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Inside China

The Chinese view their automotive future

Automotive



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TRANSPORTATION RESEARCH INSTITUTE
Office for the Study of Automotive Transportation

The University of Michigan Transportation Research Institute (UMTRI) Office for the Study of Automotive Transportation (OSAT)

This joint project with the IBM Institute for Business Value represents OSAT's continued focus on key issues facing the global automotive industry. It also fulfills OSAT's mission to describe and analyze the global automotive industry's current developments and future directions. This report serves as an example of the informed research and analysis that OSAT provides to industry stakeholders, including manufacturers, suppliers, retailers, labor, scholars, government, the media, and the general public.

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Introduction

Automotive manufacturers and suppliers view China as the largest combination of automotive market and low-cost manufacturing and supply base to appear in decades. Companies are deluged with information about the potential opportunities in China, but typically know very little about what the Chinese think about their automotive future. The steady influx of automotive manufacturers and suppliers over the past ten years has provided the Chinese with first hand experience of what the impact of a world-class, high-volume automotive industry can mean to a country. The Office for the Study of Automotive Transportation (OSAT) at the University of Michigan Transportation Research Institute (UMTRI) and the IBM Institute for Business Value consider this as an opportune time to explore what the Chinese themselves think about their recent automotive experience, and what they think the future will hold for this industry and their country.

Our study focuses on the opinions of 20 leaders in Chinese industry and government, as well as academic experts. We asked a wide range of questions to better understand their perspective of how the industry looks today and how they believe it will look in the future. Our questions focused on their view of the future auto market structure, how the industry will restructure, and what effect external challenges (air quality, oil supply and the transportation infrastructure) will have on the development of the industry.

For the purposes of this research, we define a foreign joint venture (JV) as an entity in which a portion of the company is owned by a non-Chinese organization. Domestic companies are those that are owned by some combination of Chinese investors and the government (central or local).

The results of our interviews tell us China shares the outside world's hope and enthusiasm for the development of its automotive market. Yet these leaders have a cautious optimism, based on their understanding of the challenges facing the industry.

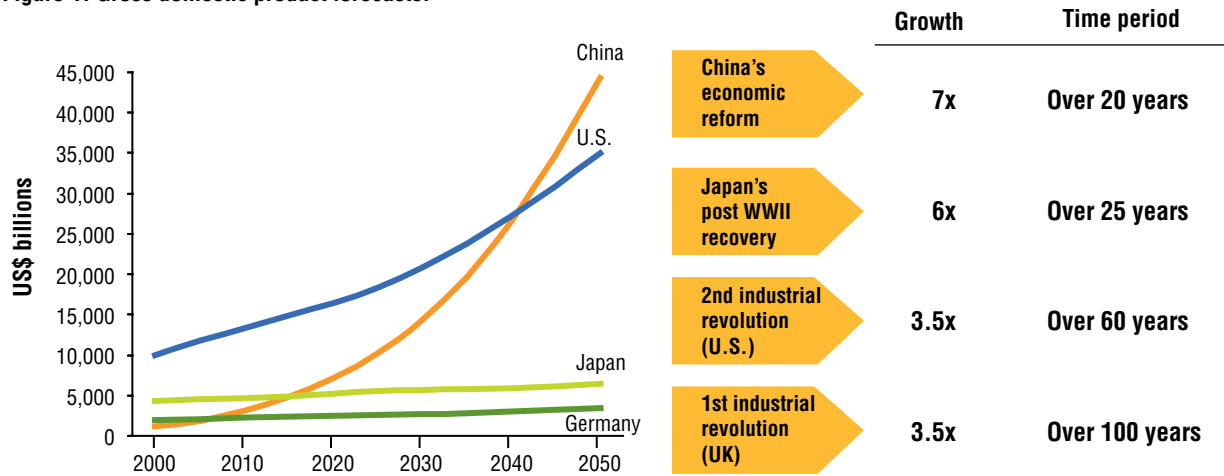
China's extraordinary market

China represents an extraordinary case of economic development in an emerging market. The number of people in the market, the number of economic reforms faced by the government, and the speed at which the country is making the transition to a full market economy all contribute to the extraordinary nature of change. As an indicator of that growth, its gross domestic product (GDP) is projected to increase more than sevenfold over the next 20 years, as shown in Figure 1. This is dramatic when compared to the amount of time other markets have taken to develop.

The automotive industry in China represents an extraordinary case of industry development. To prepare for admittance to the World Trade Organization (WTO) in 2001, China needed to open its doors to foreign investment, and that investment continues to pour in. Since 1994, foreign automakers have invested close to US\$20 billion. Billions more are planned in order to increase capacity by 2010.¹

In the early 1980s, two joint ventures dominated the small Chinese market, Shanghai Automotive Industry Corporation (SAIC) with Volkswagen, and Beijing Jeep with American Motors Corporation (now DaimlerChrysler Corporation). These companies built vehicles from imported complete knock down (CKD) kits, and had a profitable monopoly on the Chinese market. The Chinese

Figure 1. Gross domestic product forecasts.



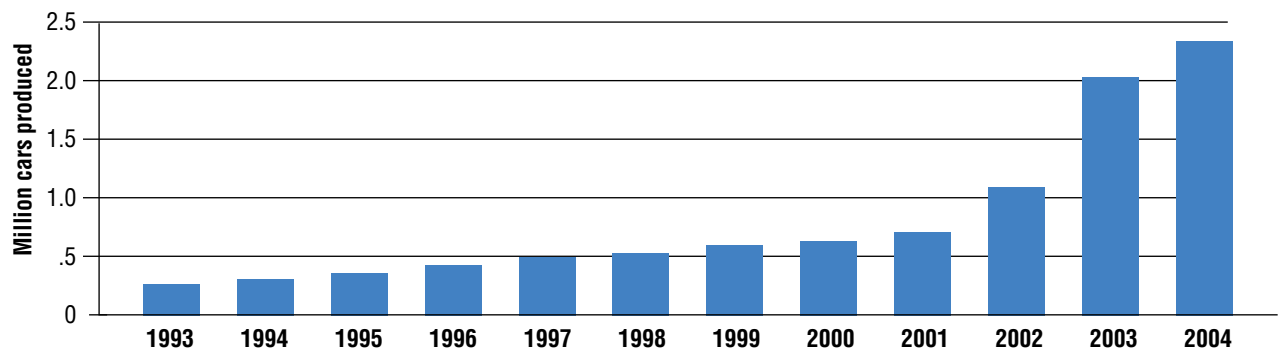
Source: Wilson, Dominic and Roopa Purushothaman. "Dreaming with BRICs: The Path to 2050." Goldman Sachs. October 1, 2003; IBM Institute for Business Value.

government, after much courting of the American Big Three in the mid-1990s, was able to establish a joint venture between General Motors and SAIC. During the last five years, the number of manufacturers and suppliers producing products in China has increased dramatically, with major global manufacturers establishing joint ventures with one or sometimes two or three domestic manufacturers. The number of domestic manufacturers has also increased to the point that more than 100

manufacturers are building some type of vehicle in China today.² Most of the companies are focused in the eastern part of China.

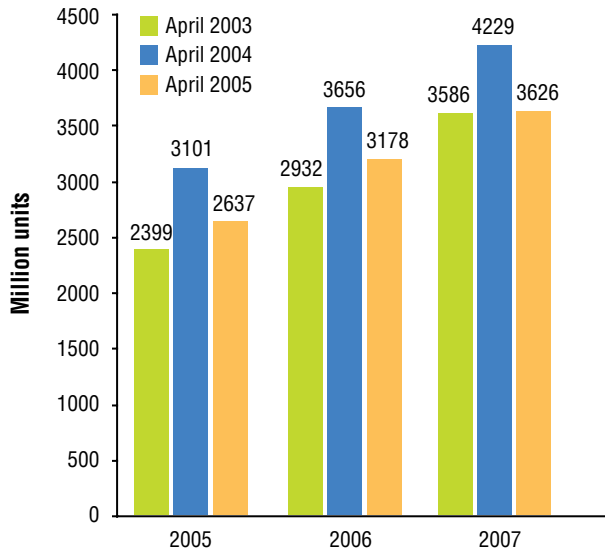
With so many companies establishing operations in China, the Chinese auto industry has grown quickly in terms of production. In 1993, only 220,000 cars were produced, while in 2004, passenger car production climbed to 2.34 million units (see Figure 2).

Figure 2. Passenger car production in China.



Source: National Bureau of Statistics of China. China Statistical Yearbook 2004; "China's vehicle output tops 5 million for 1st time in 2004." Kyodo News. January 12, 2005.

Figure 3. Annual passenger car registration forecasts from 2003, 2004 and 2005.

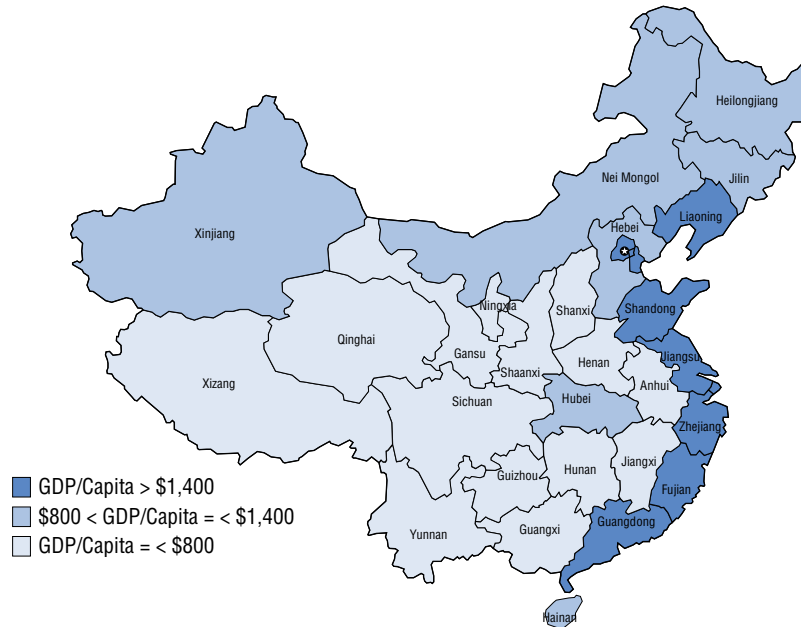


Source: Economist Intelligence Unit. "Executive Briefing: China Automotive Forecast." April 15, 2003, April 1, 2004 and April 19, 2005 (Retrieved from Factiva, a Dow Jones & Reuters Company); IBM Institute for Business Value analysis.

