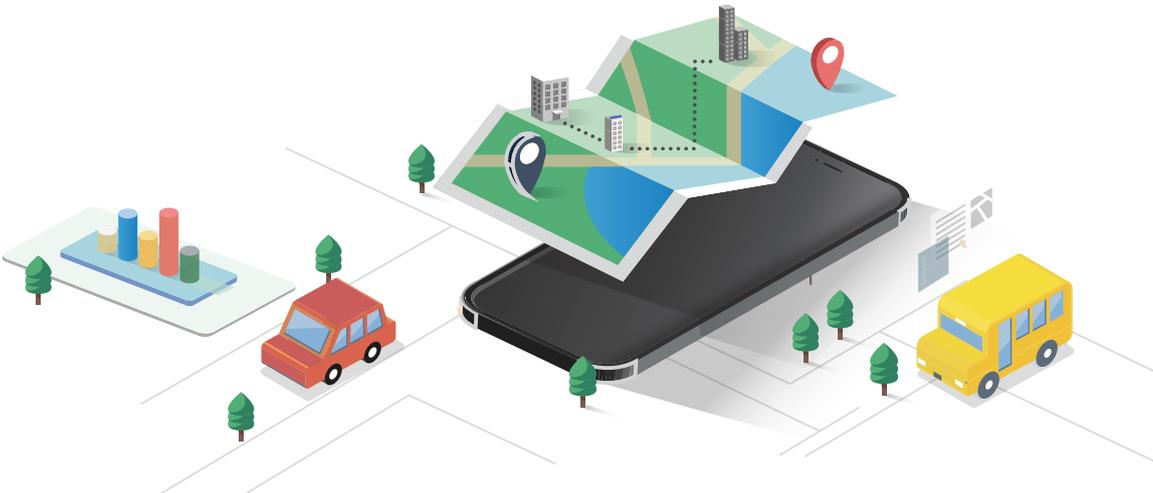




**Autonomous driving reshapes competition
in the ecosystem**

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Key viewpoints

• China is very likely to lead the world in Level 4(L4) autonomous driving technology and its related applications

• China is very likely to become the world's largest market for autonomous driving by 2030

• The ecosystem of L4 autonomous driving will be symbiotic with a flattened value chain

• Traditional car companies need to transform into full solution providers to stay competitive

• Domestic companies in China need to remain competitive in the ecosystem through proactive cooperation and M&As

Level 4 autonomous driving will rise in the East

China is very likely to become the world's largest market for autonomous driving with leading L4 technologies and applications.

Private car owners can read newspapers while drinking tea on their way to work every day, and not need to keep a close eye on road conditions; with no human intervention, buses transport millions of passengers to the other side of the city as scheduled on a daily basis; without stopovers or long-distance drivers, long haul trucks deliver thousands of packages faster to the other side of the country. All these visions are expected to first take place in China in 2025 to 2028.

In 2017, China, a late starter in the field of autonomous driving, still fell behind Europe and the United States in L2 and L3 in all aspects. However, we believe that this pattern will change in the L4 era. First, the Chinese government is pushing to establish mechanisms from its top-level design to facilitate the development and research, commercial applications, standards setting, and legislation improvements for autonomous driving. As part of China's national development plan, in January 2018, the National Development and Reform Commission released a draft Strategy for Innovation and Development of Intelligent Vehicles for public comments on its website. The draft is the first strategic guideline on intelligent vehicles, which provides a specific direction for the development of intelligent vehicles. According to the guideline, China plans to increase the share of intelligent vehicles in new cars sold to 50% and achieve market-oriented application of midsize and premium intelligent vehicles by 2020; and by 2025, establish a sound system for China standard intelligent vehicles in terms of technology innovation, industry ecosystem, infrastructure network, laws and standards, product supervision and information security, with basically all new vehicles being intelligent and sizable market application of premium intelligent vehicles.

