Countering Structural Changes in the Chinese Auto Industry Brought About by Digitalization Through Collaborations Between Governments and IT Platformers


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Abstract

1. As we enter the CASE era, China's automotive industry will see innovation in technologies and business models that are rooted in its unique advantages. In particular, tech firms in different industries are gaining notice for their advanced technical capabilities, their strong service innovation abilities, and their capacity for government-led implementation in society.
2. In each of these domains, players with high potential have already begun to emerge. Tech firms such as Huawei and SenseTime, armed with capabilities they have cultivated in other industries, are now getting involved with their eyes on the field of next-gen automotive technology. Digital platformers including Alibaba and Baidu with their customer contacts are also building and developing various data platforms both within their industries and laterally between them, and are actively engaged in the next-gen automotive area and the smart traffic field. The central government and regional governments have also begun leveraging their considerable powers of mobilization and financial strength to develop next-gen traffic systems in smart cities and inter-urban digital highways.
3. US and European companies have also started not only to corner the Chinese market (the largest automotive equipment market in the world), but also to explore ways of making their own products more sophisticated by adopting Chinese technology.
4. It is important for Japanese automobile-related companies to participate in China's smart city initiatives involving field demonstrations of self-driving and next-gen traffic systems, as well as to engage in product launches and business development that account for anticipated technical standards. Further, they should also consider partnering with Chinese enterprises so as to promote world-leading technological and business model innovations there over the medium- and long-term.

1. Structural Change to "Integral 2.0"

The technological transformations collectively known as "CASE" (Connected, Automated, Shared, Electrified) are fostering structural changes in the automotive industry. For example, the advance of electrification has reduced the number of components in vehicles, thereby making it less difficult to design and manufacture cars and leading many companies in other fields and startups to enter the automotive industry. At the same time, as connectivity and automated driving are making it more difficult to develop vehicle control systems for vehicle models individually, Bosch, Continental, and other mega-suppliers that boast outsize corporate strength capable of responding to complex technical problems have accelerated their transition to business models that provide services, software and the like for diverse customer needs. Likewise, with the rise of sharing, people's approaches to car ownership and transport selection are changing, and business models focused mainly on individually-owned cars are giving way to Mobility-as-a-Service (MaaS) and smart city business models involving coordination with traffic controls, medical/care services, and other urban life services.

In the automotive industry thus far, the key to competitive superiority has lain in how companies build large, vertically integrated corporate structures. More specifically, it has been important to enable efficient large-scale production of high-quality, low-cost products by assembling corporate system groups of automobile component manufacturers into a pyramid structure with the finished vehicle manufacturer at the top, and gathering development, procurement, production and other essential functions around a main production facility. In contrast, the new automotive industry structure inaugurated by CASE is eliminating the advantages of vertical integration and unbundling the structure of the industry.

I will now provide some concrete examples. Up to now, vehicle design has required that fine-tune integration [*suriawase*] of complex information be conducted on the design drawings, thus necessitating that the design divisions of vehicle manufacturers and suppliers be located near each other, and that supplier technicians be permanently dispatched to vehicle manufacturers as guest engineers. In the CASE era, however, there will be wholesale changes in the nature of this fine-tune integration of design information. Electrification will lead to the standardization of component interfaces, reducing the volume of information requiring such fine-tune integration. Connectivity will make it possible for auto manufacturers to obtain city driving data

directly, thus facilitating calibration in virtual spaces that recreate actual driving environments. In addition, the sources of added value will shift from the cars themselves to their convenience for MaaS, and it will be more important to construct metropolitan highway infrastructure, law/traffic control systems, and service networks with high usefulness for public transportation, real estate, food/beverage service, and other diverse industries. These changes, however, will not mean the end of development, procurement, and production functions; rather, they will enable finished vehicle manufacturers without supplier groups to offer products that compare favorably with those of vertically integrated manufacturers.

If "Integral 1.0" is what we call the era that privileged fine-tune integration between companies and functions in a vertically integrated industry structure, then I believe the coming era will be "Integral 2.0". In other words, the new era will demand a multifaceted battle on many fronts that automobile manufacturers have not experienced thus far, including fine-tune integration to driving data, to servicers, and to law and society. China is a marketplace where the seeds of this new automotive industry structure are especially visible; thinking about how to compete in this market will be a major challenge for all automobile manufacturers, including Japanese manufacturers.

