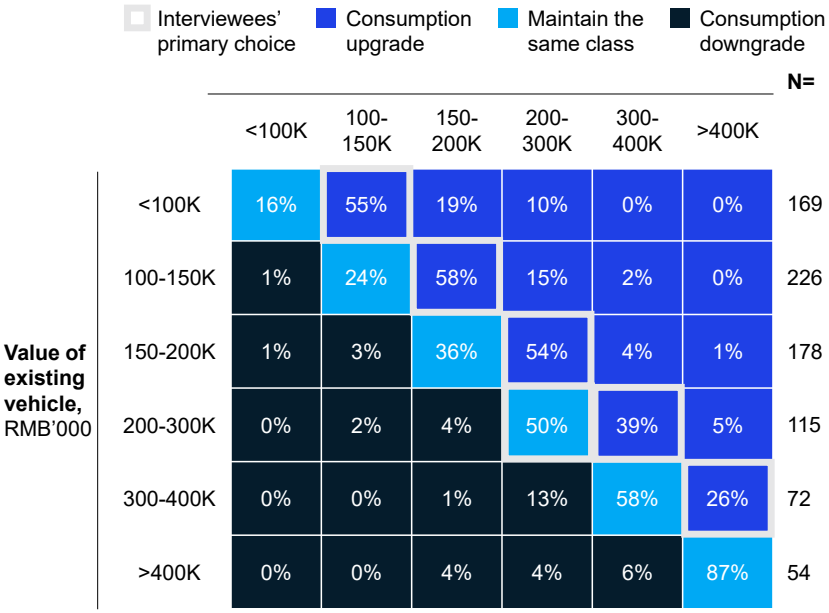
of 200,000 to 300,000 RMB, while few said they intended to make a radical upgrade in terms of price. For example, 54 percent of owners whose existing car cost 150,000 to 200,000 RMB said they would increase their budget to 200,000 to 300,000 RMB for their next purchase. This represents something of a key price range in China, with half of car owners owning a car in the 200,000 to 300,000 RMB bracket intending to stay within that price range when the time comes to replace their vehicle.

Our survey suggests that car models priced at 200,000 to 300,000 RMB are a vital battleground for auto OEMs. In a bid to counter falling sales, many brands have cut the prices of luxury models in recent years, crowding this price range with products that meet consumer demand for both performance and premium experience. OEMs seeking to capitalize on the willingness of consumers to trade up are advised to extend their product portfolio in this segment, in particular their range of entry-level high-end vehicles.

The preference for vehicles in the 100K-200K RMB price range is in keeping with strong appetite for sports utility vehicles (SUVs). From 2013-2017, sales in the passenger vehicle market increased from 16 million units to 24 million units, of which SUVs contributed close to 90 percent of the incremental volume. Although SUV sales did fall from 2017 to 2018, the drop was only 4 percent. Our survey suggests existing car owners still tend to want to buy a SUV when it

Exhibit 4: Budget for the next vehicle

Proportion of interviewees, horizontal rows add up to 100%



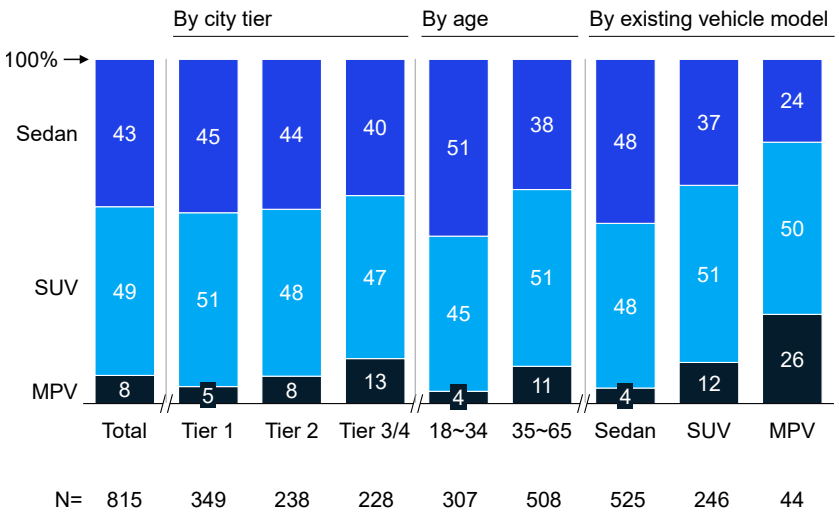
Source: McKinsey China Auto Consumer Insights 2019

comes to purchasing their next car. Nearly half of respondents said they would buy an SUV next time, followed by a sedan (approx. 43 percent). Consumers aged 18 to 34 prefer sedans (51 percent), while older respondents (aged 35 to 65) said they would buy an SUV or multi-purpose vehicle (MPV) (see Exhibit 5). Existing owners of SUVs and MPVs are more likely to stick with this type of vehicle upon their next purchase, displaying little interest in switching to a sedan.

Engaging these driver subsets requires strong understanding of consumer preferences, but Chinese OEMs tend to rely on dealers to manage direct consumer interactions. Most lack sufficient access to or awareness of customers, stymieing their ability to collect firsthand data. OEMs must address this shortfall in access to consumer analytics to better understand the market, accurately interpret consumer behavior, and foster impactful decision-making.

Exhibit 5: Types of vehicle under consideration for the next purchase

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

Brand dominates consumers' purchasing considerations

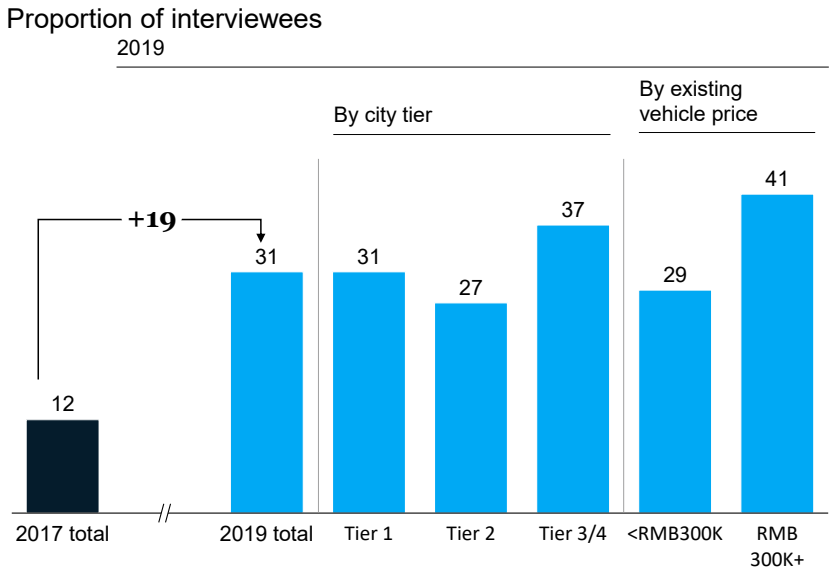
In addition to challenges arising from shifts in the composition of the market, subtle changes in consumer behavior are reshaping the trading environment, and adding to the difficulties automakers must overcome to stay competitive.

Branding alone can defend against competition; being top of mind is key

As indicated in our survey, the three most important factors for consumers when considering buying a vehicle are configuration and features, brand, and running costs, respectively. At this mature stage of automotive technology development, configuration and features no longer serve as effective barriers to competition, while running costs have come down considerably due to efficiency improvements. Brand alone provides automakers with the foundation to build unique competitive advantage, and deter potential rivals. Creating brand advantages and communicating brand value effectively is the basis for every automotive manufacturer to achieve differentiation.

Customer loyalty to automotive brands among Chinese consumers is increasing, indicating that the passenger vehicle market has entered a knockout phase in which branding packs the fiercest punch. According to our 2017 survey, only 12 percent of respondents said they would purchase the

Exhibit 6: Willingness to purchase existing brand again



Source: McKinsey China Auto Consumer Insights 2019

same brand again, but this rose to 31 percent in 2019. Notably, 40 percent of owners whose existing car values more than 300,000 RMB said they would buy vehicles from the same brand again. This suggests the automotive market is experiencing a demand-driven integration, particularly among high-end consumers (see Exhibit 6). Weaker and new brands face huge challenges in building market profile. This outlook also suggests that favored OEMs must double down on protecting their brand image, and be aware of the damage that can be done to credibility by pushing sales at the expense of prices.

Increasing brand loyalty means the market is becoming increasingly concentrated, and competitive. Domestic brands in particular face a difficult road ahead: The market share of the top eight domestic brands rose from 64 percent in 2016 to 79 percent from January-May 2019, a nearly 15-percentage-point surge in just three years. Market power is evidently concentrating in the hands of a select group of dominant brands, with their weaker counterparts being pushed to the curb. Brands must act now to improve brand image, and brand loyalty, or risk sliding into irrelevance.

Driving loyalty programs are the most effective means of increasing brand loyalty. Examples include setting up vehicle owners' clubs, organizing regular gatherings and activities, holding joint promotional events with other merchants

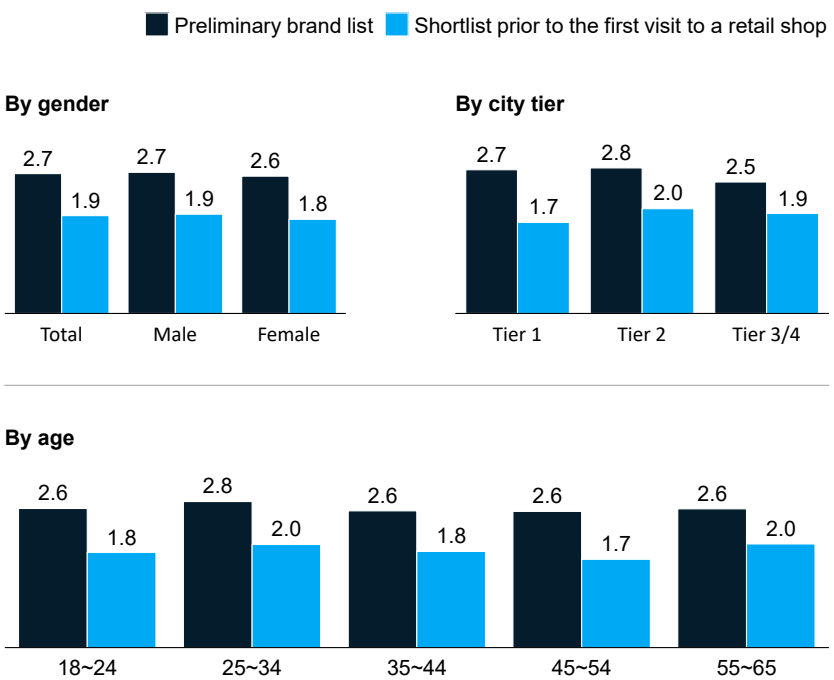
to create top-of-mind awareness; developing value-added services such as auto finance and aftersales services; introducing preferential offers for the next vehicle purchase or trade-in, and so on. In promoting loyalty, automotive companies can collect more information about their target customers, and obtain valuable big data insights.

Being among brands consumers first consider for purchase is vital

When consumers set out to buy a car, they first establish a group of brands to consider and research before making a final decision. Our study shows that for Chinese car buyers, only two or three brands make it into that initial consideration, falling to one to two after a period of research. The trend is remarkably consistent across gender, age, and income bracket. Importantly, over 60 percent of final purchased brands are within this pre-purchase set (see Exhibit 7). Therefore, being on this list is crucial for achieving sales conversion, further reinforcing OEMs' need to concentrate on building brand awareness.

Exhibit 7: Number of brands on consumers' pre-purchase consideration list

Number of brands



Source: McKinsey China Auto Consumer Insights 2019

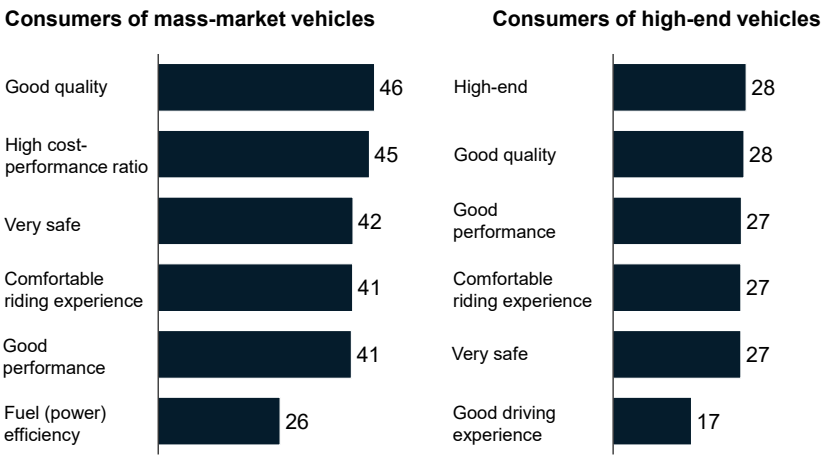
The key challenge facing brand manuacturers is how to stand out from the competition, be shortlisted by consumers, and convert this positioning into sales.

To be shortlisted, manufacturers must communicate a brand image in line with their product positioning as well as consumers' requirements

After developing an "intention to buy", consumers often select the brands that match their functional requirements, thereby establishing a preliminary shortlist. For example, general customers tend to put most emphasis on cost-performance ratio, safety, and quality, and select two to three brands that convey these attributes in their marketing.

According to our survey, the primary requirement of most vehicle owners is being able to meet their daily travel needs, while safety, functionality, and cost-performance ratio also figure prominently in their thinking. Therefore, most of the brands featuring on consumers' shortlists communicate these general, mainstream needs: good quality, high cost-performance ratio, safety, fuel and power efficiency. Other consumers want to enjoy a high-end auto experience, and are attracted to brands that communicate high-quality, luxurious experience, including high-end image, good quality, good performance, comfort and safety, and a fun driving experience (see Exhibit 8).

Exhibit 8: Brand image communicated by the top 5 brands shortlisted by consumers



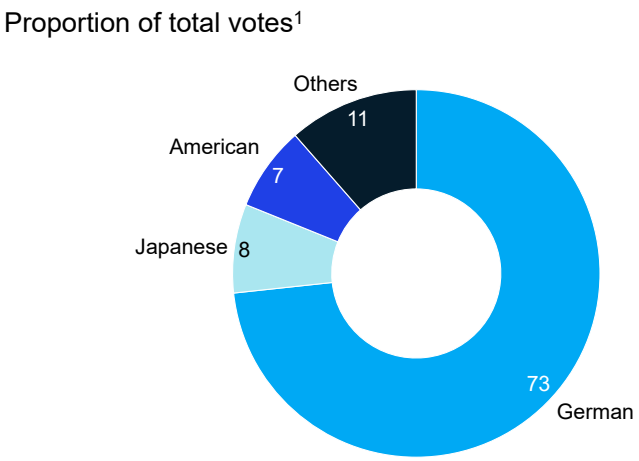
Source: McKinsey China Auto Consumer Insights 2019

For automotive manufacturers, creating a brand image and value proposition appropriate for their target consumer group, and ensuring this figures prominently in consumers' psyches, is key to being shortlisted for purchase.

Brands from Germany, Japan and the US dominate the high-end segment, whereas domestic brands are notable by their absence

Clearly, Chinese brands are not top of mind when it comes to high-end auto brands. According to our survey, the top 10 perceived high-end brands are all based overseas. More than 70 percent of respondents favored German brands, followed by Japanese and American peers. Only 3 percent selected a domestic brand (see Exhibit 9). Foreign brands have already established a deep-rooted high-end image among Chinese consumers.

Exhibit 9: Country of origin of auto brands consumers perceive to be high-end



1 Each interviewee can have a maximum of five votes, each vote representing one brand; total number of valid votes is 6,765

Source: McKinsey China Auto Consumer Insights 2019

In contrast, domestic brands barely figure in high-end auto consumers' calculations. When asked to give examples of domestic high-end brands, a notable proportion (23 percent) of respondents said they could not think of any. Even among those who could call a high-end domestic brand to mind, the average rating still lagged behind those of foreign brands. Domestic brands have a long road ahead if they are to cement high-end associations among Chinese drivers.

Automotive brand manufacturers, especially domestic brands, should focus on enhancing consumer experience to develop a high-end image. Examples

include improving performance, safety features, comfort level, and vehicle interiors to create a high-end, prestigious driving experience; optimizing one-on-one services; setting up exclusive clubs, and introducing top-grade aftersales services.

Omnichannel innovation is essential

The rising penetration and popularity of digital technology and services in China means that the number and nature of channels available to connect with auto consumers is increasingly diversified. This poses new challenges for brand manufacturers seeking to capture consumers at every juncture of the customer journey. In order to maximize their sales conversion ratio, an omnichannel strategy is imperative.

In communicating information to consumers, online channels are indispensable

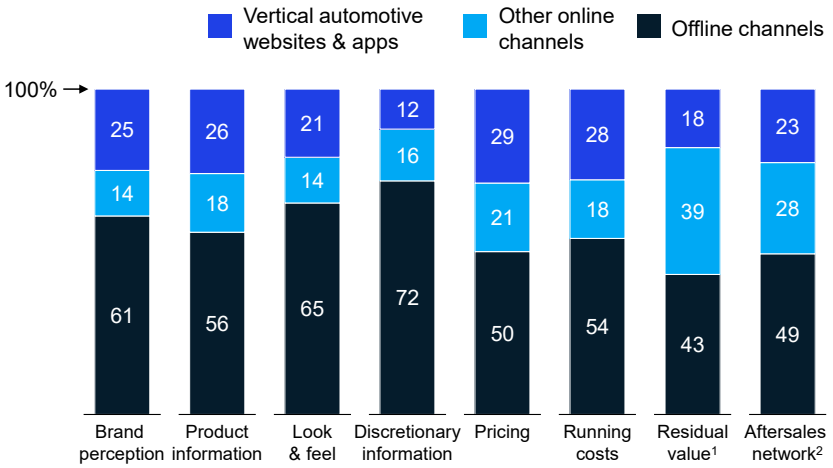
Chinese auto consumers are increasingly comfortable consulting online channels for information, and the auto market is no exception. According to our survey, 30-40 percent of respondents believe online channels are paramount for learning about the market. Among these, vertical automotive websites and applications are considered the most important. At every key juncture of the purchase process, 20-30 percent of interviewees ranked such portals and apps as their number one choice, followed by search engines.

Offline channels are more dispersed. Word of mouth, auto shows, and brick and mortar shops all serve as sources of reference at different stages of the purchase process. For example, in terms of brand perception, 14 percent of interviewees prefer obtaining information from their friends and family, while around 10 percent opt for brick and mortar shops. Meanwhile, 12 percent choose to test drive the vehicle for a better understanding of its look and feel, rising to 34 percent when seeking to obtain discretionary information. In researching information on product pricing and running costs, over 10 percent learn via exchanges with friends and family.

Regarding aftersales services, close to 19 percent of our sample tend to visit 4S shops and other independent sales networks (see Exhibit 10). From the perspective of brand manufacturers, both online and offline means should be adopted for the communication of brand information and consumer education in order to accommodate consumers' different decision-making habits. In addition, messaging should be carefully crafted to maximize conversion at every juncture of the customer journey.

Exhibit 10: Key channels consumers use to obtain information during purchase process

Percentage of interviewees



1 For residual value of second-hand vehicles, "other online channels" mainly refer to e-commerce platforms for second-hand vehicle transactions, etc.

2 For aftersales network, "other online channels" mainly refer to search engines, etc.

Source: McKinsey China Auto Consumer Insights 2019

Among offline channels, 4S shops are still important, but new channels are gaining significant edge

Despite the irreplaceable role of offline 4S stores, consumers are increasingly dissatisfied with traditional service models, and are demanding innovation around customer experience. For example, more than half of our respondents said they would like to learn about the look of cars via online exhibitions, videos, and photos, or by having the vehicle delivered by a sales representative, to supplement a visit to a 4S store. Forty-four percent said they would expect a vehicle to be delivered for test drive by a sales representative. Two-thirds said they would review online price offers alongside those available in multiple offline stores.

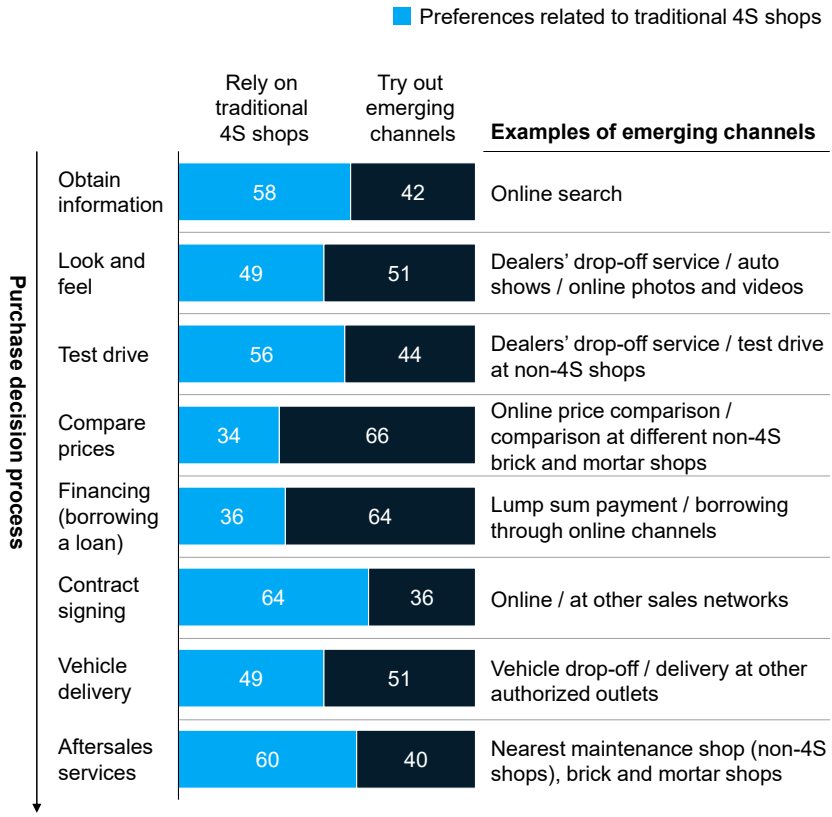
Various new service models are also now on offer when it comes to buying a car, covering contract signing, vehicle delivery, and after-sales services (see Exhibit 11). For automakers, the key to increasing conversion is to enhance the consumer experience by leveraging both emerging channels as well as traditional 4S shops.

Automakers should capitalize on the rise of new aftersales channels

Traditionally, Chinese consumers rely on 4S stores for aftersales services, but even here the nature of the market is beginning to change. For example, 20

Exhibit 11: Leading behavior patterns along consumers' purchase decision journey

Proportion of interviewees



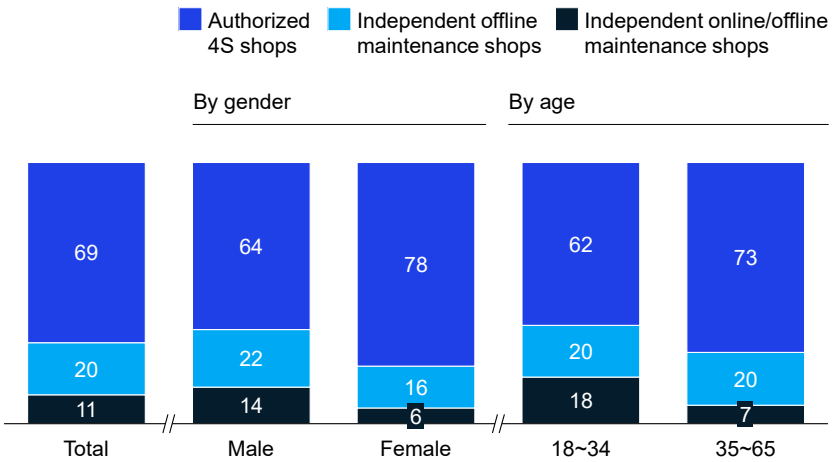
Source: McKinsey China Auto Consumer Insights 2019

percent of our sample opted for independent offline maintenance shops for aftersales services, attracted by their proximity, reasonable prices, and quick turnaround. At the same time, 11 percent chose integrated online-offline service providers, encouraged by the option to bring their own parts, and the fact that services are now viewed as technically on a par with those in 4S stores. In particular, male and young consumers are more receptive to these emerging channels (see Exhibit 12), enabling them to gradually grab aftersales market share from traditional 4S shops.

For automotive manufacturers, developing diversified channels is essential to communicate information effectively and enhance competitiveness. Firstly, brands should deploy targeted communications tailored to each juncture of the purchase decision process, allocating resources to the most frequently used channels. For example, for improving brand perception, combining online

Exhibit 12: Primary aftersales service providers in the past year

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

and offline channels should prove highly effective. However, for discretionary experience, more emphasis should be placed on offline channels. Secondly, automotive manufacturers should use personalized marketing approaches targeting different consumer clusters. Leveraging big data analysis, companies should tailor their marketing to different target audiences, improving consumer experience, and maximizing marketing efficiency.

Consumers hold the key to ACES success

New energy vehicles (NEVs) are increasingly popular, led by preference for hybrids

With an increasing number of NEVs on the road, and sales continuing to grow rapidly, Chinese consumer awareness towards NEVs is improving. A winding down of government subsidies has not curtailed growth momentum, but rather encouraged consumers to make purchase decisions based on the quality of the vehicle.

Since 2017, the proportion of consumers willing to embrace NEVs has risen to 55 percent from 20 percent. High income earners are particularly positive, with 81 percent of those bringing in a monthly household income of more than 48,000 RMB indicating they are willing to consider buying a NEV. Residents in large cities are also more open to NEVs than those from lower-tier cities. Automakers have worked hard to educate consumers, while central government subsidies, and local government perks like expedited or permitted license plate approval, and travel privileges, have all played a part in shifting

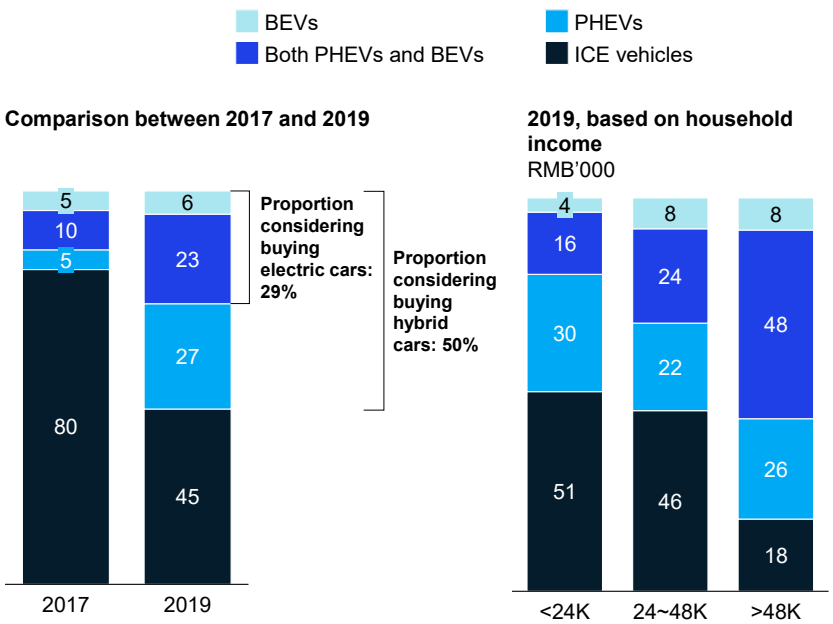
market sentiment. Expanding charging station infrastructure is also lifting consumers' confidence in NEVs.

At the same time, consumers are much more receptive towards plug-in hybrid electric vehicles (PHEVs) compared to battery electric vehicles (BEVs). In the 2017 survey, respondents' receptiveness towards BEVs and PHEVs vehicles ranked equal at 15 percent. However, in 2019, the gap between the two significantly widens, with half of interviewees considering buying a PHEV, while less than 30 percent would buy a BEV. (see Exhibit 13).

Consumers intending to buy PHEVs are mainly motivated by relatively mature technology, and better endurance. Additional advantages include the

Exhibit 13: Types of vehicle under consideration for the next purchase

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

perception of better vehicle safety, stability in different weather conditions, and avoiding having to worry about charging infrastructure.

While 45 percent of Chinese consumers have no plans to purchase a BEV, our survey shows public concerns over key elements of their performance have eased significantly since 2017. Doubts over availability of charging infrastructure, mileage, technological maturity, and safety are markedly less pronounced than they were two years ago. Vehicle mileage and access to

charging points are still the biggest worry, but our research shows that this is now a major concern for less than half of respondents, versus about three-quarters of the survey sample in 2017. Our sample suggested they would be satisfied by a BEV battery capacity capable of supporting a one-way journey of more than 500 km (with air-conditioning on). As BEV technology has matured, models with battery endurance of more than 500 km have blossomed, with brands like Geely and BAIC BJEV launching such vehicles to market. As such, we suggest the market is becoming more comfortable about, and capable of delivering, adequate mileage, indicating the time is ripe for automakers to focus more on consumers' overall experience.

Advanced driver-assistance systems (ADAS) appeal to consumers

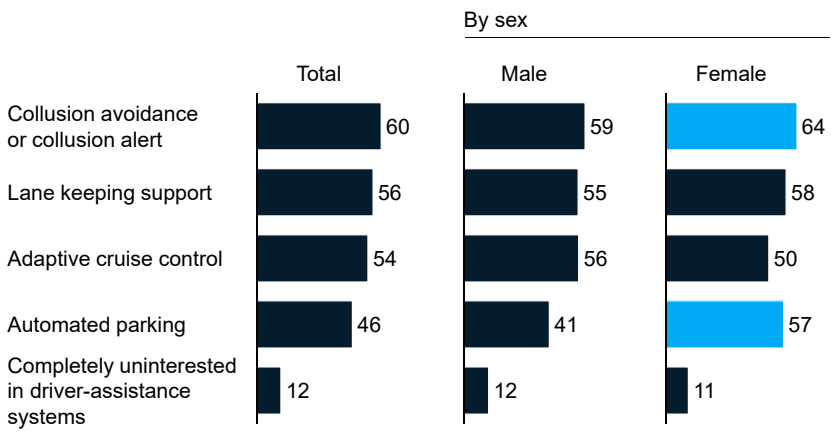
Close to half of respondents indicated interest in ADAS, including automated parking, adaptive cruise control (ACC), lane-keeping support (LKS), and collision avoidance systems. In particular, automated parking is especially appealing to female consumers, with close to 60 percent expressing desire for access to such a system (see Exhibit 14). Most consumers indicated their willingness to pay an average premium of 5-6 percent of the vehicle price for these features.

Consumers are cautious about autonomous driving

According to our survey, about a quarter of consumers believe that self-driving technology is far from mature, and in some cases makes little sense. About 30 to 40 percent of respondents said they would consider using an autonomous system in certain scenarios, such as autonomous tracking through traffic jams, autonomous parking, and autonomous driving on expressways and closed

Exhibit 14: Consumers' interest in advanced driver-assistance systems

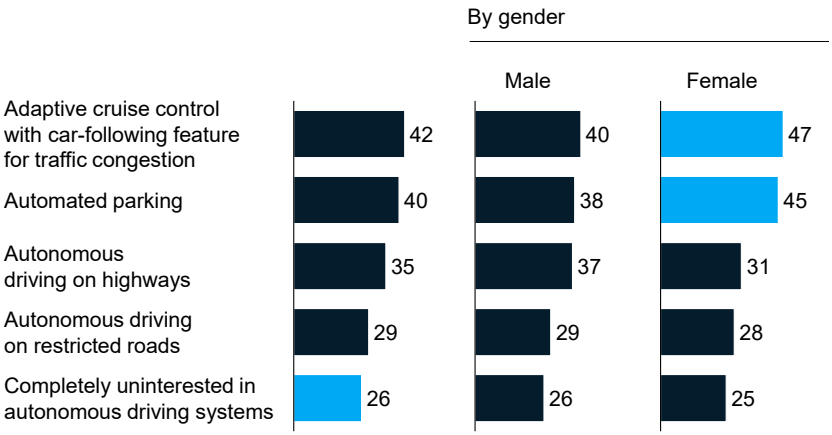
Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

Exhibit 15: Consumers' interest in autonomous driving systems

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

roads. Notably, female consumers are most interested in car-following and automated parking systems (see Exhibit 15).

Of those interested in autonomous driving, the majority indicated their willingness to pay an average premium equivalent to 5~6 percent of the total vehicle price for the technology. Our findings imply that in general, consumers' autonomous driving needs can already be satisfied by L2-level autonomous driving systems or ADAS, and have not reached the stage of L3-level or above.

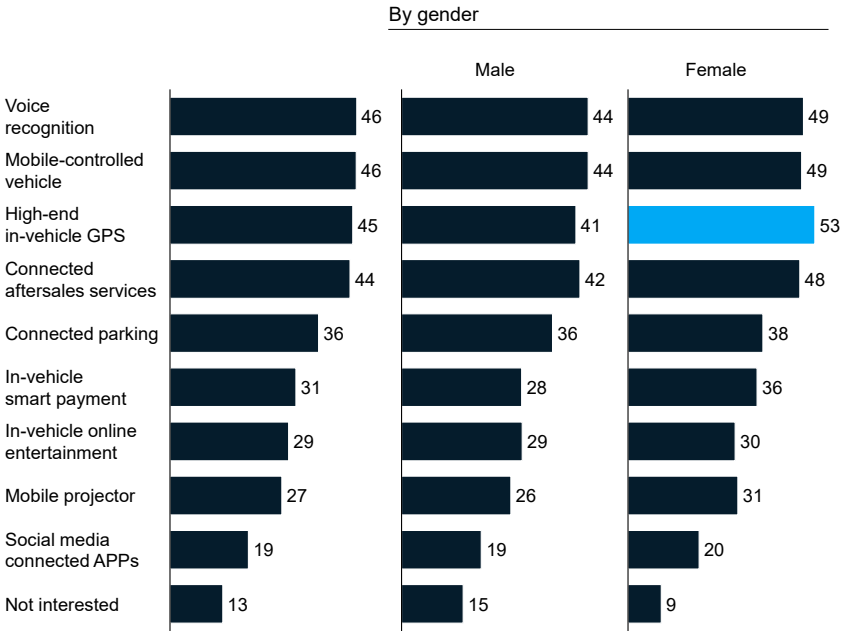
Smart features must connect with consumer preferences

In our 2017 poll, more than 80 percent of respondents were interested in features such as car navigation, online entertainment and mobile phone mirroring, but these figures have all declined to varying degrees in 2019. The latest survey results suggest that while consumers are most interested in voice recognition, they do not have pronounced preference for other connectivity services such as on-board Internet, or smartphone-to-vehicle links. Some 13 percent said they were not at all interested in connected car technology. Otherwise, demand for in-vehicle GPS is relatively strong among women, with 53 percent of female interviewees saying that they want to have this feature (see Exhibit 16).

As technology matures, automakers should strive to acquire a precise understanding of consumer needs, so as to preempt market demand for new connected features. However, it is important to bear in mind that China's super-digital consumers, who are used to enjoying low-cost connectivity across touchpoints in their daily lives, are relatively reluctant to pay for related functions in their cars, with the average premium for smart connections around 4~5 percent of the total vehicle price.

Exhibit 16: Consumers' interest in connected digital and online systems

Proportion of interviewees



Source: McKinsey China Auto Consumer Insights 2019

For car companies and service providers, R&D strategies should place improving consumer experience at their heart, and assess the profitability of new functions as early as possible. According to our survey, more than 70 percent of consumers are unwilling to pay more than 5 percent of the total vehicle price for ACES functions, which puts great pressure on their development. In the past, we have seen many initiatives abandoned because of their failure to truly enhance consumer experience. Therefore, automakers must review their targeted areas of investment, focusing on their strong suits, and avoid blindly investing without a clear path to profit.