Prior to the guideline, China has explicitly elevated the development of intelligent vehicles to a national strategic level. The "Opinions on the Development of Automobile Industry During the 13th Five-Year Plan Period" issued by the China Association of Automobile Manufacturers also provides a detailed roadmap for the development of intelligent vehicles - by 2020, 50% of new intelligent cars sold will be equipped with driver assistance systems (equivalent to L1), and 10% will achieve conditional autonomy (equivalent to L2). We predict that in the future "14th five-year plan" and "15th five-year plan", the above-mentioned ratio will increase gradually and steadily. L4 will soon be included in the national plan as technologies, laws and regulations becoming mature in the future.

As to laws and regulations, at the end of 2017, Beijing took the lead to introduce the first regional regulation in testing autonomous vehicles, fulfilled the legal gaps with regard to autonomous vehicles testing, and set up the first autonomous vehicles testing lane in Yizhuang. Shanghai also issued the first batch of licenses to SAIC, BMW, and NIO for them to do open-road testing on their autonomous vehicles since March 2018. Meanwhile, Guangzhou and Shenzhen are taking proactive approaches in setting up road test demonstration sites and facilitating the introduction of related regulations.

Second, China has a huge market demand for autonomous vehicles, not only because it is the world's largest market for passenger cars, but also because Chinese consumers are more inclined to adopt autonomous technology², implying a promising prospect for consumer-oriented autonomous vehicle market. China has a well-established mobility and logistics industry. The L4 era will ignite the demand

of businesses for commercial autonomous vehicles, helping businesses to lower labor costs. Moreover, the promotion and penetration of new energy vehicles and "smart cities" will further build up the demand for autonomous vehicles.

Under such circumstances, China is bound to become a hotbed for world-leading autonomous driving companies. In recent years, domestic tech companies have stepped up R&D efforts in the field of autonomous driving and are emerging to compete in core fields of software and hardware development such as algorithms and LIDAR. Powered by a robust capital market in China, these companies strive to surpass their competitors in the field of autonomous driving, especially in L4 autonomy. For example, in October 2016, Hesai, a start-up company, announced that it had successfully developed a relatively low-cost 32-line LIDAR, breaking the long-standing monopoly of Velodyne, a US LIDAR sensor manufacturer, and the mass production of LIDARs is considered a key premise for the commercial application of L4 technology. Another company that has attracted attention in autonomous driving is SenseTime, an AI startup, whose valuation is expected to reach USD3-5 billion after a Series C round of financing at the end of 2017 (merely three years after it was founded). The company is growing just as fast as Mobileye, an industry-

leading company that was acquired by Intel at USD15.3 billion. Qualcomm, a world leading US chip manufacturer, recently announced that it has reached cooperation with SenseTime, whose machine learning algorithms will be integrated into Qualcomm's Opteron™ processors. The two companies will join hands in promoting commercial applications of AI algorithms in autonomous driving and other areas. At the same time, SenseTime has also received a big order from Honda for autonomous driving AI development and research. All of these indicate that China tech companies are achieving commercial application of their technologies.