Although production has grown steadily, the volatility of China's emerging automotive market makes it difficult to predict future sales and production trends based on recent historical data. As shown in Figure 3, in April 2003, the Economist Intelligence Unit forecasted new passenger car registrations of 3,586 million for 2007. One year later the forecast rose to 4,229, but fell back to 3,626 million in April 2005. Despite uncertainty on the level of sales and production, both are projected to increase year over year.

When considering the Chinese market, one must take into account the vastness of the country with dramatic geographic and demographic differences. Figure 4 shows the large income discrepancies between the urban, coastal regions and the rural, inland regions. Urban income is more than three times that of rural areas, and six provinces represent over half of the market and are projected to continue that dominance with a 15 percent CAGR in 2008.³ These differences certainly impact the types and quantities of vehicles sold.

Figure 4. The wealth is concentrated in urban and eastern coast areas.



Source: National Bureau of Statistics of China. China Statistical Yearbook 2003.

The significant changes taking place in China's economy and its automotive industry over a short period of time create a sense of euphoria about the opportunities ahead, but also a sense of uncertainty about which path China will take to that future, and what the effects of different growth patterns will be on society. These ideas come out of our interviews with a select group of Chinese manufacturers, suppliers, dealers, local and national government officials, and academic experts. Results from these interviews can be categorized into three major areas:

- Future market structure: Steady growth versus exponential growth
- Industry structure: Partnerships versus independence
- External challenges: Infrastructure, air quality, and oil supply

Future market structure: Steady growth versus exponential growth

Our interviewees view the Chinese vehicle market as being in its early development phase, with growth determined by a variety of factors that may either facilitate or hinder that growth. Their varied responses to the issue of current and future market conditions reflect the enthusiasm, optimism, and uncertainty that are characteristic of a market burgeoning from the rush of foreign manufacturers and suppliers to China and the energy of a populace excited about the opportunity to participate in it.

“At present, 1000 Chinese people on average own 24 vehicles, but the global average level is 120 vehicles per 1000 people. Hence, there is still large room for improvement.”

– Government interviewee

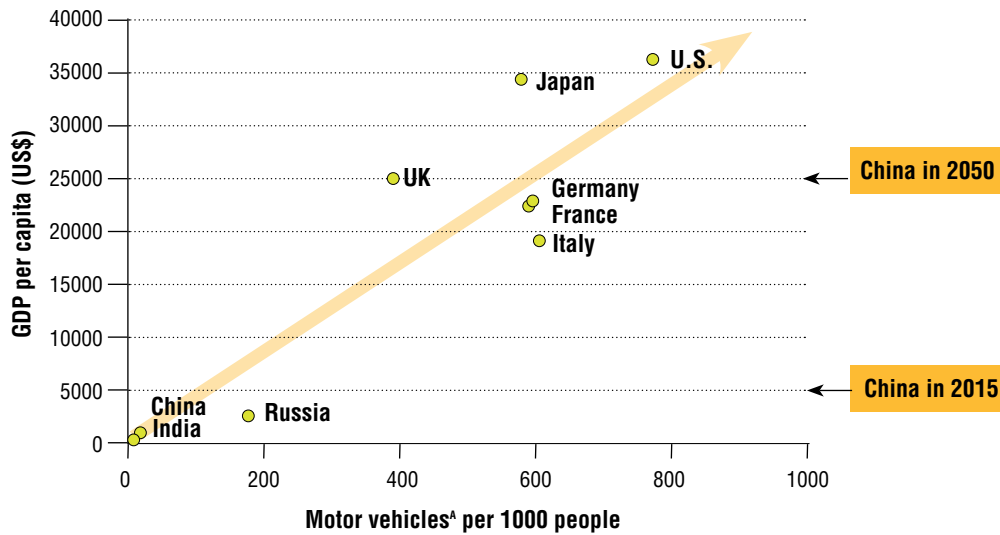
Interviewees are generally optimistic about continued growth of auto sales in China. Some suggest exponential growth, while most interviewees suggest steady growth that will have China surpassing Japan as the second largest market by 2010 – and competing with the United States as the largest market by 2015. As shown in Figure 5, as GDP per capita increases, so do vehicle sales. As GDP per capita reaches the tipping point to where households consider their incomes sufficient to warrant vehicle ownership, there is the potential for dramatic increases in sales.

But there is a tension between steady and exponential sales growth. Steady growth may provide enough time for the Chinese government to take a more deliberate approach in developing standards and policies – time that could provide domestic Chinese manufacturers, suppliers, and dealers an opportunity to build their knowledge bases and capital resources. In contrast, exponential growth may force all groups to respond quickly to market demand, potentially affecting long-term viability.

Foreign manufacturers and suppliers are bracing for the exponential growth scenario by building capacity in China to meet demand. But exponential growth could force major changes in the structure of the industry as domestic Chinese manufacturers, suppliers, and dealers struggle to compete against the foreign manufacturers and suppliers that have the products, processes, and experience to build, sell, and service higher vehicle demand. As we will see in our section on external challenges, exponential growth also may create major challenges in infrastructure, the environment, and oil supply requirements.

Several key parameters can trigger the type of growth that will take place in the Chinese automotive industry: vehicle/component export, vehicle financing, vehicle sales and service, and the used vehicle market.

Figure 5. High-income countries have more vehicles per 1000 people than developing countries.



Note:^a Cars, buses, and freight vehicles, but not two-wheelers.
Source: "World Development Indicators 2005," The World Bank, March 2005; Wilson, Dominic and Roopa Purushothaman, "Dreaming with BRICs: The Path to 2050," Goldman Sachs, October 1, 2003; IBM Institute for Business Value analysis.

Export strategies differ for domestic and joint venture manufacturers

In terms of vehicle exports, interviewees believe vehicle exports in 2010 will be in the 5 to 10 percent range, but a number of interviewees assert that foreign joint venture manufacturers will restrain exports until China's own market demand is met. This can be seen in the uncertainty of vehicle exports for 2015, where our interviewees estimated percentages of vehicle exports ranging from 5 percent to 60 percent. But several interviewees state that Chinese domestic manufacturers are pursuing overseas exports, "They are only starting now, but they will accelerate their exports."

There has been much made of Chinese domestic manufacturers building vehicles for export to established markets in the next five to ten years. To be sure, there will always be a market for inexpensive vehicles, but in order to sell in these established markets, Chinese vehicles will have to meet more stringent requirements for air quality and safety than they must meet in China.

This will demand that these manufacturers increase their technological capability and testing procedures, which can potentially increase the cost of the vehicles. These manufacturers must also develop a dealer network in each foreign country to support sales and service. All of these requirements could possibly increase the cost of their vehicles and slow the process of globalizing their products. This is not to say that Chinese vehicles will not appear on foreign shores, but because of the significant hurdles these companies must overcome, we do not anticipate a considerable amount of exports in the next five years.

Chinese domestic manufacturers can learn from history when they consider exporting to established markets. In the United States, for example, both Japanese and Korean manufacturers tried to enter the market with inexpensive vehicles that did not meet local quality levels, and it took a number of years to improve their processes to meet those levels. In the meantime, their vehicles were characterized as poor-quality vehicles by buyers, and it took years to overcome this negative image.

Besides meeting the needs of the Chinese market, foreign joint venture manufacturers have another reason for not exporting: if they export vehicles built in China but originally designed for their home markets, they will have to share the profits from those vehicles with their Chinese joint venture partners. One Chinese supplier interviewee noted this tension, "Foreign automotive manufacturers have a strict definition of market segmentation and strict control over joint venture enterprises, thus leading to some constraints on export. Manufacturing cost in China is low, but foreign manufacturers would not like to export their low-cost autos to oversea markets. This is a contradiction and produces a painful struggle."

Chinese component export strategies are completely different from vehicle export strategies. Since China joined the WTO, there are few demands that foreign suppliers must partner with a Chinese supplier. Although China component exports have been increasing, our interviewees were hesitant to predict what the export percentage would be in the future. The few that did respond to this question suggested that approximately 50 percent of components built in China will be exported in 2010 and 2015. According to the China Auto Supplier Survey, Chinese domestic firms plan to focus on Southeast Asia for export development, while foreign joint ventures focus on Southeast Asia, Japan, and the United States.⁴

Vehicle financing provides an important tool for market development

The China vehicle financing market is still an underdeveloped one. The first wave of buyers at the turn of the century typically had cash savings to pay for their new vehicles. The second wave of buyers used savings and vehicle loans. A series of defaults on vehicle loans in 2003 forced the government to rethink its policies on vehicle financing, so less than 20 percent of vehicles sold in 2004 were financed by some form of lending institution.⁵

Subsequent waves of buyers may use a combination of cash and loans to finance their purchases. Issues such as the transition to a market economy, a lack of collateral by people outside the cities, and the transparency

of information on households that allows credit risk assessment are all major challenges to overcome before vehicle financing will be viable. If loans are not widely available, new vehicle buyers may choose to purchase less expensive new vehicles or used vehicles. This could create a dramatic shift in the number and types of vehicles produced in China. These financing issues raise two major questions:

- How long will it take for the government to address these issues?
- How long will it take for companies to adjust their business models as the government rolls out new policies and standards for loans?