As the Chinese automotive market matures and is increasingly driven by demand from existing car owners, consumer behaviour and decision-making over vehicle purchases is becoming more rational. Attracting increasingly savvy consumers through the creation of differentiated product positioning, while enhancing brand loyalty, is crucial to staying competitive.

We believe automakers must double down on communicating brand image

across all touchpoints on the customer journey, effecting an omnichannel strategy as part of critical efforts to penetrate consumers' top-of-mind awareness. As we have seen, this is crucial if brands are to stand any chance of securing significant sales in this fast-evolving market.

While formulating and adjusting their strategies, automotive brand manufacturers should also use diversified and innovative means to highlight their brand's unique advantages. Amid the downturn, best-in-class innovation that touches the needs of consumers is a sure-fire way to raise brand image, and secure the trust of increasingly loyal consumers. ■

About McKinsey's China Auto Consumer Insights Survey 2019

In July 2019, we surveyed 2,500 auto buyers representing a range of demographic attributes in more than 20 major cities across China. The goal of the survey was to establish a better understanding of buying behavior and attitudes towards autos, with a view to drawing insights that automobile OEMs can use when crafting their strategies. Survey questions addressed major touchpoints along the purchasing journey, including brand and channel preferences, pricing, product preferences, brand loyalty, and after-sales behavior.

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The authors would like to acknowledge the contributions of the following colleagues to the research and writing of this report: Paul Gao, Arthur Wang, Bill Peng, Ting Wu, Frank Chu, Eric Shuping Fan, Deyang Ren, Cherie Zhang, Aaron Hsu, Shawn Liu.

CEO views

The road ahead: Thoughts on the future of China's auto industry with FAW Chairman Xu Liuping

Bill Peng, Arthur Wang

China's automotive market has endured a year of falling sales and prices, one that will likely mark a transition into a second phase of development as the period of rapid sales growth comes to a close.

As the downturn extends into uncharted territory, automotive players accustomed to long-term growth are feeling the pinch of subdued demand, and heightened financial pressure.

Promotional campaigns lack the impact they once enjoyed; sales of leading products are missing expectations; suppliers are operating on increasingly tight margins; and distributors are reluctant to carry inventory.

Across the board, the market is considering how best to adjust and emerge from the transition in a position of strength.

FAW Chairman Xu Liuping is better placed than most to offer guidance, having overseen remarkable success at FAW Group, China's oldest state-owned automaker, since taking the helm as chairman in August 2017.

Under Xu's guidance, FAW's iconic Hongqi sedan has evolved into a leading choice for luxury car owners, enabling sales to beat the downturn and stay on track to meet a target of 100,000 units this year, up from 30,000 in 2018.

Meanwhile, FAW's two car joint ventures, FAW-Volkswagen and FAW Toyota, have continued to expand their market share, with the former now the leading auto venture by sales in China.

FAW's Jiefang commercial truck brand enjoys similar dominance, having extended its lead over its closest competitor in the heavy-duty truck industry.

Recently, Xu shared his thoughts on the outlook for China's auto market, the prospects for industry consolidation, and why product innovation and technological edge must lead every automaker's competitive strategy.

On the market

McKinsey: *China's automotive market is experiencing its first continuous decline in 30 years, opening the door to debate the market's future. Some say the number of vehicles in operation per capita is still relatively low, and annual sales will eventually exceed 40 million units. Others suggest the market is saturated, and sales will level out at approximately 20 million per year. What's your opinion?*

Xu Liuping: Two key factors will determine the trajectory of China's automotive market. Firstly, if the Chinese economy grows at more than 5 percent, the Chinese automotive market will continue to grow. Chinese consumers have strong aspirations for car ownership, so potential demand remains significant.

The second factor is whether the environment for automotive consumption improves. Some Chinese cities still have rudimentary administrative policies. For example, to address traffic jams, city governments simply adopt a license

plate quota. Local governments lack fiscal motivation to encourage auto consumption, in part because consumption and sales tax are collected by central government. If taxes levied on new automotive sales could be shared by both local and central governments, then local governments would be encouraged to explore improved models of urban transportation administration.

On avoiding obsolescence

McKinsey: *How can automotive makers survive intensifying competition in China?*

Xu Liuping: There are two key factors. The first is product innovation. The automotive industry is still a product-driven industry. Hence, CEOs should have a religious fervor for their lead product. Automotive industry product innovation and development melds engineering technology with artistry. Success can only be achieved by combining both perfectly. Corporate leaders must therefore be hands-on when it comes to product innovation. Delegating the responsibility to another person is highly risky. The second key factor is good corporate governance. Currently, private enterprises have very flexible governance structures. They react faster to the market, but sometimes they are a little capricious, and their decision-making is random. Hence, standardization is key. For SOEs, the primary governance challenge is inadequate institutional flexibility.

On risk and decision-making

McKinsey: *The global automotive market is also experiencing a downtrend. What are the major risks facing global automotive players?*

Xu Liuping: Three areas of decision-making are most critical. The first is product decision-making. Product innovation will still be the decisive factor for the automotive market in future. If a corporate leader is not personally involved in making the product, pays little attention to innovation, or is not passionate about the product, the automotive enterprise will likely run into trouble. The second is making decisions appropriate to the Chinese market. If product innovation is not closely bound to China, and the needs of Chinese consumers, problems will arise. As far as global automotive players are concerned, the level of priority they give to the Chinese market, the amount of time they invest here, and the attention they pay to the market are the key decisions. The third is China's industry policy decision-making. The government imposes regulatory targets and measures, and industry policies also have a significant impact on the market and production activities. An automotive maker must be able to respond to these changes in policy requirements.

On removing of ownership restrictions

McKinsey: *What's your view on the strategies of multinational corporations (MNCs) in China?*

Xu Liuping: By 2022, China's automotive industry policy will see the complete removal of ownership restrictions on joint venture enterprises. Some MNCs may hope to take a larger stake in Chinese joint venture companies. This is a complicated issue. If the capabilities and contributions of both joint venture partners are about equal, there may be little room for adjustment. In contrast, if they are unbalanced, the potential for adjustment could be huge. At the same time, the central and local governments play a very important role, and their differing priorities must also be taken into account. Similarly, Chinese joint venture partners operate under different share structures across central enterprises, local SOEs, and privately-owned companies. Ownership structures of joint venture enterprises are thus likely to diversify in future.

On competitive strategy

McKinsey: *The proportion of first-time auto buyers is falling, and competition is intensifying. Do you think automotive makers should adopt competitive strategies that are different from the first phase of China's auto market evolution?*

Xu Liuping: There will be some differences, but product innovation is still the core issue. Those involved in product innovation must have deep insight into human nature, and an acute sense of fashion. They should also have an accurate grasp of future sales when drawing up product plans. If sales estimates are incorrect, this will result in oversupply, which puts the company in a passive position. In addition, enterprises should not tolerate shortcomings in their existing products and industrial chains.

On SOE reform

McKinsey: *You have been at the helm of FAW for two years, during which the vitality of the entire organization has improved significantly. How did you achieve it?*

Xu Liuping: First, my superiors, such as the central government and higher-level departments, required that we push forward with reforms. Second, there was a strong call for reform among our employees. Third, if FAW did not reform, we would lose the last window of opportunity in China's automotive industry, and become obsolete. This sense of crisis, urgency, and responsibility, is very strong. The organization's efficiency and vitality have improved significantly thanks to the implementation of the "four possibilities" reform over the last two years. These four possibilities include that of managers to be promoted or demoted; of employees to join or leave; of pay to be raised and lowered; and of the organization structure to expand or contract. The implementation of the "four possibilities" reform made us more dynamic and energized us, while putting more pressure on the group to improve. In the end, they helped foster stronger business development.

On core technology

McKinsey: *In future, how will FAW approach technological leadership?*

Xu Liuping: Automotive industry technology involves several key elements. First, you must acquire and master core technology. Otherwise, product innovation will become a tree without roots. Second, you need strong system integration capabilities because of the preponderance of new automotive technologies, none of which can be skipped over. Integration is a must. Third, you must quickly gain control of cutting-edge technology. There are no shortcuts. Of course, enterprises in different stages should do different things, but corporate leaders must position technology as a core driver of product competitiveness.

On young talent

McKinsey: *What advice do you have for young people entering the job market with a passion for automotive?*

Xu Liuping: First, automotive is a sunrise industry in China. It is not merely that the market capacity is large and will continue to grow, but also that the industry is an integrated entity combining new technology and new applications. Second, automotive combines both engineering technology and artistic design – both static and dynamic. Last but not least, the industry is in a period of change, and, with change, comes new breakthroughs. This will create plenty of opportunities for young people to show what they can do.

Bill Peng is a partner in McKinsey's Hong Kong office;
Arthur Wang is a partner in McKinsey's Hong Kong office.

Insights into China's dynamic auto market: An interview with Hubertus Troska, Daimler's Board Member responsible for Greater China

Daniel Zipser

Under its “Made in China, for China” ethos, Daimler has embraced the notion that success in China requires long-term commitment to the local market and its customers.

For example, its Beijing Benz Automotive Co. (BBAC) joint venture with Beijing Automotive Group Co. (BAIC) has produced a staggering two-million-plus cars since the first E-Class peeled off the production line in 2006. Those vehicles have been supported by local research and development facilities to delight Chinese customers with specialized market features.

Daimler continues to focus on localization, last year committing 1.5 billion euros together with BAIC to operate a second production location for high-quality premium vehicles.

Bringing the production of electric cars under Mercedes-Benz's product and technology brand “EQ” to China is another testament to Daimler's long-term commitment to the Chinese auto market. Meanwhile, together with BYD Co Ltd., Daimler will further develop the home-grown NEV brand DENZA with the all-new DENZA X due to hit the market by early 2020.

In addition, Daimler this year agreed to form a 50-50 joint venture with Zhejiang Geely Holding Group to operate the smart brand, and to produce an entirely new generation of electric cars in China, with global sales due to start in 2022.

Daimler also expects its R&D Tech Center China, set to open in 2020, to drive further innovation in the Chinese market. Along with several other landmark investments announced in the last few years, these deals speak to the confidence of Daimler's commitment to the market, which has been articulated in China for the last seven years by Hubertus Troska.

Under his watch as Member of the Board of Management of Daimler AG responsible for Greater China, the German group has grown into one of the dominant players in China's premium segment, from a less competitive position just 7 years ago.

Sitting down with McKinsey Senior Partner Daniel Zipser, Troska elucidates the strategy behind Daimler's success, why Mercedes-Benz is positioned to take advantage of China's unique consumer profile, and the psychology behind Chinese customers' appetite for its ultra-luxury Mercedes-Maybach S-Class.

Daniel Zipser: *Daimler has achieved a remarkable leadership position in China's competitive market for premium cars. What are the major factors behind that success?*

Hubertus Troska: China is by far the biggest car market in the world, having achieved in 10 to 15 years a level of development that took almost a century in Europe and the US. Mercedes-Benz in China has also changed dramatically, having advanced from a position of lesser strength seven or eight years ago to become one of the dominant players in the premium market.

Hubertus Troska

Age: 59

Education:
Alexander von Humboldt school in Mexico, Economics

Career Highlights:
Steered Daimler to leadership of the premium car segment in China, booking record sales amid an historic industry downturn.

Led concerted efforts to grow localized production of Mercedes-Benz vehicles in China, including investments in Daimler's truck joint venture with Beiqi Foton, as well as expanding existing partnerships with BAIC and BYD, and forging new ventures with Geely Auto.

Appointed Member of the Board of Management of Daimler AG responsible for Greater China in 2012.

Excelled in a series of positions at Daimler AG, including Executive Vice President, Truck Europe/Latin America (Head of Mercedes-Benz Truck).

President of Mercedes-AMG GmbH, and Head of Product Marketing Passenger Car Sales at Mercedes Car Group, DaimlerChrysler AG.

Held a series of Director-level positions with Mercedes-Benz at the country market level, as well as senior sales and management positions at Daimler-Benz AG headquarters.

The most important success factor is having a dedicated sino-international team, wholly committed to delivering exciting products and services to our Chinese customers, and supported by a strong local production and R&D footprint. Number two is nurturing the strength of the Mercedes-Benz brand and adapting its positioning in the China market. Last but not least, is our mutually respectful and strong relationship with our Chinese partners, which is crucial when doing business in China.

Daniel Zipser: *Since summer of last year, the overall China auto market has*

experienced a meaningful dip, and we've seen double-digit sales declines, even as the premium market has held up fairly well. Has the downturn affected your China strategy?

Hubertus Troska: The pullback this year and through part of last year is a normalization process of the overall market, following more than a decade of impressive growth. But we still see continued demand for premium products. We are up 4 percent versus last year – and I'm cautiously optimistic also for the years to come. China still offers enormous potential, so our strategy remains broadly consistent to focus on our customers.

Daniel Zipser: *How would you describe the Chinese auto buyer, and how might they compare with their German and American peers?*

Hubertus Troska: China has the world's most fascinating customer base. It is not only our biggest market, but also hosts by far the youngest customers in the world. The average premium buyer of Mercedes-Benz in China is less than 36 years old. That's almost 20 years younger than the typical German premium buyer, and almost 10 years younger than their average American counterpart.

Our Chinese customers are young and ambitious people with high expectations on products and services. They are tech savvy and interested in innovation. Moreover, they truly appreciate brands that deliver great design and craftsmanship. And, believe it or not, about 30 percent are first-time buyers. Needless to say that our first priority is, to give them the perfect Mercedes-Benz experience when they make their first premium buy.

Daniel Zipser: *How is China's fabled role as the world's most digital nation impacting the automotive industry?*

Hubertus Troska: Living in China, it is clear that the people here are “always on”. The breadth of digital services available and the predominance of online

payments, are unparalleled. Chinese consumers want to bring this lifestyle into their cars and into our brand environment. They expect to carry all aspects of online connectivity into their vehicles. We have state-of-the-art connectivity in our cars with MBUX – Mercedes-Benz User Experience – and our strategy is to offer specifically Chinese digital solutions. Our models carry special China-focused digital features that have a very high take rate. Clearly, digitalization is already massively impactful, and it will continue to grow in importance going forward.

Daniel Zipser: *Daimler maintains several joint ventures with Chinese OEMs, while working with major dealer groups here. What advice would you give to foreign companies trying to work in partnership arrangements in the China market?*

Hubertus Troska: In the automotive industry, having strong local partners is very important for understanding the market, the customers, as well as business development. We're fortunate to have three strong industrial partners. Beijing Automotive Group Co. (BAIC) is the longest partnership we have, and has been Mercedes-Benz's main partner in China for over a decade.

Given the importance of new energy vehicles, we started developing a Chinese electric car early on with BYD, and that partnership continues under the DENZA brand that we jointly developed in China. Our largest shareholder, Geely, is another industrial partner, and together we're developing – amongst other projects - a joint venture to take the next generation smart brand fully electric for the global market.

We operate over 600 retail outlets in nearly 230 cities in China, and partner with leading Chinese dealer groups, which along with our joint venture partners underpin the success of our business here.

Daniel Zipser: *Even amid a dip in the overall auto market, and a wider economic slowdown in China, the ultra-luxury Maybach is selling 600 units per month. What attracts Chinese consumers to the Maybach brand?*

Hubertus Troska: This young automotive market is strongly motivated to upgrade, to embrace premiumization.

We are fortunate to be a dominant player in the premium market, the S-Class segment. The very top model of the S-Class segment, the Mercedes-Maybach S-Class, is indeed performing well. The Maybach offers the most space in the luxury sedan segment, coupled with all the hi-tech features of Mercedes-Benz. At the same time, it appears somewhat understated from the outside. The combination of the mentioned features is highly appreciated in the current Chinese business environment.

Daniel Zipser: *At the end of this year, you'll start producing electric vehicle models in China. What does the future hold for electric vehicles here, and specifically for Daimler?*

Hubertus Troska: China is not only the biggest auto market, it's also the world's biggest market for new energy vehicles. It has the vision and the sales potential, backed by strong government support.

At the global level, we flipped the switch by putting billions of euros behind the launch of 10 new electric cars within the next several years. We will localize the majority of them in China, starting with the EQC at the end of this year. Meanwhile, we will further develop our DENZA brand with the all-new DENZA X due to hit the market by early 2020. And these will also be followed by the production of smart electric vehicles in China later.

Daniel Zipser: *What's your view on Chinese electric automakers' global aspirations?*

Hubertus Troska: Local brands form the biggest part of the electric car market today, and they're clearly shaping up to leverage the scale of the domestic market to make an impact worldwide. On the other hand, we have substantial experience in building cars, and we're investing heavily into electric. As we like to say, "Electric now has a Mercedes." Whilst volume brands now command the lion's share of the electric market, more premium electric cars on the street, including from Mercedes, are only likely to fuel additional demand for the segment.

Daniel Zipser: *Electric and autonomous driving is drawing interest and substantial investment globally, as well as in China. What is Daimler doing in this space in China, and how do you see the market developing?*

Hubertus Troska: We refer to the future of automotive with the four letters "CASE" – Connected, Autonomous, Shared and Services, Electric. Autonomous vehicles will have a huge impact on the industry, but the shift towards fully autonomous driving is not going to happen overnight. We will see a step by step evolution that has already begun. There are already advanced driver assistance systems in our cars that allow you to drive hands-off for longer periods, both stop-and-go, and on the highway. And together with Bosch we have pioneered the world's first automated driverless SAE Level 4 parking system.

These experiences will only become more widespread, and China will play a very important role. For example, we are a founding member of Baidu's open source autonomous vehicle technology platform, Apollo. We were also the first foreign company to obtain an autonomous test driving license in Beijing, and are working with several universities on the deployment of autonomous technology in China.

Daniel Zipser: *What's the biggest challenge in the China market, and how are you tackling it?*

Hubertus Troska: "CASE" is changing the industry dramatically on a global scale, and these changes will occur most rapidly in China. Our biggest challenge, and that of any automaker, is to stay ahead of the transformation. This requires huge investment to shape or co-shape industry change, and in our case to deliver the Mercedes of electric cars, the Mercedes of autonomous cars, and the Mercedes of connected cars. In this we have an advantage as technological innovation sometimes comes with higher costs, and the premium customers, our customers, tend to be able to afford innovative technology first.

Daniel Zipser: *What has it been like working here in China, and what advice would you give other executives in this market?*

Hubertus Troska: I've worked at Daimler for more than 30 years across five countries, but these seven years in China have been the most formative of my life. I continue to be deeply impressed by the ambition, the hardworking spirit, the rich culture, and the kindness of Chinese people. For a car guy – especially for a car guy – China is the place to be.

This interview was conducted by **Daniel Zipser**, a senior partner in McKinsey's Shenzhen office.

The future of ACES

Seizing the ACES opportunity in China's 14th Five-Year Plan

Mingyu Guan, Pei Shen, Tony Zhou

China is gearing up to release its 14th Five-Year Plan, the document that will guide economic policy development from 2021 to 2025, and the evolution of China's auto industry along with it.

Seizing the opportunities encouraged by the plan, which we expect to revolve around autonomous, connected, electric, and shared (ACES) vehicles and technology, could spell the difference between success and failure for Chinese automakers, and impact their ambitions to lead on the global stage.

The idea of innovating around ACES was first proposed in the 13th Five-Year Plan, in response to which all major automotive players in China rolled out related strategies. Half a decade on, global automakers are investing heavily in ACES vehicles and technology as part of a massive industry shift that the next five-year plan will accelerate.

On the eve of the 14th Plan, which is expected to be released by China's economic planners sometime in the second half of 2020, we look back at the past five years for guidance as to what to expect for the evolution of ACES in the world's largest auto market.

Over the last five years, China's automotive market has enjoyed remarkable growth, with local players leading significant innovation in ACES technologies. Below are some of the highlights:

— **New-energy vehicle (NEV) development proceeded in step with policy guidance, and the market surged:** Between January and May 2019, annual sales of NEVs in China, comprising battery electric vehicles and plug-in hybrid electric vehicles, accounted for 56 percent of total sales worldwide, and approximately four times that of the US, the world's second-largest market. China's NEV market growth averaged 107 percent per year over the last five years, well ahead of the 30-40 percent growth rates seen in major markets such as the US and Europe. Chinese brands commanded more than 40 percent market share.

— **Automotive players and Internet companies teamed up to drive automotive connectivity:** Chinese auto consumers are very particular about connectivity, with higher expectations than consumers in Germany, the US, and other markets. Some 69 percent of Chinese auto consumers told McKinsey they would be willing to switch brands for a better automotive connectivity experience, much higher than the 19 percent of consumers in Germany, and 34 percent of consumers in the US. The mid-2016 launch of SAIC Motor's Roewe RX5, equipped with the Alibaba-backed Banma connectivity system, significantly advanced automotive connectivity in China's passenger car market. In August 2019, Changan and Tencent jointly launched "in-car WeChat", adding a voice-activation function to ensure

drivers can use the messaging service safely while they drive.

— **As Level 2 autonomous driving capability matures, various players are betting on L3 and higher autonomous vehicles (AVs):** Autonomous driving in China is now characterized by the sophisticated application of L2 technology. All mainstream brands have launched corresponding products. Meanwhile, OEMs, technology companies, and mobility service providers are actively investing in R&D for L3 and higher. Some leading companies have also joined in the global competition, achieving solid results in AV tests on roads in California. After smart connected cars were included in the overall industrial planning blueprint, various arms of China's government have implemented related policies, and local governments have begun to permit AV road tests.

— **The shared mobility market has grown rapidly, and a landscape with one dominant player, and several new entrants, has taken shape:** Online ride-hailing services booked approximately 10 billion orders in 2018. Assuming an average of 20 RMB per order, the market size would amount to 200 billion RMB (US$28.1 billion). After multiple market reshuffles, Didi has emerged as the dominant player with a market share of more than 90 percent. It is also the only Chinese enterprise to rank as a truly global shared mobility player. Nonetheless, new companies continue to emerge in regional markets and sub-sectors, including T3, which has drawn a lot of attention for its plans to develop a smart mobility ecosystem.

On the other hand, a review of the 13th Five-Year plan reveals that most local Chinese automotive players have yet to fully achieve the objectives they set out in their ACES investment plans, and presents the following challenges:

— **Although the BEV market attracted massive capital investment, only a few top-tier players have scaled up.** Meanwhile, only a handful of suppliers, as opposed to OEMs, possess core battery technology.

— **Local OEMs have yet to master core automotive connectivity technologies.** Automotive players still rely heavily on high-tech companies or local Internet giants for major automotive connectivity controls such as operating systems, app stores, and online ecosystems. In addition, there is little differentiation in the automotive connectivity experiences of different brands, and no effective data monetization strategy has yet emerged.

— **L2 autonomous driving is currently heavily dependent on technological support from foreign suppliers:** In the L3 and higher AV sector, a wide gap exists between Chinese companies and world industry leaders in driverless technology, such as Google and GM Cruise. In autonomous driving tests in California, Google's Waymo averaged one manual intervention per 18,000 km, and GM Cruise had one intervention per 8,400 km. By way of comparison, the leading Chinese enterprise reached just 330 km.

— **The earnings outlook for shared mobility remains unclear:** The shared mobility earnings outlook, even for Didi, which has an absolute market share advantage, remains uncertain. Small companies continue to endure losses, and even closures, as the market develops.

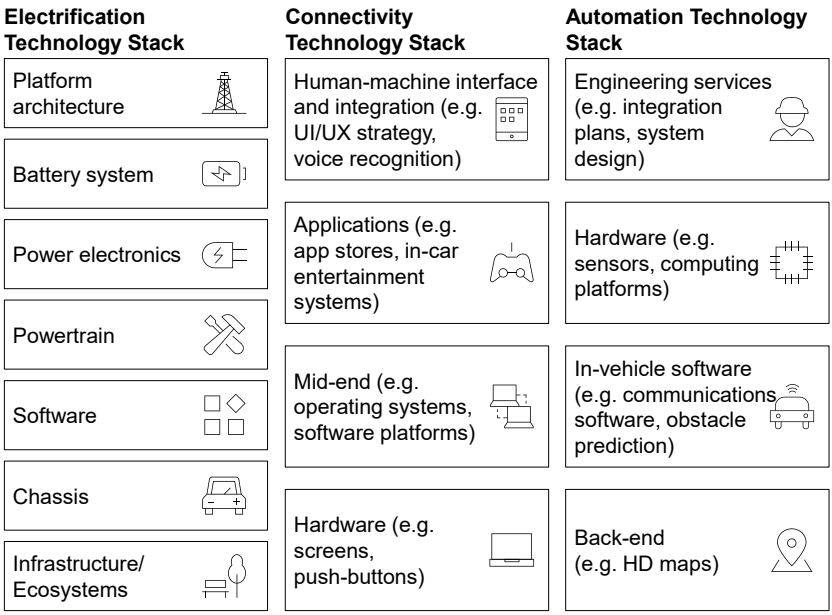
McKinsey research indicates that if an OEM wants to achieve significant success in all areas of ACES, it would have to invest approximately 500 billion RMB over 10 years, of which 300 billion RMB should be invested in NEVs. Of the leading local automotive OEMs in China, the top five players invested approximately 34 billion RMB in R&D in 2018, or about one-third of the R&D investment of Germany's Volkswagen alone. This significant difference in investment has undoubtedly restricted the ability of Chinese companies to build sustainable competitive advantages in the ACES space.

In recent years, China's automobile industry has seen its profit margin decline from 8.3 percent in 2016 to 6.4 percent in the first half of 2019. Investing in ACES vehicles and technology has put further pressure on automotive companies' profitability, making it essential they capitalize on the opportunities presented by the forthcoming 14th Five-Year Plan. Based on decades of experience serving leading global automotive enterprises, McKinsey suggests that automotive players focus on the following three areas:

— **Innovation and prioritization:** Investment and development in ACES vehicles and new businesses by leading Chinese automotive players lacks clear prioritization. Globally, no OEM has been able to guarantee that new businesses and innovation advance in tandem. Even well capitalized companies, such as Volkswagen and Toyota, have weighed their new business and investment priorities, optimizing resource allocation and intensifying key investments in a bid to ensure that every investment is converted into sustained technological advantage and market share. Major automotive players should narrow the focus of their ACES development, and target their investments accordingly. Automotive players must make strategic choices regarding the items in the ACES technology stack strategic framework (Exhibit 1). Here are some key questions for automotive executives to consider:

  - In the EV technology stack, how should a company balance control over battery systems and investment in motors and charging facilities?
  - In the connectivity technology stack, should a company spend heavily on enhancing control over software platforms and app stores, or continue to invest in hardware?
  - In the autonomous driving stack, can a company grasp all opportunities in sensors, computing platforms, obstacle prediction, and other key technologies, and maintain this technological advantage?

Exhibit 1: ACES technology stack overview



Source: McKinsey

— **Open collaboration and giant alliances:** OEMs "going it alone" on ACES have found it increasingly difficult to sustain market position. Global automotive players are consequently teaming up in two distinct models:

- Collaboration between traditional OEMs: In the pursuit of economies of scale, R&D investment is being shared to reduce costs. We have seen collaboration between multinational automotive players, including Ford and Volkswagen, which have teamed up to research and develop BEV platform architecture, and AV technology. Elsewhere, Daimler and BMW are collaborating closely in shared mobility, BEVs, and autonomous driving.
- Collaboration between OEMs and high-tech companies: The Renault-Nissan-Mitsubishi Alliance has partnered with Google's Android Automotive. There are also indications that Volkswagen and Waymo are working together to develop AV technology.

These collaborations do not merely seek to develop technological advantages, but also trim costs and maximize future earnings. Major automotive players should follow suit and plan their future partnership strategies. This includes actively acquiring quality assets and ACES technology, and working with non-OEM partners.

— **Organizational transformation, cutting costs, and increasing efficiency:** As the focus of industrial development shifts over the next three to five years, OEMs will have to introduce software development, big data analytics, and other new capabilities. Therefore, in addition to seeking the necessary talent, automotive players should aim to transform into more agile organizations. Today, OEMs tend to develop products with an eye to integrating the latest technology, rather than first determining what customers really need. Breakthroughs can be achieved by switching focus away from such technology-centered development to a more customer-centered approach. Moreover, OEMs can move on from pure manufacturing business models to ones which provide value-added services, and consider the sale of hardware as a trigger for the provision of lifetime services. These shifts require leaders to invest in corporate culture and organizational change. At the same time, automotive players should improve efficiency across R&D, production, sales channels, marketing, and corporate operations, while simultaneously lowering costs across all segments. These savings and margin improvements will help increase cash flow, and build up reserves for ACES investments.

■ ■ ■

We believe that ACES vehicles and technology will be integral to the 14th Five-Year Plan, and China's ongoing ambition to build a world-class auto industry. Chinese automotive players must act now to focus their ACES investments and cement the foundations for a successful, world-leading future. ■

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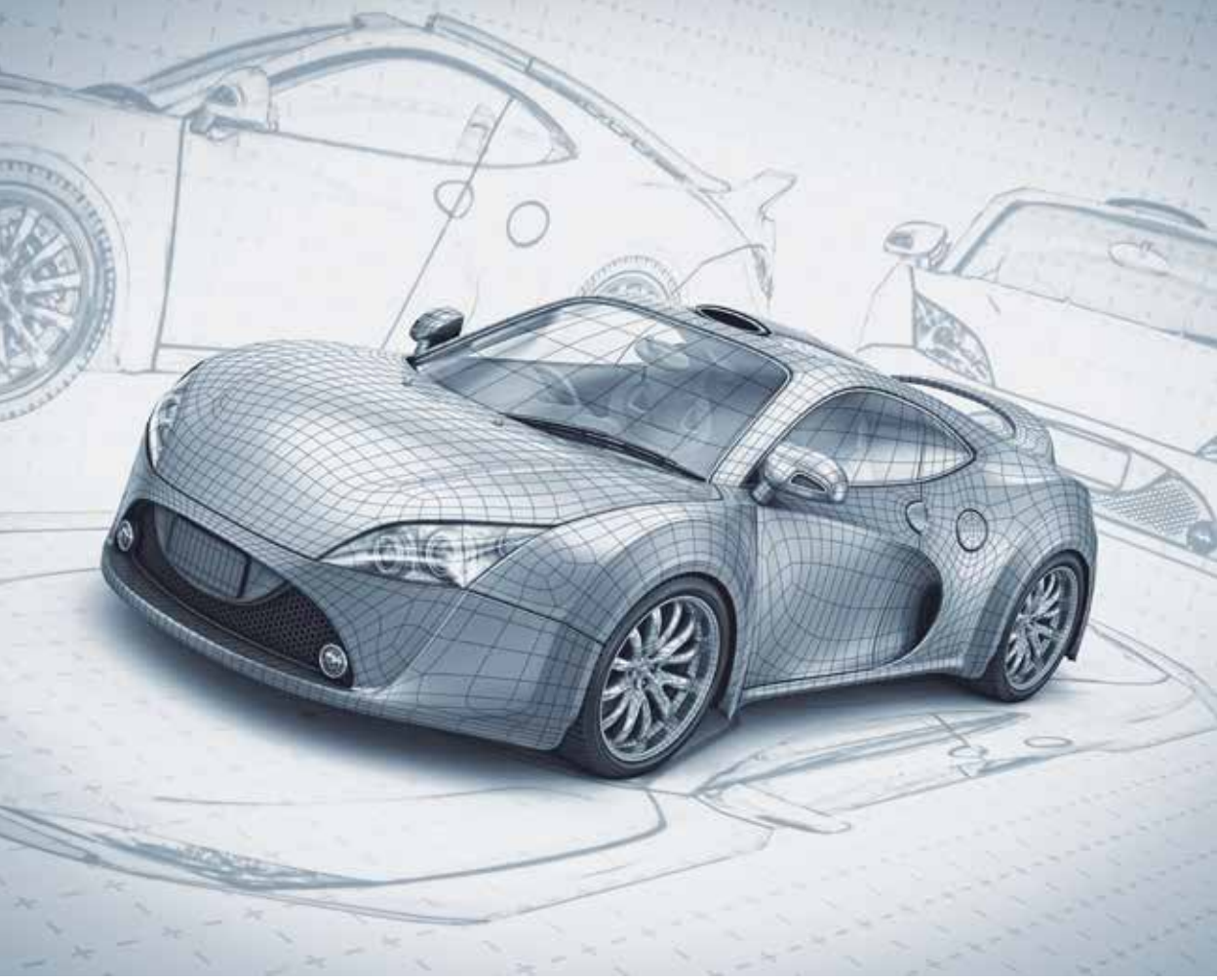


Rethinking car software and electronics architecture

Mingyu Guan, Arthur Wang, Ting Wu, Ondrej Burkacky, Georg Doll, Johannes Deichmann, Christian Knochenhauer, Tony Zhou

The engine was the technology and engineering core of the 20th-century automobile. Today, software, large computing power, and advanced sensors increasingly step into that role; they enable most modern innovations, from efficiency to connectivity to autonomous driving to electrification and new mobility solutions.

However, as the importance of electronics and software has grown, so has complexity. Take the exploding number of software lines of code (SLOC) contained in modern cars as an example. In 2010, some vehicles had about 10 million SLOC; by 2016, this expanded by a factor of 15, to roughly 150 million lines. Snowballing complexity is causing significant software-related quality issues, as evidenced by the recent recalls of millions of vehicles.

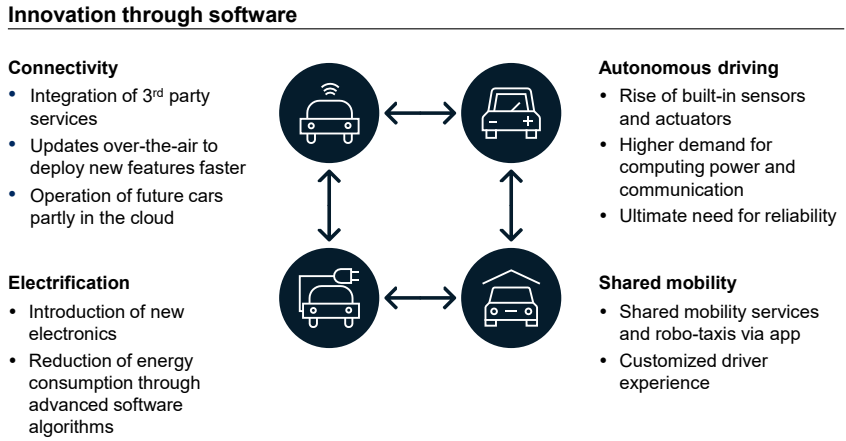
With cars positioned to offer increasing levels of autonomy, automotive players see the quality and security of vehicle software and electronics as key requirements to guarantee safety. And this is requiring the industry to rethink today's approaches to vehicle software and electrical and electronic architecture.

Addressing an urgent industry concern

As the automotive industry is transitioning from hardware- to software-defined vehicles, the average software and electronics content per vehicle is rapidly increasing. Software represents 10 percent of overall vehicle content today for a D-segment, or large, car and the average share of software is expected to grow at a compound annual rate of 11 percent, to reach 30 percent of overall vehicle content in 2030. Not surprisingly, players across the digital automotive value chain are attempting to capitalize on innovations enabled through software and electronics (Exhibit 1). Software companies and other digital-technology players are leaving their current tier-two and tier-three positions to engage automakers as tier-one suppliers. They're expanding their participation in the automotive technology “stack” by moving beyond features and apps into operating systems. At the same time, traditional tier-one electronic system players are boldly entering the tech giants' original feature-and-app turf, and premium automakers are moving into areas further down the stack such as operating systems, hardware abstractions, and signal processing in order to protect the essence of their technical distinction and differentiation.

One consequence of these strategic moves is that the vehicle architecture will become a service-oriented architecture (SOA) based on generalized computing platforms. Developers will add new connectivity solutions, applications, artificial-intelligence elements, advanced analytics, and operating systems. The differentiation will not be in the traditional vehicle hardware anymore but in the user-interface and experience elements powered by software and advanced electronics.