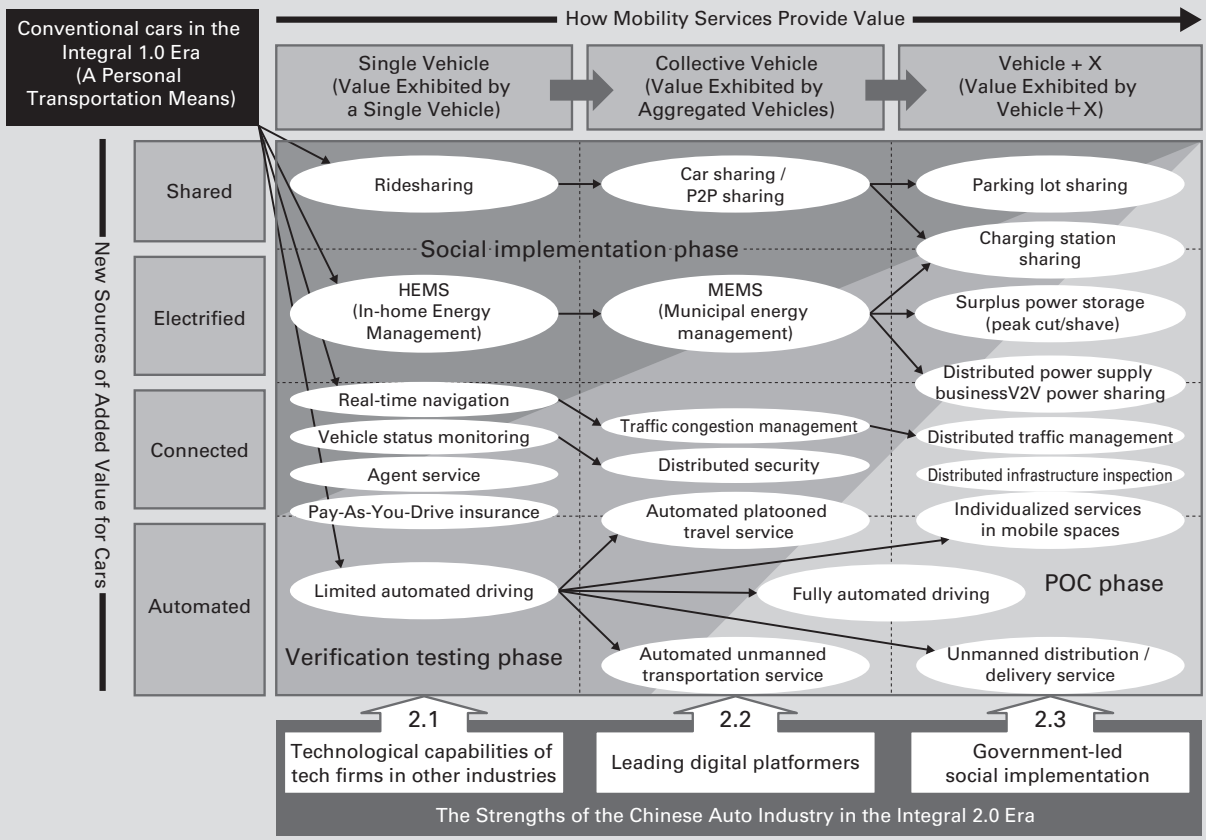
2. Structural Characteristics of the Chinese Automotive Industry

Although China is solidifying its status as a "car empire" for both production and sales, it has not been easy for Chinese manufacturers to catch up with Japanese, U.S., and European manufacturers in the field of internal combustion technology. This is because in the "Integral 1.0" era, there were major barriers to Chinese manufacturers forming vertically integrated structures rooted in fine-tune integration with upstream parts manufacturers. In the CASE era, however, electrification will lead to a substantial reduction in components that involved fine-tune integration with upstream actors, and the importance of the above-described "Integral 2.0" will markedly increase. As a result, the Chinese automotive industry will witness technical and business-model innovations rooted in its unique advantages. (Table 1)

2.1 Technical Prowess of Tech Companies in Different Industries

The progress of electrification and connectivity has spurred integration into the auto industry of the logic of the electronics and digital industries, resulting in shorter development cycles and increasingly horizontal industry structures. In the United States, in addition to IT and EV

Fig. 1: The Strengths of the Chinese Auto Industry in the Integral 2.0 Era



ventures, conventional auto manufacturers are shifting the focus of their activities to Silicon Valley with the aim of recruiting talented staff with expertise in high-performance semiconductors, control algorithms, sensors, and other component technologies for next-generation automobiles, and of deepening their collaboration with tech companies outside the automotive industry.

The Chinese city of Shenzhen, which has been the world's largest industrial center in the electronics industry for some time, has continued its evolution as a center of innovation, and is now being called the Silicon Valley of China. Shenzhen is also beginning to exert influence in the next-generation auto industry. For example, in addition to Huawei, the telecom giant that has announced its full-scale entry into automated driving, tech companies holding diverse component technologies are already entering the next-generation automotive field, including LiDAR developer/seller LeiShen, environmental recognition system developer forward-system, and SenseTime, which has strengths in AI-aided pedestrian and vehicle driver

face/emotion recognition.

One case study that has already shown success is CATL, a leading local vehicle battery manufacturer spun off from ATL in the city of Dongguan, which is adjacent to Shenzhen. In only a few years, this company has mobilized the supply chain it built in the electronics industry, an abundant and talented scientific workforce, and capital power from various investment funds, to grow itself into a vehicle battery manufacturer with competitiveness recognized even by automobile manufacturers in advanced countries. It is only a matter of time before this type of success story makes itself heard in the field of automated driving.

2.2 Strong Digital Platform Developers

In China, the three most popular digital companies are collectively known as "BAT". This acronym refers to top search engine developer Baidu, e-commerce giant Alibaba, and social media leader Tencent. These three companies have built platform empires by mobilizing digital technology to provide various products and services online, in areas ranging from the sale of daily necessities and industrial goods to administrative procedures, financial products, and medical services.

The BAT digital platform developers have seized on customer contact points to build and accumulate diverse data infrastructures within and across industries. Recently, they are said to have been developing various business models, in anticipation of the realization of automated driving and the world thereafter.

Aspects of innovation power in the Integral 2.0 era will be determined according to the "volume of big data". This is because the extent and precision of knowledge and judgment will differ depending on however many patterns and uses AI has envisioned and learned in advance. In addition, the volume of accessible information resources, number of committed users, and amount of data accumulated therefrom, will directly determine the attractiveness of the business models of the various services of the CASE era. In China, because local automobile manufacturers do not have strong technological development capacity and business creativity, it will be easy to realize the "cross-automobile-manufacturer-type" business model pursued by the digital platform developers represented by BAT. Therefore, the creation of technologies and business models that utilize big data may experience more rapid progress than that made in advanced countries.