The government has begun issuing new financing policies and has allowed a number of manufacturers to develop their own financing units. These companies are implementing services for vehicle loans, and are incorporating such techniques as training specialists for home visits to assess customer credit status and educating their brand dealers to provide feedback about customers. Dealers are also trained to assess customer credit status through their communication with customers. Until the government finalizes standards for assessing credit risk, these manufacturers that set up their own risk assessment to control defaults have an important competitive advantage in selling vehicles.

The government has tried to control this advantage by limiting the amount of money a finance company can make. This keeps companies from growing too fast and allows other companies to catch up if one company comes up with a good idea and becomes very successful. But companies that develop processes to provide loans are not only selling vehicles, they are learning more about their customers and creating relationships with them. They are teaching them how to manage loan payments, thus extending their buying power. Also, being the first company to help buyers manage these types of financial relationships establishes a level of trust with the buyer that can be invaluable for future purchases of new vehicles, accessories, service, insurance, and any other ancillary products manufacturers may market.

One can look at the China market as the opportunity for manufacturers to manage the complete lifecycle of their customers from their first vehicle purchase and all subsequent purchases of new and used vehicles and associated services and products over the course of the customers' lifetime.

Understanding vehicle buying preferences of Chinese buyers is important for future competitiveness

Most new vehicle buyers in China are first-time purchasers, so as with financing, manufacturers have an opportunity to develop a long lasting relationship with their customers by providing vehicles that not only meet buyers' needs but also "surprise and delight" buyers. Manufacturers are seeking market share at this point in the industry's development because companies that have larger shares have a positive psychological effect on consumers.

Most interviewees report that Chinese vehicle buyers, like the industry itself, are in the early stage of developing their purchasing preferences. Yet the top five purchasing factors interviewees cite are similar to the top purchasing factors in the United States: price, brand, fuel economy, exterior styling, and after-sales service. U.S. vehicle buyers may prioritize them differently, but these factors seem to represent important universal components of a vehicle purchasing paradigm.

Price and fuel economy relate to the buyer's sensitivity to the cost and operation of a vehicle; brand relates to the reputation of a manufacturer in a country, which may be based on a combination of factors including previous experience, word of mouth, advertising or industry awards; exterior styling relates to a visceral sense buyers have to all objects, especially those they are purchasing with a significant amount of money; and after-sales service relates to the uncertainty of the need for repairs.

“At present, it is not the consumers leading the market but the market leading consumers.”

– Supplier interviewee

But will the next wave of new vehicle buyers, either first- or second-time buyers, focus on these same purchasing factors, or will factors such as safety, technology, quality, incentives or resale value play more important roles? What role will brand loyalty play in future purchase decisions? Are there true differences in purchasing factors between buyers in Western China and Eastern China or between people residing in cities and those in the countryside, as noted by some interviewees? How long will first-time buyers keep their vehicles?

“Car models are mostly dominated by manufacturers, and the market is a sellers' market. Few efforts have been done in studying local consumer habits.”

– Manufacturer interviewee

When considering purchasing factors, there is consensus on one issue: prices of new vehicles in China today are higher than comparable vehicles outside of China, as shown in Figure 6. Though all interviewees think prices will gradually decrease in the future, there is some uncertainty about how much they will decrease. One expert sees this issue as core to the future development of the market, “China's vehicles are more expensive than similar international vehicles, and in the future, they will be cheaper than foreign ones. Otherwise, there will be no development of the industry.”

Same car, different price

Here are some examples of new vehicle price differences between China and the United States.

Figure 6. Price premiums inside China.

	U.S. (US\$)	China (US\$)	China premium
BMW 325i	30,900	50,559	63%
Mitsubishi Outlander 4x2/2WD	18,499	20,700	12%
Toyota Corolla 1.8L	14,640	17,324	18%

Note: Specifications may vary in different markets. Exchange rates used: 1 Euro = 1.2055 USD, 1 RMB = 0.1239 USD.

Sources: “Price of select car, MPV, and SUV models,” China Automotive Review, May 2005; Company data (as of November 2005); IBM Business Consulting Services analysis.

Our experts have some interesting views on the effects of changing prices: Some see prices as part of the shakeout of the industry, with domestic Chinese manufacturers focusing on low-end vehicles, and foreign manufacturers controlling the mid-level and high-end vehicles. Others see domestic Chinese manufacturers eventually playing at the level of high-end vehicles. One interviewee really does not see prices changing the industry because of the higher number of buyers who will enter the market. "I think lowered prices will not exert observable effects on the manufacturers, suppliers, and dealers because lowered prices are based on increased sales volume. I think the manufacturers will only see lower profit margins. But sales will go up and so will the gross profit. And more and more consumers will be able to afford a car."

Some 2005 prices have already been lowered as sales slowed in 2004. For example, in April 2004, the Chevrolet Spark cost US\$7,500, and the Chery QQ cost US\$6,000, while in September of 2005, the Spark cost US\$5,800 and the QQ cost US\$4,000.⁶ Lower prices could potentially mean lower profit margins for manufacturers and dealers, creating fierce competition. One interviewee states "This will make dealers more proactive in selling vehicles rather than reactive as they are now. They will be interested in finding out customer preferences and improve their service operations. Only the best-managed will survive."

Dealerships must evolve to a model of servicing vehicles and selling new and used vehicles

One manufacturer stated, "I have always been confident that the size of the automobile industry in the United States today is our tomorrow." As in the United States, Chinese dealerships are the face of the brand, and they play a key role in managing the relationship between the manufacturer and the customer. With first-time buyers, Chinese dealers play an even more important role in directing buyers to their first vehicle purchase. Unfortunately, the current state of sales and service varies greatly.

"Behavioral differences among the local and foreign brand dealers lie in sales and service systems, where the local brand dealers do not perform well. No matter what form of service, the customers are underserved."

– Supplier interviewee

Foreign manufacturers that are opening dealerships in China have the opportunity to learn from any mistakes they may have made in their home countries when setting up a dealer system, and use the clean slate available to them to manage the customer experience from the purchase of their first vehicle (new or used) to the last. Dealers understand the opportunity for developing the "customer for life" scenario and look forward to the opportunity to sell financing and used vehicles, as well as new vehicles and service, much like their global counterparts.

Used vehicles in China represent the "final frontier" of vehicle sales. As new vehicle sales continue to grow, the number of used vehicles that appear on the market is expected to grow as well. But the current process for selling used vehicles is cumbersome and costly. One interviewee estimates that the cost of a late-model used vehicle, including taxes and commissions, would be nearly the same as a comparable new vehicle. One supplier reports, "... you need instructions from a professional expert when buying a used vehicle. The market is not well regulated." Timely government reform of this process will provide manufacturers and dealers another tool to aid with sales to the next wave of buyers who are purchasing their second new vehicle.

The resale value of used vehicles will play an important role in the near- and long-term success of vehicle manufacturers. In the near term, as first-time buyers return to the market to purchase a new vehicle, they will use their current vehicle as a trade-in for a new vehicle. As one manufacturer interviewee notes, "Automotive manufacturers will pay more attention to the resale value of their

Change is in the air

Things are changing quickly in China. Our interviewees report that the used vehicle process was so unmanageable that they thought the market for used vehicles would not develop unless the government brought out new standards and policies to support it. One could even argue that the government might not allow the used vehicle market to develop in order to support the new vehicle market. But change is in the air in China. The government has issued new regulations that lower the barriers to engage in used vehicle sales and provide consumer protections in record-keeping and warranty periods for used vehicles. These new regulations apply only to privately owned used vehicle dealerships, not to individual-to-individual sales.⁷

vehicles to help sell new cars. It will fuel additional profits in the future by providing a trade-in value for customers.” In the near term, consumers may be shocked or pleasantly surprised when they trade in a vehicle. Prices for used vehicles will probably vary greatly among sellers because there are no financial bodies or industry guides that accumulate the information on used vehicle prices and set resale values for new vehicles.

In the long term, we expect that resale values of vehicles will become established and new vehicle buyers will begin to understand the different resale values for different vehicles. This will become another factor buyers will consider when purchasing a new vehicle: how does the vehicle hold its value compared to other vehicles? Because very few manufacturers have a long-term track record in China, each manufacturer has an opportunity to start with a clean sheet and establish a resale value for its vehicles irrespective of their resale value in the rest of the world. Falling new vehicle prices will also confuse the resale value estimate unless some authority sets prices for used vehicles.

Interviewees are generally optimistic about the fast development of the used vehicle market. One dealer notes, “If the government is open to changing the policy, there will be a breakthrough in used vehicle sales. In fact, the profit from new cars will be lower, and the profit from used cars will be higher.” Used vehicles also provide dealers another possible source of profits if new vehicles sales decline.