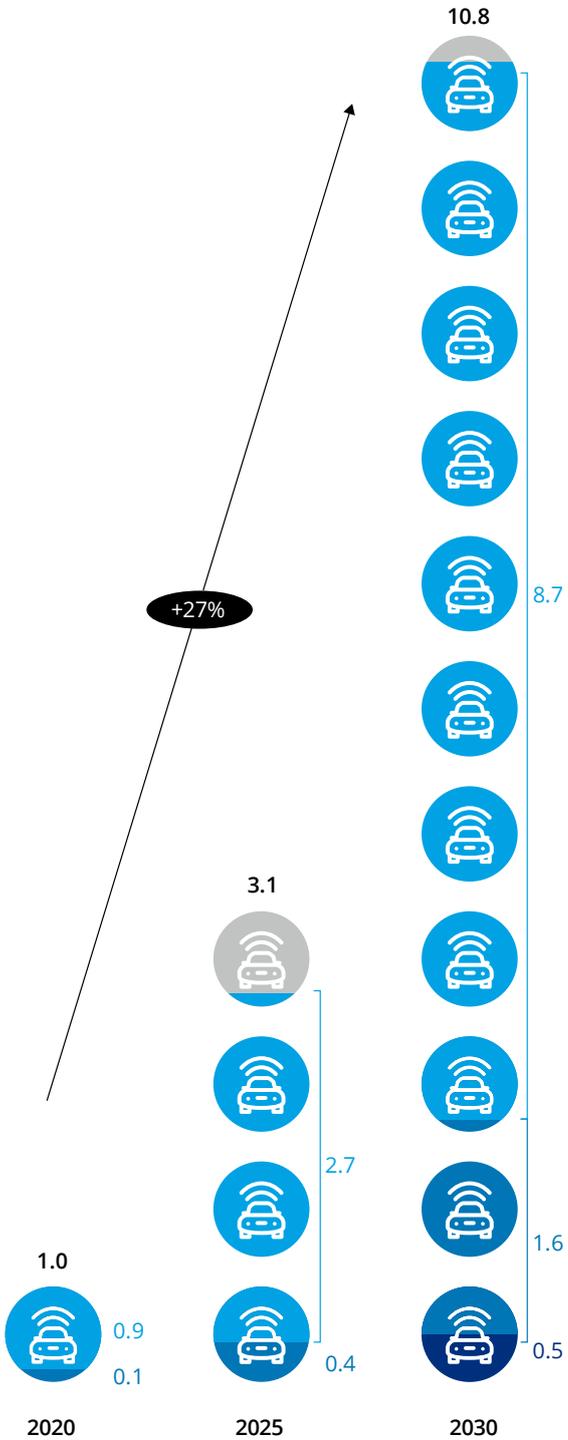
With the strong market momentum, China is very likely to become the world's largest market for autonomous driving with leading L4 technologies and applications. We predict that by 2030, annual sales of new L4 autonomous vehicles in China will exceed 500 thousand units³, accounting for approximately 24% of annual global sales, and the L4 market size will reach USD2.3 billion. Our forecasts of autonomous vehicle sales and market sizes for each level are shown in Figure 1³.



Figure 1: Forecasts of autonomous vehicle sales and market sizes by level³

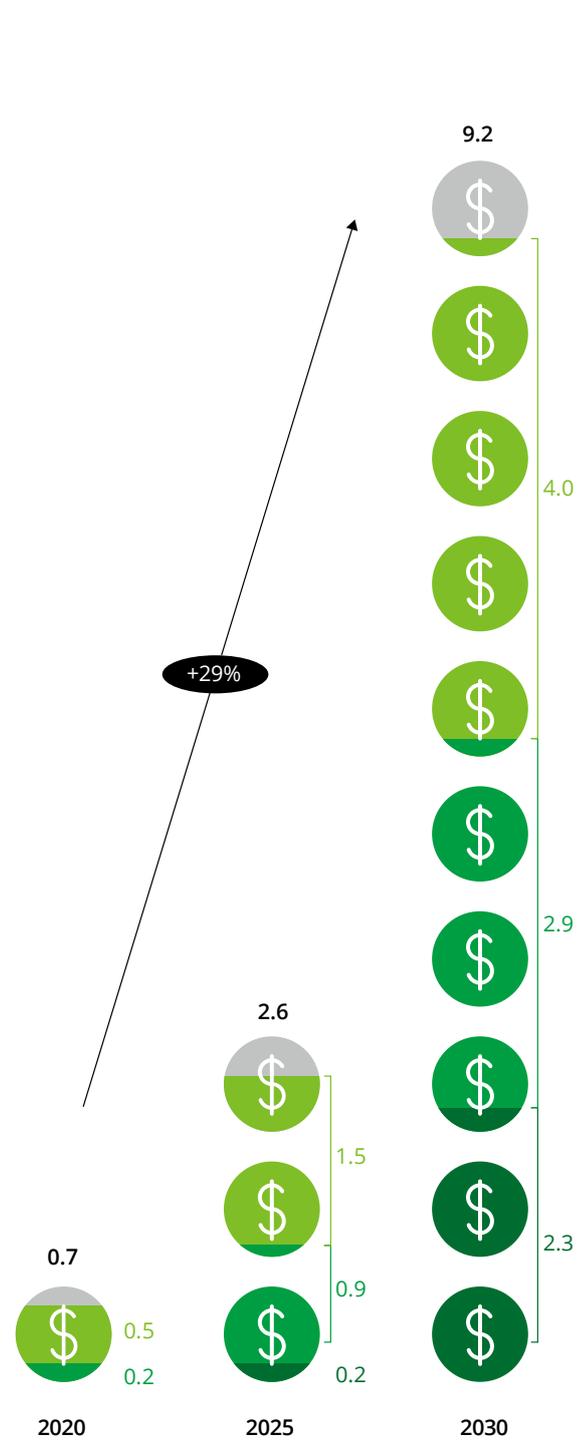
Forecasts of autonomous vehicle sales by level (2020-2030)¹
(million units)