2.3 Government-Led Societal Implementation

One important characteristic of Chinese-style innovation, as represented by the technological advances in China's

high-speed rail areas, is the "societal implementation first" technological development model, in which applied technologies are developed in succession in the course of market formation, even when the upstream component technologies were not originally developed in China.

The gigantic domestic market and strong government mobilization power are favorable conditions for societal-implementation-first-style innovation. More specifically, thanks to the government's mobilizing power, trial and error processes in the initial stages are rapidly overcome, and a virtuous circle of market expansion and innovation acceleration takes hold. In next-generation automotive fields, local governments have already begun moving to create this virtuous circle, through the creation of smart cities and the like.

In these smart cities, technological testing and feasibility studies are conducted in large volume by internal and external players, thus facilitating rapid standardization and business model creation. In addition, smart cities gather the needed operators from automotive, IT, telecom, and other such fields into one place, thus making it possible to efficiently fine tune automated driving value chains and business models while advancing societal implementation.

3. Notable Trends among Key Players

3.1 Component Technology Accumulation by Tech Companies in Different Industries

Recently, attention has begun to focus on Chinese component technology players with strong technical prowess. Based on the high-volume data sources and advanced software development capability that have been accumulated in non-automotive Chinese industries over the years, product and service development outstripping players in advanced nations has been achieved in various technical fields, including AI, semiconductors, image recognition, and voice recognition. Many players in advanced countries have embarked on rapid relationship building initiatives with these component technology makers. This section will introduce three players that have burst into next-generation automotive fields and shown particularly impressive growth there.

■ Huawei Sets its Sights on Tier1 in the Electronics Field

Huawei, China's leading manufacturer of telecommunications devices, has cited the in-vehicle devices business as a pillar of the growth to follow on the telecom, consumer electronics, and cloud businesses that are its current driving force. With U.S.-China trade tensions intensifying and

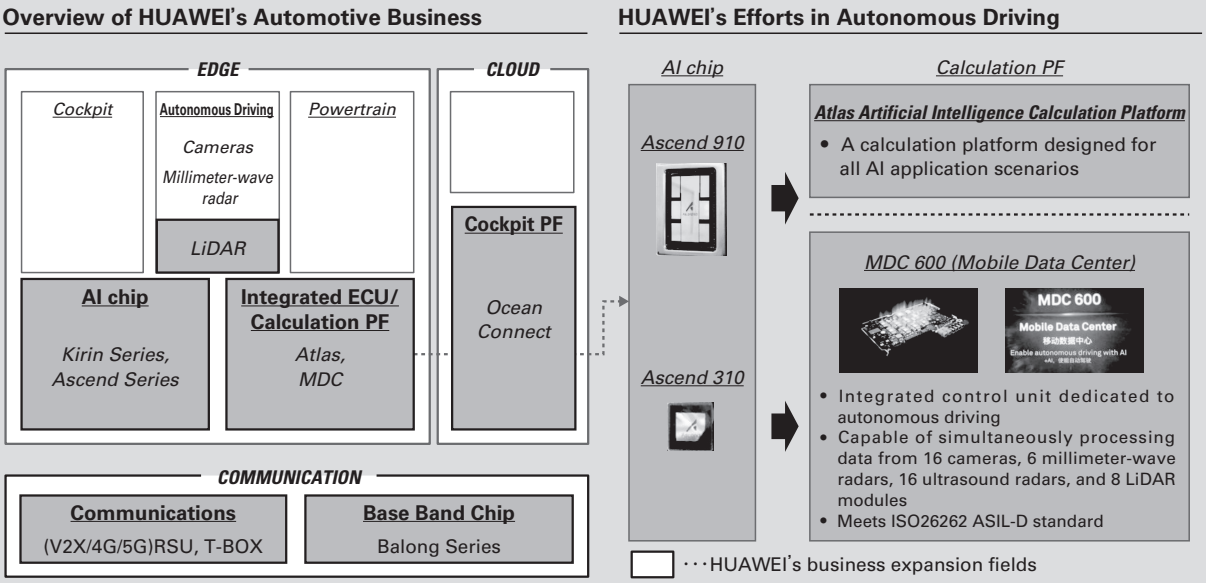
the growth ceilings of existing businesses becoming sources of concern, Huawei has adopted the attitude of making firm effort to strengthen its advances into the in-vehicle electronic component field, where rapid market growth is anticipated going forward.

In May 2019, Huawei established an intelligent vehicle business unit as a new organization directly under the CEO, thus embarking on full-scale business expansion. Huawei is pursuing "Tier1" status in the automotive industry for this in-vehicle business. At the Shanghai International Motor Show 2019, the first auto show in which the company is participating, Huawei Deputy Chairman (Rotating Chairman) Zhijun Xu stated, "Huawei will not make cars, but will instead focus on ICT technology to help car manufacturers produce better cars. Huawei will utilize ICT to provide new components to bring about digital cars."

China's in-vehicle electronic component market is currently monopolized by a handful of automotive Tier1 companies (the top 10 suppliers occupy at least 70% of the market), and the Chinese domestic market is likewise currently led by Bosch, Continental, and other foreign Tier1 companies. The in-vehicle electronic components market is thought to be in a rapid growth period driven by the spread of automated driving and MaaS; Huawei's ambition is to raise its presence in a market led by foreign companies.