Key implications for future market structure

The Chinese market is on track to become one of the largest automotive markets in the world. There are many different viewpoints on where the China market is and where it is going, but there are several implications to consider when assessing China’s market, based on the input from our interviewees:

- *They expect steady versus exponential growth.* Actions by the government and the competitiveness in the Chinese market foretell more of a steady growth scenario for the automotive industry. Steady growth allows more time for Chinese domestic manufacturers and suppliers to catch up technologically with foreign manufacturers and suppliers, while exponential growth might strain the resources necessary to keep up with the advantages foreign manufacturers bring with them.
- *Exports are definitely part of the plan.* Exportation of vehicles and components are part of the overall plan, but the timing and final destinations of the products differ. Chinese companies intend to export their products, but emerging markets are a primary focus. We expect that component exportation will continue to be profitable, especially if parts scrappage due to engineering changes can be reduced.
- *Exporting vehicles to developed markets is not imminent.* The logistics of establishing an entire sales and service infrastructure in an already established market can challenge even the most capable Chinese manufacturers. The export of products from a foreign joint manufacturer to its home market also has its complexities and is unlikely to happen on a large scale in the next five to ten years.
- *There is tremendous room for growth in understanding and catering to the Chinese consumer.* Companies that cater to the Chinese consumer, understand the local preferences, and leverage this knowledge across the vehicle design and sales processes will be in a much better position to retain a “customer for life.” A full complement of services (used vehicle sales, service, financing) helps establish a strong competitive advantage.
- *The Chinese government plays an important role in determining China’s future market.* Over the past 20 years, the Chinese government’s management of its economy has shaped the structure of the auto industry by determining the joint venture relationships among Chinese and foreign manufacturers. Today, it manages the growth of the market through its restriction of financing as a tool for vehicle sales. As the government’s banking reforms progress and vehicle financing becomes available, there will likely be significant opportunities for growth in auto sales.

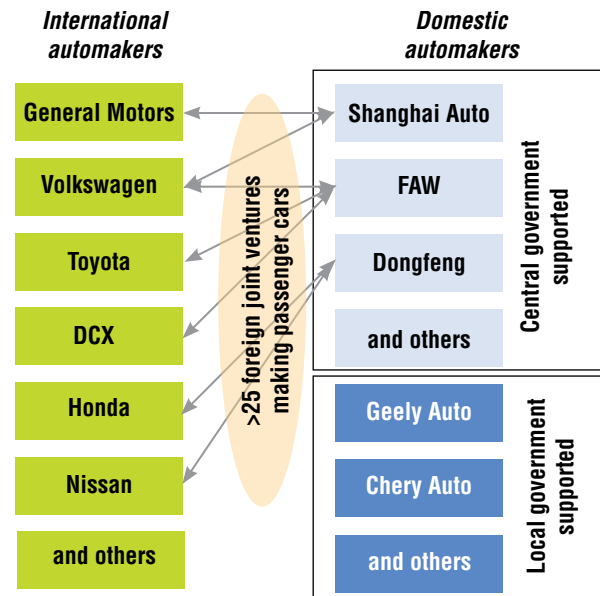
Industry structure: Partnerships versus independence

The euphoria and uncertainty that characterizes the potential Chinese market also applies to the structure of the Chinese auto industry. The industry has seen tremendous growth over the past ten years which has provided the euphoria. The uncertainty comes from the less than satisfactory relationships that have developed between the Chinese and their foreign joint venture partners.

The Chinese government's five-year plans, which are used to direct the economy, and the Automotive Industry Policy issued in 1994 both expected there to be three to nine major manufacturers building vehicles in China in the future. One stipulation requires that joint ventures producing vehicles for the local market cannot have more than 50 percent ownership by a foreign company (the 50-percent cap does not apply to the supplier base). The intent has been to facilitate the growth of Chinese research, development, and manufacturing knowledge, and to stimulate the growth of domestic automotive companies. During this time, most foreign manufacturers found a joint venture partner with a government-owned (and government-managed) Chinese manufacturer.

Though the Chinese government allowed joint ventures in the 1980s, the joint venture between General Motors and SAIC in the mid-1990s is considered the beginning of the major opening of the Chinese market to foreign manufacturers. It appears that the goals of this government strategy were not only to increase the local content of foreign partners, but also to provide technology transfer and an automotive supply base. Local governments, much like the individual states in the United States, are trying to develop their local economies by designating the automotive industry as a "pillar" industry in their economic development strategy, thus supporting many local Chinese manufacturers that are not part of the central government-supported manufacturers. The relationships have contributed to the complexity of the Chinese auto industry as depicted in Figure 7.

Figure 7. Today's industry structure is complex.



Source: OSAT and IBM Institute for Business Value analysis.

The new Automotive Industry Policy issued in 2004 works to address the problem of the large number of manufacturers by encouraging manufacturer mergers and acquisitions. Over time, this policy and competition may lead manufacturers to merge or be acquired by other manufacturers as they try to become one of the primary manufacturers recognized – and thus supported – by the government.⁸ To date, most vehicles are sold by government-owned automotive groups, under the foreign partner's brand.

The Chinese automotive supply base followed a similar pattern of joint ventures with foreign manufacturers as well as the development of its own domestic suppliers. But foreign and domestic suppliers have a different marketing focus than do the manufacturers. Currently, almost all of the vehicles manufactured in China are built for that market, while both domestic and foreign suppliers not only expect to supply local manufacturers but also those

manufacturers and suppliers throughout the world that are trying to lower the cost of their components. Indeed, suppliers may be almost as likely to ship their products overseas as they are to supply manufacturers building vehicles in China.

Conflicts abound in the relationships of joint venture partners

Despite the prevalence of joint ventures in China's auto industry, interviewees see significant conflicts between the joint venture partners. These conflicts are based on the uncertainty of the relationships between the partners caused by the differing views of business relationships and some basic fears of working together. The Chinese companies' fear is that, as the partner with less experience and funding, they may lose their own market as well as export opportunities if they do not develop the ability to design high-quality vehicles. As one interviewee put it, "The stronger partner becomes stronger while the weaker partner becomes weaker. The foreign capital tends to get an advantage and has stronger performance."

The fears of the foreign companies are based on China's recent history of dominating a number of areas including consumer electronics, white goods, furniture, and textiles. When foreign companies see the success of the Chinese companies in these other industries, they see themselves creating their next global competitor. When Chinese automotive companies learn how to develop high-quality vehicles, they will be able to compete on price and cost as they do in other industries. They fear these companies exporting vehicles that offer premium features at low prices to their home markets.

Our interviewees report the tension these fears create in the relationships between foreign manufacturers and their Chinese partners. The tension between the foreign and Chinese cultures in each joint venture enterprise often elicits actions that discourage the development of a unifying culture. One supplier interviewee clearly recognizes this conflict, "Culture is a big concept that deals with understanding [how] Chinese and foreign

cultures [work] together on the same team. The team must be open and innovative, which will drive the enterprise to develop in the correct direction. If each party insists on its own position and reaches no consensus, the joint venture actually has no culture or only one culture featured over another." Another interviewee notes a similar challenge at the individual, managerial level, "Understanding between the partners has improved, but there are still some problems with foreign managers. Foreign manufacturers perform scientific management well, but there is not enough suitable management art in dealing with Chinese thinking, styles, and culture, such as coordination with Chinese employees. To solve these problems requires equal respect for both groups."

Another major issue confronting the joint venture relationship is the sharing of profits and its relationship to the need for Chinese firms to develop their own research and development capability. Currently, as one of our industry expert interviewees reports, "The production costs of joint ventures include a fee for technology importing, equipment purchasing (for equipment that is not available via domestic manufacturing), and component importing. And half of the profit is given to the foreign partners after the product is sold. Therefore the foreign partner gains the lion's share."

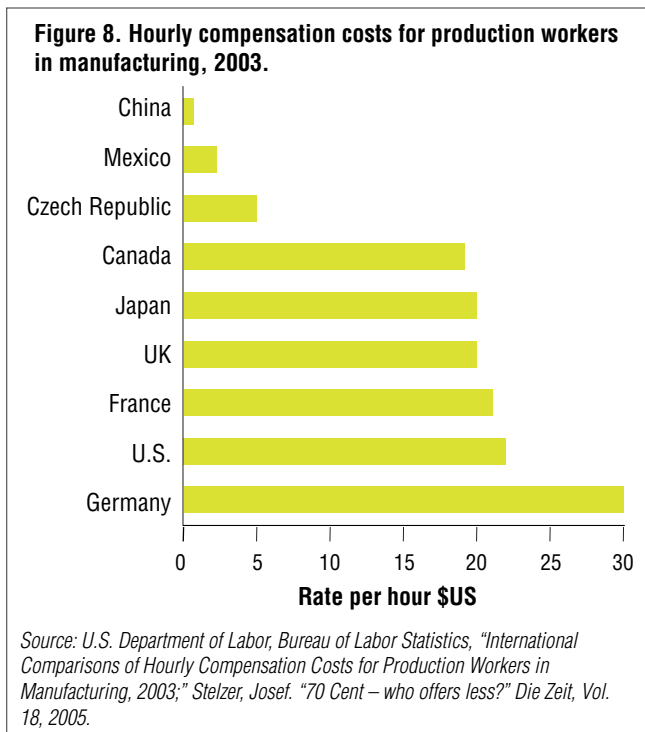
Chinese companies understand that the current state of the industry requires importation, but they also focus on the need to improve their own research and development capability, which they do not obtain from the joint venture if core technology, equipment, and components are imported. They need a mechanism that allows them to develop their research and development capabilities without violating their partner's intellectual property.

Finally, one government interviewee notes how the market contributes to inadequate development of techniques and technical skills of Chinese companies. "When customers are sensitive to price, more technology will mean higher cost, and a company's competitive advantage will be lost.

The drive for improving the technical levels of joint venture companies is not strong because it will greatly increase the cost of the final product. In this stage of market development, the key point is to develop market share.”