Exhibit 1: Software, the core enabler for key automotive innovations, is increasingly a differentiating factor

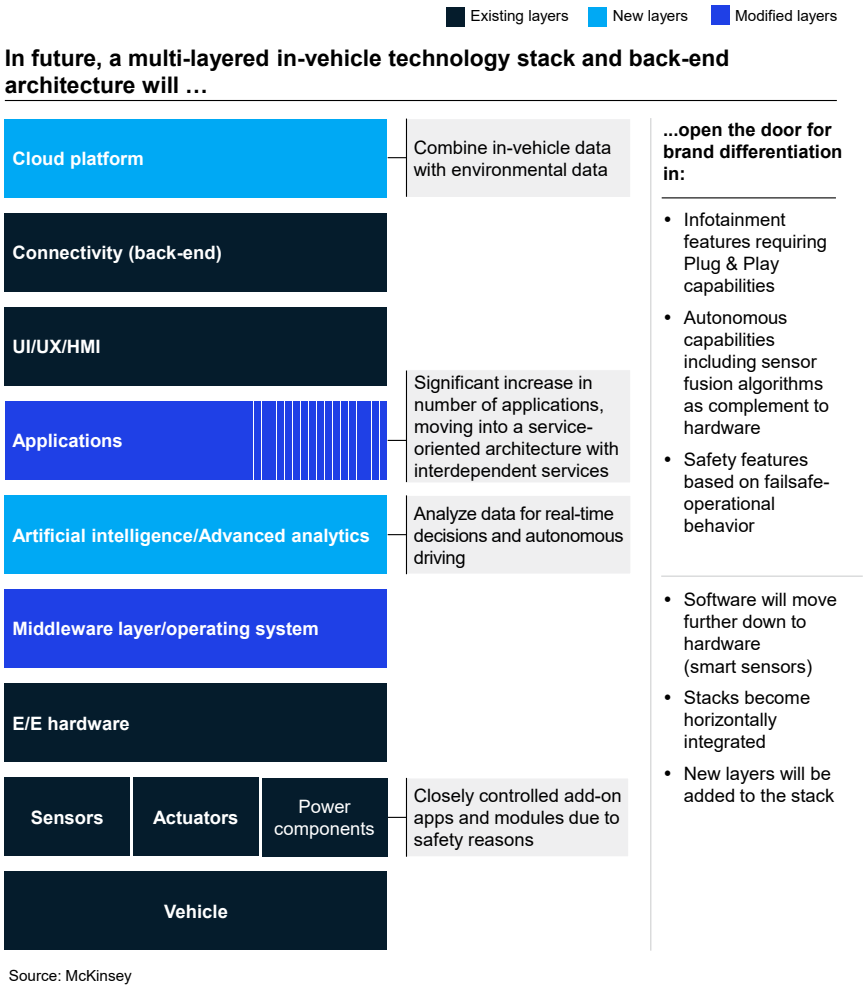


Source: McKinsey

Tomorrow's cars will shift to a platform of new brand differentiators (Exhibit 2). These will likely include infotainment innovations, autonomous-driving capabilities, and intelligent safety features based on “fail-operational” behaviors (for example, a system capable of completing its key function even if part of it fails). Software will move further down the digital stack to integrate with hardware in the form of smart sensors. Stacks will become horizontally integrated and gain new layers that transition the architecture into an SOA.

Ultimately, the new software and electronic architecture will result out of several game- changing trends that drive complexity and interdependencies. For example, new smart sensors and applications will create a “data explosion” in the vehicle that players need to handle by processing and analyzing the data efficiently if they hope to remain competitive. A modularized SOA and over-the-air (OTA) updates will become key requirements to maintain complex software in fleets and enable new function-on-demand business models. Infotainment, and, to a lesser degree, advanced driver-assistance systems (ADAS), will increasingly become “appified” as more third-party app developers provide vehicle content. Digital-security requirements will shift the focus from a pure access-control strategy to an integrated security concept designed to anticipate, avoid, detect, and defend against cyberattacks. The advent of highly automated driving (HAD) capabilities will require functionality convergence, superior computing power, and a high degree of integration.

Exhibit 2: Vehicle architecture will add new layers for connectivity, apps, AI, and operating systems



Source: McKinsey

Exploring 10 hypotheses on future electrical or electronic architecture

The path forward for both the technology and the business model is far from fixed. But based on our extensive research and insights from experts, we developed 10 hypotheses regarding tomorrow's automotive electrical or electronic architecture and its implications for the industry.

There will be an increasing consolidation of electronic control units (ECUs)

Instead of a multitude of specific ECUs for specific functionalities (the current "add a feature, add a box" model), the industry will move to a consolidated vehicle ECU architecture.

In the first step, most functionality will be centered on consolidated domain controllers for the main vehicle domains that will partially replace functionality currently running in distributed ECUs. These developments are already under way and will hit the market in two to three years' time. This consolidation is especially likely for stacks related to ADAS and HAD functionality, while more basic vehicle functions might keep a higher degree of decentralization.

In the evolution toward autonomous driving, virtualization of software functionality and abstraction from hardware will become even more imperative. This new approach could materialize in several forms. One scenario is a consolidation of hardware into stacks serving different requirements on latency and reliability, such as a high-performance stack supporting HAD and ADAS functionality and a separate, time-driven, low-latency stack for basic safety features. In another scenario, the ECU is replaced with one redundant "supercomputer," while in a third, the control-unit concept is abandoned altogether in favor of a smart-node computing network.

The change is driven primarily by three factors: costs, new market entrants, and demand through HAD. Decreasing costs, both for the development of features as well as the required computing hardware, including communication hardware, will accelerate the consolidation. So too will new market entrants into automotive that will likely disrupt the industry through a software-oriented approach to vehicle architecture. Increasing demand for HAD features and redundancy will also require a higher degree of consolidation of ECUs.

Several premium automakers and their suppliers are already active in ECU consolidation, making early moves to upgrade their electronic architecture, although no clear industry archetype has emerged at this point.

The industry will limit the number of stacks used with specific hardware

Accompanying the consolidation will be a normalization of limited stacks that will enable a separation of vehicle functions and ECU hardware that includes increased virtualization. Hardware and embedded firmware (including the operating system) will depend on key nonvehicle functional requirements instead of being allocated part of a vehicle functional domain. To allow for separation and a service-oriented architecture, the following four stacks could become the basis for upcoming generations of cars in five to ten years:

— **Time-driven stack.** In this domain, the controller is directly connected to a sensor or actuator while the systems have to support hard real-time

requirements and low latency times; resource scheduling is time based. This stack includes systems that reach the highest Automotive Safety Integrity Level classes, such as the classical Automotive Open System Architecture (AUTOSAR) domain.

— **Event- and time-driven stack.** This hybrid stack combines high-performance safety applications, for example, by supporting ADAS and HAD capability. Applications and peripherals are separated by the operating system, while applications are scheduled on a time basis. Inside an application, scheduling of resources can be based on time or priority. The operating environment ensures that safety-critical applications run on isolated containers with clear separation from other applications within the car. A current example is adaptive AUTOSAR.

— **Event-driven stack.** This stack centers on the infotainment system, which is not safety critical. The applications are clearly separated from the peripherals, and resources are scheduled using best-effort or event-based scheduling. The stack contains visible and highly used functions that allow the user to interact with the vehicle, such as Android, Automotive Grade Linux, GENIVI, and QNX.

— **Cloud-based (off-board) stack.** The final stack covers and coordinates access to car data and functions from outside the car. The stack is responsible for communication, as well as safety and security checks of applications (authentication), and it establishes a defined car interface, including remote diagnostics.

Automotive suppliers and technology players have already begun to specialize in some of these stacks. Notable examples are in infotainment (event-driven stack), where companies are developing communications capabilities such as 3-D and augmented navigation. A second example is artificial intelligence and sensing for high-performance applications, where suppliers are joining with key automakers to develop computing platforms.

In the time-driven domain, AUTOSAR and JASPAR are supporting the standardization of these stacks.

An expanded middleware layer will abstract applications from hardware

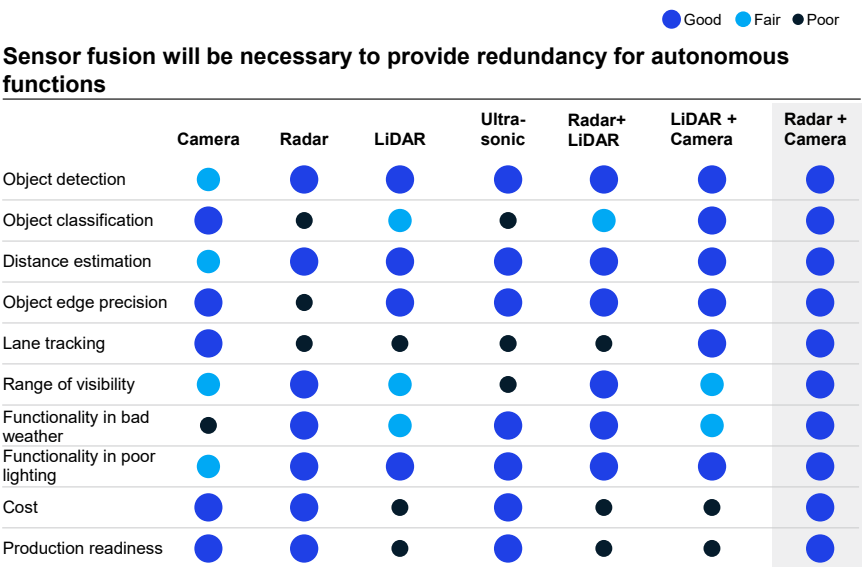
As vehicles continue to evolve into mobile computing platforms, middleware will make it possible to reconfigure cars and enable the installation and upgrade of their software. Unlike today, where middleware within each ECU facilitates communication across units, in the next vehicle generation it will link the domain controller to access functions. Operating on top of ECU hardware in the car, the middleware layer will enable abstraction and virtualization, an SOA, and distributed computing.

Evidence already suggests automotive players are moving toward more flexible architectures, including an overarching middleware. AUTOSAR's adaptive platform, for example, is a dynamic system that includes middleware, support for a complex operating system, and state-of-the-art multicore microprocessors. However, current developments appear restricted to a single ECU.

In the middle term, the number of onboard sensors will spike significantly

In the next two to three vehicle generations, automakers will install sensors with similar functionalities to ensure that sufficient safety-related redundancies exist (Exhibit 3). In the long term, however, the automotive industry will develop specific sensor solutions to reduce the number of sensors used and their costs. We believe that a combined solution of radar and camera might be dominant for the next five to eight years. As autonomous-driving capabilities continue

Exhibit 3: Autonomous vehicle safety can only be ensured through sensor fusion based on redundant sensors; the number of sensors will thus significantly increase



Source: McKinsey

to rise, the introduction of lidars will necessary to ensure redundancy for both object analysis and localization. Configurations for SAE International L4 (high automation) autonomous driving, for example, will likely initially require four to five lidar sensors, including rear-mounted ones for city operation and near-360-degree visibility.

In the long term, we see different possible scenarios concerning the number of sensors in vehicles: further increase, stable numbers, or decrease. Which scenario will come to pass depends on regulation, the technical maturity of solutions, and the ability to use multiple sensors for different use cases. Regulatory requirements might, for example, enforce closer driver monitoring, resulting in an increase of sensors inside the vehicle. It can be expected that more consumer-electronics sensors will be used in the automotive interior. Motion sensors and health monitoring of measures such as heart rate and drowsiness, as well as face recognition and iris tracking, are just a few of the potential use cases. However, as an increase or even a stable number of sensors would require a higher bill of materials, not only in the sensors themselves but also in the vehicle network, the incentive to reduce the number of sensors is high. With the arrival of highly automated or fully automated vehicles, future advanced algorithms and machine learning can enhance sensor performance and reliability. Combined with more powerful and capable sensor technologies, a decrease of redundant sensors can be expected. Sensors used today might become obsolete as their functions are overtaken by more capable sensors (for instance, a camera- or lidar-based parking assistant could replace ultrasound sensors).

Sensors will become more intelligent

System architectures will require intelligent and integrated sensors to manage the massive amounts of data needed for highly automated driving. While high-level functions such as sensor fusion and 3-D positioning will run on centralized computing platforms, preprocessing, filtering, and fast reaction cycles will most likely reside in the edge or be done directly in the sensor. One estimate puts the amount of data an autonomous car will generate every hour at four terabytes. Consequently, intelligence will move from ECUs into sensors to conduct basic preprocessing requiring low latency and low computing performance, especially if weighting costs for data processing in the sensors versus costs for high-volume data transmission in the vehicle. Redundancy for driving decisions in HAD will nevertheless require a convergence for centralized computing, likely based on preprocessed data. Intelligent sensors will supervise their own functionality while redundancy of sensors will increase reliability, availability, and hence safety of the sensor network. To ensure correct sensor operation

in all conditions, a new class of sensor-cleaning applications—such as deicing capabilities and those for dust or mud removal—will be required.

Full power and data-network redundancy will be necessary

Safety-critical and other key applications that require high reliability will utilize fully redundant circles for everything that is vital to safe maneuvering, such as data transmission and power supply. The introduction of electric-vehicle technologies, central computers, and power-hungry distributed computing networks will require new redundant power-management networks. Fail-operational systems to support steer-by-wire and other HAD functions will require redundancy system designs, which is a significant architectural improvement on today's fail-safe monitoring implementations.

The 'automotive Ethernet' will rise and become the backbone of the car

Today's vehicle networks are insufficient for the requirements of future vehicles. Increased data rates and redundancy requirements for HAD, safety and security in connected environments, and the need for interindustry standardized protocols will most likely result in the emergence of the automotive Ethernet as a key enabler, especially for the redundant central data bus. Ethernet solutions will be required to ensure reliable interdomain communication and satisfy real-time requirements by adding Ethernet extensions like audio-video bridging (AVB) and time-sensitive networks (TSN). Industry players and the OPEN Alliance support the adoption of Ethernet technology, and many automakers have already made this leap.

Traditional networks such as local interconnected networks and controller area networks will continue to be used in the vehicle, but only for closed lower-level networks, for instance, in the sensor and actor area. Technologies such as FlexRay and MOST are likely to be replaced by automotive Ethernet and its extensions, AVB and TSN.

Going forward, we expect the automotive industry to also embrace future Ethernet technologies such as high-delay bandwidth products (HDBP) and 10-gigabit technologies.

OEMs will always tightly control data connectivity for functional safety and HAD but will open interfaces for third parties to access data

Central connectivity gateways transmitting and receiving safety-critical data will always connect directly and exclusively to an OEM back end, available to third parties for data access, except where obliged by regulation. In infotainment, however, driven by the “appification” of the vehicle, emerging open interfaces will allow content and app providers to deploy content, while OEMs will keep the respective standards as tight as possible.

Today's on-board diagnostics port will be replaced with connected telematic solutions. Physical maintenance access to the vehicle network will not be required anymore but can go through the OEMs' back ends. OEMs will provide data ports in their vehicle back end for specific use cases such as lost-vehicle tracking or individualized insurance. Aftermarket devices, however, will have less and less access to vehicle internal data networks.

Large fleet operators will play a stronger role in the user experience and will create value for end customers, for example, by offering different vehicles for different purposes under one subscription (such as weekend or daily commute). This will require them to utilize the different OEMs' back ends and start consolidating data across their fleets. Larger databases will then allow fleet operators to monetize consolidated data and analytics not available on the OEM level.

Cars will use the cloud to combine onboard information with offboard data

Nonsensitive data (that is, data that are not personal or safety related) will increasingly be processed in the cloud to derive additional insights, though availability to players beyond OEMs will depend on future regulation and negotiations. As the volumes of data grow, data analytics will become critically important for processing the information and turning it into actionable insights. The effectiveness of using data in such a way to enable autonomous driving and other digital innovations will depend on data sharing among multiple players. It's still unclear how this will be done and by whom, but major traditional suppliers and technology players are already building integrated automotive platforms capable of handling this new plethora of data.

Cars will feature updateable components that communicate bidirectionally

Onboard test systems will allow cars to check function and integration updates automatically, thus enabling life-cycle management and the enhancement or unlocking of aftersales features. All ECUs will send and receive data to and from sensors and actuators, retrieving data sets to support innovative use cases such as route calculation based on vehicle parameters.

OTA update capabilities are a prerequisite for HAD; they also will enable new features, ensure cybersecurity, and enable automakers to deploy features and software quicker. In fact, it's the OTA update capability that is the driver behind many of the significant changes in vehicle architecture described previously. In addition, this capability also requires an end-to-end security solution across all layers of the stack outside the vehicle to the ECUs in the vehicle. This security solution remains to be designed, and it will be interesting to see how and by whom this will be done.

To achieve smartphone-like upgradability, the industry needs to overcome restrictive dealer contracts, regulatory requirements, and security and privacy concerns. Here too, a variety of automotive players have announced plans to deploy OTA service offerings, including over-the- air updates for their vehicles.

OEMs will standardize their fleets on OTA platforms, working closely with technology providers in this space. As vehicle connectivity and OTA platforms will become increasingly mission critical, we can expect OEMs to take more ownership in this market segment.

Vehicles will receive software and feature upgrades as well as security updates for the designed life span. Regulators will likely enforce software maintenance to ensure the safety integrity of the vehicle designs. The obligation to update and maintain software will lead to new business models for maintenance and

operations of vehicles.

Assessing the future implications of vehicle software and electronic architecture

While the trends affecting the automotive industry today are generating major hardware-related uncertainties, the future looks no less disruptive for software and electronic architecture. Many strategic moves are possible: automakers could create industry consortia to standardize vehicle architecture, digital giants could introduce onboard cloud platforms, mobility players could produce their own vehicles or develop open-source vehicle stacks and software functions, and automakers could introduce increasingly sophisticated connected and autonomous cars.

The transition from hardware-centric products to a software-oriented, service-driven world is especially challenging for traditional automotive companies. Yet, given the described trends and changes, there is no choice for anyone in the industry but to prepare. We see several major strategic pushes:

— **Decouple vehicle and vehicle-functions development cycles.** OEMs and tier-one suppliers need to identify how to develop, offer, and deploy features largely apart from vehicle-development cycles, both from a technical and organizational perspective. Given current vehicle-development cycles, companies need to find a way to manage innovations in software. Further, they should think about options to create retrofitting and upgrade solutions (for example, computing units) for existing fleets.

— **Define the target value add for software and electronics development.** OEMs must identify the differentiating features for which they are able to establish control points. In addition, it is crucial to clearly define the target value add for their own software and electronics development and to identify areas that become a commodity or topics that can only be delivered with a supplier or partner.

— **Attach a clear price tag to software.** Separating software from hardware requires OEMs to rethink their internal processes and mechanisms for buying software independently. In addition to the traditional setup, it is also important to analyze how an agile approach to software development can be anchored in procurement processes. Here suppliers (tier one, tier two, and tier three) also play a crucial role as they need to attach a clear business value to their software and system offerings to enable them to capture a larger revenue share.

— **Design a specific organizational setup around new electronics architecture (including related back ends).** Next to changing internal processes in order to deliver and sell advanced electronics and software, automotive players—both OEMs and suppliers—should also consider a

different organizational setup for vehicle-related electronics topics. Mainly, the new "layered" architecture asks for potentially breaking up the current "vertical" setup and introducing new "horizontal" organizational units. Further, they need to ramp up dedicated capabilities and skills for their own software and electronics development teams.

— **Design a business model around automotive features as a product (especially for automotive suppliers).** To remain competitive and capture a fair share of value in the field of automotive electronics, it is crucial to analyze which features add real value to the future architecture and therefore can be monetized. Subsequently, players need to derive new business models for the sale of software and electronics systems, be it as a product, a service, or something completely new.

China is becoming the new front for the development of automotive software and electronics

The ten trends that we just discussed are working to the Chinese automotive market as well. Multiple examples from the China market have been observed.

— **A consolidation on ECU:** in the most recent e-platform presented by BYD, the Shenzhen-based car company delivers a ten-in-one control module that making different features integrated , e.g. instruments, air conditioners, audios, smart keys, etc. This helps the company to reduce the amount of cables used, improve the module quality, and increase the working efficiency on the assembly line.

— **Automotive Ethernet:** SAIC is employing the automotive ethernet technology in its latest Double-E architecture, which is featured with high speed data transmission capability that empowered by the automotive ethernet technology.

— **Data access open by OEM:** BYD has launched a new data platform to third party developers, where the developers could get the data from various sensors on the BYD vehicle, e.g. body, speed, air conditioning, radar, charging situations, etc. By doing so, BYD hopes more external developers could be attracted to develop new APPs that tailored to its vehicles.

— **Cloud-based data services:** Alibaba is presenting its cloud services to the mobility industry. By leveraging the cloud and multiple Alibaba ecosystem services, the Hangzhou-based tech giant believes business partners with different backgrounds could all been benefitted from it.

— **OTA (Over-the-air update):** The Banma connectivity system, which is co-developed by SAIC and Alibaba, has experienced multiple rounds of large-scale OTA. The success of Banma is making it a true milestone for the smart vehicle development in China.

As the new era of automotive software and electronics begins, it's drastically changing a wide variety of prior industry certainties about business models, customer needs, and the nature of competition. We are optimistic about the revenue and profit pools that will be created. But to benefit from the shifts, all players in the industry need to rethink and carefully position (or reposition) their value propositions in the new environment. ■

This article was developed in collaboration with the Global Semiconductor Alliance.

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Designing a customer-centric experience for China's connected vehicles of the future

Sonny Chen, Pei Shen, Yezhou Shi, Tony Zhou

Vehicle connectivity is becoming a key differentiator and source of value-creation for automotive OEMs and industry value chain players. However, despite universal recognition of the importance of connectivity, automotive executives still wrestle with a number of fundamental questions:

— What connectivity solutions should we offer and prioritize?

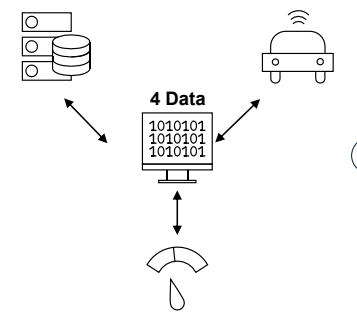
— Do we have the correct technology, infrastructure, capabilities, and resources to ensure our solutions are feasible?

— How can we differentiate our solutions with compelling and unique selling points?

— There are high expectations for revenue and profits from connectivity, particularly around data monetization, but how realistic are they, how can we maximize revenue potential, and in what timeframe?

Over three years of industry roundtables, customer and executive interviews, and client experience, McKinsey has developed a framework centered on customer experience to help answer these fundamental questions. (Exhibit 1)

Exhibit 1: Customer experience-centered vehicle connectivity framework



1 Technology Stack

- How should the tech stack be set up to enable various use cases that will provide satisfactory customer experiences?
- What "make-buy-partner" decision should be taken for different components of the stack, and what are the critical control points?
- **Data implication**: How does the tech stack setup affect the ownership and usage rights of various data?

2 Use Cases

- What potential connectivity use cases would be attractive to both customers and service providers (including OEMs)?
- What eco-system (e.g. content) needs to be in place, when can use cases be implemented, and what are the current road blocks?
- **Data implication**: What types of data can be generated and captured, and what privacy and security concerns need to be addressed?

3 Customer Experience

- How to assess customer experience levels across various use cases?
- What does it take to elevate customer experience to the next level?
- **Data implication**: How to integrate data from different use cases and eco-system partners, and how to use data science (e.g. AI) to achieve the best customer experience?

4 Data

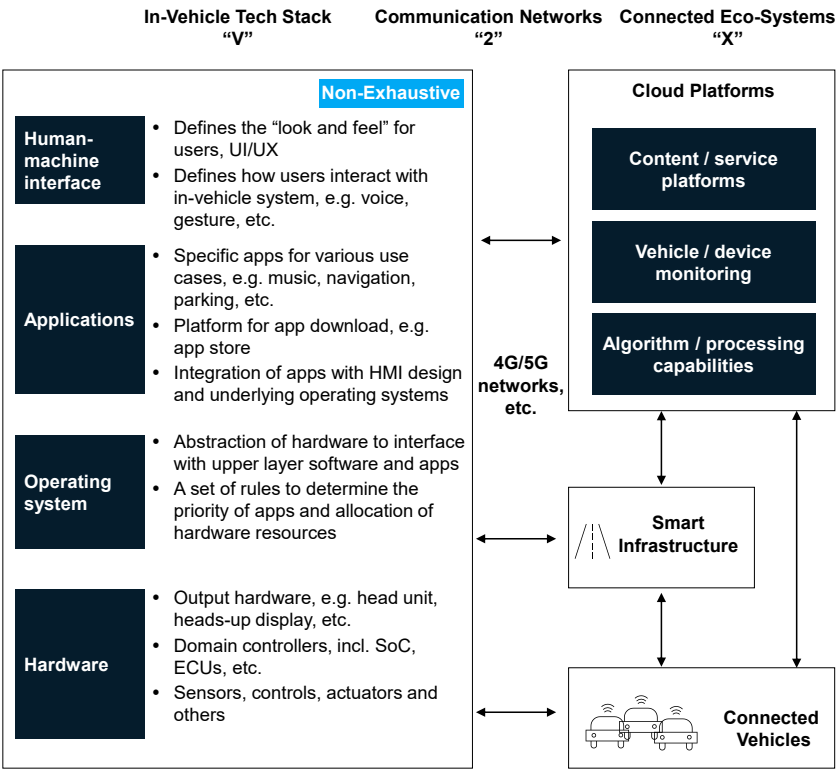
- What are the data monetization opportunities?
- How to create a data loop to continuously improve user experience and explore alternative profit pools?

Source: McKinsey

Making the most of the technology stack

The technological foundations (tech stack) supporting vehicle connectivity are by no means fixed. Value chain stakeholders and ecosystem partnerships are continuously shaping the landscape. However, an overarching connectivity tech stack structure has emerged. (Exhibit 2)

Exhibit 2: The 'V2X' connectivity tech stack



Source: McKinsey

Automotive executives still find it hard to decide whether to make key components (or sub-components) in the stack independently, buy them from elsewhere, or acquire them through partnerships. These "make-buy-partner" decisions have a profound and lasting impact on companies' ability to offer desirable connectivity solutions, and their potential to develop innovative businesses.

The operating system (OS) is a case in point. OEMs can choose between creating an OS from scratch, or building upon an existing open architecture with varying degrees of customization. Having a "closed system" offers OEMs better control over the consistency of customer experience, but could result in inadequate participation from third-party application developers, thus limiting OEMs' ability to offer a broad range of connectivity solutions. There is no single "right answer", so executives need to consider their company's scale

and market influence, target customers and competitive strategy, as well as the availability of ecosystem resources, and the ability to control and influence partners.

Developing new use cases

Some industry professionals are skeptical about the potential of vehicle connectivity, mainly because most use cases are still "traditional" solutions, such as navigation, and audio. To fundamentally change this situation, two prerequisites are required: Innovative vehicle connectivity use cases need to be created and launched to a wider audience; and these need to create real value by providing a sufficient level of customer experience and satisfaction. Identifying, creating, and successfully launching truly innovative use cases will require sufficient data, analytical tools (including machine learning & AI), and coordination among ecosystem stakeholders.

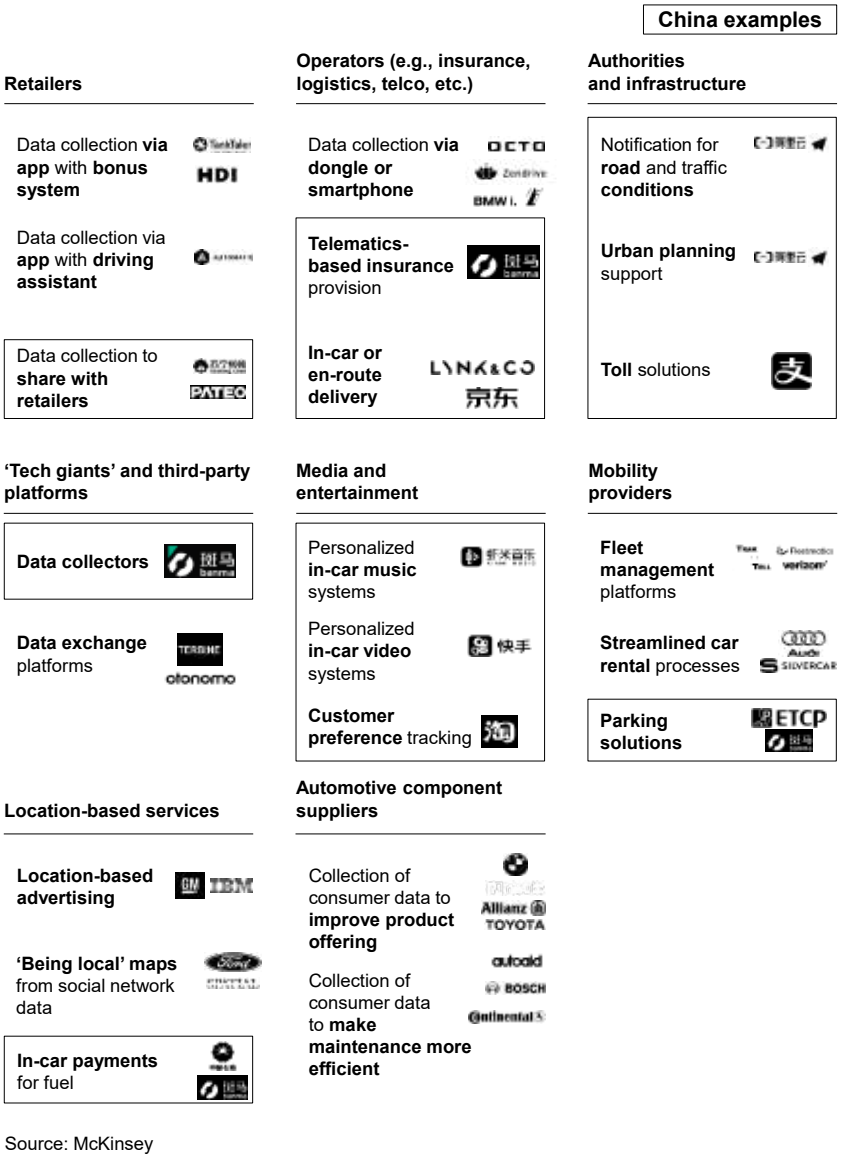
— **Digitization and availability of data.** An increasing number of sensors present in vehicles or integrated into mobility infrastructure means that almost every aspect of how a car is used, functions (or malfunctions), and the routes it takes, can be digitized, and the information collected. Although data transparency could be improved further, the key challenges have now shifted to organizing, understanding, and leveraging the data.

— **Data analytics and insight.** Some use cases rely on a single or limited dataset, but it will still take time to create and validate the efficacy of models and algorithms. Take usage-based insurance (UBI), which aims to calculate premiums based on driver behavior, rather than demographics. The underlying logic is quite straight forward, but finding the correct balance in terms of setting premiums requires repeated testing and tweaking of the models. As such, the product develops gradually, and will not replace traditional insurance products overnight. Use cases requiring integration of multiple datasets from different sources will drive exponential increases in complexity. Examples include, in-car delivery of customized content and services based on mobility analysis, especially when third-party service providers and multiple models and algorithms are involved – each of these algorithms needs to be effective individually, and capable of speaking, and synchronizing, with others.

— **Stakeholder coordination.** Delivery of connectivity use cases requires flawless execution, which is particularly challenging when there are multiple stakeholders. Even with the best intentions, problems ranging from IT infrastructure gaps (e.g. if data fails to sync in real time) to operational delays will make use case delivery problematic.

Despite these challenges, we have seen an increase in both the number of innovative use cases, and the penetration / adoption rate of existing ones. The diversity of players entering the market is also noteworthy. (Exhibit 3)

Exhibit 3: Example connectivity use case clusters



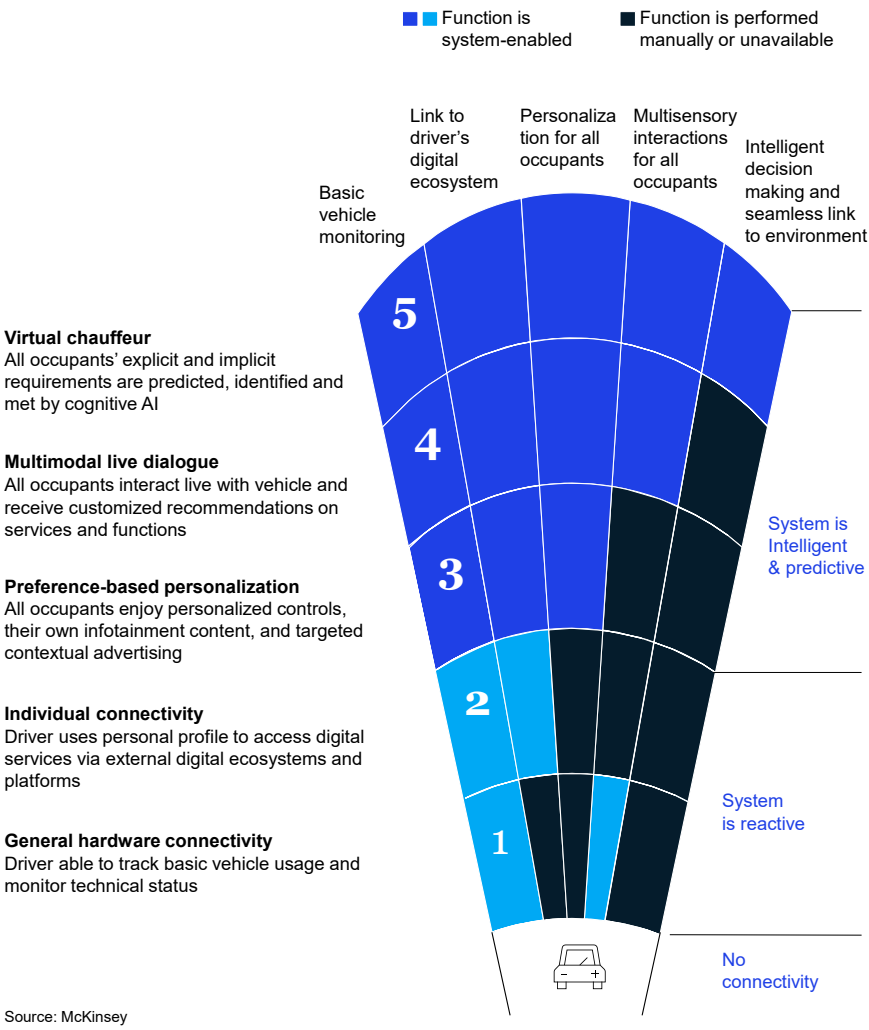
Source: McKinsey

Another interesting trend is the frequency with which players from different backgrounds are teaming up to explore new connectivity use case opportunities. For automotive executives, it is time to think about creating new experiences and solutions for customers, independently or with cross-industry partners.

Customer Experience

As mentioned above, effectively defining levels of customer experience across various vehicle connectivity use cases is a critical task. Without uniform standards, automotive executives will find it frustrating to determine where their current solutions stand, or analyze the potential for improvement. To address these concerns, McKinsey developed the Connected Car Customer Experience (C3X) Framework. (Exhibit 4)

Exhibit 4: McKinsey Connected Car Customer Experience Framework (C3X) Levels 1-5



Source: McKinsey

The C3X framework breaks down user experience in connected cars into five levels, i.e., L1-L5, from the most basic to the highly complex. For the first two levels, the system reacts to the commands of the driver or other car occupants. For L4 and L5, AI intervenes, and the car proactively predicts and meets both the explicit and implicit requirements of the occupants.