Huawei is developing its in-vehicle business through the three product groups

Fig. 2: An Overview of Huawei's Automotive Business and Its Efforts in Autonomous Driving



Source: Created by NRI using various public information sources

shown in Table 2 – namely, "Edge", "Communication", and "Cloud".

(1) Edge: Huawei has robust technical strength and a strong product lineup in the area of in-vehicle edge devices.

In 2018, Huawei announced the Ascend 310 and Ascend 910 AI chips, which boast computing power up to the highest global standards, on par with Nvidia and Google. Huawei has also announced "MDC600", an automatic driving computer platform for Lv4 that is based on these AI chips. This platform was developed in-house by Huawei as a total solution for everything from hardware to software, and is intended to expand to Huawei's domestic and international automotive OEMs. In addition, Huawei has made forays into developing not only automatic driving control modules, but more recently, into development of LiDAR, which is considered indispensable for environmental recognition in automatic driving, and into developing the electronic control units that are the heart of electric vehicles. Huawei is thus rapidly expanding its range of products in a number of fields related to next-generation automobile electronic components.

(2) Communication: The driving forces among Huawei's in-vehicle products are low-cost, high-quality broadband chips and communication modules, which are indispensable for automated driving vehicles and for connected vehicles that require internet communication. These components are already being supplied to many automotive OEMs domestically and internationally, with a particularly commanding market share among local OEMs in China.

The barriers to achieving Lv4/5 in automated driving are substantial at the level of the individual vehicle; C-V2X technologies for communication between vehicles and infrastructural equipment will be essential going forward, and Huawei has extremely high business potential in the area of in-vehicle components and infrastructural communication devices, where it enjoys a commanding market presence. In January 2019, Huawei took the lead in the market by announcing, ahead of other companies, the Balong 500 broadband chip capable of 5G communication.

(3) Cloud: Huawei is seeking to build in-vehicle connected ecosystems based on "Huawei Cloud", which provides AI, high-performance computing (HPC), and other cloud services.

In 2018, Huawei announced a connected platform named "OceanConnect" at the Center for Office Automation, Information Technology and Telecommunication (CeBIT), thus ac-

celerating sales for this platform to third-party service providers and automotive OEMs/Tier1. 2018 also saw the announcement of PSA DS7 Crossback, a new concept car supported by the platform.

■ SenseTime Accelerates In-Vehicle Business Expansion Using Sophisticated Image Recognition Technology

SenseTime is an AI venture, established by Dr. Li Xu of The Chinese University of Hong Kong and his research team, which provides high-precision image recognition services based on sophisticated AI technology. In 2014, the deep learning developed by SenseTime attracted worldwide attention by becoming the first in the world to surpass the average human recognition rate. With an internal specialist team of academic researchers, SenseTime has produced more papers accepted by image recognition conferences (CVPR, ICCV, ECCV) than Google and Facebook. Its technologies and products have shown a commanding presence in security fields such as monitoring cameras and face recognition, and are additionally used in 70% of Android terminals with face recognition functions. SenseTime's face recognition technology is also provided in the "SNOW" selfie camera app.

The foundation of SenseTime's technological power is the abundance of facial image data accumulated in the Chinese marketplace. Over the years, analysis and tagging of significant details in image data and images has been steadily implemented based on China's low labor costs, thus improving the precision of the deep learning models developed by SenseTime.

In recent years, SenseTime has reinforced its new entry into the in-vehicle business, and in Japan, has announced joint research and development with Honda R&D for automatic driving Lv.4 AI technology.

One of the main in-vehicle products developed by SenseTime is the "SenseDrive DMS" driver monitoring system.

This system provides real-time alarms for drivers by performing driver face recognition using driver monitoring systems (DMS) and analyzing factors such as driver fatigue and driver risk with cloud AI. SenseTime's expansion into in-vehicle business marks the dawn of a new era, and, in light of the company's sophisticated image recognition capabilities, can be expected to achieve a vital presence in China's in-vehicle market going forward.

■ iFLYTEK

iFLYTEK is a flagship voice recognition technology company established in 1999 and headquartered in Anhui Province. The company has been selected as representative for voice recognition to the Chinese government's first National New Genera-

tion AI Open Innovation Platform honor roll. (Tencent for medical, Alibaba for smart city, Baidu for automated driving, iFLYTEK for voice recognition.)

Over the years, iFLYTEK has refined voice recognition technologies specialized for the Chinese language, raising the precision of automatic Chinese translations to 97%. iFLYTEK's voice recognition AI is used in a wide range of fields, including customer service and medical.

Behind iFLYTEK's rapid growth lies the unwavering support of the Chinese government. The company's origins can be traced to a decision by the Chinese government to collect voice data from Chinese language speaking tests, whereupon iFLYTEK developed voice recognition devices, on the basis of this big data, for determining whether a speaker can speak standard Chinese. iFLYTEK has used this data as a foundation to improve the precision of voice recognition AI.

iFLYTEK has continued strengthening its in-vehicle businesses at a fever pitch. In August 2017, the company announced the Xiaofeiyu (Little Flying Fish) voice assistant for professional drivers. By connecting to the internet or to driver smartphones, this app allows users to make phone calls, play music, search routes, and search restaurants by using their voices instead of operating screens. Xiaofeiyu is intended for use in cars and is designed to enable voice recognition even in noisy environments.