Chinese companies foresee ten years or more to reach world-class levels

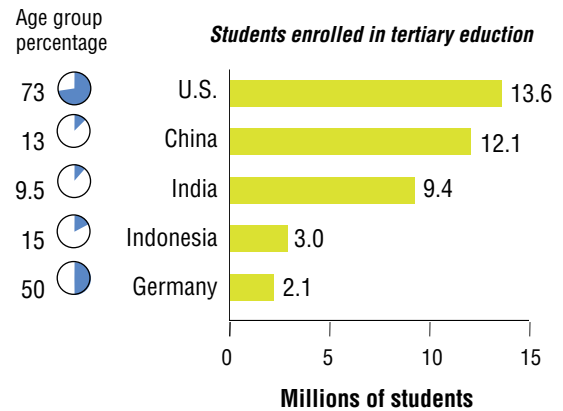
China has experienced tremendous foreign investment not only because of its potential market, but also because of its cost advantages, either in the basic cost of doing business or in the cost of labor. China’s cost of labor offers it an advantage as shown in Figure 8.



In addition to the current low labor rates, China is also graduating large numbers of college-educated individuals as shown in Figure 9.

Nevertheless, Chinese companies sometimes lack the experience in combining the necessary skills (designing, developing, testing/validating, building, marketing, and distributing) to provide vehicles that meet international standards, especially in terms of quality.

Figure 9. One of China’s core strengths is its huge base of young and highly-skilled resources.



Source: Organisation for Economic Co-Operation and Development, "Education at a glance 2005;" 2004 Education and People/Population category data, nationmaster.com

The global automotive industry has come a long way in the last decade to assure the quality of vehicles and components through extensive testing before the start of production. But Chinese companies see large gaps in many of their automotive products and processes when compared to world-class products and processes. Most interviewees expect a time frame of 10 to 30 years to close product and process gaps between Chinese manufacturers and suppliers and their world-class counterparts. The three biggest gaps cited are in design capability of components, production management capabilities, and business management skills and experience.

“Years of accumulated knowledge is available in large international corporations. Giant gaps exist not only in the technology but also in system and production knowledge, which are reflected in our sales. We are not on the same level of scale as our partners.”

– Supplier interviewee

The gaps in technology, system and production knowledge, and management skills and experience translate into issues with product quality, and many companies encounter big quality gaps with their Chinese suppliers. Quality problems encountered range from not knowing how to meet a customer's deadlines to inadequate testing of raw materials. Many foreign companies insist that international quality standards must be maintained, and as a result, many foreign companies introduce strict, centralized approaches, which are not appreciated by Chinese companies. As one interviewee states, "The foreign side insists on sending Chinese substitute components to headquarters for authentication with very strict examination and approval which may take a year and a half to finish with a cost two to three times higher than that of China's."

For the domestic Chinese manufacturers and suppliers, improving quality is an imperative. One interviewee reports that though there is some local governmental support for their companies, no amount of support will shield them from competitors with better quality vehicles; their survival over the next few years will depend on their ability to overcome the quality gap.

However, one of the areas where our Chinese interviewees see opportunities for supporting their joint venture partners is in marketing to the Chinese people. Though they acknowledge that the foreign companies bring expertise in marketing research, many are convinced that foreign manufacturers, especially U.S. and European manufacturers, cannot develop vehicles for their market without being there or at least having input from Chinese engineers and marketers. They conclude there is an Asian design mentality that automakers from Korea, Japan, and China understand better than Western designers. One interviewee notes that some joint ventures are less successful because they will not accept suggestions from their Chinese partners about what products are a good fit for the Chinese market.

Joint venture knowledge sharing looks different from the Chinese perspective

Chinese companies agree that intellectual property (IP) issues are a problem now, but they are confident this will diminish. Many see it as a natural phenomenon in the startup of an industry and point out that this same situation happened when other countries' auto industries were developing (imitation being the sincerest form of flattery, as the adage goes). Others see IP issues as more of a business culture issue, where imitation has become an acceptable way of doing business. Changing the business culture is an enormous task, but the Chinese government has an opportunity to begin the process when it rules on some upcoming court cases. How it rules may provide direction for future relations between the Chinese and their foreign partners.

The world watches

One of the most controversial court cases involves a suit brought by General Motors against the Chinese domestic automaker Chery Automotive. There have been numerous complaints of copyright infringement of company logos and the duplication of components among other manufacturers and suppliers, but this case represents the first time a foreign automaker has alleged that an entire vehicle was copied by a Chinese domestic manufacturer.⁹ Both the Chinese and the foreign manufacturers and suppliers are watching this case closely because it may act as a turning point in shaping Chinese business ethics in the future.

It will be a difficult decision for the government because domestic manufacturers are struggling to gain market share with their current products while trying to develop the next generation of vehicles. If Chery is found guilty, the ruling would send a strong signal supporting intellectual property rights, but it might also put Chery out of business. Siding with Chery against General Motors might make technology sharing even less likely, and may move foreign manufacturers to become even more independent of their joint venture partners.

Another main reason for conflict on IP issues may be the different interests of the two partners in the joint venture. Today, many foreign partners are disappointed about the efficiency of the "go-to-market" support from Chinese companies. Foreign partners perceive that their Chinese partners are not adding the expected business

value they hoped would be part of the relationship. An industry expert interviewee suggests that foreign automakers are more interested in increasing the return on their investment rather than developing the JV. Another interviewee summed it up by stating, “The foreign partner feels that technology transfer should be for the investors’ benefit and not the joint venture’s benefit.” The Chinese partners are also concerned about the unwillingness of their foreign partners to share core technology and process knowledge. As one government interviewee noted, “Though the stock-holding proportion is equal, the Chinese side has little control or power [over] the technical aspects. Developing our own intellectual property is something our country advocated and expected through these JVs, but there has been little substantial progress.”

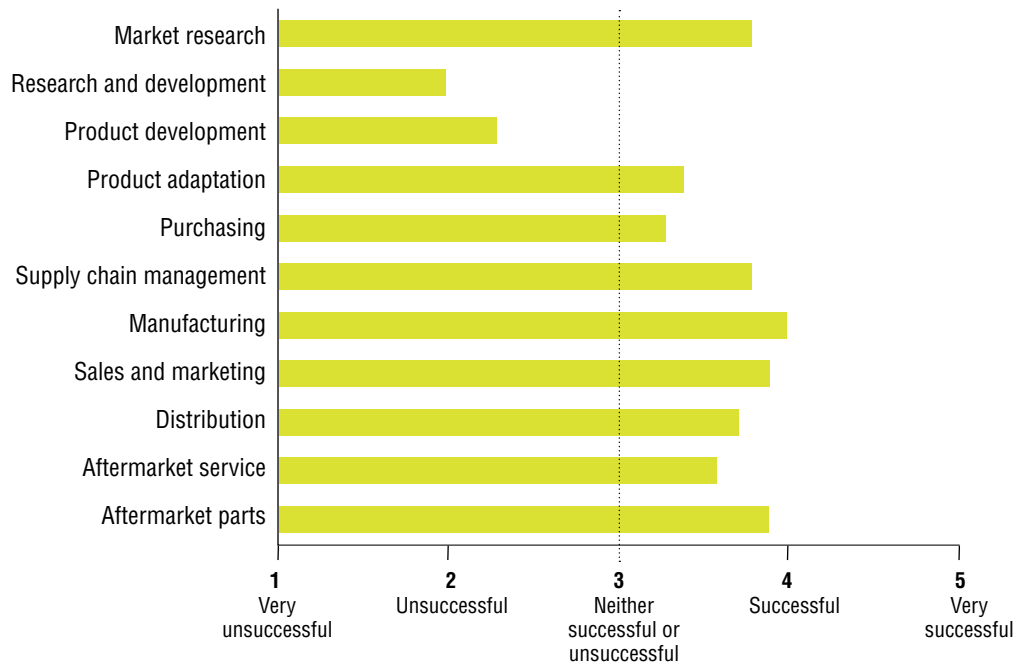
Though Chinese automotive companies are disappointed about not gaining access to core technology, this does not mean they consider joint ventures un-

successful. Interviewees rated most functions or activities as close to successful, as shown in Figure 10. The only exceptions are research and product development. These exceptions are part of the technology sharing challenge already mentioned, but the numerous areas where the joint ventures have been successful show that strong bonds have been formed. If the business culture changes and IP protection becomes a valued part of the relationship, these successes may provide the foundation for technology sharing.

The Chinese plan alternatives to joint ventures to acquire technology and skills

Despite the large gaps reported by our Chinese interviewees between Chinese manufacturers’ and suppliers’ performance and world-class levels of products and processes, Chinese companies recognize they must develop these capabilities in order to survive. As one interviewee states: they have no other options. If they do not continually improve their products, profits will likely

Figure 10. How successful is collaboration?



Note: n=20

Source: Study interviews conducted by the Office for the Study of Automotive Transportation (OSAT) at the University of Michigan Transportation Research Institute (UMTRI) and the IBM Institute for Business Value.

level off, and companies may be forced to increase production, which then begins the downward spiral of volume versus profit.

“Core technology can’t be developed very quickly, instead, it can only be gained by accumulating knowledge over time... It’s impossible to quickly develop these technologies by ourselves.”

– *Manufacturer interviewee*

In order to close these gaps, the Chinese are trying the following approaches to acquire knowledge and technology:

- Purchasing technologies or the companies that have the needed technologies
- Performing cooperative development with foreign manufacturers or suppliers
- Obtaining help from foreign engineering services firms
- Working with global, tier-one suppliers.