The exhibit below demonstrates the use of in-car climate control to illustrate the five levels of customer experience under the McKinsey C3X framework: (Exhibit 5)

Over the longer term, AI will be fundamental to differentiating connected car customer experiences. Most connectivity systems in China are currently L1. Some, such as Banma, which has access to the Alipay accounts of car owners, rank as L2. Only a handful, such as Chery Automobile's i-Connect@Lion, which has in-car sensors with the potential to identify occupants, could be categorized as L2.5. We forecast the penetration rate of connected cars at L4 and above may reach 25-30 percent by 2030 on a worldwide basis.

Exhibit 5: Connected Car Customer Experience Levels 1-5 using in-car climate control as an example

5 Virtual chauffeur

Vehicle performs real-time climate control adjustments based on occupants' body temperature biometric readings, mood detection, and ambient temperature outside, and informs the same in natural language

4 Multimodal live dialogue

Vehicle greets occupants and detects presence in the vehicle zone (e.g. voice recognition), and **asks if it may adjust** climate control according to their preference AND **checks if preference today has changed** due to colder than usual weather outside

3 Preference-based personalization

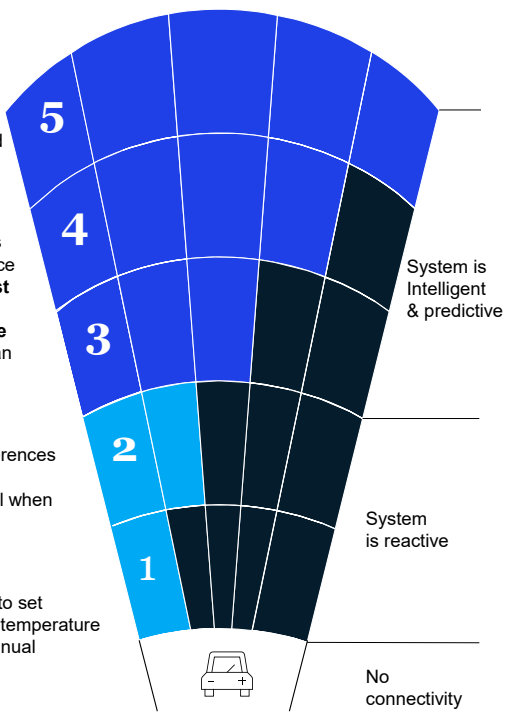
Vehicle 'remembers' occupants' preferences as part of stored profile on cloud, and **automatically adjusts** climate control when occupants log in to their accounts

2 Individual connectivity

Driver uses direct voice command to set personal preferences, vehicle adjusts temperature and fan speed accordingly without manual operation

1 General hardware connectivity

Driver able to **manually** adjust temperature and fan speed as required, potentially repeatedly



The technical obstacle to creating L4 and above user experience is integrating related hardware, software, and algorithms. In addition, privacy protection, as well as obtaining and accessing data are other key challenges.

Consumers are generally unwilling to have their in-car conversations monitored and recorded, though Chinese consumers are more tolerant than their global peers in this regard. The technical difficulty and cost of recording conversations is quite low, and the potential benefits are tempting, but automakers should be wary of taking advantage of Chinese consumers' more relaxed attitudes to privacy protection. Protecting consumer privacy not only requires self-discipline on the part of industry players, but also the parallel development of related regulations and legislation.

As for accessing data, OEMs will find obtaining first-hand records of various online services difficult. This requires in-depth cooperation with relevant Internet companies. In the negotiation process, careful thought should be given to who plays the leading and supporting roles, how rights and obligations are demarcated, how profits should be shared, so that the sum gain is greater than the component parts of the partnership.

Data Monetization

By effectively managing and leveraging data, OEMs and value chain players can not only create innovative connectivity use cases that derive value both in-house and to customers, but also have the potential to generate further profit. This value pool – comprising more than 30 car-data-enabled use cases representing new features and services – is projected to reach $450 billion to $750 billion worldwide by 2030. Three value creation models underlie such use cases:

— **Revenue generation.** Players generate revenue through the sale of products/services to customers, pushing tailored advertising, and the sale of data to third parties.

— **Cost reduction.** Players use car data to reduce costs by making R&D more efficient and/or minimizing the need for repairs, among other instances.

— **Enhanced safety and security.** Players improve safety and security by leveraging vehicle data to speed up safety interventions that prevent or lessen physical harm to drivers, or prevent theft of their belongings or personal information.

Meanwhile other automotive trends, particularly the evolution of autonomous driving technology, will likely change the value potential of these data monetization opportunities. For example, the value of some monetization opportunities might rise, e.g. connected parking services; while others could have less of an impact, e.g. over-the-air software add-ons. There is also a chance some opportunities become obsolete, e.g. tracking and theft protection services.

For automotive OEMs and value chain players in China, vehicle connectivity presents significant opportunities for creating competitive advantages, and alternative sources of profit. To achieve these goals, strategic choices need to be carefully weighed, and swiftly acted upon. The aim should be to both build up the correct technological infrastructure, and pinpoint the right partner(s). Ultimately, building competitive advantage and winning in the connectivity space, will require players to provide the best customer experiences through use cases that create real value. ■

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How China will help fuel the revolution in autonomous vehicles

Christopher Thomas, Arthur Wang, Ting Wu

Self-driving cars could hold the key to China's automotive industry assuming a position of global leadership. From driverless taxis to automated cargo trucks, autonomous vehicles (AVs) will change the nature of on-road driving and, in the process, revolutionize the automotive and mobility industries. Within this mix of opportunity and uncertainty, we believe AV players (from components vendors to mobility service providers) could earn revenues in the trillions of dollars in China.

Fundamentally transforming mobility

McKinsey research suggests autonomous vehicles could, at some point, take over most of the automotive market in China. For instance, industry respondents to a recent survey indicated passenger vehicles used for mobility services such as “robo-taxis” will see a peak adoption rate of 62 percent, followed by private premium vehicles (51 percent) and private mass-market cars (38 percent). Mobility services will lead due to the AV’s expected increased utilization (close to 24/7 operation) and lower labor costs (no drivers). The same rationale puts city buses at 69 percent adoption and commercial vehicles (CVs) at 67 percent.

AVs will likely shift a substantial share of the mobility market value away from products (that is, buying vehicles) and toward services (that is, paying for transportation per mile). This “mobility-as-a-service” (MaaS) transformation suggests dramatic changes ahead for vehicle sales volumes, business models, and the capabilities companies will need to thrive in this new environment. In China, we believe fully autonomous vehicles (SAE Level 4 and above) will see mass deployment from the next decade onwards .

These shifts will change the rules of the game across the entire mobility space, as software and data become fundamental differentiators when building and operating cars. As such, the mobility sector will become ground zero for a convergence of industries that include automotive, transportation, software, hardware, and data services.

Today's automakers focus on selling new cars, transportation companies on providing services, and technology players on supplying hardware and software to automakers. In the future, new business models might emerge. Technology players could buy vehicles from automakers to provide services direct to consumers. Alternatively, automakers might vertically integrate in services and software development (as leading players are already doing today). Players in these sectors must reconcile their differences in product life cycles (for example, three to four years for automotive, weeks to months for software) and business models (for instance, products versus services) to compete and cooperate effectively with each other.

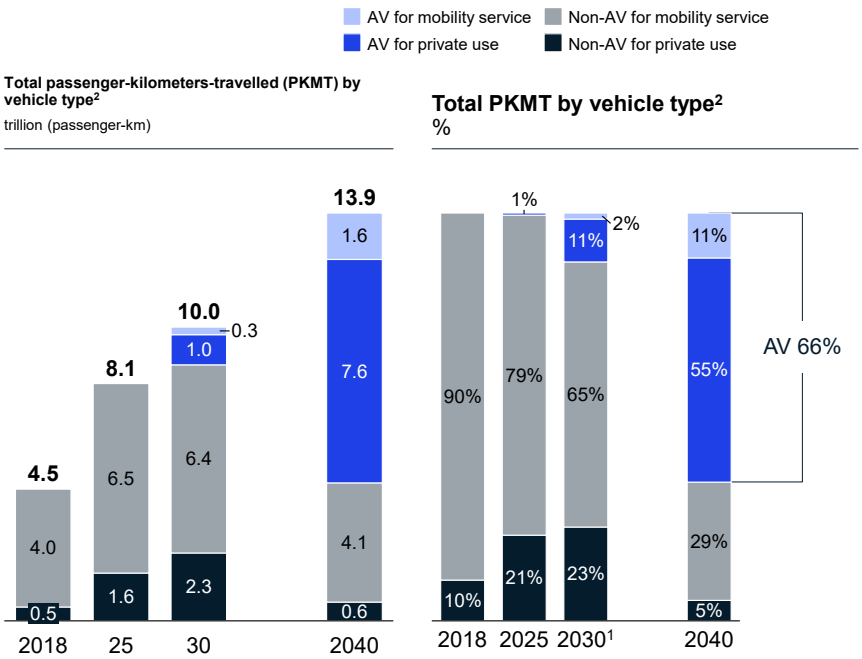
Clearly, many companies already have active AV strategies, including technology players such as Baidu, Tencent, and Waymo and automakers such

as GM, SAIC Motor, and Tesla. However, given the industry's dynamic, fast-moving nature, players need to refresh their strategies constantly.

Understanding how China fits in

China has the potential to become the world's largest market for autonomous vehicles. In our base forecast, such vehicles could account for as much as 66 percent of the passenger- kilometers traveled in 2040 (Exhibit 1), generating market revenue of $1.1 trillion from mobility services and $0.9 trillion from sales of AVs by that year. In unit terms, that means AVs will make up just over 40 percent of new vehicle sales in 2040, and 12 percent of the vehicle installed base.

Exhibit 1: Autonomous vehicles will travel about 66 percent of total passenger miles in 2040



1 Due to rounding, the sum of the numbers does not necessarily match the actual total
2 Base case scenario

Autonomous vehicles could solve major infrastructure problems

In 2009, China passed the United States to become the world's largest and most important automotive market, going on to consume nearly 30 million

light vehicles in 2018, almost 70 percent more than the United States. This continued explosive growth is overtaxing the country's automotive-related infrastructure, driving increased traffic congestion and pollution.

Beijingers spend an average of 1.3 hours every day commuting—more than three times as much as the average US commuter. AVs will offer a potential solution to some of these infrastructure challenges. In the realm of shared mobility, they could reduce the number of vehicles on the road and free former drivers to work or relax en route. If powered by green electricity or hydrogen, they could also help reduce local vehicle emissions.

However, a complex environment could slow initial uptake of AVs

In the short term, given China's complex traffic environment, AVs must adapt to road conditions and aggressive driving behaviors, which could slow adoption. However, a review of traffic severity worldwide reveals China's problem as one of degree, not kind. Western cities from downtown New York to Rome have similarly dense populations and levels of mixed traffic.

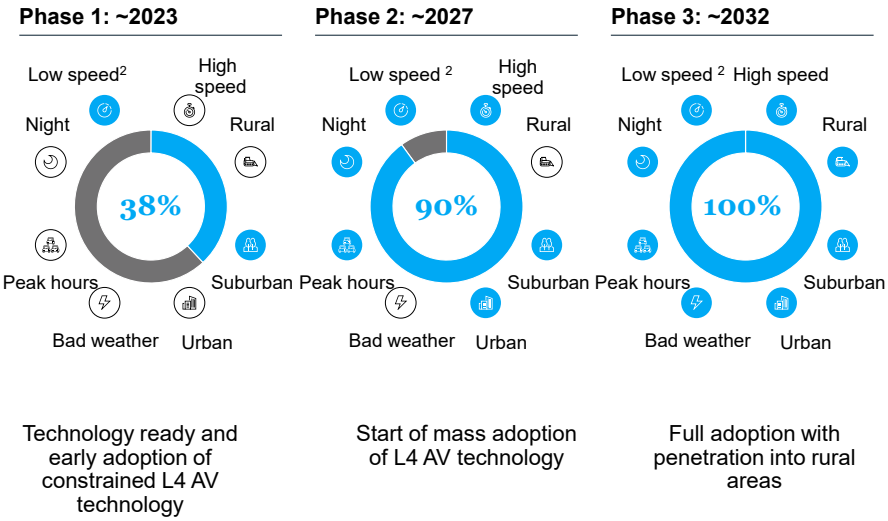
Consequently, the technology solution in China for autonomous driving will not differ much from those in other nations. Required computing platforms will likely conform because existing platforms feature enough “buffer” capacity to handle the more complex computing tasks required to analyze objects on Chinese roads. Sensor configurations would probably not change from region to region because current setups can cover all critical directions across very different driving use cases.

China’s highly complicated signage, with traffic lights and road signs not yet fully standardized, does present a unique challenge. Likewise, right- of-way issues resulting from the failure of Chinese drivers to follow road rules strictly add a major element of uncertainty to programming and “training” requirements for AVs. Consequently, the need to optimize AV decision algorithms for Chinese roads could take more effort and training, which could add roughly two to three years to the adoption timeline compared with the United States. As such, the first applications of AVs in constrained environments might begin in the next five years, but mass adoption will likely occur only after 2027, as it will require the technology to address the majority of conditions of urban and suburban driving (Exhibit 2).

While the core algorithm for the operation of autonomous vehicles is largely the same on a global basis, operating in China will require additional data and testing. For example, developers need to collect and input local traffic data to resolve the issue of unique and ununified road signage. They must also optimize motion planning through road testing, so the algorithm can learn to deal with issues caused by the relentless driving styles of some Chinese motorists.

Exhibit 2: Mass adoption of L4 autonomous vehicles in China will likely start around 2027

Potential use cases for autonomous vehicles to be "unlocked" over time and share of PKMT[1]
% of PKMT



1 Suburban area has less traffic and simpler driving conditions than urban area
2 Driving speed no more than 60 km per hour

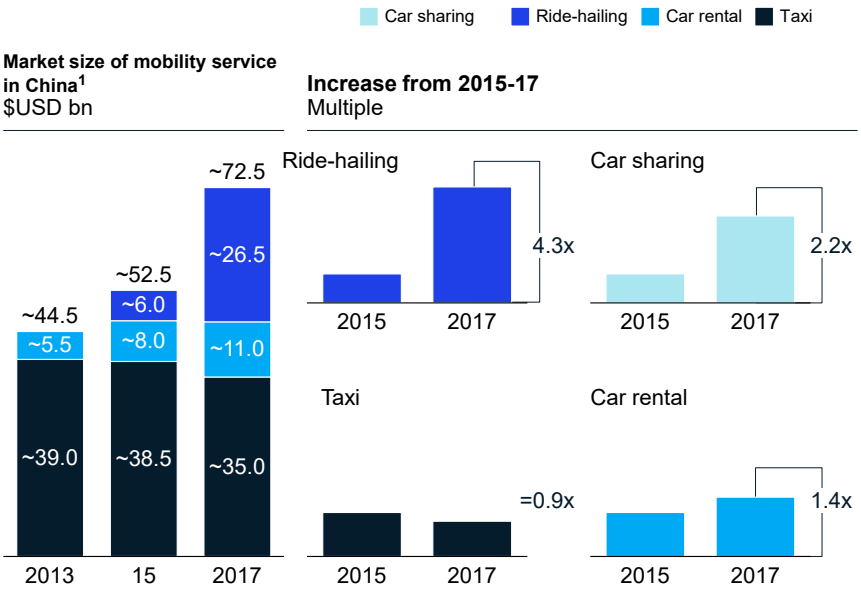
Still, longer-term prospects appear promising

In the long term, China will likely emerge as the world's largest market for AVs. In fact, the Chinese automotive market is already adopting MaaS at a rapid rate. For example, cars sold to provide mobility services today represent about 10 percent of China's total cars sales, and the country's mobility-services market has grown at double-digit rates over the past several years (Exhibit 3). This familiarization should translate into strong demand for mobility via AVs in the long term.

Reaching an adoption inflection point

We developed a proprietary sizing model to forecast China's market for AVs. The model takes a use-case approach, which analyzes the developments required for a specific category of AV, such as robo-taxis or automated trucks, to succeed in the marketplace. We surveyed more than 40 industry experts across the AV ecosystem and received feedback and advice from an external advisory board that included AV experts and executives from automakers, tier-1 suppliers, technology companies, and mobility service providers. We learned the experts believe technology, rather than regulation, will likely hold back the adoption of AVs. We chose two commercialization speeds: fast adoption and slow breakthroughs.

Exhibit 3: Mobility services are growing strongly in China



1 Compared to other mobility services, the car sharing market is smaller and not shown in the figure, with size of ~$60 million in 2015 and ~$130 million in 2017

Source: Ministry of Transportation in China, team analysis

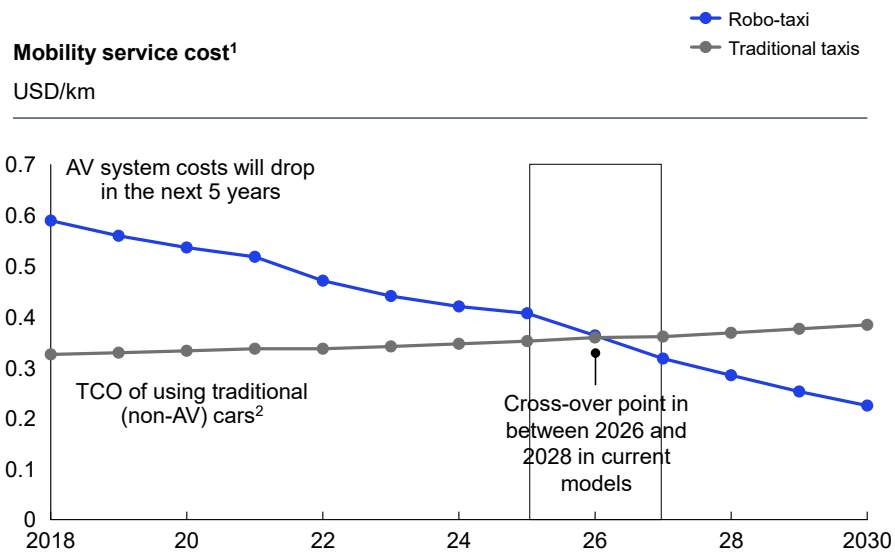
Based on that analysis, we believe 2025–30 will represent an inflection point for adoption of AVs, with the broad timespan dependent on the usage model and city-level driver economics.

Exhibit 4 shows the cost crossover analysis for a fully battery-electric vehicle used for mobility services as a robo-taxi. The major cost drivers include the vehicle's depreciation, the driver's cost, maintenance, insurance, and electricity (fuel). They do not include operational or management fees for running a mobility service fleet. The replacement of human drivers in AVs will occur gradually due to safety and regulation considerations.

The cost of the total AV system (including sensors, computing platform, and software) should decrease rapidly after the technology matures beyond 2023, to approximately $8,000 in 2025. Once AVs reach the crossover point, adoption will accelerate.

This inflection point is when, based on the functional robustness and cost curves of AV technologies, self-driven transport will reach economic parity with human-driven transport. In other words, the total cost per kilometer of an AV will roughly match that of a traditional car with driver. After this inflection point, demand for AVs should rise steadily, depending on how the market develops.

Exhibit 4: Robo-taxis could reach an inflection point between 2025–27



1. Assuming the use of a BEV; cost includes depreciation, driver cost, maintenance, insurance, and fuel/electricity cost, but excludes fleet operation and management fee
2. TCO means total cost of ownership

As this occurs, the potential for new players to seize control of the automotive value chain grows.

Industry profit pools to flow toward services and software

The advent of AVs will expand the mobility profit pool in the Chinese AV industry by at least $60 billion compared with today's value. Car sales will remain a large share of the profit pool in the overall value chain, at $50 billion to $60 billion. However, mobility services profits will grow to become 25 to 30 percent of the total profit pool (including vehicles, components, mobility services, and fleet management) and could exceed those of car sales, especially if the MaaS market were less competitive (for example, if government cooperated with mobility players). On the other hand, AV technology and system integration will produce $15 billion to $20 billion in profits, representing 50 to 60 percent of the total auto-components profit pool.

Profit pools will depend on the competitive environment. In one scenario, robo-taxis will be operating via local public/private joint ventures. In this case, MaaS could make up $50 billion to $55 billion—over a quarter of the $195 billion profit pool in China. In another scenario, if robo-taxis were operating in a much more competitive free-market environment, the mobility services segment would shrink significantly to $15 billion to $20 billion. Whichever case prevails, the

larger point is that AVs could create substantial value for the industry, and thus have a major impact on profit pools.

Shaping a Chinese AV revolution

The market for AVs in China will offer huge opportunities to players willing to shoulder the risks involved, from local Chinese automakers to multinational companies to tech giants and mobility businesses. To capture these opportunities, players can either develop a differentiating service connection to the end customers, or control key parts of AV technology. Identifying which elements of the technology hold long-term strategic value and their evolution over time will enable players to locate the high-value "soul" of the autonomous-driving machine.

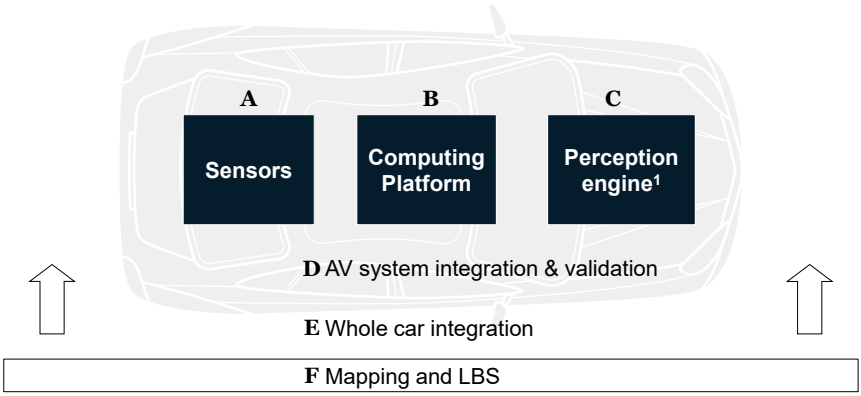
Tech stacks will complement value chains

The emerging AV ecosystem differs from traditional automotive approaches because it focuses on the technology stack—a concept used in the high technology and computing industries (Exhibit 5).

The core elements of the technology stack include the sensors, the computing platform, software (including object detection and analysis as well as motion planning), system integration and validation, mapping, and location-based services (LBS). As such, it represents the core of an automobile's autonomous driving system. That makes it a critical part of the vehicle to "own" for automakers, suppliers, technology companies, and others. It seems likely that the important elements of the stack will evolve over time, thus requiring

Exhibit 5: Technology stack for autonomous vehicles

Tech stack layers



A	B	C	D	E	F
Sensors	**Computing platform**	**Perception engine**	**AV system integration & validation**	**Whole car integration**	**Mapping and LBS**
Develop advanced AV sensor hardware with both sensing and signal processing abilities, e.g. Lidar	Develop AV computing processors (e.g. CPUs, GPUs or AI accelerators) Develop onboard computing platform with both hardware and operating system	Develop objective analysis (perception and/or sensor fusion) & decision making (motion planning) algorithms Collect driving data to train the AV algorithm and optimize its performance	Integrate off-the-shelf software, sensors and computing platforms into an AV system Test and validate the performance of AV system and interface with motion control	Design and assembly of vehicle integrating all off-the-shelf sub-systems Test and validate the performance of whole vehicles	Compose high-definition maps Establish the connectivity of infrastructure and offer LBS for AV fleet

Source: Expert interviews and survey, team analysis

1 Involving algorithm and software (object analysis & motion planning)

companies in the segment to monitor and assess the potential disruptions linked to subsequent technology innovations as they occur.

Each tech stack layer has different critical success factors. For example, the sensor layer requires robust reliability and safety elements, as well as strong mass-production and production management capabilities to achieve necessary economies of scale. The algorithm and software layers require agile development skills and fast iteration capabilities to enable companies to work

through training data to improve performance on a consistent basis. System integration and validation requires outstanding reliability and safety, and strong mass- production capabilities.

Building a Chinese tech stack

Of key interest to industry players is to what extent the Chinese stack will differ from that used in the rest of the world. The end state of this stack remains highly uncertain, as it depends on the competitiveness of different players, and the regulatory environment. However, early indicators suggest that both global and locally developed solutions will emerge across the stack.

Economics will provide much of the answer here. Hardware components are most likely to benefit from the scale economics of global solutions. Sensors, cameras, lidar, and the computing platform require the same capabilities in China as in the rest of the world (and therefore benefit greatly from the scale impact of global solutions). Mapping, LBS, and data- cloud solutions will likely require heavy localization.

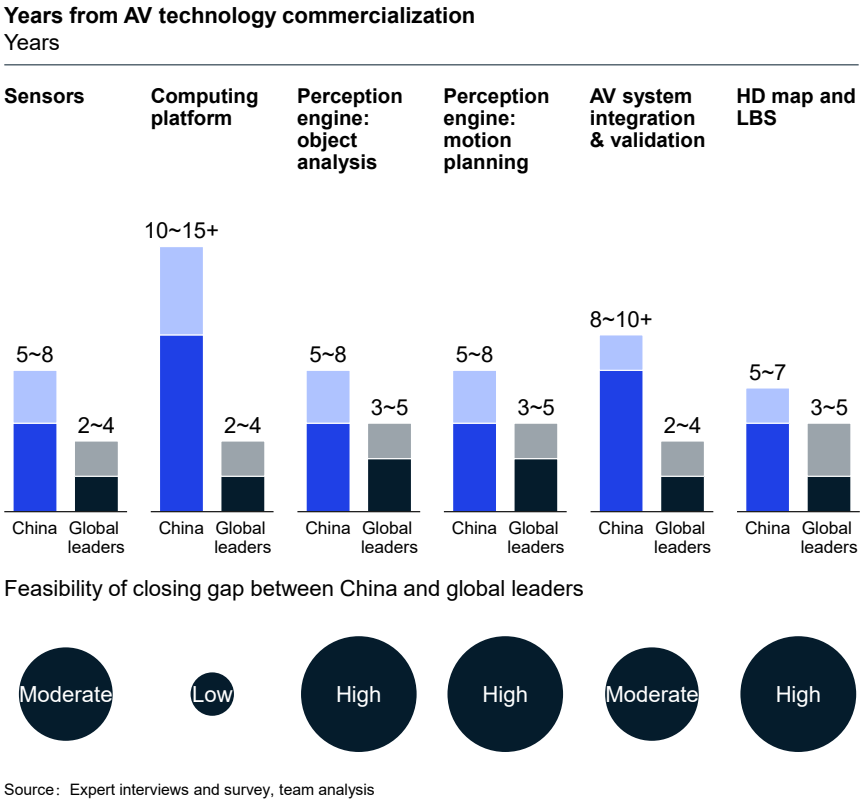
Some elements of a typical AV's technology stack—LBS and data cloud, for example—currently face so-called "negative restrictions" (for example, limitations on foreign-company involvement) by the government. Our research suggests local players alone will have access to most location-based services, leaving foreign companies and joint ventures at a disadvantage. The same appears to hold true for China's data cloud. That leaves the other five parts of the tech stack—the mobility services interface, the motion planning algorithm, connectivity functions, the central processing and graphics processing units, and sensors— currently open to foreign participation.

Surveys and interviews with experts in the automotive, mobility, and technology industries suggest Chinese players are at least two to three years behind international companies in the critical capabilities required for delivering the AV stack (Exhibit 6). In some cases, such as the computing platform and AV system integration, the Chinese automakers are more than 10 years behind.

The Chinese government strongly supports local AV technology development, as shown by the establishment of multiple AV test zones, including Jiading in Shanghai and Xiong'an outside of Beijing. Initially positive, such support can help local players develop capabilities. Over time, however, the increasing drive toward localization could restrict competition in the sector (for example, hampering outsider abilities to operate locally or access local technology).

The venture-capital community and major internet players are investing heavily in China to close the global/local gap. Over the last five years, AV and component companies have received $7 billion in funding. Alibaba, Baidu, and Tencent have all invested in the sector by participating in funding rounds

Exhibit 6: Assessing China's gap to global leaders across the technology stack



Source: Expert interviews and survey, team analysis

(for example, Baidu and Tencent with NIO, and Alibaba with Xpeng) and establishing partnerships (for instance, Alibaba with SAIC, Tencent with several OEMs, and Baidu with a wide range of players across the value chain as part of its Apollo ecosystem).

The large amounts of available capital noted above and the active involvement of the government will both actively help to shape the competitive landscape for AVs in China. At the same time, to succeed, China's AV industry must integrate itself deeply with global ecosystems to avoid reinventing the wheel.

This type of integration will be imperative for Chinese players of all kinds because high-level AV technology requirements are fundamentally similar and thus transferable across markets and regions. Additionally, international players often have considerable advantages regarding some elements of the

AV technology stack due to their global reach and expertise. As with any new technology, efforts to standardize as many elements of self-driving technology as possible could pay immense dividends down the road, especially for under-resourced local players in China.

Identifying winners and also-rans

Winning the AV race will require industry incumbents to step out of their comfort zones and fully engage with a variety of players across the value chain and throughout the technology stack. Technology giants and other outsiders must also adopt new strategies to make sure their technology offerings become core parts of any standardized AV solutions. Additionally, players might need to move into new segments of the value chain (for example, mobility). As a result, winning will require cooperation between local and multinational companies, and along the value chain.

Several alliance models exist both across the AV technology stack (Exhibit 7) and between multinational and local players (Exhibit 8).

Preparing now for tomorrow's self-driving realities

For automakers, high-tech companies, and mobility services providers competing in China, the AV phenomenon may seem a decade or two away, but deferring positioning strategies can rob players of both influence and degrees of freedom.

Winning this game will require companies to evaluate their entry strategies carefully, balancing the high risk involved against the potential value of becoming a leader in the largest long-term market for AVs in the world. In China as well as globally, autonomy and MaaS present a challenging landscape for investors due to the technological uncertainty and lack of proven business models. Companies making large-scale bets on conventional driving technologies (which will generate the bulk of market volume for at least the next half-decade) need to balance their investments in the old and the new at the same time.

We have a few suggestions for players developing their AV strategy:

— Decide where to play. Make a clear decision regarding what parts of the AV tech stack make the most sense for your company, both in terms of control points and differentiation. Establish a business model compatible with the identified source of differentiation.

— Develop a road map to access the tech stack. Identify the link between your source of differentiation and the technology road map you need to deliver. Estimate the company's capability gaps and the investments required to

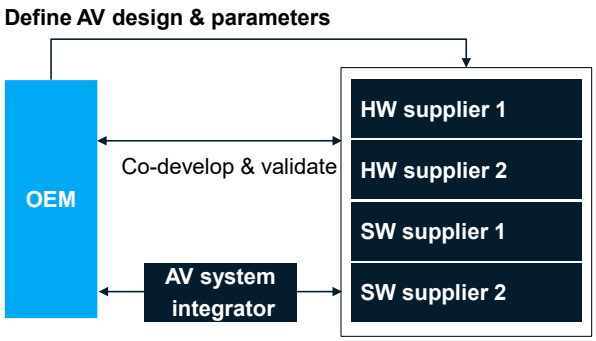
Exhibit 7: Different models for realizing the full autonomous vehicle tech stack

1 Integration by validation

OEM define AV design and key parameters

OEM co-develop AV technology with HW and SW suppliers, then integrate and validate

Driver of technology definition: OEM



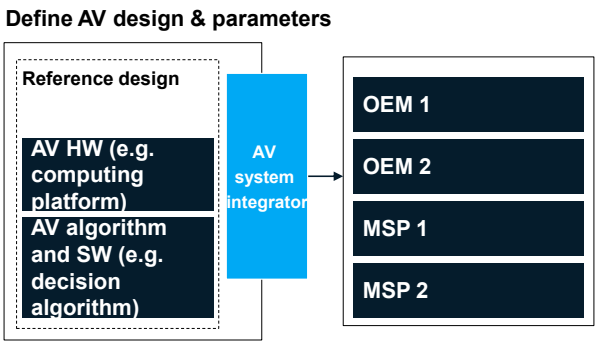
2 Integration by reference design

AV HW and SW suppliers define AV design and key parameters, and provide OEM with reference design

Supplier with core HW/SW competence conducts system integration

OEM could modify their design within compatibility of AV system

Driver of technology definition: AV system integrator

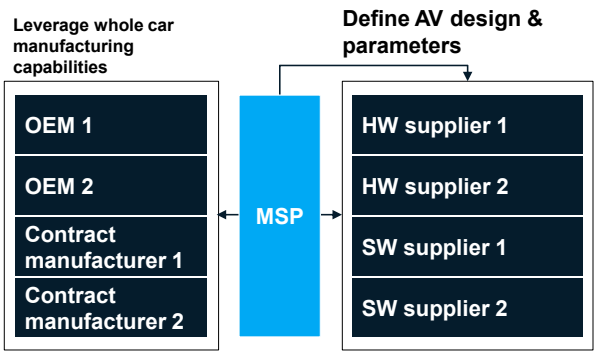


3 Mobility service-driven

MSP defines AV design and key parameters, then co-develop and validate

OEM/contract manufacturers produce AV for MSP

Driver of technology definition: MSP



Source: Expert interviews and survey, team analysis

Exhibit 8: Possible AV alliance models

	"Localizing global alliance"	"National champion stewardship"	"Locally enabled platform"
Description	Led by a MNC frontrunner in AV with global & local partners to develop full AV tech, aiming to localize its products/services for China market	Alliance of both Chinese and international players around a Chinese national champion endorsed or supported by govt	Led by a Chinese company, with MNC participation in establishment of a locally grown tech platform, empowering local OEM and tech co.
Leading companies	Leading global OEM or tech companies	Leading Chinese OEM or tech co. with SOE background	Private-owned local tech company or OEM
Common objective	Access to AV tech stack and ensure technology readiness Deliver AV at affordable price for mass adoption		
Alliance objective	• Maintain auto tech leadership in Chinese market in AV era • Gain access to local market and approval by govt	• Build up AV and auto competence for domestic companies • Provide case and experience for setting the AV regulations	• Aggressively reduce cost for local customers • Ensure wider access to AV tech among smaller and less tech-savvy players

decide whether to develop the technology inhouse or acquire the needed capabilities.

— Choose the right alliance and ecosystem. Determine your ecosystem and alliance strategy; no single player can deliver all the needed technology in the AV tech stack. At the same time, the AV value chain will differ from traditional ones. We believe going it alone is not an option. Instead, be ready to forge new partnerships and alliances as needed.

— Build organizational agility. Cultivate strategic and organizational agility so you can update your strategy and tactics to anticipate changes in market dynamics and react quickly to competitor or partner moves.

Beyond these four suggestions, multinational companies should consider creating a China-specific strategy with the flexibility to adapt their global models for China. That means developing the capacity to understand, respond to, influence, and shape what's going on in the country—and to develop tech-stack solutions in response. Multinational players today are uniquely aware of both the opportunity in China and the uncertainties regarding the competitive dynamics and localization requirements. That said, building a "global plus local" strategy and execution engine will not be a trivial exercise.

Likewise, local players should assess what specific parts of the AV tech stack it makes sense for them to own versus those they should access through

partnerships with multinational players (at the cost of partially giving away value and control). Today, most local automakers depend primarily on tech-stack components provided by global companies, and thus have only limited investments in the core technologies and integration capabilities. Such a strategy can work for fast followers, but to play a disruptive role, companies will need to control their own tech stacks.

Getting started

While an autonomous vehicle can drive itself, firing up a company's AV strategy for China is more of a hands-on proposition. In addition to sorting through the traditional “where to play” and “how to play” questions, leaders need to make an unblinking assessment of the risks involved—both in being an industry leader and in waiting for others to lead the way. While such decisions are challenging under any circumstances, this one involves a trillion-dollar bet in China, home of the world's largest and most dynamic car market. With stakes this high, players will need much more than luck to gain a winning position.