■ L2 ■ L3 ■ L4 & L5



Forecasts of autonomous vehicle market sizes by level (2020-2030)¹
(USD billion)

■ L2 ■ L3 ■ L4 & L5



A rebalance of power

The pyramid structure of the traditional auto industry puts OEMs on the top, followed by various tiers of suppliers who have limited powers. In the L4 era, however, the dominance of OEMs will face stern challenges as auto parts suppliers, internet giants, algorithm companies, chip manufacturers, and sensor suppliers have stepped up efforts on R&D and related commercial applications of autonomous driving, aiming to take hold of technological commanding heights and reshape the ecosystem of the auto industry.

In the L2 and L3 eras, OEMs and first-tier suppliers (including ABCD⁴) continue to dominate the industry, and companies such as map providers, LIDAR manufacturers, and IoV telecommunication operators have limited applications in terms of autonomous driving and are unable to bring fundamental changes to the competitive landscape. In the L4 era, however, there will inevitably be a rebalance of power in the auto industry. The traditional top-down value chain will be flattened, and certain non-first-tier suppliers will not only supply parts to higher tier suppliers but also cooperate directly with OEMs. They can even shift

their focus from traditional 2B business to 2C business and develop direct relations with end users for data collection and product sales (such as OTA business).

On L4 application side, customer structure will become more diversified. Domestic mobility companies, logistics firms, and "Smart City"-related enterprises will all become major buyers of L4 technologies. On L4 technology side, Chinese companies are also constantly challenging the dominance of first-tier suppliers. Tech giants such as Baidu and Alibaba are determined to become autonomous driving solution providers with proactive actions taken in areas such as software algorithms, high-precision maps, cloud services, and data services. For example, at the beginning of this year, Baidu and Hesai jointly launched a developer suite for autonomous driving named Pandora, which provides integrated solutions including hardware, software, and AI for autonomous driving R&D organizations. AutoNavi of Alibaba has completed high-precision mapping of all highways in China. Meanwhile, domestic autonomous driving start-ups are gradually narrowing the gap with foreign companies in core areas such

as algorithm and LIDAR. In particular, these companies will have clear advantages in cost-effectiveness and supply capacity as mass production of LIDAR speeds up.

China unique auto industry pattern, partially blocked autonomous driving value chain, and the emergence of high-quality start-ups, fueled by talents and capital, will all contribute to the rebalance of power in the future L4 industry in China.

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Prepare for transformation

The value of China domestic autonomous driving companies lies in their absolute dominance in areas such as high-precision maps, cloud services and Internet of Vehicle (IoV), and the ensuing spillover effects...

"Cooperation is more important than competition" has become the consensus of the industry for autonomous driving ecosystem in the L4 era. This means that no company would be able to do everything on its own and wall itself off from the new ecosystem. OEMs, first-tier suppliers and domestic companies in China should take actions.