Purchasing technologies or the companies that have the needed technologies

A recent example of the acquisition of new technology is the government-owned carmaker Shanghai Automotive Industry Corporation (SAIC) that currently builds cars for Volkswagen and General Motors in separate joint ventures. SAIC last year bought SsangYong, a South Korean maker of sports utility vehicles. In 2004, it purchased a number of intellectual property rights from the now bankrupt MG Rover. SAIC will begin production of a sedan based on the Rover 75 lower-premium model in China in late 2006. The sedan is likely to be sold as the first SAIC-badged car. Former MG Rover researchers will help with the engineering changes to adapt the car to China. At SAIC’s request, a British engineering services subcontractor has hired dozens of former MG Rover researchers to work on SAIC projects.¹⁰

Performing cooperative development with foreign manufacturers or suppliers

Cooperative development with foreign manufacturers or suppliers seems like the very definition of the term “joint venture.” But in the context of China, the joint venture is seen as joint manufacturing and marketing of vehicles the foreign partner has already developed outside China and is bringing to China to adapt, build, and sell. As noted earlier, the Chinese are disappointed that cooperative development has not occurred, so there is a need to develop a “win-win” situation for both groups. One method proposed by General Motors’ CEO Rick Wagoner is to jointly develop a completely new vehicle that will be designed for the Chinese market and would not compete with its joint venture models. Wagoner says that “It’s really pivotal for a company’s development to embrace its own brands.”¹¹ It is more of a long-term mission, probably 10 or 20 years, but it is necessary for long-term survival in the automotive industry. The government recognizes this need and is planning to support such ventures.

Once companies have developed a vehicle that can be benchmarked against the competition, a Chinese manufacturer can enlist the aid of the joint venture partner to improve processes and the vehicle itself. One such example occurred in Romania ten years ago when the Romanian auto company Dacia was able to optimize design, improve quality, and cut costs of its own cars with the help of its partner Renault’s technological platform, management experience, and sales network. Not only has it kept the brands, but the company has seized a larger market share in the country.¹²

“Cooperation will be better. The country will be asking the joint venture to develop separate brands in collaboration with the joint venture partners, which will provide benefits to both sides of the JV. And the foreign partner will save a great deal of development cost.”

– *Government interviewee*

Obtaining help from foreign engineering services firms

One of the problems with copying technology is that a manufacturer's engineers do not learn from all the failures that led up to the final product. Engineers and the company do not have the accumulated experience of past successes and failures to make good decisions about the time and activities it takes to develop future technology. Companies that have the benefit of developing their own internal engineering capability will be well-positioned in the future to compete. However, companies that compete in today's market must find ways to respond quickly to market changes. This explains why the domestic Chinese manufacturers are looking to outsource some of their engineering and design.

“There are lots of global engineering firms, especially from Europe that can help with styling, prototypes, and power-train development. These organizations can offer lots of experience, and they have no competing products with the Chinese manufacturers.”

– *Chinese manufacturer interviewee*

Working with global, tier-one suppliers

A fourth alternative in gaining new technology may be through global, tier-one suppliers. These companies are already supplying complete systems to global manufacturers, so Chinese manufacturers may be able to use their expertise to provide needed technology for their vehicles. These systems will not be inexpensive, but if Chinese manufacturers choose one or two systems that will differentiate their vehicles, they might still be able to maintain their low prices. Integrating these global suppliers into their product development processes will not only help shorten their development time, but they also may be able to take advantage of the deep system knowledge and development processes these suppliers employ in their own development.

Chinese companies that can master research and product development should be able to introduce more technology on their vehicles at a lower cost because their lower labor rates help them keep development costs low. This situation probably strikes fear into global manufacturers because the Chinese could potentially introduce low-cost vehicles with high technology into the global automotive market, challenging the foreign manufacturers in their home markets as well as throughout the rest of the world. By our Chinese interviewees' own admission, this scenario will probably not play out for quite some time, but foreign manufacturers and suppliers are clearly focused on not letting it happen sooner than it would normally occur.

Less government influence is expected to lead to wholly owned foreign manufacturers in China

Our interviewees draw important distinctions between local and central government support for China's auto industry. They view the central government's role in developing the auto industry through industrial policy as slow and inefficient. By moving to more of a market adjustment model, they feel the auto industry has seen substantial development. Asked about their future expectations, most Chinese interviewees expect that the government will separate from state-owned enterprises and have less influence on the market, consistent with its actions in other industries.

“The central government should emphasize the function of regulation, with the institution in control of its own processes. It should only guide industries instead of taking control and replacing the management of enterprises.”

– *Government interviewee*

Interviewees believe the central government's biggest failure has been its inability to manage and develop China's own automotive intellectual property. Some argue that the government painted itself into a corner by entering into the WTO without first obtaining evidence that the automotive joint ventures it approved were actually transferring knowledge and technology to their Chinese partners. Once in the WTO, China would face harsh treatment from world economic leaders if it took draconian steps such as asking some foreign manufacturers to leave the country because they were not abiding by the knowledge and technology transfer goals of its national automotive policies.

Local governments practice economic development in order to increase revenue and employment in their particular areas, but the effect, though powerful in their local area, is limited on the overall industry. One interviewee thinks local governments may resist mergers between Chinese manufacturers from different provinces, especially when the market is doing well. As important investors in these local manufacturers, local governments may "protect" their investment to the detriment of the company that may need to merge in order to improve its technology or market position.

Though Chinese executives expect that the joint venture will stay the major form of relationship with foreign partners, our interviewees also expect that there will be more wholly owned foreign manufacturers and suppliers. Honda is currently the only foreign manufacturer that has majority ownership (65 percent) in a joint venture. This joint venture with Guangzhou Automobile Company in Guangdong was approved by the government because all the vehicles built at the plant are exported.¹³ As one supplier observes, "Joint investment is of value at some stage of industry development. But over time, the inherent system weaknesses will appear." The expectation is that

the government will eventually loosen the requirement for a 50-percent ownership stake in automotive manufacturing companies, paving the way for foreign manufacturers to act more independently.

Market consolidation causing an uncertain future for Chinese manufacturers and suppliers

Nearly all our interviewees expect market consolidation, driven by price pressure, with mergers taking place at the manufacturer and supplier levels. Global manufacturers and suppliers will probably lead the consolidation process and will not give up their businesses in China easily due to the potential size of the market. The question becomes: which Chinese manufacturers and suppliers will merge, be acquired or divested? The expectation is that the government will not discourage these mergers, leading to a sharp decrease in the number of Chinese manufacturers. One government interviewee sees the coming five to ten years as challenging times for manufacturers and suppliers, "In the coming five to ten years, there will be lots of changes. In the past, Sino-foreign cooperation was in its honeymoon period, and there was little conflict. With fiercer competition, some joint ventures will report deficits, and the Sino-foreign conflict will appear. The coming five years will be the breakout period. Some joint ventures will be split. How to develop the enterprise is a challenge for the joint venture partners."

The domestic Chinese manufacturers sell low-priced cars, but as the interviewees note, they do not have competitive quality, brand perception, and after-sales service. However, these companies typically have entrepreneurial leaders that are described as fresh, fast-acting, "out-of-the-box thinkers," who are eager to try new business models (see Geely sidebar). To be successful these companies need access to capital and open competition. The new auto policy is seen as the wrong step for the domestic Chinese manufacturers since deregulation is important to nurture these companies.

Geely Motors: Starting from scratch

Many small domestic Chinese automakers have faced significant obstacles in becoming viable auto manufacturers. Li Shufu typifies the efforts to overcome the obstacles through his creation of Geely Motors. Roadblocks included resistance from the Chinese government and refusal of Chinese banks to lend him the capital to become a private carmaker in China. He used unorthodox alternatives such as purchasing a building that had formerly been used to house ducks and chickens to house his first facility, and began by studying foreign-made vehicles. This “study” included disassembling these vehicles in order to learn whatever the company could from the fit, finish, and assembly of the product. Li, by his own admission, was not concerned with intellectual property rights in his initial efforts to start his company.¹⁴

One future scenario for the automotive market described by one of our industry expert interviewees has luxury-grade vehicles mainly being imported, the vehicles from joint ventures as the mid-size vehicles, and the popular small vehicles produced by independent domestic Chinese manufacturers, especially the vehicles with a total price of less than RMB 100 thousand (about US\$12,500).

Key implications for industry structure

The Chinese automotive industry is going through a number of the same challenges that other more mature markets have already passed through, but at a much faster pace and with some interesting twists.

- *Conflicts abound in joint venture relationships.* The productive business relationships the joint venture partners have developed, with the exception of research and product development, provide a good foundation for future relations, but overall success has fallen short of original expectations. Foreign manufacturers and suppliers, wary of creating their next competitor, must find ways of developing the trust needed in a joint venture relationship or risk alienating themselves from the Chinese local or central governments.
- *Mergers and acquisitions are replacing joint ventures as the next alternative in acquiring industry and technological skill.* Chinese manufacturers are acquiring companies outside of China in order to obtain necessary skills, products, and technology. They are also establishing relationships with foreign engineering services firms and specialty and global suppliers in order to develop new products, as well as enhance their skill sets and their own intellectual property.
- *Consolidation is coming.* We expect mergers and acquisitions within the Chinese auto industry to continue for the next five to ten years and beyond. It is unclear which Chinese companies will merge, be acquired, or be divested. Government deregulation and policy setting at the national and local levels will remain key factors, but the competitiveness of the China market will likely drive consolidation among manufacturers and suppliers.
- *Competitiveness will increase, not decrease.* Although many manufacturers are protected by local governments, their competitiveness could be challenged by foreign manufacturers and their joint venture partners, especially some of the Chinese joint venture partners as they begin to develop their own brands.
- *Intellectual property ownership continues to be controversial.* Intellectual property violations by domestic Chinese manufacturers and suppliers are making it increasingly difficult to partner with foreign firms and to have Chinese products accepted in the global marketplace. As Chinese manufacturers and suppliers develop their own intellectual capital, they will likely take steps to protect it.
- *Quality is a key critical success factor.* Quality is key to the long-term viability of domestic manufacturers and an absolute requirement if companies anticipate exporting their products outside of China. If Chinese manufacturers don't raise their quality levels to the level of their global competitors, they will not be able to compete.