The automotive business models being developed by iFLYTEK can be divided, broadly speaking, into three types.

(1) Retrofitted Voice Assistance Devices for Aftermarket

The "FEIYU" in-vehicle voice assistance device announced in August 2017 is a retrofitted device that connects to smartphones with Bluetooth and enables users to utilize iFLYTEK's voice recognition over smartphone networks.

(2) Voice Recognition Tier2 Business

iFLYTEK's voice recognition technology is already being used in more than 200 vehicle types and at least 10 million total cars. The company provides voice recognition software to leading automotive OEMs and to Tier1 and other developers of voice-recognition-compatible devices.

(3) Voice Assistance Device Tier1 Business for Automotive OEM Market

iFLYTEK is developing businesses to provide OEMs with total solutions in the form of hardware/software that defines the entire car navigation system and is equipped with voice recognition functions. In recent years, iFLYTEK has sought to strengthen this business with the aim of reaching "Tier1" status in the automotive field.

Recent years have seen iFLYTEK announcing partnerships with Chinese state-

owned car manufacturers in rapid succession. In 2017, iFLYTEK entered a strategic joint business agreement with Beijing Automotive (BAIC), under which it expects to pursue full-scale collaboration in the area of AI technology, including voice recognition AI. The company has also partnered with Guangzhou Automotive (GAC) for next-generation automobile development.

Going forward, when smart cars are developed for China, it is a strong prospect that iFLYTEK's voice recognition AI will become a de facto standard; automotive-related enterprises targeting the Chinese market are already feeling a desire to build relationships with the company as quickly as possible.

3.2 Initiatives by Data Platform Developers

■ Alibaba's Smart City Plan

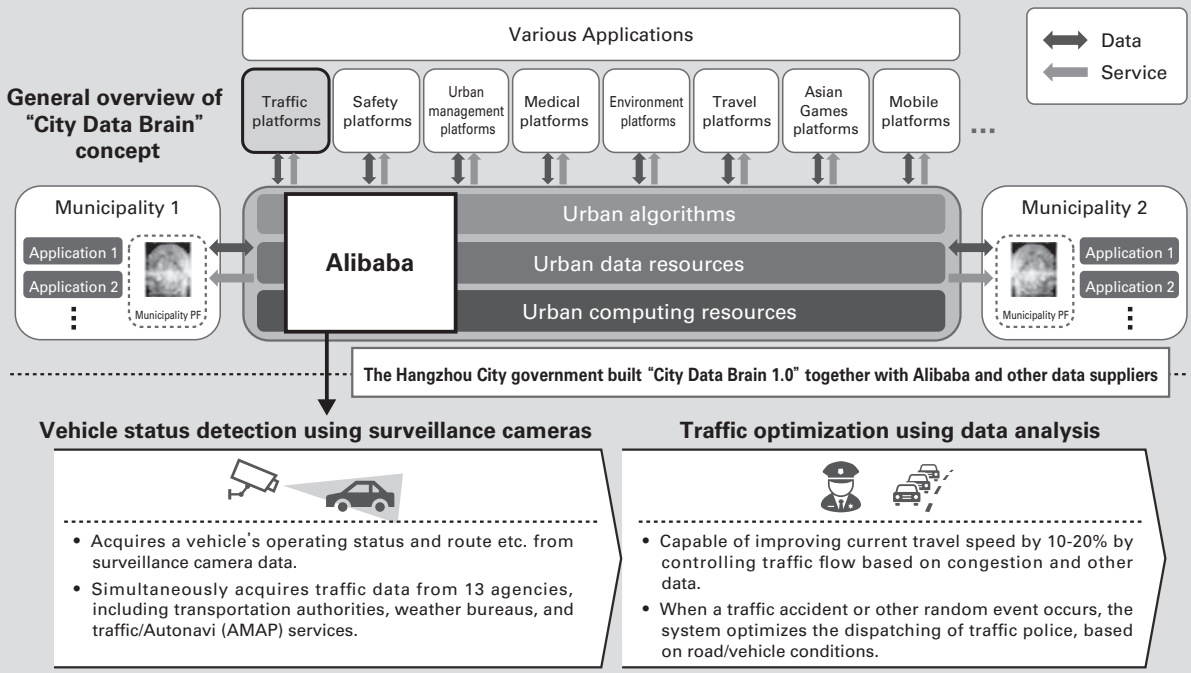
Since its founding by Jack Ma in 1999, Alibaba has developed a variety of e-commerce-related businesses and vastly expanded its operations. In addition to the "e-commerce businesses" centered around the e-commerce site the company has operated since its founding, Alibaba has expanded its business areas to include "local service businesses" that support people's everyday lives, such as the "Amap" travel site map and LBS business, the "Hema" fresh food supermarket, and the "Ele.me" home delivery service, and to include "digital media & entertainment businesses" such as the distribution/streaming of video games and movies.

It is said that the key to Alibaba's rapid growth has been "big data and the power to use it". With data being been called the "new resource for the 21st century", just as oil was for the 20th century, Alibaba's greatest strength going forward will be the scale of its home market, the world's largest population consisting of 1.4 billion people. With value relocated to such areas as "demand prediction" and "customer-to-product matching" through analysis of voluminous data using AI, profits will be earned through various services including payment settlement fees, advertising, and customer attraction. This is the earnings model Alibaba has established.

Most recently, Alibaba has turned the big data accumulated in the digital world into a weapon with the aim of developing business in the "smart city building" field and sparking evolution in the ecosphere in partnership with various "physical business operators". At the core of these efforts is "Alibaba City Brain", which can be considered an "urban OS" for smart cities.