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Commercial excellence

Next generation sales management in China's auto market

Mingyu Guan, Frank Chu, Daniel Zipser

The end of an era in China auto sales

In 2018, retail sales of passenger cars in China declined for the first time in two decades, falling 4 percent in volume, according to the China Association of Automobile Manufacturers (CAAM). The decline accelerated in the second half of 2018, and continued at a double-digit pace in the first half of this year. The downward trend marked an end to a 20 year period of continuous growth for the Chinese auto sector. It also reflects several significant shifts indicating a new era:

— Retail economics moving from undersupply to oversupply, with dealer stock building to historically high levels

— Consumer profiles maturing from first-time to experienced car buyers

— Discovery moving online. While >95 percent of new car sales are still transacted in dealership, car buyers are spending more time researching and evaluating cars online before the transaction

— Use car sales continuing to accelerate, growing 13% in 2018 to reach nearly half of new car sales volumes

We are witnessing a landmark moment for OEMs in China as brands shift to retail-focused rather than wholesale-focused operating models. Many OEMs have already adapted by shifting KPIs and operational incentives towards retail activities, often using tactics that are already commonly deployed in North America and Europe.

However, tactics that proved effective overseas may not necessarily work in China, where consumers' openness to digital engagement, as well as more relaxed legal frameworks for dealer franchises, present a unique market profile.

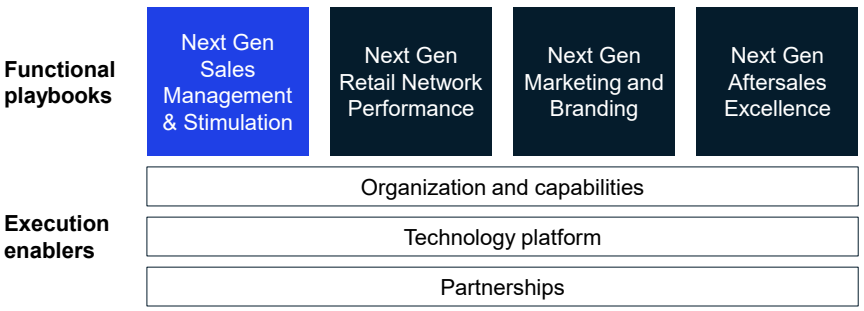
Meanwhile, the global automotive industry is being disrupted by what the US Center for Automotive Research refers to as ACES – autonomous, connected, electric and shared – vehicles. These changes have direct implications on how Chinese OEMs and dealers should approach their customers. For example, mobility service offerings raise questions as to how OEMs should balance sales with demand for shared vehicles. In aftersales, connectivity enables new business models that impact dealership profitability. As consumers come to expect more from OEMs and dealerships, industry players need to act now to adapt.

OEMs will need to transform their sales and marketing practices in this demanding new environment. This transformation spans seven components: four functional areas (sales and stimulation, network layout, marketing and branding, and aftersales and customer management); and three execution enablers across organization and capability, technology platform, and ecosystem partnerships. We believe that addressing all components holistically

rather than treating each function individually is key for success. (Exhibit 1)

This article focuses on sales. Below, we provide a playbook for OEMs to transform their sales activities to stimulate topline growth, to help them change sales behaviours and stimulate revenue growth. We also explain the key elements in depth. Please note that the below only pertains to OEMs that have independent dealer networks. Those with direct-to-consumer sales models are not covered.

Exhibit 1: Next Generation Automotive Marketing & Sales in China



Source: McKinsey

Three phases of sales maturity

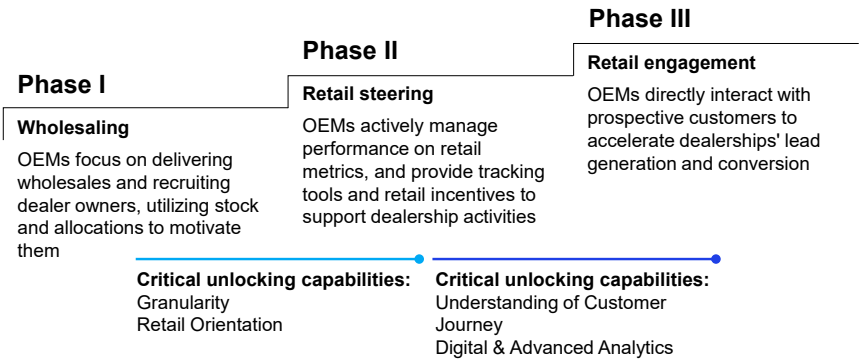
Globally, passenger car OEMs demonstrate three stages of sales maturity (see Exhibit 2):

Phase I – OEM in Wholesaling role: OEMs primarily focus on producing cars and wholesaling those cars to dealerships. Interactions with end customers are generally constrained to marketing and branding activities. Incentives are focused on wholesale activity such as stock, ordering, and allocations.

Phase II – OEM in Retail Steering role: OEMs actively drive retail performance, primarily through dealer performance management, including retail targets, retail incentives, and vehicle allocations. OEMs also tie marketing more closely with dealerships' activities, and provide tools such as dealer website platforms, CRM systems, sales coaches, and training modules for dealerships. Direct interaction with consumers is still limited to marketing and branding.

Phase III – OEM in Retail Engagement role: To accelerate dealerships' lead generation and conversion, OEMs' interaction with consumers is not limited

Exhibit 2: Three phases of sales maturity for automotive OEMs in China



Source: McKinsey

to marketing and branding, but also includes partnerships along the whole customer decision-making journey, including generating and processing leads, moving leads to dealerships, as well as aftersales.

Most larger OEMs in China are in the process of shifting from Wholesaling (Phase I) to Retail Steering (Phase II). The majority are familiar with the end state of Phase II based on the pattern of OEM operations in retail environments like North America and Western Europe. However, the transition is not easy, as it requires a change in mindset among OEMs and the whole dealer network. In the current difficult macroeconomic environment, maintaining the determination to complete the transformation will pose a challenge for OEMs.

Several pioneering OEMs are already incorporating elements of Phase III (Retail Engagement) by collaborating with online platforms to drive lead generation, or building advanced analytics partnerships that leverage both self-generated and third-party data. However, these pilots have so far achieved only limited success, both due to teething problems on the OEM side, and the absence of compatible models when it comes to working with dealers. In order to manage the transition toward a successful collaboration between OEMs and dealers, and accelerate next generation sales performance, we recommend several changes that can smooth the transition through the three phases of development.

What can OEMs in China do to improve sales performance?

OEMs are undertaking trials to manage sales through the phases outlined above, but in many cases the impact has been limited. We believe that such

shifts must be comprehensive and holistic – not just a set of initiatives, but a broad transformation supported by fundamental changes in setting targets, performance management, and resource allocation carried out by the OEM and its retail partners. For example, switching from wholesale to retail incentives will not work unless OEMs invest resources to train dealerships in retail best practices. OEMs must also train their own regional sales managers to emphasize retail over wholesale.

Exhibit 3 highlights a few elements that should change in tandem to move from one phase to the next.

Transitioning from Phase I to Phase II – The WHAT

This phase requires OEMs to change their mindset to more closely link retail and wholesale initiatives. The four components of such a transition include:

1. **Setting granular retail targets that are simple to measure:** These should be specific to each dealership's market, and translate into a discrete annual, quarterly, or monthly target retail volume. This acts as the central component of the "performance contract" between OEM and dealership. In some cases, it is also appropriate to set targets tied to net revenue or trading profit, in order to motivate dealerships to sell the right mix of vehicles. Whatever the target, it is essential to assign a clear metric for the OEM and dealerships to rally around.
2. **Defining incentives around retail targets that are holistic and directly attributable:** OEMs should shift more than 50 percent of incentive dollars from wholesale to retail incentives. They should also establish comprehensive sales stimulation programs that cover both dealer and customer incentives. Finally, incentives must be quantifiable and easy to understand, so dealership owners, managers, and sales staff know what they will receive when they sell a car.
3. **Developing and offering retail support to dealerships:** OEMs could help dealerships improve their retailing capabilities. First, OEMs can provide salesperson training. Second, OEMs can take advantage of their scale to centrally negotiate contracts with dealer website providers and CRM system providers at preferred prices. Third, OEMs should push dealerships to adopt best retail practices on metrics such as minimum stock and showroom density. Finally, OEMs can develop marketing and other creative content for dealerships to leverage.
4. **Building a performance management infrastructure that re-enforces targets and incentives:** OEMs and their dealer networks should engage in active dialogue around targets, incentives, and performance drivers. We recommend the following approach:

Exhibit 3: General practices in each phase of sales maturity

	Phase I **Wholesaling**	Phase II **Retail steering** ***Drivers: Granularity, Retail Orientation***	Phase III **Retail engagement** ***Drivers: Consumer Journey, Digital & Advanced Analytics***
Target setting	• Wholesale-focused • Top-down (total volumes) • Based on prior year	• Retail-focused (at least 50%) • Granular (model, model-year level) • Based on individual dealership's retail market dynamics	• Targets at pre-transaction level (leads, prospects, impressions, etc.) • Very granular (segment by customer type, vehicle grade, trim/options)
Performance management	• Transactional & high-level (focused on total wholesale volumes without much granularity) • Mainly focus on sales quantity KPIs, little KPIs on sales quality • Push model (OEM motivates retail sales by pushing stock and allocations) • OEM field team acts as "volume supervisor"	• Mix of sales quantity and sales quality KPIs • Add process KPIs on top of performance result KPIs • Focused on retail support (providing dealerships with tools, content, training) • OEM filed team acts as "field support" and helps dealerships obtain unique resources they need most	• Leverage digital toolkits to enable granular performance management including "pre-retail" steering (test drives, conversion rates, etc.) • Focused on retail empowerment – OEM provides toolkits /platforms to enable digital and advanced analytics marketing and CRM so that dealerships can focus on selling • OEM field team acts as "coach"
Resource allocation - vehicles	• Wholesale allocations at total level • Set early and unchanged throughout year	• Dynamically adjusted allocations based on market condition • Granular at model / trim level • Closely linked with sales quality KPIs, e.g. sales in local market, etc.	• Predictive modeling for optimized build • Dynamically adjusted based on lead generation and conversion momentum • Possibility of offering "build to order"
Resource allocation - incentives	• Dealer-oriented wholesale incentives and little to no customer-oriented incentives • National with little customization • Potentially very complex with inconsistent methodologies, yet without tracking of incentive efficiency and effectiveness	• Retail incentives at model & model year level, potentially customized by dealer location • Transparent tracking of incentive efficiency and effectiveness (elasticity modeling) • Consistent approach, qualification and redemption	• Incentives tailored to individual customer archetypes • Incentive levels determined by machine learning models • Dynamic tweaking of incentive programs for continuous improvement
Resource allocation - leads	• No allocation of leads	• Leads allocated in mass and based on geography only (OEM takes leads from brand website or events and distributes all of them to dealerships in customers' geographic proximity) • Lack of effective leads qualification and follow up mechanism	• Highly prioritized (OEMs only pass on high potential leads that are worth the effort for dealerships to pursue) • Leads allocated based on dealerships' ability to convert leads (leads act as a 'currency' for higher performing dealers)

Source: McKinsey

a. Formal quarterly (or at least semi-annual) meetings with each dealership to review prior year performance and agree on retail targets for the next period

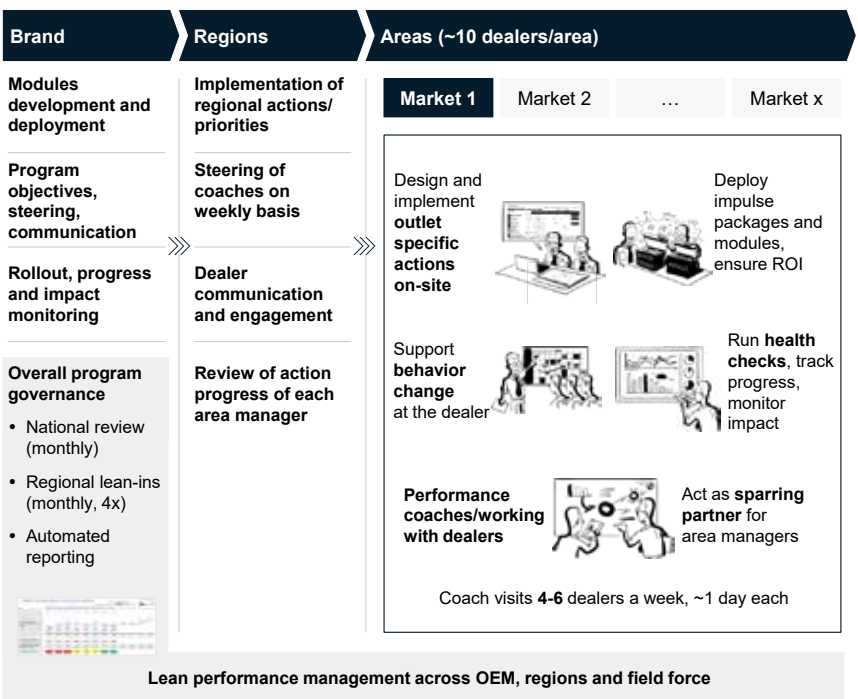
b. Monthly "performance dialogues" between OEM and dealership, focused on two or three areas in which the dealership can improve performance (and how the OEM can help)

c. Within the OEM, quarterly reviews of individual sales managers' performance (retail sales in dealerships that he/she is responsible for) cascading up to regional managers and eventually national sales.

Transitioning from Phase I to Phase II – The HOW

A number of OEMs transitioning from Phase I to Phase II have struggled to drive immediate improvements, in part because dealerships find it difficult to adapt their operating models. Across our three execution enablers, we recommend OEMs consider the following when shifting to a Retail Steering role (see Exhibit 4):

Exhibit 4: Phase I - Phase II transition, enforced by structured cascade of OEM responsibilities that shift brand from wholesale to retail



Source: McKinsey

OEM Organization and Capabilities:
OEMs must internally shift towards retail targets and retail incentives if they expect dealerships to do the same. OEMs will need to train regional/sales managers to build retail capabilities and expertise. Hiring employees with direct retail selling experience could help.

Furthermore, OEMs are advised to offer a set of standard tools, templates and best practices for dealerships to accelerate their own retail capabilities. Exhibit 5 below highlights a number of these capability-building modules.

While OEM discounts and rebates are quite diverse, keeping tabs on and continuously improving incentives across wholesale and retail, volume bonuses, dealer margin incentives, and physical benefits, is a more difficult task. As incentives become a bigger differentiator for retail, OEMs will need to enhance incentives data transparency and reporting in order to make informed decisions.

Exhibit 5: Commercial Excellence Playbook components

Source: McKinsey

Technology Platform:
At the bare minimum, OEMs will need to track and tie incentives to retail transactions. While this is already common in more mature regions, it may require a technology upgrade in China, or at least an improvement in usage of existing tools. More mature OEMs have deployed robust solutions that automate incentives collection, aggregation and reporting to guide monthly or quarterly changes in incentive programs.

Ecosystem Partnerships:
In transitioning from Phase I to Phase II, dealerships are flipping their entire profit model from wholesale- to retail-incentive oriented. This is a big change. OEMs may need to become a deeper financial partner for dealers, providing loans to bridge dealerships' short-term profit gap during the transition. OEMs may also help the dealer network secure ecosystem retail partnerships with vertical websites.

Transitioning from Phase II to Phase III – The WHAT
The primary distinction between the Retail Steering and Retail Engagement phases is the way the OEM interacts with existing and prospective car buyers. In the latter, even though vehicle sales still go through the dealership, OEMs play a larger role in generating and shepherding leads along the customer journey. Although dealerships may push back, it is actually more efficient for OEMs to drive parts of the customer decision journey themselves for the following reasons:

— OEMs' economies of scale allow them to develop and roll-out technology platforms (e.g. websites, call centers, CRM systems) and provide advanced analytics capabilities based on data (such as machine learning, and precision marketing)

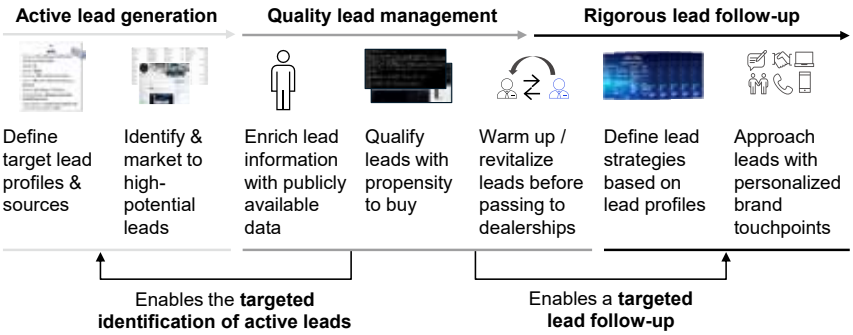
— OEMs can better drive partnerships with third-party providers across ecommerce, brand marketing, and customer data

— As the brand owner, OEMs can coordinate end-to-end marketing campaigns and incentive promotions with partner dealerships

Importantly, we expect the transition from Phase II to Phase III to happen more rapidly in China than it has in other markets due to prevailing consumer trends. Chinese consumers are more willing to share personal data in return for a better consumer experience than any other large market in the world, and the country's technology ecosystem of at-scale data providers and e-retail platforms will also likely accelerate evolution of the retail engagement model.

This phase is critical and should focus on customer-centric initiatives. Dealerships will provide offline experiences like “face to face” services and test drive services on critical conversion steps. OEMs will also need to shift

Exhibit 6: OEMs' potential role in the lead management process



Source: McKinsey

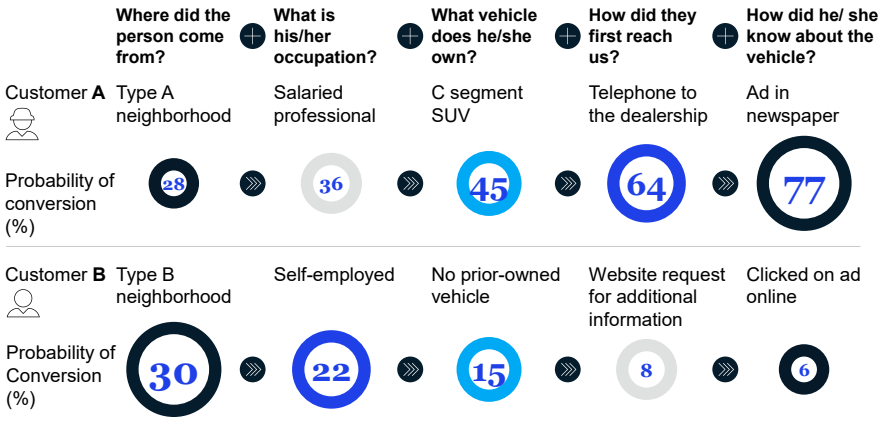
their mindset towards enabling dealerships during this process – peer-based collaboration will be the key to success for both parties.

Exhibit 6 above highlights the role that OEMs can have in the lead management process. In this phase, OEMs should prioritize:

1. **Understanding consumers at a granular level and segmenting target customers:** The first step is to segment consumers into five to eight actionable archetypes. Variations within each archetype may require additional customization but the total archetypes should not exceed eight.
2. **Applying robust data and analytics to generate and prioritize leads:** OEMs can leverage their superior scale compared with dealerships to acquire access to internal and third-party data. Using this data, OEMs can run marketing campaigns with at-scale personalization to generate high-quality leads. Moreover, OEMs must prioritize leads so they send only high-probability targets to dealerships. Machine-learning algorithms have a big role to play in both lead generation and lead prioritization, and can greatly improve ROI. Using machine learning to prioritize brand website leads can eliminate up to 60 percent of leads, thus saving dealerships' time, while improving overall lead conversion rates by 10 percent (see Exhibit 7).

   As consumers transition from first-time to repeat car buyers, OEMs are collecting more data about consumer preferences, which they can supplement with third-party sources to develop a more robust model for predicting purchasing behavior.
3. **Investing in scalable capabilities that focus dealerships on selling:** OEMs can (and already have in some cases) set up call centers to qualify and

Exhibit 7: Predictive analytics to prioritize leads (illustrative example)



Actions

- Develop machine learning algorithms built on past customers
- Supplement existing leads' information with external data (brand engagement on social media, market registration / insurance data)
- Apply predictive analytics to current leads
- Prioritize Customer A as "hot lead" and pass on to dealership along with recommended touchpoints
- De-prioritize Customer B; OEM call center contacts first to qualify lead before passing on to dealership

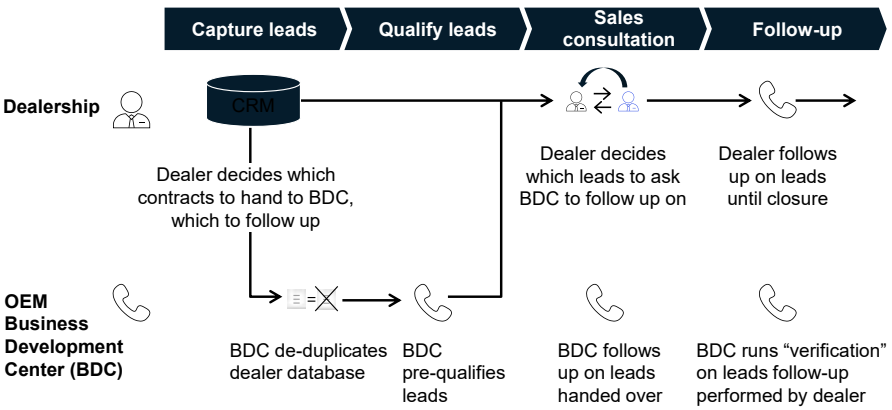
Source: McKinsey

warm-up leads before passing them to dealerships. If the dealerships are willing, the OEM can even act as an "internal sales team" on their behalf. This eliminates some of the lower-value activities such as cold-calling leads, or running background checks, and frees up time for dealership salespeople to focus on selling cars (see Exhibit 8).

4. **Tracking and performance managing based on leads, not just sales:** If OEMs are taking a hand in generating, processing and warming-up leads, then it is critical that they help dealerships track these leads. This not only helps determine if the OEM's activities are effective, but also trains dealerships to refine sales prospects. In order to improve efficiency, OEMs will need to consolidate lead information across all channels, including brand website, flagship stores on ecommerce websites like Tmall, as well as brand-owned WeChat stores, and one-off touchpoints like auto shows.

5. **Analyze and stimulate incentives decisions with advanced and predictive analytics:** Once OEMs have aggregated incentives data (in Phase II), the next step is to utilize the data (and other available outside data) to determine which incentives will drive the most volume, revenue, or profit. OEMs and dealerships should work together to develop more effective sales

Exhibit 8: Example Business Development Center for OEMs to pre-qualify leads and revive dealerships' 'dead' leads



Targets

- Increase follow-up on offer rate from 30% to 100%
- Revive 20% of "dead" leads that dealership stopped contacting
- Convert 8% of total leads funneled to BDC

Source: McKinsey

incentives and promotions.

Transitioning from Phase II to Phase III – The HOW

Based on the experience of leading global OEMs, the transition from Phase II to Phase III is harder to pull off than the transition from Phase I to Phase II. After all, OEMs are not used to directly engaging consumers. Moreover, dealerships may feel that the OEM is overstretching, so many are hesitant to share their CRM data. In addition to focusing on the three key enablers--organization and capabilities, technology platform, and partnerships--OEMs should invest in setting up sales and marketing teams that are capable of adopting new business models.

OEM Organization and Capabilities:

OEMs should invest in building advanced analytics capabilities, including hiring or engaging data scientists and data translators. This requires a short-term increase in operating budgets. However, advanced analytics will enable OEMs to improve the return on investment of their marketing activities within 6-12 months. Therefore, these investments aiming at improving analyzing capabilities should pay for themselves, through either reduced marketing spend due to improved efficiency, or through sales lift.

OEMs should also investigate transforming the sales and marketing

organization to accommodate the emergence of more collaborative models. The front desk should act as a sales center in which digital touchpoints collect the majority of customer insights. Data scientists typically staff a middle desk that handles analytics based on primary and third-party data, alongside product managers who design campaigns and incentive programs based on the insights data scientists generate. The back-end desk handles target-setting, vehicle allocation, and performance monitoring, while providing market information so the front and middle desk can streamline their efforts.

Technology Platform:
Technology is a critical component for unlocking the full potential impact of Phase III. However, OEMs do not have to build a comprehensive in-house platform to conduct lead generation, qualification, and conversion. Instead, OEMs only need to invest in priority control points and then build out, leveraging third-parties where needed.

— OEMs must own a CRM system that tracks OEM-generated leads end-to-end. This includes tracking the lead once it is passed to the dealership. OEMs should form an agreement with dealerships that, in return for giving them solid leads, the dealerships commit to sharing lead conversation data back with the OEM.

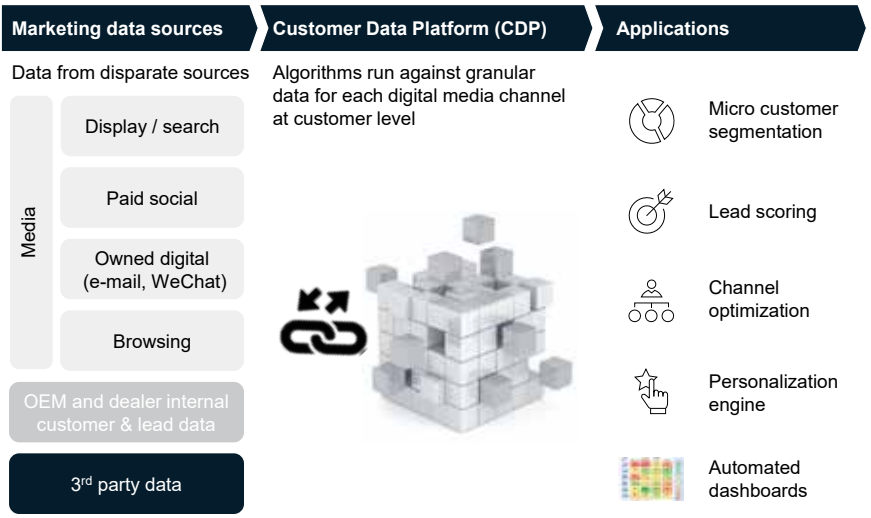
— OEMs must own a standard suite of advanced analytics tools and programming licenses to design and run machine learning scripts, optimization algorithms, and other analytics for precision marketing, and lead scoring.

— OEMs can own a CRM system that integrates with dealerships' CRM systems so that the OEM can track performance of ALL leads, not just the ones that the OEM generates. While this is a relatively common practice in some countries, it is difficult in China because dealerships are likely using a wide variety of different CRM systems. Middleware providers can link dealerships' CRM systems to the OEMs' central CRM system, and should become more prevalent and affordable over time.

— OEMs can own a customer data platform (CDP) that aggregates individual customer data into a “single source of truth” database (see Exhibit 10). A CDP ensures that OEMs are not just collecting data, but structuring the data so that it can be used to drive sales and marketing activities. The exhibit above highlights the high-level components of a CDP. In short, it takes data from various sources, stitches together a unified view of individual customers' decision journeys, and then structures the data for different sales and marketing applications. There are various third-party providers of CDP software that are already gaining traction in China, and should be considered as technology partners.

Partnership:

Exhibit 10: Customer Data Platform: 'A single source of truth' for customer data



Source: McKinsey

OEMs should partner with an ecosystem of additional data, technology and analytics providers to unlock the full potential of Phase III.

Currently, third-party consumer data platforms have not proven effective enough to justify the cost of the data. However, this is likely to change quickly, since Chinese consumers are more willing than those in any other major market to share personal information in exchange for a better shopping experience.

OEMs can work with other partners, who have existing capabilities that OEMs can leverage to accelerate performance and reduce in-house investments. These include companies that specialize in advanced analytics, agencies that track marketing ROI, technology providers that automatically de-duplicate leads, digital marketing platforms that consolidate marketing providers, brand website providers, and outsourced call centers. It is important for OEMs to partner selectively with 3-5 providers that will directly help them generate, prioritize and track high-potential leads. Anything else is likely a "nice to have" rather than a "must have".

Finally, the OEM must interact with its dealerships as a partner in customers' end-to-end journeys. At some point, the OEM will have to hand off every lead it touches to the dealership. Messaging before and after that handoff should be consistent, with the OEM ensuring it communicates the rationale and mutual benefits of its control of customer touchpoints to dealership partners. The OEM should only assume control of such touchpoints when it is more efficient for them to do so than the dealership.

In China, the power balance between OEMs and dealerships tilts toward the OEM. However, as retail becomes a bigger focal point, power will shift steadily towards dealerships, ensuring OEMs should develop partnership structures that will enable future collaboration.

Accelerating toward sales success

Auto OEMs in China are shifting focus towards retail, mirroring what has happened in more mature markets around the world, but at a much more rapid rate. Simply changing a policy or investing in a new capability will not be sufficient to lift an OEM above the pack in China's increasingly competitive market. Successful businesses will embark on a comprehensive transformation that commits resources early, despite the short-term difficulty. If implemented effectively, these investments should generate outsized returns that more than justify their expense. Making the transition will also require the adoption of new digital tools and the cultivation of talent capable of driving organizational change towards the new generation of sales management techniques we have detailed here. Only by digitizing their entire business can automotive leaders achieve game-changing efficiency savings. Finally, OEMs must also foster long-term partnerships with dealers, and actively cooperate with them to improve their abilities in tandem with the OEM at each stage of the customer journey. ■

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Billion RMB opportunity: Rethinking auto variable marketing expense

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Why managing dealer incentive spending is crucial

In the days of rapid auto sales growth, China's dealer incentive spending historically lagged behind the global average. However, Chinese passenger vehicle sales volume declined 9.6 percent[1] in 2018, marking the first fall since the turn of the century, and driving dealer inventory to near double versus the year earlier period.

Many OEMs are responding by raising dealer incentive spending to help drive sales growth. Chinese auto OEMs typically spend about 10-20 percent of their revenue on dealer incentive spending each year – equivalent to 10-20 billion RMB for an OEM with sales of 100 billion RMB.

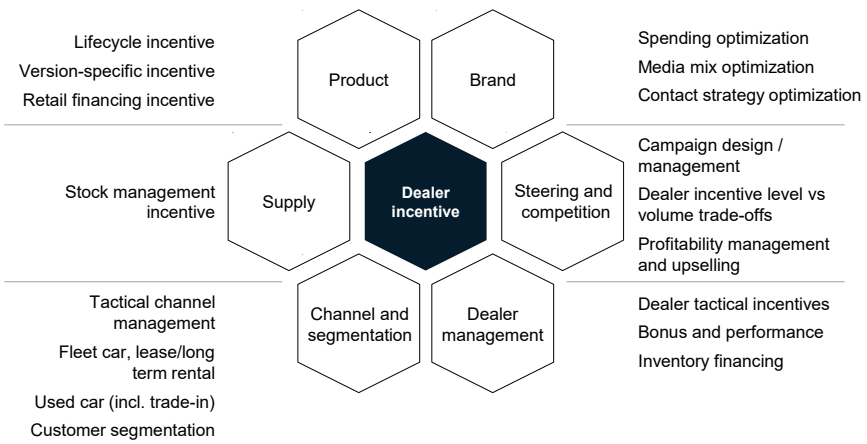
Despite the large size of these dealer incentive budgets, OEMs' management and control of dealer incentive spending efficiency has not been as strict as other high-spend items such as capital expenditure and material costs. Moreover, the scale of dealer incentive expenditures and the way they are managed can have a significant impact on the profitability of OEMs and dealers, while also affecting an OEM's brand recognition, and the behaviour of its sales team.

With no end in sight to the downturn, OEMs are under pressure to further increase dealer incentive budgets, making improving the management of related expenditures even more crucial.

China's complex dealer incentive management environment

Although the main purpose of dealer incentive spending is to drive sales growth, dealer incentive spending in China are influenced by a series of interrelated factors, such as brand positioning and pricing strategy, product competitiveness and life cycle stage, as well as the supply and demand balance (see Exhibit 1).

Exhibit 1: Dealer incentive spending in China is affected by multiple factors



Source: McKinsey

Clearly, China's auto market presents a unique set of challenges when assessing dealer incentive spending. Dealer incentive policy structure is more complicated than other regions, and multiple objectives make it tough for OEMs to coordinate and enforce policies effectively. In addition, it is extremely difficult for OEMs to track incentive expenditures on a transaction-level basis in a transparent and timely manner.

Dealer incentive management in China is complicated by the following set of overlapping factors:

Complex dealer incentive structures and opaque distribution:
Dealer incentive spending in China is a very broad concept, which encompasses almost all rebate transactions with dealers. It is thus common for a single OEM to operate 50-100 incentive policies, making it challenging to build a holistic view of the spending distribution across models/trims, regions, dealers/dealer groups, and incentive types.

Mixed objectives provide challenges in managing spending effectiveness: (see Exhibit 2):
OEMs use dealer incentives to serve multiple objectives, typically a mix of volume incentives, price discounts, and policies designed to optimize dealer management and provide retail support:

"Volume incentives": These typically account for the highest share of dealer incentive budgets. OEMs need to focus on three areas to design effective volume incentives:

— **Target setting:** Setting the "right" targets for each dealer is critical for volume incentives to be effective. Typically, OEMs will seek to balance dealer capability (e.g. based on historical performance) with micro-market potential, (e.g. the potential to increase market share) to ensure dealer targets are set at a challenging yet achievable level.

— **Steering objectives:** OEMs determine the desired behavior they wish to incentivize, for example pushing wholesale or retail sales, sales volume or profit, and establish measurement indicators accordingly. We observe that many China-based OEMs have placed increasing emphasis on retail sales steering in the past two years. This presents challenges in accurately tracking retail sales volume and transaction pricing, as well as managing inventory and car flow.

— **Policy design:** Depending on the level of transparency on total incentive per unit OEMs would like dealers to have, OEMs adopt different incentive policy designs. These include setting qualification criteria for dealers to earn volume incentives (e.g., dealer must achieve 80 percent of sales volume target), or designing tiered incentives linked to the level of volume sales achieved (e.g. for achieving 90-110 percent, or between 60-110

Exhibit 2: Dealer incentives are complex and numerous in China, but major OEMs tend to operate similar policy structures

		SVW	GAC -TOYOTA	SGM
Price discount	Unconditional cash discount	✓	✓	✓
Volume incentive	Conditional target achievement incentive	✓	✓	✓
	Auto-finance interest compensation	✓	✓	✓
	Insurance	✓	✗	✓
	Trade-in reward	✓	✓	✓
	Repurchase reward	✓	✗	✓
	Auto accessory	✓	✓	✓
	Customer referral reward	✓	✗	✓
	Warranty extension rebate	✓	✓	✓
	Dealer store sales incentive	✓	✓	✗
Dealer support/ management	Marketing support	✓	✓	✓
	Store capex support	✓	✓	✓
	After sale capex support	✓	✗	✓
	Inventory finance interest subsidy	✓	✗	✓
	Test drive reward	✓	✓	✓
	Sales related dealer management reward	✓	✓	✓
	After sale related dealer management reward	✓	✓	✓

Source: Expert interviews; Team analysis

percent, of the volume target). Other variations include bundling different key performance indicators, for example linking a bonus to meeting both wholesale and retail sales targets.

Pricing discounts: OEMs are typically reluctant to downwardly revise the manufacturer's suggested retail price (MSRP) because of the negative signal this sends to the market. Instead, most opt to enhance product competitiveness, or compensate for reduced competitiveness driven by new

entrants or aging models, by offering dealers unconditional price-discount incentives. For example, with China now implementing the "National Six" emission standards, many OEMs offered a large price discount incentive for the "National Five" model to reduce inventory. However, compared with adjusting MSRP, discount incentives increase financial pressure on dealers who must endure prolonged selling and settlement periods before they are compensated. OEMs may be able to better control when and how to provide "price discounts", while at the same time compensating dealers for lost profits through other incentives (such as higher inventory financing subsidies).