The value of OEMs in autonomous driving mainly lies in their abilities to design and produce products and to develop and integrate overall solutions. OEMs need to have clear plans for long-term development and define their own positions in the industry chain. Compared with smaller OEMs that target at the lower end of the industry chain, large OEMs are more likely to transform themselves into providers of full autonomous driving solutions, and algorithms would be their top priority. Recently, some OEMs have begun to build their algorithm muscles through acquisitions and investments. Forming strategic alliances and incubating start-ups are also major means, especially when L4 technology and

applications are still immature. Low-risk, non-compulsory and non-obligatory cooperation would be a more appropriate approach.

The value of first-tier suppliers in the autonomous vehicle area lies in their ability to become full solution providers as an essential part of the autonomous driving industry chain. First-tier suppliers will face revolutionary changes as the importance of traditional auto parts integration business will be greatly weakened in the L4 era. They must quickly transform themselves into full solution providers in order to maintain their power in the industry. Similarly, algorithms (and related hardware electronic control units) will be of vital importance to first-tier suppliers since they also need to focus their efforts on developing algorithmic capabilities. Companies that take the lead in developing sufficient algorithmic capabilities and ECU integration capabilities stand a better chance of winning the interest of weaker domestic brand OEMs. As algorithms would continue to evolve on the basis of road test

data, the sooner companies begin to accumulate algorithm-related road test data, the more likely they will develop an irreplaceable set of secure and efficient algorithms by 2030. In the short term, first-tier suppliers may cooperate with suitable Chinese OEMs to experiment on the commercial application of L2/L3 in China market, which will help generate significant revenue and build consumer recognition for the company. We suggest that first-tier suppliers act as early as possible. Continental AG and China Unicom already established a joint venture company in October 2017, each holding 50% of shares, to embark on the development of intelligent transportation system and IoV.

The value of China domestic autonomous driving companies lies in their absolute dominance in areas such as high-precision maps, cloud services and IoV, and the ensuing spillover effects that, for example, provide Chinese consumers with more affordable and tailored services or bring MNC partners greater benefits with reduced risks

compared with standing alone. While expanding home-field advantages, domestic companies may also tap into European and US markets and commit to becoming global leaders in related fields. Datang and Huawei have been leading the world in the setting of LTE-V connected vehicle standards and the development of related technologies. In February 2017, Huawei joined hands with Bosch and Vodafone to test the LTE-V connected vehicle standards that based on cellular communications technology. Related domestic companies will also have huge opportunities for development.

Domestic internet companies backed by large capitals may focus on intelligent connected solutions. High penetration rates of the top three internet giants in map services, GPS services, and on-board operating systems are a manifestation of their optimistic expectations for the commercialization of L4 technology and IoV.

Domestic autonomous driving startups, on the other hand, have a strong appeal to talents and capital. For fleet management and mobility service providers, their advantages in the L4 era lie in their ownership of first-hand consumer data. Digging out the business value of these data will help them find the right position in the ecosystem.

The market for autonomous driving in China is going to be huge and complex. Stakeholders need to establish a clear strategic positioning as early as possible, closely monitor the shifts in the marketplace, especially the potential impact of regulatory changes, and, at the same time, collaborate more with the ecosystem to expand their partnerships.



Endnotes

1. Based on the level of driving automation defined by SAE International, <http://cyberlaw.stanford.edu/files/blogimages/LevelsofDrivingAutomation.pdf>
 - 2) L2 (Partial Automation): the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task;
 - 3) L3 (Conditional Automation): the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene;
 - 4) L4 (High Automation): the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene;
 - 5) L5 (Full Automation): the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver.
2. 76% of respondents in China were willing to ride on autonomous vehicles, a percentage much higher than other countries (US: 52%, Japan: 60%)
3. Source: IHS Automotive, Deloitte analysis
4. ABCD first-tier suppliers usually refer to Autoliv, Bosch, Continental, and Delphi

Deloitte China contacts

Dr. Marco Hecker

Partner, China Future of Mobility Leader

mhecker@deloitte.com.hk

Andrey Berdichevskiy

Director, China Future of Mobility

anberdichevskiy@deloitte.com.hk

Zhou Quan

Associate Director, China Future of Mobility

qzhou@deloitte.com.cn

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