City Brain is a system that gathers urban big data to manage city traffic, energy and the like efficiently through AI utilization. Using data collection, processing, and analysis technologies established by Alibaba, City Brain gathers and processes, in 15-second intervals, (1) videos from live

Fig. 3: Alibaba's "City Brain" Introduced in Hangzhou City



road cameras and surveillance cameras installed by police, (2) GPS data and operation information for taxis, ride shares, and distributor trucks, (3) data from telecom businesses, (4) operation information for bus lines and other public transit organizations, and (5) data from map and LBS. This process has made it possible to predict traffic congestion with machine learning, automatically detect traffic accidents using Alibaba's image recognition AI, and trace vehicles that have traffic violations, among other benefits.

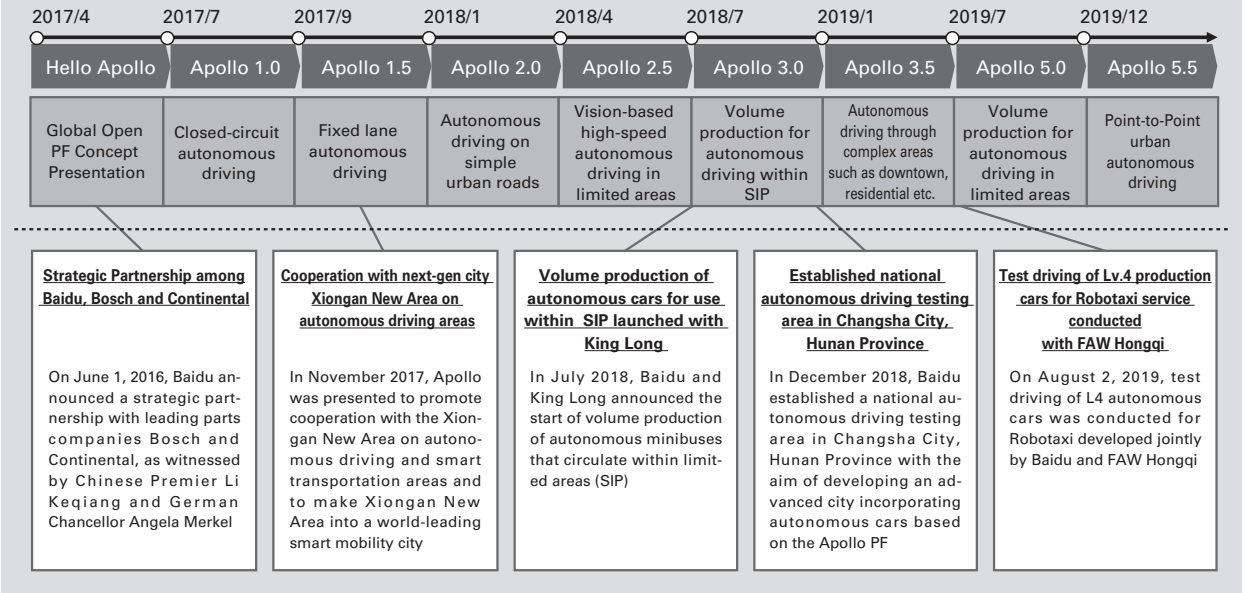
Starting from the company's headquarters in Hangzhou (Table 3), Alibaba's smart city projects have been developed in 7 regions in China and one country outside China. With a budget in the hundreds of billions of yuan, these projects include MaaS and the creation of smart traffic systems, and the development and procurement of required hardware products is being conducted jointly with partner enterprises.

■ Baidu's Apollo Plan

Baidu, which has been called "the Google of China", is focused primarily on the internet search business and has abundant knowledge in AI and big data analysis. The "New Generation Artificial Intelligence Development Plan", a national strategy, has likewise designated Baidu as one of the "leading enterprises" pulling the entire industry forward.

In 2017, Baidu made a full-scale entry

Fig. 4: The Steps in Baidu's Apollo Plan



into the "AI × automatic driving" field, establishing a cross-industry next-generation automobile consortium named the "Apollo Plan" (Table 4). In addition to internal development, the company has lined up the necessary component technologies rapidly through external procurement from partners. The scope of the Apollo Plan encompasses not only cloud service platforms (high-precision mapping, big data infrastructure, etc.) and in-vehicle software layers (recognition → decision → control algorithms utilizing deep learning) that are Baidu's area of specialty, but also technological development platforms for integrated control chips and sensors, and platforms for evaluating and approving vehicles. Foreign automobile manufacturers and parts manufacturers have also recognized Baidu's strengths and involved themselves proactively in the Apollo Plan.

At the end of 2019, Baidu announced that it had 150 public road test license plates for L4 driverless vehicles, employed 36,000 developers, and was conducting public road tests in 23 cities. By fully utilizing the AI simulation technology that is Baidu's primary strength and the big data gathered through verification experiments in public road tests, these activities rapidly reached technical completion. Baidu's number of patent applications for automated driving have likewise caught up to Google and other world-leading enterprises at breakneck speed.

Drawing on the fruits of the Apollo Plan, in 2017 Baidu began pursuing automated driving verification experiments in the Xiong'an New Area discussed above, and announced its intention to turn the

Xiong'an New Area into a world-leading smart mobility city. In addition, last September saw the beginning of experimental robotaxi service in Changsha, Hunan Province. In a joint venture with a Changsha government-led investment fund, the "Apollo Intelligent Transportation" service operation company has been established, with a plan to begin commercial operation for the general public in the near future. As was discussed above, China is characterized by "social implementation first" technological development in which multiple applications are developed in succession in the course of market formation. If a virtuous circle of robotaxi market expansion and accelerating technological development takes hold, Baidu's advantageous position will be further strengthened.