Dealer management and retail support: Dealer management incentives consist of upwards of 30 policy items designed to improve the quality of services provided to customers. These usually aim to improve sales quality, for instance customer satisfaction bonuses, subsidies to promote test drives, and inventory financing subsidies. Such incentives usually account for a small proportion of OEM revenue – usually less than 2 percent – but can still run into billions of RMB for larger Chinese OEMs, which are consequently reviewing whether they really move the needle on sales conversion.

Retail support incentives benefit the consumer, and include financial support, for example interest-free installments, insurance additions, or trade-in subsidies, as well as non-finance incentives such as car accessories, and extended warranties. OEMs are allocating larger budgets to retail support, both to limit the direct impact of incentive spending on transaction prices, and because they offer transparency in terms of tracking how the dealer deploys them.

Inefficiency in co-ordination and execution across departments: Dealer incentive budgets in China are often spread across multiple departments, including sales management, after-sales, auto financing, and dealer management. This absence of centralized steering and coordination presents problems for OEMs trying to maximize the efficiency and effectiveness of their incentive programs.

Low transparency on how incentives are spent by dealers: For many incentive spending items, OEMs can only manage how dealers earn the incentive, not how they are spent during the sales process. This deprives them of the ability to effectively steer sales. For example, dealer sales representatives may not know how to apply "non-pricing" sales techniques, and offer direct cash discounts instead, which can undermine brand image, and their ability to meet sales targets. Some automakers are shifting incentive budget towards items that directly benefit consumers, such as retail financial interest subsidies and trade-in subsidies, to enhance the direct impact on sales conversion rates.

Limited granularity and transparency:
For the most part, OEMs do not have systems capable of holistically tracking dealer incentive spending down to the level of policy, model, or dealer. Instead, data is scattered across different budget owners and worksheets. As a result, dealer incentive policy adjustments are often made based on experience with delayed market responses, rather than consistent and timely fact-based data analytics.

Optimizing dealer management spending in China

Optimizing incentive spending decisions requires transparency at the customer-order level, and dynamic data updates to facilitate robust management of incentive campaigns

The following seven "rules" can help optimize incentive spend:

1. Steer incentive spend based on facts, not just experience; for instance, seek a granular view (at the level of the vehicle identification number, or VIN) and manage the dispersion of incentive spend (across dealers, models, and regions, for example).
2. Keep incentive spend structures simple: Define a clear taxonomy with a limited number of policies.
3. Define incentive guidelines to foster upselling.
4. Build a digital/IT environment to run automated analyses and intelligent reporting cockpits to support interventions.
5. Build incentive spend management capabilities in target markets.
6. Build a management alliance to solve conflicts between incentive spending and volume.
7. Become more customer-centric in the way you set your incentives – for example, consider and understand the amount of dealer incentives passed on to the customer.

Operating based on these seven rules will require adjusting capabilities at headquarters, as well as the regional level. This is an opportunity to transform the organization, enabling it to set consistent spending guidelines, and adopt a data-driven decision-making process to optimize incentive campaigns.

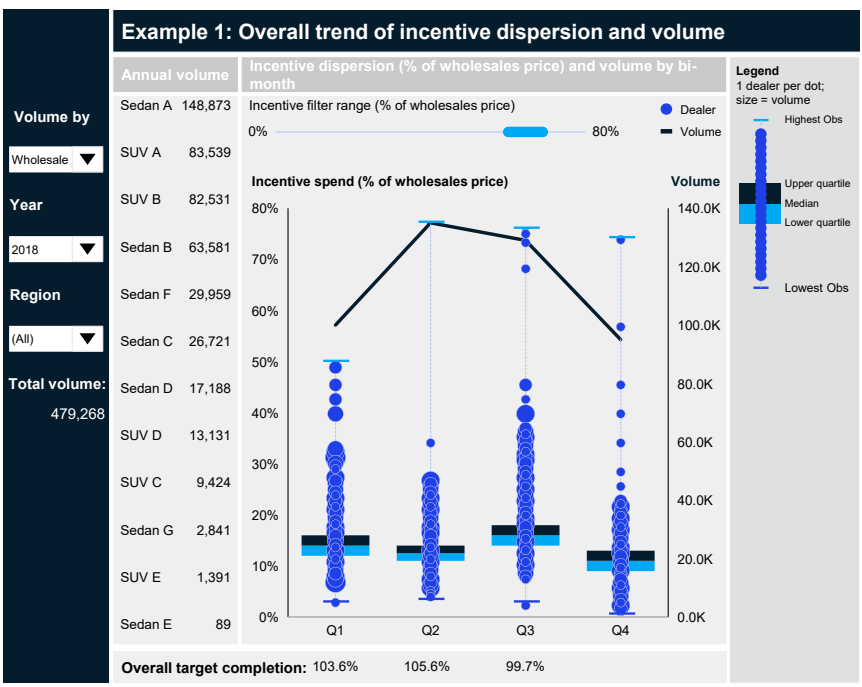
A dynamic approach to incentive-spend management, based on these rules, can drive 3-5 percent margin improvements, equivalent to between 300 million RMB and 1 billion RMB in annual impact for a 100-billion-RMB-revenue OEM operating a typical dealer incentive spend baseline.

The impact is driven by operationally steering the level of the incentive (for

example, incentive amount along models, or trims to promote upselling), the design (for example, an in-kind benefit or finance support versus a pure cash rebate), the mix between the channels (such as setting a discount grid for corporate sales, thereby fostering discount rigidity), and the link to key performance indicators (for instance, incentives versus dealer performance). Furthermore, measures to strengthen the brand – for example, shifting away from short-term incentives towards marketing spend – could unleash additional potential.

Such an approach should integrate all relevant VIN data and include dynamic updates. Preconfigured, customizable analyses can aid rapid visualization and uncover hidden insights. These analyses focus on model, trim, and version-level incentive spend, customer discounts, and dealer and manufacturer profitability. This approach also makes regional, dealer group, and dealer-level performance tracking possible, helping managers understand the sources of any performance disparity. Likewise, stock-level promotion analysis can identify which incentive types can effectively drive volume as units age. Channel-level performance indicators can involve retail, fleet, and government customers. Exhibit 3 shows some example analyses. The approach enables OEMs to deploy best-practice interventions to address gaps and track them to ensure they produce the desired impact. Ultimately, the overall transformational approach can help companies change their DNA.

Exhibit 3: Sample dashboard: Sales volume vs incentive spend and dispersion



Analysis objectives

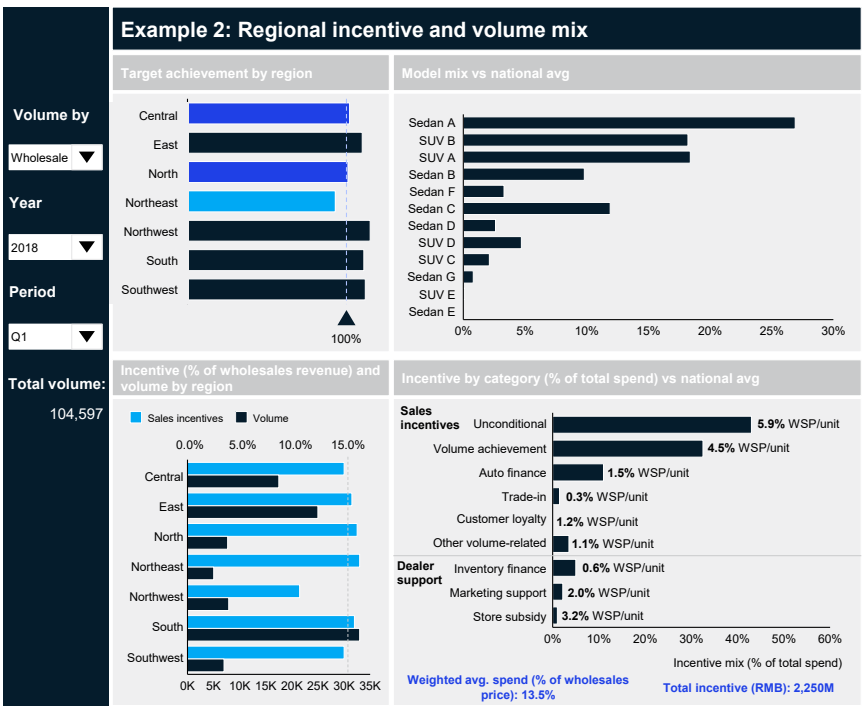
— Visualise and compare sales and incentive spending over different time periods

— Visually present the dispersion between incentive spending across dealers or transactions

Application examples

— Identify unexpected incentive spending dispersion patterns, evaluate if they are in line with the positioning of existing incentive programmes, and assess how they are influencing sales behavior

— Determine if it is necessary to rethink and revise the trade-off between incentive spending and sales volume



Analysis objectives

— Enhance transparency of regional target achievement rates, total sales, vehicle model mix, as well as incentive spending and incentive mix

— Compare these indicators with the national average to identify outliers

Application examples

— Review the viability of regional vehicle model mix targets, and evaluate sales

capabilities of regional dealers (such as the use of non-cash consumer benefit policies)

— Formulate regional support programs to resolve issues related to regional market share, product mix, or sales capabilities

The battle for sales at the automotive dealership level in China will only intensify, compelling automakers to increase their incentive spending. OEMs should resist the temptation to throw good money after bad merely to maintain market position. Instead, a streamlined, data-driven approach can help tailor dealer incentive programs to improve spending effectiveness, and enhance the competitiveness of OEMs by facilitating targeted product offerings that better meet the needs of customers.

[1] China new car insurance database, excludes mini-vans.

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Crafting a successful channel strategy in China's auto aftermarket

Micheala Fang, Wang Rui, Ting Wu

Opportunities and challenges abound in China's auto aftermarket

New auto sales have slowed in China, and annual average growth is forecasted to decline to 4 percent for the next five years from 8 percent over the past five years. [1] As vehicle parc—the number of vehicles in a market—continues to rise, the focus of China's automotive market is gradually moving from the assembly market to the aftermarket. For instance, the growth rate of the aftermarket for auto batteries is expected to reach 9–10 percent in the next five years, but the assembly market is only forecast to expand about 4 percent. The share of the aftermarket is also expected to rise to 70 percent, up from the current 65 percent. [2]

Aftermarket growth has slowed for three important reasons:

— Vehicle parc growth has slowed and the average annual growth rate for the next five years is forecasted at 8 percent, down from 18 percent over the past 10 years.[1]

— The emergence of shared mobility has resulted in a declining trend in the average mileage of passenger cars: In the past three years, the average mileage of passenger cars fell by 6 percent to 8 percent, and is forecast to decline by between 2 and 3 percent over the next five years.[3]

— The accessory replacement rate in some subsectors is also declining, causing a further decrease in growth. For example, lubricants for passenger cars are forecasted to stagnate over the next five years—CAGR is expected to be between 0 and 2 percent. This reflects not only slower growth of the entire market but also a gradual upgrading of market products toward fully synthetic motor oil, thus lowering lubricant consumption per kilometer.

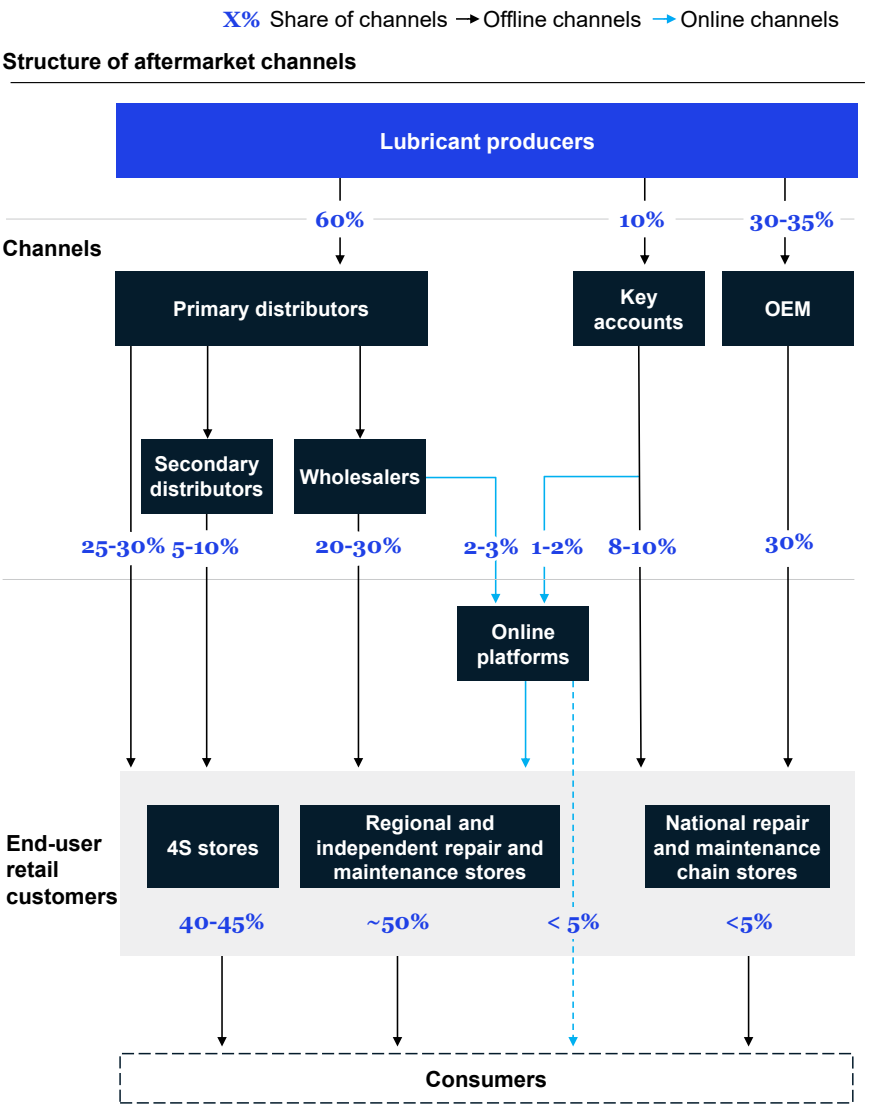
Meanwhile, product homogenization has meant that the gap between market players is narrowing. In addition, emerging local brands have intensified market competition. Local tire brands such as Chaoyang, for instance, have gradually closed in on the standards of international brands in terms of quality, performance, and other areas, and now account for 50 percent of market share. In the auto battery market, local brands have a competitive advantage. Camel and Fengfan, for instance, have a market share of 28 percent and 17 percent, respectively, ahead of international brands such as Varta and Yuasa.[4]

Three key trends in auto parts sales channel development

The key players in China's auto parts aftermarket channels include authorized sale, spare part, service, and survey (4S) distributors operating in channels dominated by OEMs and traditional offline distributors. They also compete with emerging channels that have developed along with the internet economy, including online-to-offline e-commerce platforms, one-stop auto parts

distributorship platforms, and national chain stores. Three key evolutionary trends of the aftermarket channels and retail are shaping the auto parts market in China.

Exhibit 1: The structure of China's aftermarket channels, with lubricant as an example, is fragmented



Source: Interviews with experts

The fragmented retail store landscape is likely here to stay

China's automotive retail stores are highly fragmented. Incomplete data reveals that there are currently more than 400,000 auto repair and maintenance stores in the country, mainly in three categories: 4S stores, regional and independent repair and maintenance stores, and national repair and maintenance chain stores. In terms of sale of parts and components, regional and independent repair and maintenance stores have the largest share. They sell 50 percent of the country's lubricants and nearly 70 percent of China's auto batteries.

Because the barriers to enter the auto repair and maintenance industry are low, many auto-repair practitioners choose to start their own businesses. Meanwhile, among repair and maintenance chain stores a lack of cooperation among stores has made it difficult for them to grow and gain significant competitive advantages over independent stores. Capital investment and maintaining a pool of repair and maintenance technicians are also major bottlenecks for scaling up store chains. Therefore, the highly fragmented structure of retail stores is forecast to linger for a long time to come, and it will be difficult for a meaningful industry consolidation to emerge. In the next five years, the share of national repair and maintenance chain stores is forecast to increase only to between 3 and 5 percent, up from the current 1 percent or so. 5

In our experience, retail stores are generally reluctant to stock auto parts because of the wide variety of product categories, particularly in less popular products with low demand. Therefore, the top three purchasing factors for retail stores are whether distributors can provide comprehensive product selection, quick delivery (such as tires and batteries within two hours), and flexible after-sales service (such as handling quality issues).

Manufacturers must ensure also ensure they have a plan to cover and service retail stores efficiently to succeed in the auto parts aftermarket.

Traditional distributor channels remain the main battlefield

From a distribution channel perspective, given highly fragmented retail stores, localized traditional distributors will continue to have an advantage and dominate the share of channels. The key reasons are as follows:

— Numerous traditional distributors have remained committed to their respective regions for years and have in-depth understandings of the retail network outlets in their regions. They have also built tight-knit partnerships, thus creating a natural barrier to entry. For instance, most leading national auto battery brand distributors have operated locally for more than 10 years. They are very familiar with the layout of the retail network outlets, as well as the characteristics and requirements of the shop owners; they have also built long-term partnerships with mutual trust.

— Traditional distributors have built very competitive service capabilities in the region, including highly efficient distribution and delivery systems, as well as after-sales service, flexible credit terms, and marketing activities appropriate to the local market, among others. For instance, the leading auto battery manufacturers in the industry have more than 1,000 physical distributors, with coverage reaching local- and county-level cities. They can usually ensure orders are delivered the following day, and even within a few hours.

— Traditional distributors have optimized their operating costs. This is because their management is more flexible than large enterprises and they benefit from local logistics and lower labor cost.

Emerging channels have yet to mature but should not be ignored

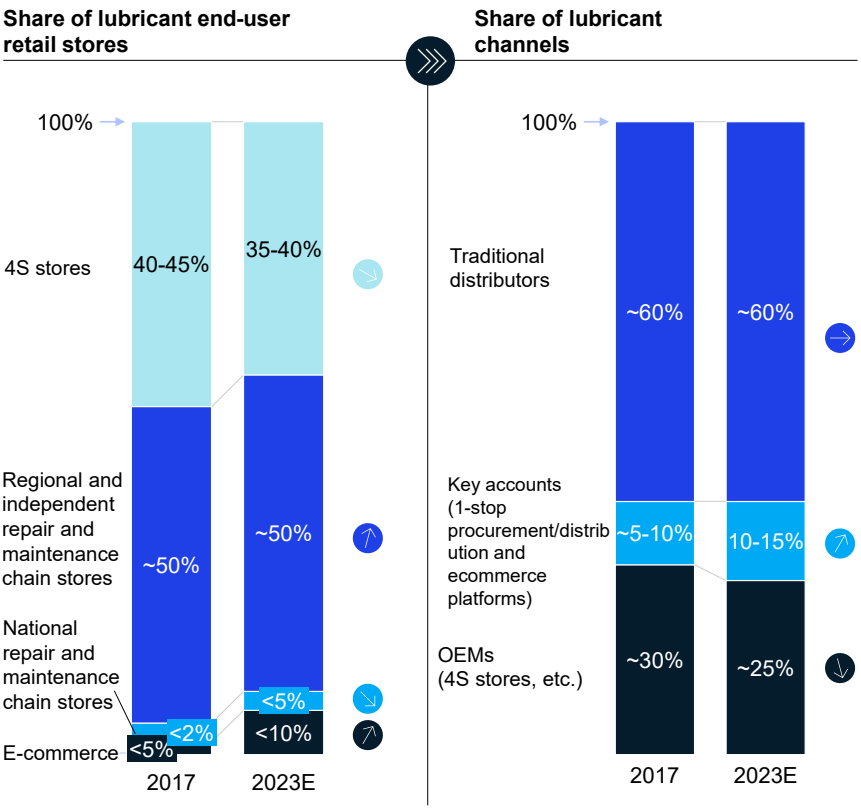
Innovative business models for nationwide, one-stop procurement and distribution platforms have also captured market share, though the overall share of these new channels is still relatively low. Within the procurement and distribution subsector, their market share is between 5 and 10 percent, and is forecasted to increase to between 10 and 25 percent in the next five years. Note, however, that the penetration rate of emerging channels in each subsector is different. For instance, in lubricants they are forecasted to achieve 10 to 15 percent by 2025, while auto batteries could reach 20 to 25 percent market share.

However, in order to grow, emerging channels will also need to overcome three enormous challenges. First, their costs (such as employee wages and tax) are no lower than those of localized traditional distributors and establishing distribution and delivery capabilities are major challenges as well. Second, as the existing retail network outlets are highly fragmented, setting up a national high-density logistics infrastructure requires significant investment, and the service cost is excessive. Third, building a large-scale retail network, and incorporation of retail network outlets is very difficult and costly. For instance,

building a store requires an investment of up to 500,000 RMB, and will take nine months to break-even. Training enough professional staff for those retail outlets is another challenge.

On the whole, emerging channels are a strategic area that aftermarket players need to pay attention to over time, but traditional distributors will continue to be the most important sales channel, and are forecast to maintain more than 50 percent market share over the next five years (Exhibit 2).

Exhibit 2: Aftermarket retail store structure to remain stable; traditional distributors to dominate sales channels. Key account channels expected to grow rapidly



Source: Interviews with experts; IHS; McKinsey

Aftermarket players face numerous challenges

In the past two to three years, many auto-parts aftermarket enterprises have been confronted with major challenges. Some have even experienced significant declines in performance. Our analysis and observation of the key subsectors in the auto parts aftermarket reveals that market players primarily face the following challenges:

— It is difficult for manufacturers to customize elaborate channel designs based on varying regional characteristics.

— They also tend to have weak control over retail stores. The traditional model of controlling the market by selling products to distributors no longer works. Under new market conditions, market share can only be ensured by controlling retail stores.

— E-commerce providers have made market prices much more transparent. This in turn has put pressure on traditional distributors' earnings and has dampened their enthusiasm. It has become important to help traditional distributors elevate their competitiveness and profitability.

— Many manufacturers do not actually know the sourcing of goods by retail stores or distributor shipment trends and prices, among other critical details. This lack of transparency has made retail management a challenge, and as a result many manufacturers cannot build the proper digital capabilities to manage retail outlets.

— Sales organization capabilities and concepts are still managed based on traditional distributor purchases.

Channel transformation in response to brand new market changes

To cope with new market changes and challenges, automotive components and parts enterprises should create an end-to-end (E2E) retail management system centered on retail customers in the aftermarket. They should also digitize and comprehensively upgrade their channel capabilities.

Formulating new regional channel strategies

These strategies should avoid national, homogenized models with extensive channels. Rather, automotive aftermarket manufacturers should build new regional models based on the types of retail network outlets that already exist. When deciding on a model, market players often hesitate between two strategic alternatives: selecting a large distributor or small distributor system and continuing to use an existing distributor, or bringing in a new distributor or partner for emerging channels.

We analyzed the industry leaders of different subsectors and believe that there is no one-size-fits-all solution for all players and regions, but strategic planners

should consider the following factors:

— The capability and willingness of existing collaborating distributors and manufacturers to jointly carry out reforms, including control over retail store networks, delivery capabilities, and the store management capability of salespersons, among others.

— Whether the distribution density of local retail stores helps large distributors enhance their scale of operations. For instance, southern Jiangsu's logistics are well developed and store distribution density is high; large distributors will find expanding regional coverage more beneficial to increasing logistics efficiency and lowering costs. Transportation in Yunnan and Guizhou is less convenient and store density is lower, however; large distributors will find building an efficient and integrated logistics system challenging.

— Potential new partners' ability to control local retail networks, as well as logistics distribution and delivery and other service capabilities.

In addition, many manufacturers need to build capabilities when it comes to managing distributors, particularly those with bigger scale.

Take genuine steps toward end-users

Currently, manufacturers primarily manage distributor purchases. But they must evolve and develop the ability to also manage their distributors' retail sales, which will help them gain a genuine understanding of retail store requirements. With this understanding, manufacturers can thoroughly change their sales model toward something that is more centered on retail customers. For instance, a certain leading domestic lubricant brand is very particular about managing distributor sales and building retail network outlets. It has successfully set up a national sales network comprising more than 600 distributors and more than 50,000 retail network outlets.Its channel coverage extends to tiers three and four cities. Its 120 sales representatives and more than 1,200 salespersons of its distributors work closely together to manage retail network outlets. More than 70 percent of the sales team's time is spent supporting distributors on the front line and managing retail stores.

Reposition channel partners

Automotive aftermarket manufacturers should attempt to reposition distributors as logistics service providers, for example, to better serve retail stores. One leading tire brand was the first to attempt a direct-sales model and redefine the responsibilities of distributors as logistics and retail store payment collection service providers. Meanwhile, manufacturers took over the entire management and sales responsibilities of retail stores. The direct sales model helped this brand ensure that retail store information is transparent and prices are stable, improving retail store sales management and elevating E2E supply chain efficiency through more precise inventory management and production planning.

Expand the scope of operations

Companies can help their partners increase competitiveness and profitability, thus increasing their viability and manufacturer loyalty by expanding, reshaping the business model, introducing new products, and other methods. For instance, Michelin helped Tyreplus find suppliers and expanded its scope of operations from tires to other car components and parts, effectively increasing the competitiveness and profitability of Tyreplus stores and driving tire sales.

Reshape the sales organization

Manufacturers can change theur sales organizations in terms of capability, philosophy, and action to move closer to end-users. Companies should build sales management capabilities based on managing traditional distributor purchases, including retail store network planning, development and management, sales planning aimed at retail stores, and helping distributors to build their own sales capabilities.

In terms of philosophy, companies should change their focus from achieving distributor purchasing targets to achieving retail sales targets. In terms of action, companies should introduce a series of standard practices aimed at retail store sales. For instance, one leading battery enterprise has added requirements to the responsibilities of its sales team—including formulating sales business plans jointly with distributors, retail store development and visits, as well as product training, among others—successfully helping distributors lower the share of wholesale business, and improving the sales of stores in the region.

Set up new digital capability

Aftermarket manufacturers should move toward the flexible use of digital tools, and away from sales management dependent on traditional IT systems. These new digital tools include retail store management tools. For example, a manufacturer's sales teams can visit stores to increase sales information transparency within the retail network, which will allow them to better manage retail stores and quickly respond to their needs. For instance, a leading tire brand recently launched a new retail store network order platform. Offline distributors are tasked with ordering goods, making actual shipments, and completing the transactions of retail stores. The order platform successfully provided access to transaction information between distributors and retail stores, helping this tire brand to better analyze retail store sales and swiftly adjust its sales strategy to boost front line sales.

As China's automotive aftermarket continues to gain prominence and competition intensifies, manufacturers must upgrade their philosophy and capabilities, and take decisive action. This must be accomplished while focusing on the retail customer, and maintaining a firm foothold in the sector's strategic core—namely, the traditional distribution channel—alongside employing digitization and other new tools. Only then will they be able to secure a place in China's increasingly crowded automotive aftermarket. ■

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1 IHS.
2 Interview with experts.
3 FGE facts; Ministry of industry and information technology.
4 Interview with experts.
5 Interview with experts; McKinsey.

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Operational excellence

Never waste a crisis: How China's automotive OEMs and suppliers can build resilience

Levix Liang, Dominik Lelièvre

After a decade of strong growth, the global automotive industry is grappling with challenges from several directions. Automotive sales in China, now the world's number one market, fell by 5.8 percent in 2018, the first drop in 28 years. Sales continued to decline in the first half of 2019, falling 12.4 percent compared with the previous year. The industry is also in the middle of the largest transformation in its history. The so-called ACES – autonomous, connected, electric and shared – revolution promises to redefine almost every aspect of mobility. Incumbents are investing billions to develop the technologies, products, and business models they need to compete in this new world, and the tectonic shift has created unprecedented opportunities for new entrants, including Tesla, Alphabet's Waymo, and Didi.

What will it take to thrive in this environment? With so many variables in play, companies across the automotive value chain will need to change the way they design, manufacture, and collaborate with customers, suppliers, and partners.

In this fast-moving and unpredictable environment, surviving the journey will be as important as choosing the right destination. Our research shows that in the face of uncertainty, successful companies make structural, strategic, and operating decisions that dramatically improve their ability to perform. In this article, we draw lessons from such "resilient" organizations, and explain why future challenges require an even bolder approach. We also lay out a strategy for developing the necessary operational and organization capabilities to surpass those who have excelled in the past.

Drawing lessons from the financial crisis

The global recession trigged by the financial crisis of 2007 precipitated the last major downturn in the global auto industry. In 2008 and 2009, worldwide vehicle production dropped by 15.8 percent compared with the previous year. The impact was uneven, however, with North America (down 43.2 percent) and Europe (25.8 percent lower) experiencing the sharpest falls, while passenger car sales continued to grow in Asia and South America. At the peak of the crisis, several major automotive OEMs, and up to half of North American suppliers, were reported to be in severe financial distress. Bankruptcies spiked, and many players survived only thanks to direct government financial support.

Amid the chaos, however, a group of companies rode out the crisis far more successfully than the majority of their peers. McKinsey analyzed the performance of around 830 large US and European companies, from multiple industry sectors, through the 2007 to 2011 period. We identified a group that outperformed the median total return to shareholders (TRS) of their industry by at least one standard deviation. Through the crisis, these resilient companies returned at least 13 percent more to shareholders than their peers in the same sector. Their performance dipped less overall during the downturn, and they were able to significantly extend their competitive advantage during the

ensuing economic recovery.

Resilient companies were not insulated from the impact of the downturn: their revenues in the crisis fell in line with their peers. Our analysis suggests that these companies succeeded because they moved further and faster before, during, and after the crisis. By 2009, for example, they had cut their operating costs by 3 percentage points more than their peers, and reduced debt, while most companies were accumulating it. Decisive action meant resilient organizations had access to more cash, which helped them maintain relationships with key customers through the recession, and acquire new assets from distressed rivals as the upswing began.

Building resilience through the downturn

Our analysis shows that high-performing suppliers applied a distinct set of initiatives to manage through the downturn and re-emerge as clear winners. Here's our summary of those capabilities:

Adjust fixed costs: One leading performer was able to adjust cost flexibly and achieve a break-even point as low as 60 percent of revenues, while a typical underperformer hit negative earnings before interest and taxes at 84 percent of revenues.

Cut fast and deep: Winning suppliers managed selling, general, and administrative (SG&A) costs effectively through the downturn, and maintained them at a relatively constant ratio relative to overall costs, while ratios for low performers worsened during the crisis, and continued to deteriorate in the upswing.

Increase working capital: Leading performers were better able to adjust inventory levels as revenue declined, as well as realize greater reductions in capex spending.

Swim with the big fish: High performers concentrated their customer exposure on the most profitable and highest-performing OEMs, achieving 44 percent revenue exposure to top OEMs versus 33 percent for underperforming suppliers.

Diversify revenue streams: Top performers managed to grow their after-market business, for spare parts, services, and maintenance, by ~7 percent throughout the downturn, against declines of ~2 percent for low-end performers.

Double down on capabilities: High-performing suppliers scoring in the top quartile on "capabilities" in McKinsey's proprietary Organizational Health Index (OHI) have >22x the likelihood of higher TSR than suppliers who performed poorly on the index.

Move money smoothly: Stellar suppliers were far quicker to reallocate capital

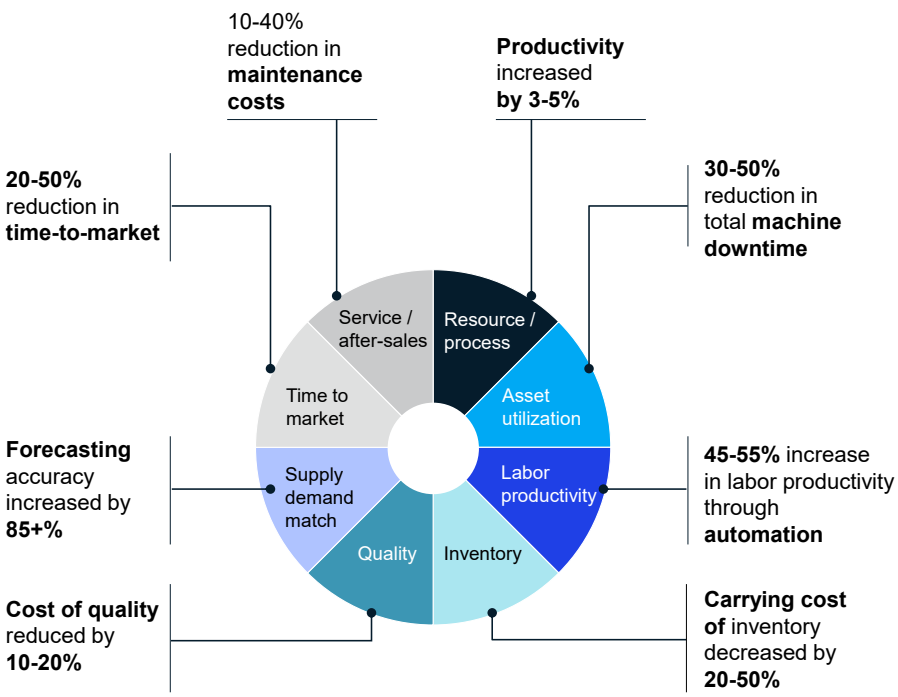
away from underperforming business units or projects than low performers.

Build a war chest: High-performing suppliers accumulated cash war chests in the recession, allowing them to rapidly acquire new businesses during the recovery phase.

Looking to the future

The experience of past crises can inform companies' planning for future challenges, but does not provide a blueprint for action. The large-scale adoption of new technologies, such as the Internet of Things, advanced analytics, and machine learning, is redefining companies' ability to transform at scale. The automotive industry pioneered the concept of incremental continuous productivity improvement, but annual changes of 2 to 3 percent will not be enough to stay ahead in a world where digital tools are delivering an immediate 10-20 percent boost. The exhibit below shows the scope of potential efficiency gains from digitization across various aspects of a typical business.

Exhibit 1:



Digital initiatives can be a double-edged sword for incumbents, as they have the potential to damage performance when poorly implemented. However, they also provide opportunities for laggards to close performance gaps, and make life easier for new entrants. Companies seeking to drive holistic change through digital initiatives should consider the following:

— Digital is not just a tool to increase productivity and reduce headcount

— Digital enables company-wide network effects that help improve product development, time-to-market, forecasting accuracy, and inventory cost, etc.

— Digital initiatives should be planned carefully; the aim is not to apply a blanket approach, but rather leverage digital as a solution to specific business problems

In tandem with implementing digital initiatives, China-based auto OEMs and suppliers can further improve productivity and agility by adopting the following guiding principles:

Fitness: Strive for best-in-class cost and productivity, and turbocharge your productivity improvement engine. For example, aim to integrate suppliers into the product design cycle as early as possible, and co-develop or share intellectual property. One auto OEM applied a "10 percent-rule" on increasing employee productivity – demanding an average of at least 10 percent productivity improvements using all available tools, including digital.

Flexibility: Understand where you might need to act, and develop capabilities and plans to move faster and further than competitors. This could involve integrating suppliers with operations and planning to reduce risks, for instance.

For automotive companies, flexibility will require a different approach to thinking about their manufacturing footprint, labor management, and supply chains. For example, one OEM's approach to supplier resilience has evolved from its original focus on monitoring financials and cost-cutting, to a broader program centered on collaboration, including developing suppliers' technical capabilities, and conducting joint capacity planning. These approaches are frequently referenced by suppliers as key differentiators in improving flexibility.

In China, we have seen a higher degree of collaboration among auto OEMs on flexibility. One example is the strategic framework agreement among FAW, Dongfeng, and Changan to co-develop core automotive technologies, and form synergies in manufacturing, supply chains, and logistics, as well as shared mobility and international markets.

Take action:

— Understand your current level of flexibility and how it compares with your industry peers.

— Test the sensitivity of your business model to changes in the external environment, and evaluate your ability to respond to those changes.