External challenges: Infrastructure, air quality, and oil supply

One cannot discuss the euphoria and uncertainty generated by China's potential market and the growth of the automotive industry without discussing the effects on China's infrastructure, air quality, and oil supply. The effects of rapid increases in the motor vehicle population in China are not only affecting the design, development, manufacture, and sale of vehicles, but the transportation infrastructure, oil supply, and environmental sustainability of the country itself. China's civil vehicle population reached 23.8 million in 2003, increasing more than fourfold from 1990's 5.5 million.¹⁵ The rate of growth is even faster in major cities, such as Beijing and Shanghai, and this strong growth could continue for many years due to current low vehicle population levels (see Figure 11). Globally, there is concern about the impact of China's rapid automotive industry development on the world's air quality, oil supply, and other material sources such as steel.

Figure 11. Comparison of the United States and China.

	China (2004)	U.S. (2004)
Area (sq km)	9,326,410	9,161,923
Highways (km)	1,809,828	6,393,603
Population	1,306,313,812	293,655,404
Civil vehicles owned (million)	26.9	226
	Shanghai (2002)	New York (2002)
Area (sq km)	6,340	785
Highways (km)	6,286	9,718
Population (million)	16.3	8.1
Driver licenses (million)	1.4	3.2
Civil vehicles	719,000	1,950,000

Source: IBM Institute for Business Value analysis; National Bureau of Statistics of China, China Statistical Yearbook 2003; National Bureau of Statistics of China, China Statistical Yearbook 2004; U.S. Central Intelligence Agency, "The World Factbook 2005;" The Nelson A. Rockefeller Institute of Government, State University of New York, "New York State Statistical Yearbook 2004," Section M: Transportation; U.S. Census Bureau, "State and Country QuickFacts."

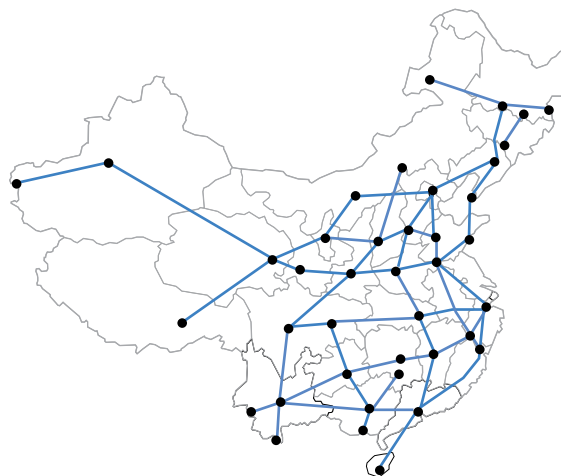
Infrastructure

In discussing infrastructure challenges affecting automotive development, our interviewees identify challenges in road infrastructure, gas station distribution, traffic management, and parking space availability.

Road infrastructure needs to link rural and urban China

The interviewees all agree that China has made great progress in the construction of expressways, and highways between cities. With a total highway length of more than 1.8 million km in 2003, and expressways accounting for 29,745 km, China now has the second longest highway system in the world (see Figure 12).¹⁶ In 2005, China's State Council announced its long-term National Expressway Network Plan to increase the expressways by a factor of four through 2035, in order to connect all cities with populations larger than 200,000.¹⁷ This will better link rural China with its urban centers.

Figure 12. Highways in China.



Source: Shen, Timothy. "Investing in Nature & Environment for Eco-tourism Development." Eco-Tourism Business Opportunities 2002 Conference, June 5-6, 2002.

There is an abundance of gas stations, but they are unevenly distributed

Key to the transportation infrastructure is the number and location of its gas stations. Compared to developed countries, China has an abundance of gas stations, but these stations are not evenly distributed, with a concentration in urban areas, and a shortage of stations in more rural areas. There are about 85,000 gas stations in China, of which 55 percent are owned by China Petroleum & Chemical Corporation (Sinopec) and China National Petroleum Corporation (CNPC).¹⁸ In addition, some gas stations are under the control of private owners, which has made oil quality unpredictable and hard to control. Cases of vehicles being badly damaged due to low quality fuel are often reported on television or in newspapers.

Management of the transportation infrastructure is a key challenge

Despite acknowledging the ongoing improvements in China's transportation infrastructure, many of our interviewees identified road traffic as a problem within cities, in particular in large cities, such as Beijing and Shanghai. One manufacturer interviewee notes, "Road traffic problems are reflected in road conditions, traffic management, traffic congestion, and limited car parking space."

Traffic congestion is a fact of life in large Chinese cities. At times, the driving speed on a number of the busiest roads in Beijing slows to only seven km/h.¹⁹ Major cities such as Beijing and Shanghai have made great efforts to build elevated ring roads, urban expressways and metro systems to enhance public transit capacity and to reduce traffic congestion.

However, compared to efforts to build more vehicles and roads, the government has paid less attention to traffic management. Traffic management is an integrated activity involving traffic planning, traffic-flow control, and congestion management for the safe and efficient movement of people and goods. Interviewees believe the biggest challenge for the government is simultaneously managing road construction, traffic congestion, and driver behavior patterns.

The specific recommendations proposed for the government's role include:

- Policies for macro-control of the traffic system
- Long-term planning and investment
- Urban planning and zoning, such as satellite cities
- Better deployment of working/living space.

No interviewees think that China should restrict car purchasing to resolve traffic congestion, but instead should restrict car usage. The methods to reach such a goal can be achieved through more investment in public transportation, special lanes for buses, limitations on automobiles in the main city zone, and economic instruments such as high parking fees.

A parking space shortage aggravates the situation

Parking is a big problem in large cities, and our interviewees believe that a parking shortage could be a barrier to future auto development. The current parking capacity can provide parking space for only 600,000 vehicles in Beijing, which has 2.4 million vehicles, and Shanghai can only provide parking space for a negligible 2 percent of its total automobiles. In Hangzhou, 1 car in every 3 has a parking space, while in Chongqing, the ratio dropped to 1 in every 13.²⁰

Most interviewees do not think automobile manufacturers and consumers can do much to improve the infrastructure problem. However, some interviewees suggest that automobile manufacturers can be more active in resolving road infrastructure problems by showing they are good corporate citizens by providing education incentives to infrastructure construction professionals or subsidizing employees who take public transportation. It was also suggested that consumers can be part of the solution as well. They can be educated to comply with regulations and encouraged to use public transportation systems, which may help to resolve current and future traffic congestion problems. Nevertheless, as with most large societal issues, our interviewees agree that the government is the key actor in dealing with China's road infrastructure challenges.

Air quality

Emissions from motor vehicles include lead, particulates, nitrogen oxides, hydrocarbons, carbon monoxide, and carbon dioxide. Most interviewees agree that industrial and residential pollution used to be the major contributors to air pollution in many Chinese cities, but motor vehicle pollution caused by the steady increase in the vehicle population has gradually made it the major contributor. In addition, rapid vehicle growth could also increase the threat of global climate change by emitting more carbon dioxide.

Catching up with European emission standards by 2010 may be very difficult

China adopted the European system for controlling emissions from new vehicles beginning in January 2000. It is aggressively pushing forward to implement these standards nationwide and is currently focusing on the implementation of Euro II for all new light-duty vehicles. The State Environmental Protection Administration (SEPA) announced that China will implement Euro III emissions standards in 2007 and Euro IV by 2010,²¹ while some local governments, such as Beijing and Shanghai, are working even more aggressively on implementation (as shown in Figure 13). As an example, Beijing advanced its deadline for enforcing Euro I standards one year ahead

of the national schedule and two years ahead for Euro II standards, but has currently postponed the implementation of Euro III due to challenges with standards and equipment.

Interviewees report a number of barriers to implementing these standards effectively:

- Difficulty in removing high sulfur content from oil during the refining process
- Low fuel quality caused by purchases from illegal sources
- Insufficient government requirements for refineries to increase fuel quality
- Policies for emission standards that change too much and too often, which make it difficult for manufacturers to prepare and implement the necessary changes
- Poor enforcement of the standards, with no strict monitoring system that requires compliance
- The high cost of vehicles that meet higher emission standards, which affects vehicle popularity.

Some interviewees express concern about China's ability to implement these standards quickly. They are skeptical that China can catch up with the standards followed by developed countries, such as the European Union and the United States, by 2010. One interviewee articulated these difficulties as, "Our foundation in controlling air pollution is not the same as developed countries like Europe and the U.S., but the progress in issuing emission standards is much faster than those in developed countries."

Government's role in dealing with vehicle emissions is regarded as key, but consumers and industry can also play a role

Similar to China's infrastructure challenges, there is a consistent view among the interviewees that the government is the key actor in vehicle emission control. The government must set rules and regulations for fuels and vehicles, strengthening enforcement of regulations through supervision and management. It must also issue policies in a scheduled time frame and in a scientific way, providing manufacturers enough transition time.

Figure 13. Vehicle emission standards in different countries.

	Euro I	Euro II	Euro III	Euro IV
European Union	1991	1996	2000	2005
China	2000	2004	2007	2010
Beijing	1999	2002	2006	2008
Hong Kong	1995	1997	2001	2006
Australia	1997	2004	2006	
India	2001	2005	2010	
Selected cities	1998	2000	2005	2010

■ Proposed

Source: Klavers, Kristine. "Asian Development Path." International Fuel Quality Center; The China Sustainable Energy Program. "China Transportation Program Strategy." June 2005; IBM Institute for Business Value and OSAT analysis.