3.3 Government-Led National Projects

The Chinese government has embarked on industrial development in a new form that draws on the country's robust state sovereignty and economic strength. Moving beyond the conventional grant-assisted and joint R&D frameworks for industrial development, this model provides strong support for the growth of the next-generation automotive industry through an industrial development scheme not readily imitated by other governments, in which test beds are constructed to provide wide-ranging technological verification fostering next-generation automotive industry cultivation in the physical urban spaces where ordinary people live. Many such government-led projects have already been proposed, but I will focus on three that have had particularly large impacts.

■ Xiong'an New Area (Future Smart City)

The Xiong'an New Area is a new development (green field) smart city devised by the central government in a region approximately 100 km southwest of Beijing, covering Xiong County, Rongcheng County, and Anxin County in Hebei Province; the area is a conspicuously massive, future-oriented smart city development project encompassing a total area of 1,770 km^2, with an initial development zone of 100 km^2.

One aspect of the project that warrants special mention is the fact that the urban designs are being subjected to government-led, zero-base fine-tune integration with digital infrastructures. When this sort of initiative is undertaken in an existing city, harmonization with pedestrians and manned vehicles becomes a problem; the Xiong'an New Area may become a new model in which these issues are avoided.

The next-generation mobility models demonstrated in the Xiong'an New Area going forward could become the founda-

tion for Chinese transportation policy. The government will use projects including (1) the 2022 Beijing Winter Olympics, (2) smart traffic in the Tongzhou subdistrict of Beijing, and (3) the Xiong'an New Area smart city, as opportunities to develop smart car model operations, including cooperative "human-car-road-cloud" systems. In addition, there is a plan to establish a standard model for a smart car innovation ecosystem (on-road communication networks, legislation, administration of traffic services, information security, etc.) based on the results of these projects by 2025.

■ Digital Expressways (Inter-City)

The Chinese government plans to enable autonomous cruising on expressways (smart highway plan) by utilizing 5G-based V2I technology. As a first case, the government is currently moving to create a smart highway between the cities of Hangzhou and Ningbo in preparation for the 2022 Asian Games.

Under this plan, a 161-km route through Zhejiang Province will be designed to enable autonomous cruising at a cruising speed of 120 km/h on six lanes respectively for inbound and outbound traffic, using navigation and sensor technology. At present, the average driving speed on expressways in Zhejiang Province is 90 km/h, significantly less than the 120 km/h speed limit, but the government is aiming to use smart systems and vehicular control to raise speeds by 20-30%. Sensors installed along the road will be connected to a cloud computer system, enabling real-time monitoring and remote control of all vehicles. The plan also calls for the installation of photovoltaic road surfaces and the use of underground charging systems to ensure that electric vehicles can operate.

It has also been reported that cloud-controlled dedicated automatic driving lanes (two out of eight lanes per side) based on road-vehicle communication will be installed on the "Beijing-Xiong'an Expressway" connecting Beijing and the Xiong'an New Area (total length 97 km).

All of these projects are being led by the government using a basic scheme formulated by the Chinese ICV Research Institute. Behind these efforts, the advice of major companies in China's IT and ICT (Information and Communication Technologies) industries is said to play a large role. These companies have taken the lead over other interested parties in entering the digital infrastructure field for next-generation automobiles. Alibaba Group has drawn on its strengths in road traffic big data and cloud computing to team with the government in creating the "Highway Joint Laboratory of Vehicle Infrastructure Cooperative Systems", thus rushing ahead in the development of com-

ponent technologies necessary to digitalize the highway infrastructure.

■ Shanghai International Automobile City

Smart cities and automated driving pilot areas themed around automated driving and smart traffic are under development in 10 municipalities, including Shanghai, Wuhan, Beijing, and Chongqing. These smart cities all enjoy advantages such as site quality and locally-headquartered car manufacturers, but in terms of space used for POC, business particulars, and current results, the "Shanghai International Automobile City" established in Shanghai's Jiading District can be considered the most advanced smart city.

This large-scale driving experimentation facility in Shanghai realistically recreates actual city streets and suburban roadways with the aim of achieving practical implementation of automated driving. It appears that, ultimately, 100 use patterns have been prepared in consideration of the complex road traffic environment and situation in China. Driving experiments are being undertaken using automated driving and connected cars developed by car manufacturers and parts suppliers including SAIC Motor, Chang'an Automobile, GM, Volvo, Bosch, and Pony.AI, and by research institutions including Tsinghua University, Tongji University, and the Chinese Academy of Sciences. The plan is to expand into an open environment by starting from a first stage 5-km2 closed area and pushing for the development of infrastructural facilities gradually. It is expected that upon entering the fourth stage in 2020, the facility will expand to a total area of 150 km2, and POC will be conducted using 10,000 vehicles on arterial roads totaling 500 km in length between the Anting and Hongqiao Airport areas of Jianding District.