— Identify areas for action and build a flexibility improvement roadmap.

■ ■ ■

In short, never waste a crisis: China's auto market downturn presents an important opportunity for industry OEMs and suppliers to improve their business resilience, and emerge ready to take advantage when the market eventually rebounds. ■

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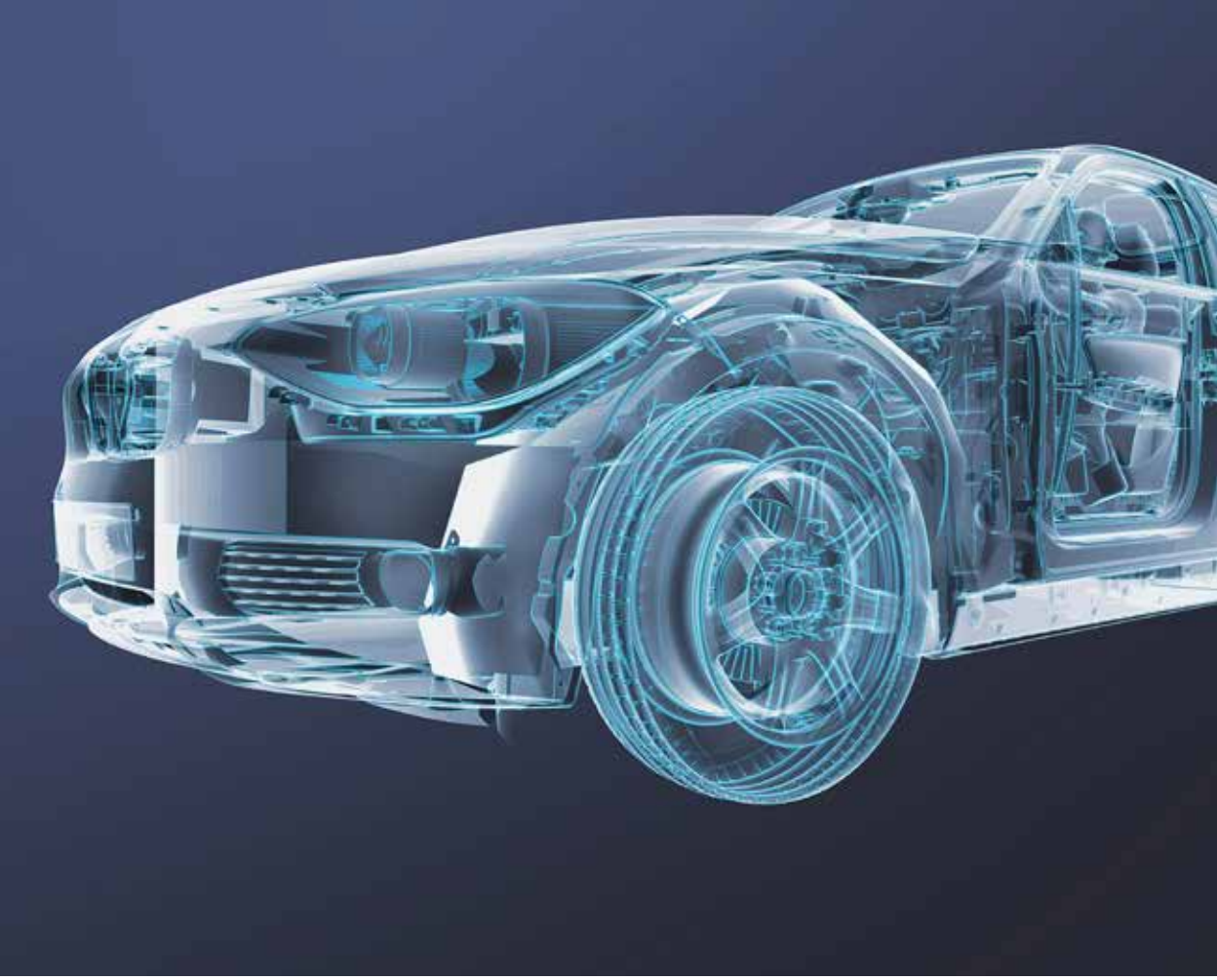


The road to smart manufacturing in China

Forest Hou, Arthur Wang

Germany first proposed the Industry 4.0 strategy in April 2013, and officially released its National Industrial Strategy 2030 in February 2019. It stated that Germany may be required to take equity stakes in flagship enterprises in Germany and within Europe.

In February 2019, the United States released its development plan for industries of the future, highlighting four key technologies—artificial intelligence (AI), advanced manufacturing, quantum information science (QIS), and 5G technology—that "promise to fuel American prosperity far into the future, while improving the security of our homeland." [1]

In April 2019, the Japanese government released a summary of its 2018 white paper on manufacturing industries that indicated small and mid-sized enterprises (SME) tend to lag behind large enterprises in digitization, and AI development achievements should be fully utilized to accelerate technology inheritance and labor efficiency in SMEs.

It has been six years since Germany first proposed Industry 4.0, and the manufacturing race among the superpowers is in full swing. The fourth Industrial Revolution is rapidly approaching, and breakthrough technologies and innovative business models will remold the competitive landscape of global manufacturing.

This is a pivotal moment in the development of Chinese smart manufacturing. A moment wherein China is using its speed and wisdom to catch up and achieve quality growth.

Smart manufacturing conceptualization and implementation leads to achievement

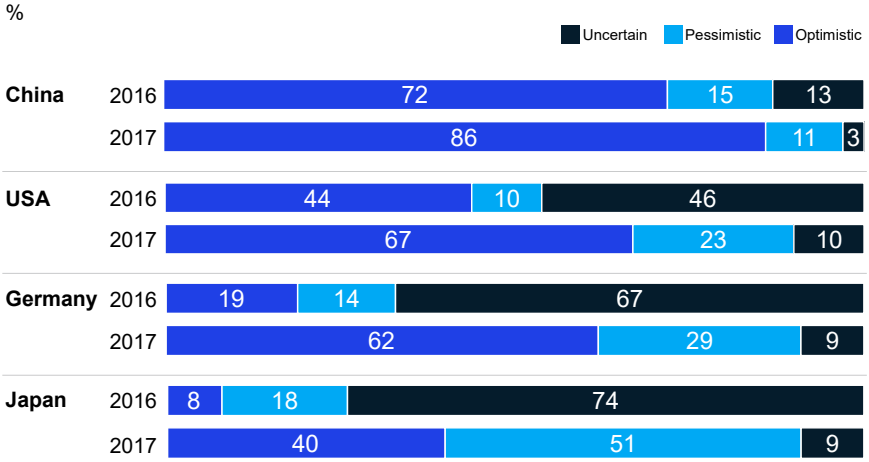
China is using a combination of conceptualization and implementation to successfully shape its smart manufacturing strategy.

Conceptualizing smart manufacturing

In 2016 and 2017, McKinsey conducted a smart manufacturing survey of more than 400 corporate leaders in China, Germany, Japan, and the United States asking the question: has your attitude toward the potential of smart manufacturing changed from a year ago? (Exhibit 1). The results revealed that Chinese enterprises were enthusiastic and had high expectations for smart manufacturing, far more optimistic than those in the United States, Germany, and Japan: 86 percent of Chinese enterprises surveyed believed in the potential value of smart manufacturing (the United States, 67 percent; Germany, 62 percent; and Japan, 40 percent). Overall, Chinese enterprises were confident about the fourth Industrial Revolution and optimistic and unhesitant about smart manufacturing.

Exhibit 1: Chinese companies are optimistic about smart manufacturing compared to those in the US, Germany and Japan

Has your attitude toward the potential of smart manufacturing changed from a year ago?
%



Source: McKinsey survey
Chart: Yu Zongwen

Implementing smart manufacturing

In 2018, we asked more than 800 manufacturers across the globe a new question: how many smart manufacturing solutions has your company tried? The results showed that many surveyed enterprises had already begun implementing smart manufacturing. Each enterprise had, on average, tried about eight digital manufacturing solutions, an encouraging number (Exhibit 2).

One to two years ago, the level of optimism and number of implementation plans in various countries were positively correlated: Chinese enterprises stood at the forefront of smart manufacturing implementation with an average of 10.2 digital manufacturing use cases per enterprise. Enterprises in the United States averaged 8.5, in Germany, 6.9, and in Japan, 4.1.

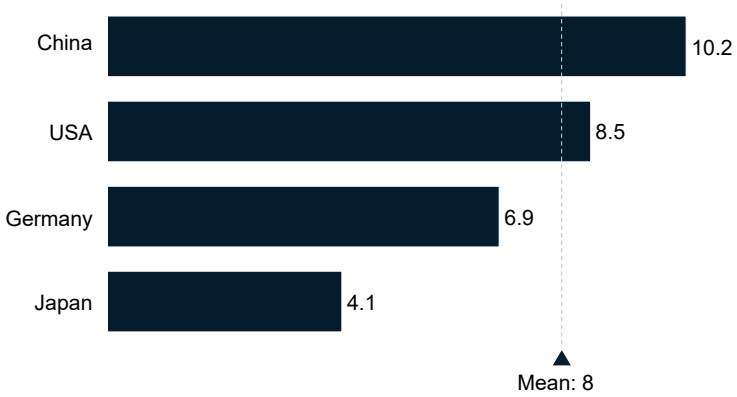
Achieving smart manufacturing

The McKinsey Industry 4.0 Global Expert survey, conducted in 2018, also revealed that over 70 percent of the more than 800 enterprises have fallen into a digital transformation trap. Following a small-scale pilot, they were unable to carry out the relevant comprehensive transformation. Piloting progress was also very slow. Approximately 29 percent of the enterprises surveyed indicated that their pilot periods were longer than two years; 56 percent said that their pilots had been carried out for one to two years; and 15 percent had only just started.

An enterprise can only realize the maximum value of smart manufacturing by

Exhibit 2: Chinese companies are most actively implementing smart manufacturing

How many Industrial Internet of Things solutions has your company tried?
Number of different solutions



Source: McKinsey survey

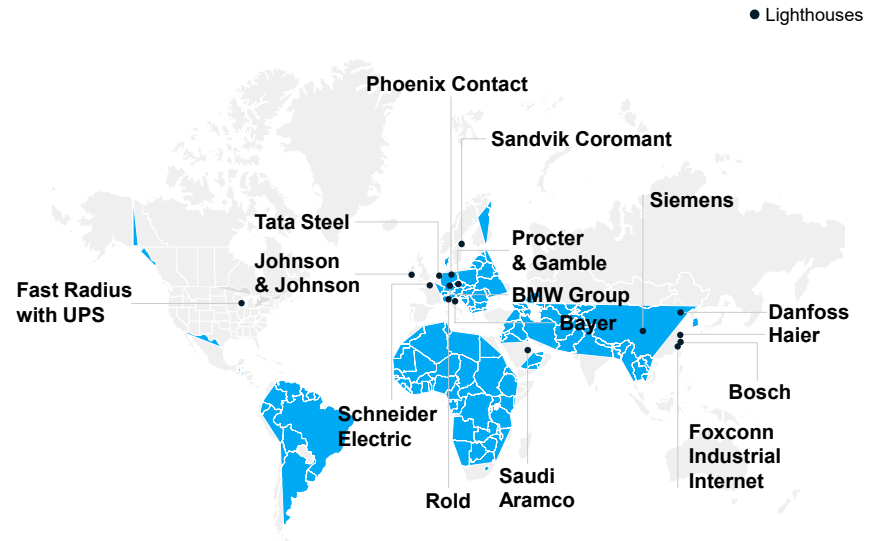
scaling up from its pilot. McKinsey has collaborated with The World Economic Forum (WEF) since May 2018 to select achievers in smart manufacturing around the world—Industry 4.0 "lighthouse factories." Its purpose is to summarize successful smart manufacturing experiences to boost the global manufacturing ecosphere. We ultimately selected 16 "lighthouses" from approximately 1,000 worldwide enterprises in various manufacturing sectors. After the digitization pilot, these enterprises successfully applied smart manufacturing and achieved significant financial and operating benefits (Exhibit 3).

Of the 16 lighthouses, five are German and three are American. Germany is the world's model high-end manufacturing center, while the United States is the world's technology innovation center. Their deep advanced industrial heritage and comprehensive high-quality production capabilities have yielded the two countries a first-mover advantage.

China has contributed two lighthouses (Haier and Foxconn), with five lighthouse factories based in China (Haier, Foxconn, Siemens, Bosch, and Danfoss)—the most in a single country. This WEF report also marked the first time a developing country ranked among the front-runners in global manufacturing.

Since 2015, China's Ministry of Industry and Information Technology has selected 305 smart manufacturing pilot demonstration projects, creating a Chinese version of "lighthouses" across various industries. These smart manufacturing pilot demonstration projects involved 92 sectors, covering all

Exhibit 3: Locations of 16 Industry 4.0 exemplar factories around the world



Source: McKinsey, World Economic Forum

provinces in China, driving investment in excess of 100 billion RMB. Preliminary estimates showed that productivity rose by an average of 37.6 percent, with the maximum at 300 percent after the implementing the smart transformation, according to China News Service.

Multiparty collaboration in smart manufacturing

On May 8, 2019, we conducted in-depth interviews with more than 100 Japanese corporate leaders on digital transformation in Tokyo. More than two-thirds of the Japanese senior executives acknowledged that their enterprises had fallen behind the global pace of innovation in the industrial internet of things (IIoT). In contrast, they generally believed that prior to the implementation of digitization, it was necessary to properly prepare, assess difficulty, and calculate the return on investment.

In Germany, we visited a manufacturer on the banks of the Rhine and presided over a seminar to promote lean production and digital transformation efficiency. In addition to management, the organizers also invited several frontline production managers.

We were impressed by Oliver, the head of a production assembly line. Oliver had worked in the plant for more than 30 years. While we were discussing whether wearable technology, indoor positioning, and RFID technology should be introduced, and if efficiency digitization for production workers in the plant should be enabled, Oliver stood up and indicated that he had something to say.

He said that smart manufacturing may not be the most appropriate path for his factory at this time. There were three reasons. First, the significance of digitization was not apparent. This factory did not have a standard operating procedure. Oliver and his more than 200 production coworkers had familiarized themselves with the intricacies of the assembly process, production parameters, and equipment conditions over the past 20 to 30 years. The stable workforce and consistent focus on quality had resulted in a worker-driven production quality management system. Introduction of digital tools may not necessarily help these veterans work more efficiently.

Second, policies and regulations protecting personal privacy were mounting. Digital applications required obtaining the data of frontline workers. The EU had recently approved regulations pertaining to the protection of personal data that required consent every time data was collected. This made implementation almost impossible in EU countries.

Third, the rate of return on digital investment was unclear. Most German factories operated on one shift. The union was, at the time, discussing further cutbacks to the work week. Limited production resources would neither be able to support the efficient implementation of pilot digital applications nor the digital transformation of the entire organization.

Existing ideologies and institutional rules of developed nations have constrained Germany's manufacturing reform. In our experience, radical, thorough, and quick-win reform measures will not be well-received by German manufacturers. Germany requires suitable, reasonable, and compliant implementation methods.

“Suitable” refers to adapting to the current low turnover and people-centric

manufacturing conditions in Germany and providing a more convenient and friendly production environment for grassroots workers. “Reasonable” refers to optimizing the entire manufacturing process with the following goals: increased quality, better productivity, and lower operating cost. “Compliant” refers to ensuring that enterprise transformation aligns with State laws. Smart manufacturing in Germany requires meticulously considering sustainable relationships between technology and humanity, technology and manufacturing systems, as well as technology and the law.

At present, China's population dividend, which has lasted nearly 30 years, is about to end for the manufacturing industry. Rising labor costs and an aging population are compounding impacts on manufacturing. Many labor-intensive industries face costly labor and labor shortages.

In a private meeting, the chairperson of a Taiwan-based manufacturer once vented his frustration, saying that he wanted to retire but couldn't. His factory employed more than 6,000 workers, but had suffered from labor shortages in recent years. The average length of service at the factory was less than six months, and the turnover rate had been high for an extended period of time. Wages in the factory's area had continued to rise, and the existing remuneration level had failed to attract today's young workers. The company's level of automation was very low, and most processes were heavily dependent on skilled operators.

Recruitment was difficult, and the manufacturer had experienced production volatility and product quality issues. Talking about this, the more than 70-year-old chairperson was nearly in tears.

In the future, key manufacturing stakeholders should confront the current labor challenges in China's manufacturing industry. We hope they will embrace innovation with an open mind and amass capabilities from all areas. Specifically, four strengths will propel China's manufacturing industry.

First, employees are open-minded about digitization. Unlike developed countries, China's frontline employees appear more optimistic about smart manufacturing and emerging technologies. Many grassroots workers are accepting and learning digital tools, laying the foundation for transformation.

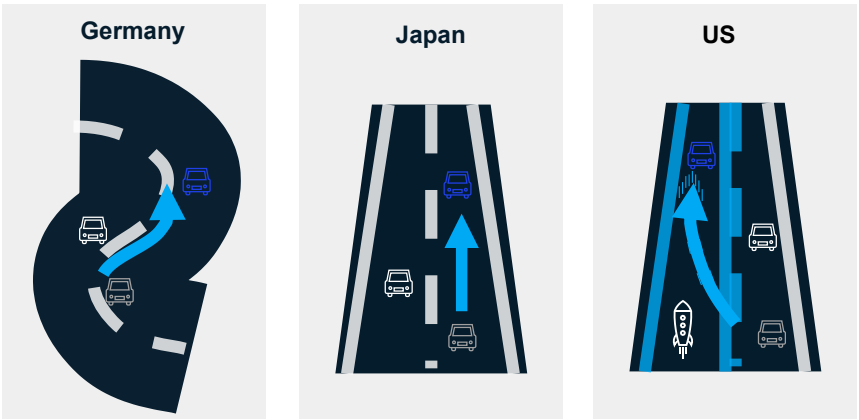
Second, business leaders have high expectations for scaling up. The workers responsible for transformation identify with China's large-scale manufacturing and generally operate on three shifts. Therefore, the return on smart manufacturing investment will be quick.

Third, technology suppliers prefer new factories. China's local technology suppliers regard remodeling factories with breakthrough technologies as their mission and are committed to developing digital applications and providing technical support to promote transformation.

Fourth, government departments are supportive. In 2018, Foxconn's newly incorporated Foxconn Industrial Internet, an innovative industrial connectivity enterprise, took just 36 days from the first submission of information pack to clear a listing committee hearing, making it the fastest A-share market IPO. At the core, the government's ambitions and strong support for smart manufacturing are crucial.

In China, an increasing number of manufacturers are adopting the Internet of Things (IoT), artificial intelligence (AI), new generation automation, and other Industry 4.0 breakthrough technologies. After visiting the five lighthouse factories in China, we understood the two main reasons why leaders of these factories prioritize introducing digital and automated technology relevant to their employees: increasing production workers' efficiency and enhancing product quality. At Haier's Qingdao central air conditioner factory, real-time digital performance management provides a real-time link between a worker's performance while on duty and their individual bonus. At the production site of Wuxi Bosch, the newly completed digital skills training center nurtures a new generation of “smart manufacturers” for the smart production line. At Tianjin Danfoss's quality control station, the inspection system based on AI machine vision completes each high-precision component quality inspection with zero errors. By adopting smart manufacturing technology, frontline production workers carry out higher value work instead of work they dislike, are unskilled at, or that is dangerous.

Exhibit 4: China should assimilate the smart manufacturing achievements of Germany, Japan and the US



Source: McKinsey

China's smart manufacturing should be inclusive

China's smart manufacturing is quickly catching up, but much work remains. If we were to compare smart manufacturing to a long-distance race, then most Chinese enterprises are still behind Germany, Japan, and the United States. Smart manufacturing is an unconventional long-distance race, one without a predetermined track. We believe that selecting the track is the key issue confronting companies, and the answer may be learning from the achievements of other developed economies (Exhibit 4). Germany, Japan, and the United States all have their own smart manufacturing development advantages. China must learn those skills from other manufacturing superpowers, and integrate them into its own smart manufacturing strategy.

Germany's smart manufacturing strategy

Industry 4.0's objective is to introduce the nation's traditional equipment design and manufacturing advantages, further increasing product market competitiveness and the value of auxiliary facilities. It prioritizes smart production and manufacturing capability.

Japan's smart manufacturing strategy

Focus on robotics and IoT, making these the three pillars that drive manufacturing industry development. Its main priority is to provide shared benefits to all relevant industrial enterprises.

The United States' smart manufacturing strategy

The objective of the IoT is to bring its traditional information industry advantage into play, further enhancing capabilities to service end users. Its key priority is in smart systematic service capabilities and customer value creation.

China's smart manufacturing strategy

"Made in China 2025" aims to transform the country from a manufacturing power to a manufacturing superpower, increasing product quality and brand value. Its crucial priority is in propelling relevant equipment, services research, and development companies by supporting manufacturing enterprises that have smart manufacturing strategies. The different approaches that developed countries have adopted as they advance toward smart manufacturing provide a road map for China. We have categorized them into three strategies.

Obtain a solid foundation in smart manufacturing from Germany

Germany's high-end industrial equipment automated production lines are world-renowned, and the nation enjoys a leading position in equipment manufacturing. Germany has also achieved an impressive integration of theoretical research and industrial applications. Advanced equipment and production systems might be Germany's smart manufacturing competitive advantage. Vertical, horizontal, and end-to-end integration are the most important terms within Germany's Industry 4.0 strategic framework. Integration as a whole helps consolidate Germany's knowledge assets into superior equipment and production system solutions. Germany aims to become a leader

Siemen's "lighthouse" factory in Chengdu

In 2013, phase I of the digital factory built by Siemen in Chengdu was a replica of its sister factory in Germany. From manufacturing processes to production line layout, manufacturing equipment to industrial software, foreign experts guided the entire process and directed all decision making. Close one-on-one guidance helped develop skills. The purpose was to introduce the purest German smart equipment and production system to China to create preconditions for the localization of smart manufacturing best practices. Five years later, phase II of its digital factory commenced. An all-Chinese team was used for the smart manufacturing solution. One hundred percent of the design and project management was carried out by local engineers and local system integration providers. Because it was more closely integrated into the local ecosystem, the entire project took only six months to complete from design to implementation. Labor productivity rose significantly, and the payback period was very short. On the same land, German quality and Chinese speed enhanced each other's strengths.

by consistently optimizing production efficiency and returns. China should emulate Germany's solid foundation to create a smart manufacturing system solution.

Learn how to deliver customer value from Japan

In Japan's manufacturing culture, trusting people outweighs trusting equipment, data, and systems. All automation, digitization, and intelligence are geared toward helping people work better. In the smart manufacturing sector, the discussion among Japanese enterprises is not centered on robots replacing people or unmanned factories. Rather, the priority is in the value of integrating smart products into people's work. The key focus of relevant research and development is centered on product IoT and AI applications to identify user pain points and demands in the various industrial IoT industries and value nodes, as well as conducting specific research into "punctiform" products that can solve onsite problems and create new value for businesses. From Japan, China could learn to refine smart products based on a user-centric approach.

The Keyence model

Keyence is the epitome of creating smart products based on the Japanese craftsman's spirit of specialization. The company was the first enterprise in the world to provide AI smart machine recognition technology. This stemmed from its long-term observation of the business pain points and core demands of its customers. Keyence recognized that only AI vision products can fundamentally resolve existing issues and obtain industry pricing power. It therefore invested heavily in research and development and customized AI and IoT functional modules according to actual user scenarios, launching a new generation of vision solutions. Using its proprietary technology, the product resolves onsite issues that could not be resolved by other products, firmly dominating high-end machine vision. In 2018, Keyence's revenue in the Chinese market was nearly five times that of its nearest competitor, and its gross margins have remained at around 70 percent for a long period of time.

Learn data and platform-driven smart services from the United States

As the birthplace of the third Technological Revolution, the United States has built up deep capabilities in the information technology (IT) sector. Therefore, at the inception of smart manufacturing, the United States had already proposed the concept of "industrial internet," making the integration and use of data strategic priorities. By setting common industrial internet standards and using

the internet to activate traditional production and manufacturing processes, it facilitated the integration of the physical and information worlds.

At its core, US smart manufacturing fully mines the value of data. Classic use cases include digitized asset management, predictive maintenance, and digital performance management. The United States could teach China to effectively build an IoT framework for data collection, transmission, management, analysis, and application, and use data-driven industrial smart services to build a new road map.

Unlike Germany and the other developed countries, the manufacturing industry in China did not experience a transition from the third to the fourth Industrial Revolution. Although China has the largest manufacturing sector, the level of advancement varies wildly across the industry. Nonetheless, China's dream of becoming a manufacturing superpower is by no means a distant one. Chinese wisdom says to be quick, agile, eager to learn, and all-inclusive; Chinese speed enables it to strive diligently; and Chinese creation entails shifting from virtual to real and universal innovations. We firmly believe that China will achieve high quality manufacturing growth.

[1] "America will dominate the industries of the future," Office of Science and Technology Policy, February 7, 2019, whitehouse.gov.

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The authors would like to thank Chen You for his contribution.

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Agility and transformation

Eight steps to beat the downturn in China's auto market

Bill Peng, Arthur Wang

The automobile market went through a sharper decline than expected in spring 2019.

When April sales data was released, the reaction was one of general despair, with the exception of Japanese auto companies. For the first time, we saw a fundamental change after more than ten years of steady competition in the industry as all three top tiers saw a decline. Several traditional powerhouses as well as new forces of Chinese OEMs also posted lackluster performances and sluggish growth.

In the face of this unusual auto market, industry leaders are worried that their companies might be in line to cave. Auto companies that have outperformed the market are also nervous about being the next to fall. Despite beating the lackluster market, Japanese auto companies are also mobilizing all their resources and proceeding cautiously to avoid capsizing in the tumultuous seas. These might be the darkest times of the Chinese auto industry. In addition, this situation might very well last for months, or even a few years. For many auto companies, the next two years will be critical to their survival. Without a doubt, the game of elimination has started and there are no guarantees of survival. In addition to the dismal market, senior management usually has to face pressure from shareholders or their peers, as well as the expectations of tens of thousands of their employees.

How should they guide the auto industry out of this dilemma and achieving success in the future?

1. Embrace the challenge and be confident of winning the competition.

An entrepreneur's business skills can only rise to the next level after leading their team out of a dilemma. Sergio Marchionne of Fiat Chrysler and Carlos Ghosn of Renault-Nissan both became famous by turning companies around. China's auto market has been smooth sailing for the past thirty years, and a company's good performance might be attributed to conducive market conditions. However, today's formidable challenges present a golden opportunity for entrepreneurs in the automobile industry to make a name for themselves and become historically significant. It is also the best time for an entrepreneur to make a lasting name. The ability of senior management to proactively embrace the challenge with a positive attitude is the key prerequisite for guiding an auto company out of this difficult situation. For an outstanding auto company, this challenging time presents the best opportunity for market consolidation and market share growth. Further, this is the ideal time for senior managers in auto companies to show their true talents.

2. Be determined, aggressive, and decisive in driving changes.

Years of rapid growth in the auto industry has created different byproducts, such as low productivity, scattered resources, lack of coordination, and poor execution. When market conditions are good, entrepreneurs tend to think that it is not necessary and lack the determination to change and eliminate such issues. In the past few years, costs have skyrocketed, but when sales and profits were solid, issues associated with unsound cost structures were swept under the rug. Similar to a sailboat with torn sails, the boat will continue to move in the right direction as long as the current is favorable. However, when the boat is going upstream, the boat will not move forward unless the sails are completely fixed. In difficult times, employees tend to work with full cooperation and with unity of purpose, making it easier for senior management to form a consensus and focus on driving changes. Leaders in auto companies should consider the following questions:

— Has the company's cost structure been optimized in practice?

— Has organizational efficiency been enhanced? Is there still a lot of going back and forth in decision-making processes?

— Are unnecessary socializing and entertainment, paperwork, meetings, and other formalities decreasing?

— Are people in key positions performing poorly being replaced with more appropriate candidates?

— Can the company break out of the existing interest structure hindering transformation?

— Can the limp and irresolute corporate culture become sharp and decisive?

— Is waste still pervasive?

3. Be persistent in focusing on the fundamentals and building internal capabilities.

In a down market, companies compete on their efficiency in every critical activity. They also compete along the core value chain, which includes research and development, manufacturing, quality, channels, and marketing. The practical improvement of basic skills in conducting these core activities is a crucial factor, as is new progress by months. In addition to benefiting from the macro environment of an improved Sino-Japanese relationship, the ability of Japanese brands to counter the market's downtrend this year is, to a large extent, directly related to their solid fundamentals. Enhancing basic skills requires persistence in focusing on these fundamentals and internal capabilities. To this end, the leaders of auto companies should pose the

following questions to their team members:

— Have product planning and life cycle management become more rational? What measures have been adopted?

— Are we truly listening to the voice of the consumers, and are consumers' observations reflected in the product development workflow and customer service workflow?

— Is the product quality continually improving in the eyes of customers?

— Do we have an accurate grasp of the market dynamics, and have we devised a sound sales strategy?

— Is dealers' confidence and professionalism improving constantly? What measures have we taken to support them?

— Are we innovative in marketing? Are the brand's market presence and consumer-perceived value stagnant, or are they improving over time?

4. Time waits for no one. Act promptly.

The more difficult the situation, the more a leader should mobilize the power of the entire team, act assertively, and respond proactively. After launching key measures, the responsible team should follow up and promptly drive the transformation. Auto company leaders should ask themselves the following questions:

— Have different measures been implemented?

— How effective are the implemented measures?

— Is there any timely follow-up and subsequent enhancement?

— Are there sufficient digital means to track and obtain feedback related to these measures?

— Is there an internal “war room” to fix senior management's attention on each key measure?

5. Be ambitious. Go beyond your limits and charge forward.

After tracking over 3,000 companies worldwide for more than ten years, we have found that countering a down market is very difficult. Without the ambition and courage to make big moves, companies cannot achieve any breakthrough. Those who succeed often make big moves in the following five areas [1]:

— Programmatic M&A and divestitures

— Large-scale resource reallocation

— Strong capital expenditure

— Distinctive productivity improvement

— Differentiation in innovation (e.g. business model innovation)

To senior management teams in auto companies, it is essential to maintain these “five mindsets.” In addition, they should also avoid the following three pitfalls.

Avoid mediocrity

Mediocrity does not lead to breakthroughs. Operating a business requires acuity and force, which can be reflected in the following areas:

— Are product models and configurations striving to go beyond the mediocre?

— Is support channeled to deserving dealers with discretion?

— Are unsound businesses being divested decisively?

— Are limited resources channeled only to the areas that deserve them?

Avoid imbalances in the value chain

The more difficult the situation, the more auto companies should strive to maintain healthy development throughout the entire value chain. Putting undue pressure on dealers in order to meet a monthly sales target should be avoided. To lower costs, it is more effective to lower product design costs instead of simply asking suppliers to lower their prices. When suppliers are squeezed to the point of not making any profit, they tend to resort to deceitful practices and substandard products. When their businesses cannot survive, dealers will have

to change and turn to other brands. Therefore, auto companies have to work on the entire value chain in order to balance the interests of different stakeholders and promote the healthy development of the industrial chain.

Avoid damaging medium and long-term competitiveness

The global automobile market in at a transitional phase at the moment. To prepare for ACES (Autonomous driving, Connected car, EV, Shared mobility), auto companies have made significant investments in electric cars, smart driving, internet technology, and other digital technologies. Nonetheless, such investments are not expected to mature in the near term. To maintain a balance in resources investment, resources should not be injected blindly across the board, and those critical to future competitiveness should be invested sparingly. We recommend that auto companies consider joint investment, joint research and development, shared platforms, and other measures to maintain medium and long-term competitiveness.

These "five mindsets" and "three avoidances" are our preliminary ideas with the experience of over 600 global transformation and upgrade projects at McKinsey. Different auto companies are at varying stages of development without the same corporate capabilities and levels of resources, so the specific measures to be adopted should be unique to the individual company. We believe that we will definitely see certain outstanding senior managers mastering these market trends and creating new success stories in auto company operation and management in the next two to three years. Additionally, we look forward to a rebound in the market, as there is still potential for growth in China's automobile market. In the meantime, however, the senior management at auto companies should be prepared for worsening market conditions in the near future.

[1] Due to space limitations, details concerning the five big moves mentioned above will not be included in this document. Please refer to McKinsey & Company's latest book, Strategy Beyond the Hockey Stick: People, Probabilities, and Big Moves to Beat the Odds.

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Building an agile organization in China

Tianwen Yu, Lihong Pan, Amy Rong

McKinsey & Company has always firmly believed that the organizational structure and human resource (HR) allocation of a company play an important role in respect to longevity. However, many companies still have ineffective organizational structure and personnel development. To help these companies move forward and find a tactical approach to organizational and HR improvements, we are launching a series of articles on the theme of "Organization and Human Resources," which will discuss the following three initiatives: 1) Building an agile organization; 2) Upgrading HR management models & re-position the HR department; and 3) Reshaping management models & establishing platform-based organizations. These articles aim to help leading Chinese manufacturers achieve greater success.

Thanks to advantages in resource and labor costs, the demographic dividend, and the reform and opening-up policy, Chinese manufacturing has made unprecedented achievements over the past forty years. Within the last two decades, the growth in domestic market demand and expansion of foreign trade has provided a solid foundation for the development of the Chinese manufacturing industry. Consequently, a vast amount of domestic and foreign investment poured into industrial manufacturing has rapidly turned China into the factory of the world.

However, following the decline demographic dividend's impact, changes in the foreign and domestic development environment, and the onset of a new economic norm, Chinese manufacturing is now suffering from an unprecedented bottleneck. The old trade environment, with its clear rules and relative stability, is changing with the onset of the big era and becoming more volatile, uncertain, complex, and ambiguous. The maturing of clients and consumers, diversity of demand, and the fierce competition among sectors have given rise to many uncertainties and challenges. Over the past decade Chinese manufacturers have struggled to significantly increase productivity, customer demand has grown further dispersed, and innovation cannot generate major results in the short term.

— **Change in the business environment:** The business environment has recently entered into the VUCA era (V-volatility, U-uncertainty, C-complexity, A-ambiguity). Companies are facing various risks and challenges, and business philosophies have shifted from "order, specifications, standardization, and company value" to "flexibility, interconnection, rapid iteration, and customer value."

— **Upgrade in client and consumer demand:** Clients and consumers have become more mature, with higher demands for quality and customization. At the same time, the new generation who grew up with the Internet and digital technology are more interested in modernity, freedom, eccentricity, and innovation.

— **Fierce competition among sectors:** The low-tech manufacturing industry, with its low barriers to entry and reliance on labor costs and economies of scale, is already facing fierce competition in China. Moreover, such manufacturers are facing new challenges from countries such as Vietnam and Bangladesh, that can provide even lower labor costs. As for high-tech manufacturing, the established powers like the U.S., Germany, and Japan are also continuously increasing their investments and jockeying for leadership. The pressure on goods "Made in China" constantly increases.

The Fourth Industrial Revolution provided an opportunity for manufacturing to achieve breakthroughs in productivity and production efficiency. Only by seizing an opportunity and riding the wave can manufacturing reach its potential and regain its vitality.

— **Define a strategic blueprint:** With the help of Industry 4.0 technologies, companies should judge the current development trends in their sectors and markets according to their own product and client types and competition dynamics. Based on their existing foundation, they can identify business areas with the highest potential in return of investment and establish relevant transformation strategies and roadmaps. Daimler, the world's leading automotive manufacturing group, launched a reform in 2016 when it announced its Connection, Autonomous, Shared, and Electric (C.A.S.E) strategy. This strategy aims to enhance C.A.S.E, making the company a leader in the automotive market of the future.