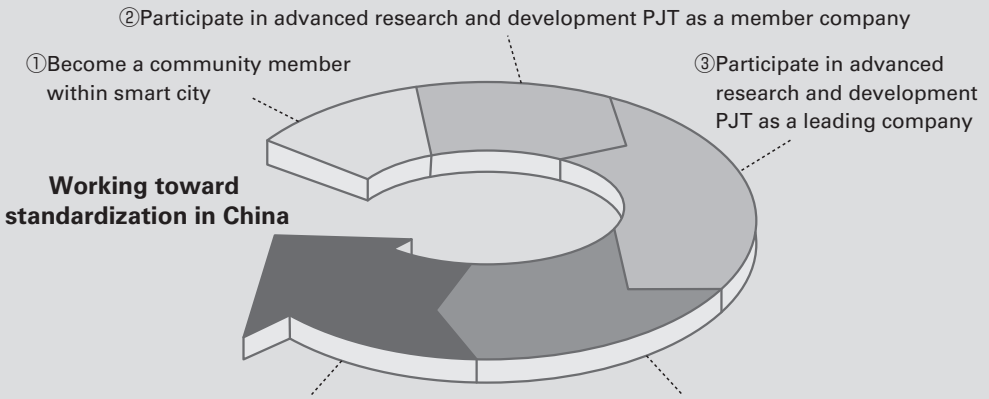
4. Chinese Key Players' Collaboration with Foreign Companies

Collaboration and partnerships are accelerating between foreign companies and China's government, major data platform developers, and component technology players.

Bosch, which has shown a commanding presence in the Chinese in-vehicle components market, has involved itself proactively in government-led smart city projects and steadily built strong relationships, thereby influencing policy for various aspects of technological standardization beneficial to its interests.

It is generally thought to be extremely difficult for foreign companies to lead or involve themselves in the standards formulation process in China directly. In smart cities, however, major industrial, academic and government institutions have

Fig. 5: The Steps for Smooth and Effective Standard Formulation via Smart City Participation



come together to pursue advance R&D, experimentation, evaluation, and standards formulation in an integrated fashion; Bosch thus regards smart cities as an opening to increase its involvement with these ecosystems and platforms.

As can be seen in Table 5, Bosch has led the formulation of various industry standards in China by strategically working through the steps of expanding its involvement in research and development in cutting-edge technology fields, involving itself in standards drafting processes in partnership with related organizations, and then expanding its presence in the standards formulation process.

In 2018, Marubeni announced a collaboration in fleet-management-related business fields with G7, a major commercial vehicle fleet management platform developer in China. They are considering jointly establishing a new lease/rental business for freezer/refrigerated trailers and other cold chain conveyance equipment in China.

G7 is a leading IoT information service data platform developer in China's distribution industry; by using in-vehicle devices to gather and analyze vehicle operation information (driving distance, acceleration, sudden braking, engine temperature, and other such data) and providing the results as information services to customers in real time, G7 provides services that improve operating efficiency, enhance safety, and otherwise serve to optimize the entire cargo transport process. Throughout China, more than 50,000 companies and 700,000 commercial vehicles are connected to G7's platforms, making G7 the world's largest commercial vehicle data platform provider.

At "Huawei Connect 2018" held in Shanghai, German auto giant Audi and

Huawei announced joint development of an automatic vehicle. The two companies announced that they had already conducted unmanned vehicle city driving tests and attained level 4 for automated driving. For mass production, the two companies intend to move forward with product development, while at the same time placing developed car models on both the Chinese and European markets.

What caught Audi's eye was Huawei's advanced technological prowess in the field of automated driving.

Huawei has developed the "MDC 600" integrated module for automatic driving. This module has eight built-in "Ascend 310" processors specialized for AI processing, and boasts specifications enabling control of 16 cameras, six millimeter-wave radars, 16 ultrasonic wave radars, and eight laser radars. The deep learning processing capability of this product is said to be up to the highest global standards, surpassing even the DRIVE AGX Pegasus automatic driving module by industry leader NVIDIA.

As detailed above, foreign companies are utilizing proactive collaboration and partnerships with key Chinese mobility players in search of ways not only to capture a Chinese market boasting the world's largest in-vehicle marketplace, but to enhance their own products by adopting Chinese-developed technology. Looking ahead, the question of how to form relationships with local Chinese players exhibiting rapid growth in their scale of business and technological capability is likely to become an even more important goal for companies looking to develop automotive business in China.

5. Suggestions for Japanese Manufacturers

The structure of China's automotive industry is experiencing ongoing changes as a result of the awakening of "Integral 2.0" and rush of new market entries occasioned by the automotive industry's transition to CASE, as detailed above. Against this backdrop, there is a high likelihood that business model and component technology innovations based on China's unique advantages will make themselves seen, exhibiting influence surpassing even that of advanced nations. For Japanese automotive-related companies, it will be essential to adopt business strategies and take measures that are tailored to these business opportunities and risks.

To achieve this, it will be necessary to begin by participating in the smart cities where verification experiments are being pursued for automated driving and next-generation traffic systems, and, through deep communication and collaboration with rule makers (government departments, associations, auxiliary organizations, etc.), to bring products to market

and advance businesses having anticipated the formulation of industry standards. At the same time, companies will have to rapidly identify the direction of developments in societal transportation infrastructures throughout China, and consider making forays into the system selling and solution selling business fields, which offer even greater added value.

Furthermore, it will be essential to partner with major IT platform developers, and thereby strive early on for the establishment of business models for the automobile use stage and the expansion of sales of component modules related to automatic driving. In the medium term, with China looking poised to become a leading market for automated driving and connected cars, it will likely be necessary to set companies' sights on collaborating with these IT platform developers to drive innovation locally in global cutting-edge technologies and business models.

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