— **Build technical capacity:** Industry 4.0 is the industry reform driven by IT and the digitalization of manufacturing. Digitalized manufacturing technology will change every step in the production chain. The digital connections between designers, engineers, managers, staff, consumers, and physical assets will unleash tremendous value and completely redraw

the landscape of the manufacturing industry. Big data analytics, e-learning, artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) are the key technologies that support the digital transformation. Many large manufacturers have started using data analysis to optimize plant operations, improve equipment utilization and product quality, and reduce energy consumption. Boeing adopted a fully virtualized design when developing the latest fuselage for the Boeing 777 and 787, which enabled them to reduce the delivery time by over 50%.

— **Reshape organizations:** The right organizational structures, mechanisms, and HR systems are at the core of business transformation and technological innovation. However, many Chinese companies are still immature in terms of organizational structure, performance management systems, and HR management. Thus, they lack the necessary support for Industry 4.0. McKinsey conducted a survey about Industry 4.0 at a number of Chinese companies. The findings show that only 9% of the respondents have clear roles and responsibilities division in Industry 4.0 projects, and the isolation of performance management systems from Industry 4.0 is another common problem. Meanwhile, there is a severe shortage in technical, analytical, and business experts, who play a crucial role in establishing a digitalized organization. Also, millennials require a new management style to meet their various needs and stimulate their motivation and potential.

Based on extensive studies and client practices, we recommend that companies consider these three key initiatives when optimizing their organizational structures:

— **Build an agile organization:** Build a "fast and stable" agile organization that ensures prompt response to market and client demands and the timely delivery of products, while improving the overall health of the organization and staff satisfaction. Break out of the rigid structures of traditional manufacturing, adopt the flat hierarchy of Internet companies, and use a product development model emphasizing rapid testing and continuous iteration. Further, establish an organization that adapts to the changes brought about by new eras in ways that suit its own business.

— **Upgrade talent management models and reposition the HR department:** Establish a forward-looking talent planning mechanism. Plan the talent requirements of each department and key positions based on a strategy, driven by productivity and logical calculations. Enhance talent management practices and upgrade talent management in hiring, training, appointment, retention incentives, and other key stages. Also, in order to promote organizational reform and talent management upgrades, the HR department must recreate itself, stepping forward as a business department instead of a backstage administration department and

becoming a promoter and creator of company value.

— **Reshape the company governance model and create a platform-based organization:** For a large leading manufacturing corporation, it may be necessary to reshape the corporate governance model. Through different management and control modules in operation, strategy, finance, and strategic guidance and their integration, establish healthier and more efficient boundaries and hierarchies in roles and responsibilities. At the same time, adopt a more open and tolerant position, grafting various complementary platform components across sectors to stimulate the vitality and potential of teams with different levels of maturity in skills and foster synergy and mutual benefits between different stakeholders, including investors, business managers, and employees.

China's abundant natural resources, demographic dividend, low labor costs, and open policies facilitated the rapid growth in advanced manufacturing of automobiles, high-tech equipment, and electronics. However, as the demographic dividend diminishes, labor costs rise, and the domestic and international economic environment changes, Chinese manufacturing is facing unprecedented challenges. On one hand, with homogenized products lacking in technical innovation and rising labor costs, company profits are further squeezed, making it difficult to grow. On the other hand, the growing middle and upper-middle classes (who are the main consumer groups of the products made by leading manufacturers) are not only sensitive to the quality and style of the product, but also the shopping experience. That raises the bar for companies. Meanwhile, the platform-based open and cooperative model pioneered by Internet companies in recent years is undermining traditional business models. It attracts more young talent, leading to a severe shortage of potential hires in the manufacturing industry, further diminishing its competitiveness.

New eras and problems require innovative solutions. “Innovation does not necessarily require high tech, but can also happen in traditional industrials.” [1] In traditional industries, new organization models are surging as companies transform to implement them.

1. Born agile, stay vital

Just as one could be born a Roman citizen, some organizations are naturally agile. The new wave of technologies has blurred the traditional industrial boundaries and nurtured many new Internet-oriented startups which are naturally agile. Company A is such a newcomer in automotive manufacturing in China. It was the first smart electric car manufacturer in China. The company was agile from its birth and quickly shook off traditional organization models.

Company A was born with the mission focused on “Creating a pleasant lifestyle

for users" and it has never abandoned this mantra. This is always on its mind while creating value for customers. No matter how the organizational structure and its business environment has changed, the company has always treated this mission as its soul, and it is firmly rooted across all business units.

The company did away with the traditional pyramid organizational structure from the start and built a stable foundation based on internal community, with flexible upper-level units based on cross-functional teams, empowered teams, and workflow groups that are able to respond quickly. All the company employees, from senior managers to frontline workers, are included in a WeChat work group. This digital communication platform flattens the hierarchy of the management, maximizes the speed of decision-making, and promotes the formation of a transparent and fair corporate culture.

The carefully designed workflows also enable the organization to meet customer demands and external changes with flexibility and agility. Currently, Company A is the only car brand that can provide a full lifecycle experience to customers. It does not have 4S shops, and all the service staff provide end-to-end service to customers. When a customer enters the store, they are served by a service staff member. This staff member is responsible for answering the customer's initial inquiries about the vehicle functions, accompanying them on test drives, completing the purchase, and after-sales maintenance. At the same time, the employee can flexibly call on relevant experts to provide necessary services to customers.

Agility is not only reflected in Company A's equipment and facilities, but also in the capacities of its people. The performance of the service staff is not evaluated by quantitative KPIs. All customers can rate them in an open platform

and give feedback. The company expects that all staff continuously improve their services based on this feedback. In addition, customers are encouraged to share their experiences to incentivize the team to do better.

2. Stable and agile, continuous evolution

In the current business world, agile manufacturing companies like Company A are still rare. Most companies still have doubts about agile organization, or are struggling with the transformation process. However, the concept of an agile organization is not as complex as one might imagine. In the article: "Agility: It rhymes with stability,"[2]we explain that agility is the "capability of an organization with a highly efficient operations model to adapt quickly to the environment, seize opportunities, and create value, while integrating the capacities of its employees." While improving its work efficiency, such a company unlocks the potential of individuals by "learn by doing" and builds an organization that is vibrant, healthy, and capable of providing a continuous flow of energy for the long-term growth of the business. A genuinely agile organization is capable of being both stable and dynamic. Take Company A as an example. From the start, it built a stable organizational platform along with platform-based software and hardware systems and resources. This gave it a stable foundation. At the same time, the organization ensures the company can meet clients' needs quickly and efficiently, giving it "quick capabilities." Combining a stable foundation and quick capabilities, this company became the classic example of an agile Chinese organization.

It is important to emphasize that agile organizations can be intrinsically agile or can become agile through an organizational transformation. When an organization becomes agile, not only will its operations models change, but also its attributes. Frederic Laloux[3] categorized organizations using colors:

— Red organization: In these organizations, leaders use forces to keep order in the groups. Such an organization is driven by force. Examples include the mafia, street gangs, and armed forces.

— Amber organization: These organizations consist of formal roles and ranks in a pyramidal hierarchy with top-down command and control and strict compliance with rules and processes. Such an organization is obedience-based. Examples include the Catholic church, an army, and government agencies.

— Orange organization: These organizations emphasize defeating competitors, increasing profits, growth, innovation, and goal-based management. Such an organization is results-driven. Examples include international corporations.

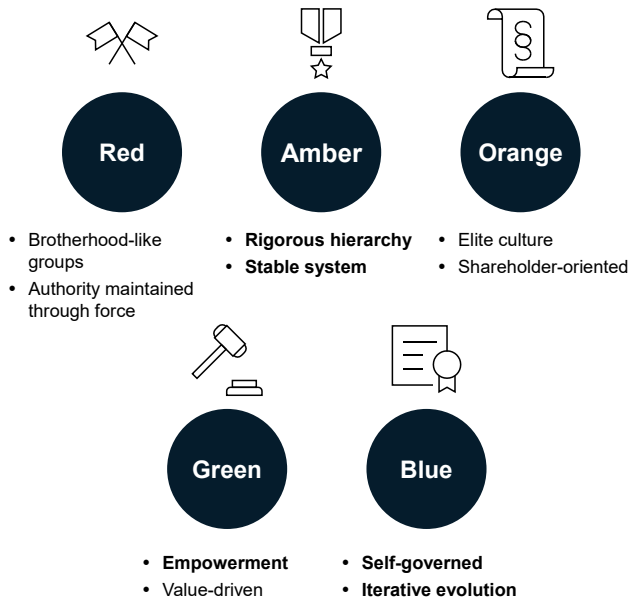
— Green organization: These organizations focus on culture and empowerment and have a classic pyramidal hierarchy with incentives

for high-performing members. Such an organization is culture-based. Examples include non-profit organizations.

— Blue organization: These organizations do away with the pyramidal structure and evolve through the efforts of self-motivated members.

Exhibit1 With the evolution of human societies, organizations have also evolved

Key characteristics



Source: Reshape organizations (Frederic Laloux)

In reality, these five types of organizations have a substantial degree of overlap and the colors blend together. For example, Company A as a whole is a blue organization. Employees are conscious, self-governed, and self-driven, but some departments are more like green organizations. The behavior of the employee is driven by the mission of "Creating a pleasant lifestyle for users." However, these are more like communities in the blue organization platform. Moreover, the company also has the characteristics of an orange organization. It emphasizes an elite culture and cares about the growth in overall sales and the creation of value for shareholders. Another Internet-oriented cross-sector travel company also represents a multi-colored organization. It has the strong elite culture of an orange organization and, as a whole, is an agile organization tending to green or even blue.

3. Make plans according to circumstances, change step by step

Any reform or transformation will inevitably bring pain. Many manufacturers in China run with low profit margins, their management and organizational mechanisms are generally immature and, with their relatively conservative culture, they may not be able to withstand too much pain. Further, many may give up halfway. "Transformation" may be reduced to a formality and a slogan. To avoid this, companies need to plan according to their circumstances and make changes gradually. They need to find their own approach to transformation, instead of following the herd.

After determining the strategies for a business transformation and manufacturing upgrading, a leading special vehicle manufacturing company in China (Company B) invited us to help it reshape its organization. It wanted a new organizational model with greater potential, vitality, and increased overall efficiency. In the early screening stage, we found that the business status of the client, the maturity of the organization, and the capabilities of the workforce were not suitable for an aggressive company-wide organizational agile transformation.

— Business status: On the one hand, due to the strategic adjustment, the main product of the client has changed from product A to product B. While A was designed for a highly standardized market in developed countries, B was for the domestic market with more custom requirements. Accordingly, its business model was switched from OEM to ODM. Meanwhile, for product C, the client wished to take advantage of a short-term preferential domestic

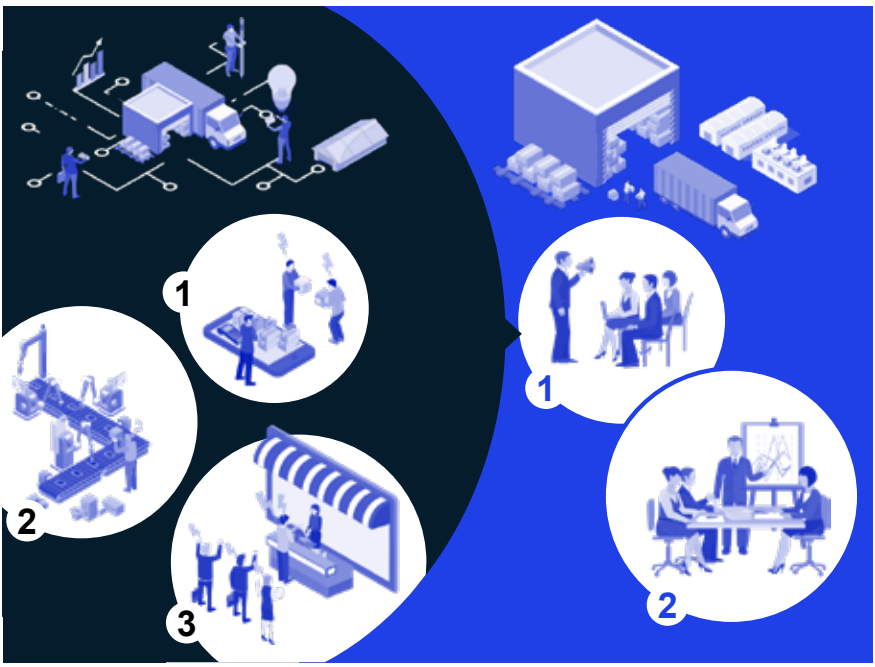
policy, using a high sales volume to dominate the market. However, due to the lack of experience in technical R&D for domestic products and unfamiliarity with market and customers, the ODM strategy suffered setbacks. The sales income in the first six months was not satisfactory, and the high sales volume did not manage to open the market. To meet the yearly financial target set by the shareholders, the company faced tremendous pressure and, in the short term, it could not withstand too much pain from an organization transformation.

— Organizational maturity: The client's organizational structure was recently adjusted due to the need to accomplish a business transformation. Transitioning from a manufacturing department-driven to a sales desk-driven structure. The organizational hierarchy, key positions, department roles and responsibilities, and performance evaluation mechanisms were all restructured. The organization as a whole was in an adaption phase, so in the short term, another major organizational transformation was not a viable option.

— Workforce capabilities: Most employees in the company had over ten years of experience and the majority were manufacturing workers, with a wealth of production experience and down-to-earth, hard working attitude. However, to accept a brand-new management model and organization mechanism and achieve the self-driven, empowered management required by an agile organization, the employees would require time, continuous training, and to see positive results in the short term.

Therefore, we recommended that the client to start with an agile pilot project: Selecting two product lines that are relevant to its business focus as the forerunners (including product C). This pilot would use the “fast” concept of agility to create momentum while gathering experience and making iterations and optimizations, with the aim of discovering a suitable approach to the transformation. In the pilot project, we started from the following two aspects:

— **Establishing an agile cross-department collaboration team:**
In the past, the design, procurement, production, and sales departments were operated independently. At the delivery stage, it might be discovered that the design produced by the design department did not match the customers' requirements, or the equipment in the production line was not capable of making the product according to the blueprint from the design department. Often, the orders placed in the sales department could not be fulfilled on time due to the production capacity limitations in the production department. In the product C pilot project, we broke down the walls between departments and established a cross-departmental project team with functions including product design, production, and sales. From order receipt to delivery, all functions work together. For example, when receiving



the order, the technical staff needs to go to the clients with the sales staff, listen to and understand client's product requirements, and confirm the technical feasibility or recommend a better solution. When producing the samples, technical and production staff work together to improve the final product according to the clients' feedback and requirements gathered by the sales staff.

— **Unified responsibilities, rights and benefits to ensure active involvement from team**

- We defined three key responsibilities of the project team: 1) To provide the fastest and best products and services to clients; 2) To utilize all resources to achieve performance targets; and 3) To build a good work environment for the members of the team and improve the capabilities and vitality of the team.
- We empowered the team with authority: 1) The project team can make decisions on market expansion, product design, client development, production plans and pricing, product marketing, and operational strategies; 2) It can also decide how to divide the bonus package; 3) It can internally and externally recruit employees, and team members are entitled to leave the project team when a specific project ends.
- Incentive mechanism: In addition to salaries and performance bonuses, employees are given a share in the project, based on the value contributed by individuals and feedback from the team. Moreover, the company will provide more opportunities for career development and capacity building

to high-performing employees, such as internal rotations and transfers to the head office or other companies in the group.

After a few months of agile practice, the project team leapt forward and launched iterative products. At the same time, the team members, especially younger ones and key sales staff, and middle managers, were motivated. They worked with passion, gained experience, and achieved great results.

4. Steering the way, starting the voyage to agility

Based on McKinsey's observations and research in recent years, we noticed that all agile organizations have five common features. The agile transformation can onlybe achieved when all five features are present and working together.

— A clear strategy capable of promptly responding to the external market

— A flexible modular organization structure with clearly defined roles and responsibilities

— A lean, efficient, and digitalized process for continuous iteration

— Value-driven, high-performance staff culture

— Technologies that can support agile and flexible organizational structures and highly efficient processes

Returning to the example of Company B, after the successful agile transformation, the company embodied all the features of an agile organization.

— In terms of organizational structure, the company transitioned from the isolated departments and linear collaboration model to a modular structure which consisted of experts from product design, procurement, production, and sales grouped in a simple team hierarchy. All members report to the team leader and have clearly defined roles and responsibilities. The team is formed according to clients' requirements and is responsible for providing end-to-end goods and services to clients. After the fulfillment of the clients' requirements, the team is dissolved. The members are then rearranged and join other suitable teams.

— In terms of processes, the production and sales process was previously complex and overlapping. After the agile transformation, benefiting from the agile organization's operations model and the support of advanced technology, Company B streamlined its internal processes. At the same time, the efficient internal processes enable Company B to adopt different agile work styles adapted to different environments and requirements.

— In terms of talent, the “unified responsibilities and capabilities” project implemented by Company B stimulates employees' motivation and forms a high-efficiency culture in the company. This enhanced trust between employees and increased overall production efficiency.

By studying multiple cases, we picked out eight issues that require special attention during an agile transformation

— **Clearly-defined organizational goals:** Agility is a means to an end, not an end in itself. The company must have clear targets which are effectively communicated and pursued.

— **Consistency in the leadership team:** The agile transformation needs to start from the top. All changes are accompanied by pain. The leadership should stay focused and be willing to learn, let go of outdated ideas, and fully support the agile transformation.

— **Pursue fundamental changes:** Rather than a single method or approach, an agile transformation requires the overall restructuring of the company's operations model, working styles, and management model.

— **Step-by-step improvements:** An agile transformation does not require perfection. Instead, the key is to start fast and small, constantly adjusting the agile organization model as you go. For a large traditional company, it is difficult to change previous practices. However, the agile transformation does not need to be accomplished overnight. Companies can adopt slow and repetitive adjustments in the beginning and gradually reach the transformation. In the end, a red organization can evolve into a blue organization, achieving the goal of agility.

— **Find a path to agility suited to the organization:** There is no one road to success. It is best to start with a trial and then expand it to other business departments, or across the whole organization. Guided by agile theories, it is helpful to explore practical and suitable approaches, instead of just copying past best practices.

— **Talent is key:** The success of an agile transformation depends on people. The organization must select and train the right people to start the transformation. Talent is key to the organizational upgrade. Agile organizations have flexibility and flat structures, which require every staff member to have the capabilities to deal with problems independently.

— **Culture is king:** Culture is the soul and backbone of an agile transformation. The organization's agile transformation should focus on changes in culture, communication, and thinking. Companies need to invest enough time to communicate with frontline staff, help them change them from obedient followers into self-driven decision-makers, and improve their capacities of self-motivation and self-management. This will ensure employees can support an agile organization.

— **Learn the right sort of agility:** The company must invest in a comprehensive transformation, including support for continuous

integration, automation, and digital technologies. This will enable the transformation to move forward steadily and make solid achievements.

■ ■ ■

Looking to the future, we believe industry sectors will merge faster and emerging technology will develop rapidly. The prospect of the current U.S.-China trade dispute is unpredictable, and the global economic environment remains turbulent. Ready or not, Chinese companies have to face a more volatile and complex environment. The leading manufacturers in China should be ready and ride the wave and evolve into powerful entities capable of strong business performance over the long term. ■

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[1] Peter Drucker, *Innovation and Entrepreneurship.*

[2] Wouter Aghina, Aaron De Smet and Kristen Weerda, "Agility: It rhymes with stability," McKinsey Quarterly, Dec.2015.

[3] An independent scholar, organization expert, and former VP partner at McKinsey.

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Making digital transformations work for China's automakers

Arthur Wang, Bill Peng, Kai Shen

China's auto industry is on the cusp of unprecedented change. Along with the recent dramatic slowdown in growth, four seismic trends are sweeping across the global auto landscape: autonomous driving, connected and electric cars, and shared mobility. These four factors, which we collectively refer to as ACES, are expected to radically transform the nature of vehicles and the driving experience. Company leaders in China and elsewhere have responded, in part, by going digital. They are collecting and analyzing large volumes of consumer data, developing online businesses, and providing more real-time data to management.

However, we have observed some companies struggling to understand the true extent of digital transformation, the value it creates, and how best to drive it forward. Three myths, in particular, are holding Chinese automakers back in their efforts to modernize. Here, we share insights on how to avoid them:

Myth one: Digitization is independent from ACES transformation

Without digitization, the shift to ACES vehicles and technologies is fundamentally unachievable. Digital technologies and capabilities are driving the development of self-driving and highly connected cars, or the Internet of Vehicles. Both trends will not only revolutionize the concept of driving; they will enable automotive companies to finally become directly connected to their end customers, which will generate new business models, and drive groundbreaking changes in customer experience.

Digital adoption is also propelling the trends of electrification and shared platforms, and vice versa. Digital control systems are easier to apply in vehicles with electric motors, which helps to drive the development of electric vehicles. Within those electric vehicles, the most energy-efficient battery management systems are often digital – cloud-connected batteries, for example.

Myth two: Digitization is an investment in the future, not for short-term performance

Auto executives know that planning for ACES requires significant levels of investment. Yet with China's auto market becoming increasingly challenging and uncertain, these leaders are under new pressure to produce near-term returns. We believe digitization is both a future strategy and a proven means of boosting short-term business performance. We have seen digitization, combined with the Internet of Things and automation, increase revenue

significantly, shorten the product development cycle by 10 to 20 percent, raise labor productivity by 20 to 30 percent, and reduce inventory by 30 percent. It has also helped companies lower material costs by an additional 15 to 20 percent, and significantly reduced costs for back office operations, more than 70 percent of which can be automated. In total, digitization can raise EBIT (earnings before interest and taxes) for auto companies by an average of 8 to 13 percentage points.

One leading, multinational auto company, for instance, used digital technologies to optimize the development and design of a new model for its flagship vehicle, which resulted in a 15 percent shorter product development cycle, and 11 percent lower research and development costs. The company mounted an exhaustive hunt for areas that could cause delays in the research, development, and launch of the new model. It collected, integrated and analyzed five years of data from 30 different sources. Using a linear regression approach, the company built and embedded a digitized model into its R&D and design processes. Regular monitoring, testing and enhancements to the model then allowed the company to streamline and improve several areas of the launch process.

In another example of a company leveraging digital for near-term gain, a leading automotive joint venture used digital tools to measure the effectiveness of its incentive program for dealers. Although automotive companies typically do not like to skimp on dealer incentives, a cross-departmental analysis gave them real benchmarks about how different incentives were performing. This allowed the company to formulate and implement a more efficient incentive program, and create better discount and commission policies. The result was a 4 percent reduction in dealer incentive spending, worth close to 1 billion RMB.

Myth three: Digitization is the domain of the IT department alone

Since digitization can help lower costs, streamline product innovation, bolster consumer experience, and create more efficient business models, the starting objective for any transformation should be development across business units, rather than just information system upgrades. Companies that delegate the task of digital transformation solely to the IT department will quickly find themselves at a dead-end. To achieve real momentum, both the CEO and business unit heads need to be active participants. We propose three guidelines to help senior management teams successfully implement their digital transformations:

1) Show strong commitment from the top

Digital transformation starts with company leaders establishing a clear vision, and creating an implementation roadmap based on the company's actual conditions and circumstances. Since digital transformations generate long and broad to-do lists, CEOs and business team leaders should first prioritize tasks that will yield the highest returns-based value. We recommend using a prioritization matrix that takes into account the magnitude of potential returns and complexity of implementation.

At the same time, leaders at the top must also allow for, and actively encourage, bottom-up innovation. Team members who are doing the bulk of implementation work, and who are closest to the customer, should have greater say than they would normally about how initiatives are run and processes are set up. Unleash their energy and creativity instead of squashing it with too many decision layers.

Lastly, company leaders must demonstrate a long-term commitment to digital. Throwing capital at a few applications will not achieve revolutionary change. Digital transformation is attained through the gradual accumulation of hundreds of new applications and initiatives, each supported by a specific business objective, such as shortening product launch time, lowering procurement costs, or improving marketing efficiency.

2) Focus on organizational transformation

Automotive companies cannot meet tomorrow’s challenges with yesterday’s organization. To be successful, companies will need to change the way they work in three important ways. First, a chief digital officer (CDO) should be

appointed to run the transformation. This individual should report directly to the CEO or the executive board, and work closely to jointly define key tasks and objectives of digital business transformation. He or she will also help prioritize these tasks, develop a transformation roadmap, assign each task to a particular team or department, and make sure that progress stays on course. Since quickly finding the right person to do this is no easy task, some automotive companies have appointed two people in a dual-leadership system, bringing in outside expertise to work in step with a partner who is promoted from within the company, and thus understands the organization's structure and how to influence it effectively.

Perhaps the biggest challenge for incumbent auto companies as they work to digitally transform is the need to change their traditional cultures, which tend to be characterized by stability, conservatism, and rigid adherence to process. In their place, companies have to build an agile culture, and cultivate agile leadership capabilities among senior management. This means letting cross-functional teams work relatively independently, and creating an environment where experimentation and risk-taking are encouraged, and feedback is used continuously and quickly to make improvements.

Finally, digital transformation requires a new kind of cutting-edge technological talent. These "software" personnel – which include product managers, agile coaches, system architects, data translators, customer experience designers, product front-end designers, data engineers, data scientists, and front-end and back-end developers – often possess completely different working styles than existing "hardware" talent. To get both groups working together effectively, companies will need to re-skill existing talent, and foster the kind of risk-taking and non-hierarchical environment that will be attractive to new talent.

3) Complete the technological transformation

To enable rapid digital transformation, a modern enterprise architecture is required to accelerate use case development, and keep up with ever evolving business needs. It comprises four key elements that we shall address in detail below: data fabric, DevOps, microservice architecture, and cloud computing.

Data fabric: Traditional corporations have data scattered around different departments. Lack of integration hinders generation of actionable insights to address interdependent complex issues. Data fabric ingests from various data sources along the value chain, and forms a comprehensive reservoir of organically linked data. It democratizes data at all levels of raw data, data features, and front-end application, meeting the demands from data-driven

business decisions.

DevOps: This is key for IT agility. Traditionally, digital products require significant manual operations in development, testing, and maintenance. DevOps provides infrastructure and improved workflow to enable continuous delivery. By unifying development and operation activities, DevOps helps to reduce time to going online with benefits in increased developer productivity, system reliability, and stability.

Microservice architecture: This breaks traditional monolithic architecture into modules serving specific business purposes. It reduces interdependency so that addition, modification, and failure of a single service can be easily managed to avoid disruption to the overall business. Microservice architecture also has greater extensibility and reusability – developers can combine existing modules to quickly provide services for new business.

Cloud computing: This is replacing capital intensive on-premise IT infrastructure with benefits in reduced maintenance cost, higher reliability, and greater flexibility to scale up and down in response to business needs. Time and cost to deploy use cases can be greatly reduced by utilizing infrastructure, platform, and software as a service models in the cloud.

■ ■ ■

Being mindful of the pitfalls and aware of these key elements of digital transformation strategy will give companies a competitive advantage as the automotive industry moves toward creating the car, and car experience, of the future. ■

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Closing thoughts

Driving toward 2030: Ten predictions for China's auto market

Paul Gao, Arthur Wang, Tony Zhou

After more than 30 years of stunning growth, China is now far and away the world's largest automotive producer and consumer. This leadership, along with a highly efficient industrial supply chain, and flourishing digital ecosystem, put China in prime position to shape the future of the global auto industry. As we close out this edition of China Auto CEO Quarterly, we look ahead to what that future might look like, and make the following predictions for the Chinese automotive industry in 2030:

Prediction 1: The market will return to growth, albeit at a slower pace. Over the last three decades, thanks to double-digit compound annual growth rates in the Chinese auto industry, multinational manufacturers enjoyed far bigger profit margins in China than any other market. While those halcyon days are unlikely to return, we believe the market retains considerable growth potential. There are still 1 billion Chinese consumers who have yet to buy or own a car, and there is substantial room for sales to improve in smaller cities and rural areas. The number of vehicles in operation (VIO or parc) in China is only about 160 per 1,000 people, much lower than in developed markets such as the US (850), and Germany (600). We believe that as long as China's economy grows at a moderate pace, the automotive industry will steadily grow sales volume from the current level of over 20 million units.

Prediction 2: Many brands will slide into irrelevance or withdraw from the Chinese market. Explosive growth over the last 30 years has resulted in the proliferation of countless automotive brands in China. Now that sales are sluggish, weaker brands face the threat of elimination. Amid intense market competition, there is no longer space for error, and those brands that do not aggressively reform will likely disappear. Only competitive manufacturers that take initiative to transform and upgrade their products and customer experience will survive.

Prediction 3: Most mid-range international brands will lose competitiveness. Several leading Chinese automotive players have

improved key aspects of their products, including design, overall performance, quality, and price. They have also performed well in the early days of electric vehicle (EV) and car connectivity development. As such, we believe autos will track the path of industries like home appliances, mobile phones, and construction machinery, where homegrown brands have risen to dominate at the expense of mid-range international brands. If auto players in this segment neglect to innovate to keep up with or stay ahead of Chinese brands, they will be pushed out of the market. Premium global auto brands, however, are likely to continue to enjoy strong success in China.

Prediction 4: Robotaxis will enjoy exponential growth. McKinsey research indicates that the total cost of ownership (TCO) of autonomous vehicle technology will equal that of traditional vehicles around 2026. We also believe that this is the point at which the Chinese government will start deploying robotaxis as a public service, replacing traditional taxi fleets.

Prediction 5: Chinese digital giants will dominate in-car connectivity operating systems, and develop the industry standard. Chinese consumers' relatively high willingness to try new digital products and mobile services, and the advanced level of China's mobile payments ecosystem, present a great opportunity for China's digital giants to dominate in-car connectivity features and operating systems. Most consumers will expect to seamlessly transfer the mobile and app ecosystems they enjoy in their daily lives into the car with them. Cars sold in China by international brands will have to use these systems, and store their collected in-car data according to China's regulatory requirements. Expect intense data ownership battles between automotive manufacturers and digital companies as a result.

Prediction 6: Enhancing the consumer experience will replace manufacturing as auto companies' core competency. Auto companies will eventually move on from the business of manufacturing cars. As cars

become increasingly autonomous and data driven, many companies will shift their focus toward customer mobility experience design and marketing services. As such, they will likely seek to outsource their automotive manufacturing operations.

Prediction 7: Traditional 4S stores, or car dealers, will adapt to survive. As car connectivity technology matures, auto manufacturers, digital players, and mobility companies will establish direct contact with end-consumers. OEMs will move closer to their customers, who will also have increasingly sophisticated auto ecommerce options to choose from. As a result, the profitability and sustainability of the traditional 4S store model will be challenged, forcing operators to redefine their business models. Many consumers will instead shop for cars and related services at downtown experiential stores, multi-brand stores, automotive hypermarkets, suburban vehicle test centers, door-to-door test drive services, and independent maintenance workshops.

Prediction 8: Car manufacturers will transform from mechanical engineering companies to software companies. As cars become computers on wheels, software will overtake hardware as a car company's main emphasis. Success will depend on how effective a company is at digital transformation, and at attracting, nurturing, and retaining software talent, as well as data translators, big data scientists, and data engineers.

Prediction 9: Joint ventures with a 50:50 equity structure will become increasingly rare. The Chinese government will fully abolish its foreign ownership restrictions on joint venture automotive enterprises by 2022. Over time, this will likely see the current 50-50 joint venture ownership structures be replaced as foreign

partners acquire majority stakes or full ownership of their Chinese ventures, particularly those involving weaker state-owned enterprises.

Prediction 10: Low- and mid-priced EVs and EV battery production will be dominated by domestic brands. On the back of government subsidies and the relatively easy availability of capital for investment, a globally competitive EV supply chain has begun to take shape in China. Chinese EV manufacturers are improving their products and lowering selling prices at a rapid pace. At the same time, Chinese OEMs are pioneering new business models and investing in the latest connectivity technology. We believe that as government subsidies are gradually withdrawn, many of these brands will disappear from the market. This will leave the field open for the remaining local champions to leverage their high brand-recognition, significant scale-based cost advantages, and supply chain integration, to dominate China's EV market.

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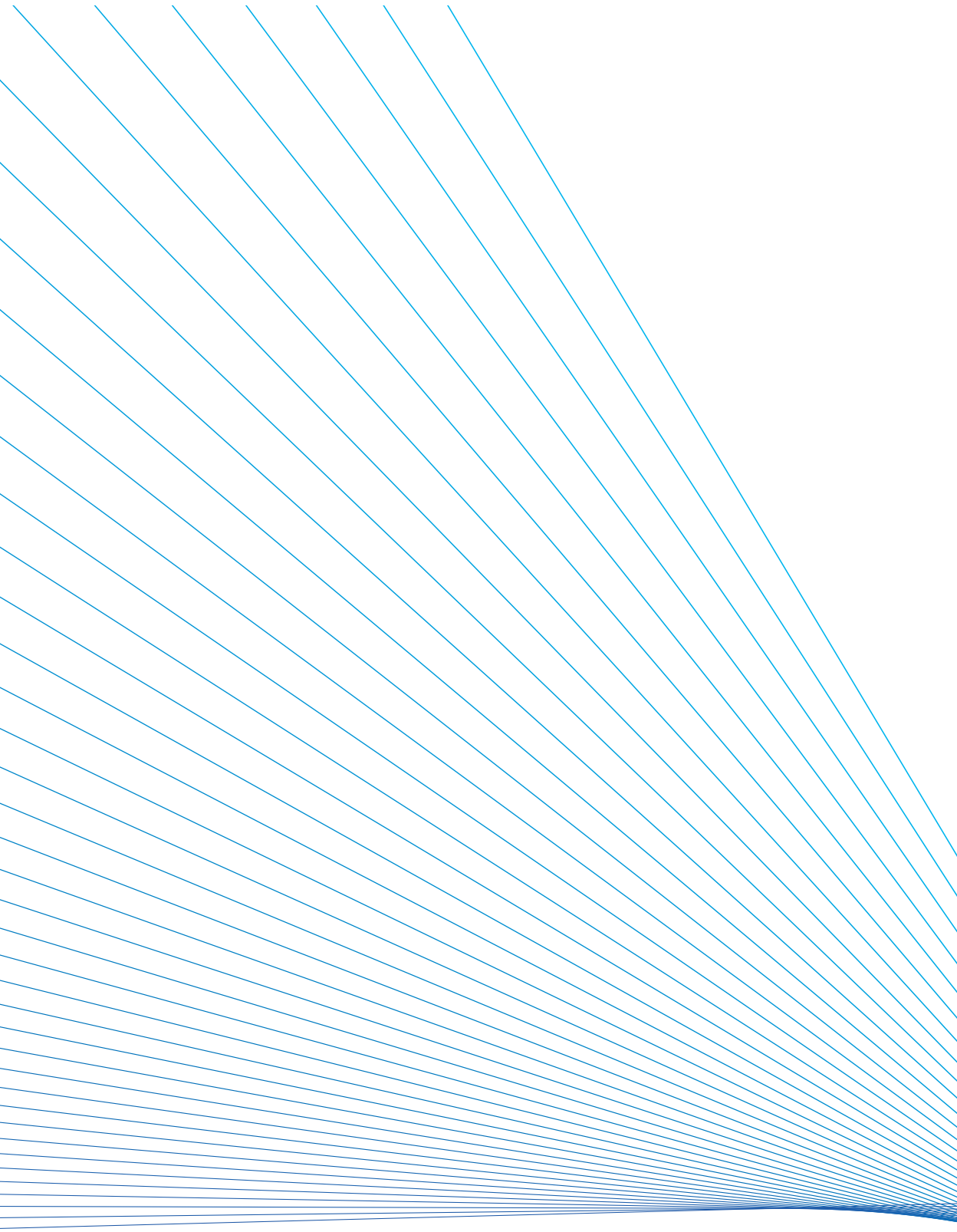

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