Another potential opportunity for governmental impact is in managing China's rising vehicle fleet. As the number of both new and used vehicles grows, so too does the need to regulate the scrappage of older vehicles. But if older vehicles are left on the roads indefinitely, then the age of the vehicle fleet increases as air quality decreases. One example of government intervention on this issue is that as a precursor to the Beijing Olympics in 2008, the government is offering incentives to encourage replacement of around 70,000 older taxis to improve the air quality of the city.²²

Even though there is argument that manufacturers only need to provide vehicles that meet government regulations and should not bring advanced environmental technology to the marketplace until it is demanded of them, most interviewees believe that the auto industry can be proactive by promoting vehicles that are more environmentally friendly than required by the government. The industry can accomplish this by conducting research and development on advanced clean technologies such as hybrids, fuel cells, and other alternative fuels.

This argument assumes that advanced environmental technologies will provide a competitive advantage to manufacturers or suppliers in the marketplace. This is a more market-oriented approach to environmental challenges because it allows manufacturers and suppliers to make their own strategic decisions about the viability of an environmental technology in the marketplace. Consumers can be educated and can have strong environmental awareness, which may affect their purchasing and driving conduct, which can then affect industry actions. To achieve this goal, incentive policies such as driver subsidies or tax benefits may be necessary.

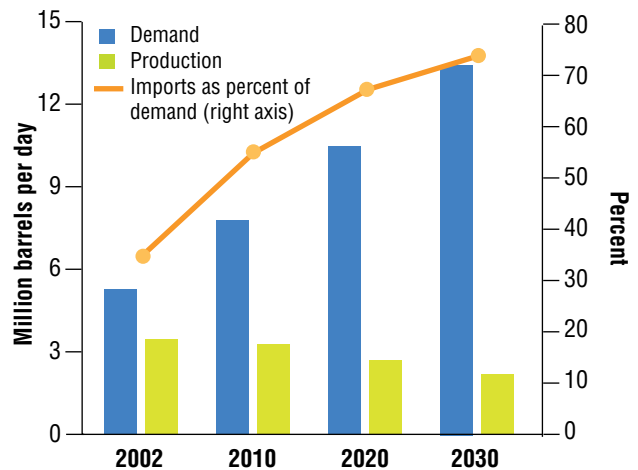
Oil supply

China became the world's second-largest oil consumer, after the United States, in 2003, and the third largest importer in 2004. Per capita oil consumption in China is currently one-fourteenth the level of the United States, and China will probably experience strong demand

for oil over the mid- and long-term. Domestic crude output in China has grown very slowly over the past five years, but the demand has increased rapidly. Forty percent of its oil demand was provided by imports in 2004. Vehicle growth is a primary driving force behind China's increased demand for oil, which accounted for 33 percent of total Chinese petroleum demand. In the future, it is expected to account for 57 percent of China's total petroleum consumption. China's total import dependency is projected to grow to 75 percent by 2030 as shown in Figure 14.²³

Most interviewees agree that further auto industry development means a rapid increase in oil consumption, which could accelerate the drain on this dwindling resource and increase international tension. As stated by one interviewee, "Our demand for gasoline makes the world panic, and especially draws the concern of the United States and Japan." There are also concerns about the impact of oil dependence on China's own auto industry and the necessity of developing alternative energy. "Once China develops into an affluent society,

Figure 14. China's petroleum production, consumption, and imports.



Source: World Energy Outlook 2004, International Energy Agency, as cited in testimony of Jeffrey Logan during U.S. Senate Hearing on the Energy Information Administration's Annual Energy Outlook for 2005 Committee on Energy and Natural Resources. February 3, 2005.

the energy conflict may become an issue, and we will face a challenge if this problem cannot be solved. In the future, we must find an alternative solution to the energy problem.” The increase in oil price and demand for alternative fuel vehicles may provide China an opportunity to develop leadership in this area of the automotive industry. A combination of government, industry, and foreign support could elevate China’s capabilities in alternative fuel research and the development of sources and low fuel consumption vehicles.

China’s increasing dependence on oil may be unavoidable in the near future

China, like the United States, faces difficult decisions if it is to control the amount of fuel consumed. Today, three major issues combine to make it difficult for China to change direction away from increased oil dependency:

- *Low fuel prices that do not provide enough incentive for fuel saving.* China’s price for gasoline (together with the United States) is among the lowest in the world. China currently has no fuel taxes on gasoline, while more than 70 percent of the cost of fuel in France, Germany, and the United Kingdom is in the form of taxes.²⁴ In addition to conflicting interests among different ministries, the central government is concerned with what measures to take to reduce unexpected and undesirable financial burdens on taxi drivers and farmers. There is an expectation that China will introduce new fuel taxes around late 2005 and early 2006.²⁵
- *Fuel-efficient, small-engine vehicles are not encouraged.* Even though it is generally agreed that small vehicles are more fuel efficient, many Chinese cities currently discourage the purchase of vehicles with small engines, by preventing them from being driven on main streets. For example, in Beijing, a car with a small engine (less than a 1.0 liter air displacement level) is not allowed to run on Chang’an Street, a major thoroughfare.²⁶ Cities are worried that these small vehicles cause traffic slowdowns and affect the city’s image. This situation may change in the near future due to high oil prices and the central government’s fuel saving campaign.
- *High cost of alternative fuel vehicles.* A hybrid vehicle or one that runs on compressed natural gas may

cost US\$3,000 to US\$5,000 more than a conventional version of the same vehicle. The higher cost is a drawback for consumers. Our interviewees report that even though oil should be replaced, the high cost of alternative fueled vehicles makes this transition very difficult.

Some of our interviewees argue that China’s oil imports will not threaten the stability of the world economy and that China should and will increase oil imports. The reason is that China still accounts for a low percentage of oil imports in the world, and its position as a center of global manufacturing requires large amounts of oil consumption.

Regulations and economic policies promoting fuel efficiency are necessary for reduction of oil dependency

The government’s drive to reduce China’s dependence on oil may provide a sense of urgency for researching alternative fuels. One interviewee reports this urgency, “Fuel saving and alternative energy are two solutions to China’s oil dependency. If we cannot reduce our dependence on oil, the development rate of the auto industry will decrease.” The Chinese government has implemented an alternative fuel vehicle program, the National Clean Vehicle Action, in 12 demonstration cities.²⁷ Our interviewees suggest that the government take the following measures to increase the efficiency of oil consumption:

- Implement rules and regulations on fuel efficiency
- Encourage the purchase of vehicles with high fuel efficiency such as diesels and hybrids
- Support research and development of alternative fuels and other new technologies
- Develop economic policies promoting fuel conservation, which may include raising fuel prices.

Additional suggestions such as raising fuel prices and encouraging diesel vehicles are also proposed by our interviewees. Some interviewees suggest that consumers can play an active role in resolving China’s oil supply issue. A previous research study surveying factors affecting consumer car purchasing patterns showed that Chinese urban consumers are very sensitive to fuel prices.²⁸

Key implications of external challenges

The central government is believed to be the key actor in dealing with these challenges; however there are some differences of opinion in the order of importance of external challenges.

- *Government officials and experts view oil supply as a critical challenge for China.* The Chinese government and media have placed oil supply as a top priority due to China's increasing oil dependency. China's potential demand can have a dramatic effect on global oil supplies. Government may need to increase fuel prices and offer incentives for conservation and alternative fuel vehicle purchases in order to manage China's oil dependency.
- *Chinese manufacturers, suppliers, and dealers tend to place infrastructure as the more urgent challenge to China's auto industry.* Despite large investments in highways, connections between rural and urban Chinese cities are lacking. Traffic management in the form of traffic planning, traffic-flow control, and congestion management is considered a main area for improvement. Traffic congestion may directly influence consumer purchasing patterns if owning a car means taking longer to go to work or shopping.
- *Alternative fuel vehicle development is an area of focus.* The government's support for alternative fuel development allows it to address multiple problems including oil dependency and air quality. Developing expertise in these areas may provide China with a solution to its oil dependency and air quality challenges, as well as its lack of research and development capabilities.
- *Like alternative fuel vehicles, technologies needed to improve air quality increase the cost of vehicles.* The central government and major cities are trying to bring forward stricter air quality standards for new vehicles, but cost constraints for the new technologies hinder this process. Government must also better regulate oil refineries and gas stations in order to provide fuel that meets the standards needed for improving air quality.
- *Partnerships are critical.* Strong relationships between government and industry, and the involvement of consumers, are necessary to resolve these oil supply, air quality, and infrastructure challenges, though government will continue to be the key actor in organizing China's response.

Conclusion

Euphoria and uncertainty form the tension our Chinese industry, government, and academic leaders describe in our study of China's automotive future. They are optimistic about the development of China's automotive industry, but see significant gaps and challenges for both domestic and foreign automotive companies. The automotive industry in China shows all the signs of a market in its early stage of development:

- Too many manufacturers and poor control of quality
- An unknown and uncertain supply base in terms of quality and innovation
- Government trying to develop a market economy across all industries and sectors, not just auto, while trying to manage a soft economic landing
- A lack of collateral/ownership of property for rural workers
- A lack of transparency of information about consumers, especially credit ratings
- Low impact of local manufacturers and suppliers in new product R&D
- Inexperienced buyers in terms of understanding the new vehicle market
- No clear export strategy
- Immature joint venture relationships, with a general lack of trust between partners
- Intellectual property concerns that limit the introduction of new technology to the market.

The effects of exponential growth at the beginning of this century are impacting Chinese manufacturers, dealers, and suppliers, as well as the government, Chinese consumers, and foreign firms seeking market share.

Our study results pinpoint a number of serious challenges stemming from this rapid growth, including defaults on auto loans, uncertain relationships with joint venture partners, higher demand for oil, higher pollution levels, and severe traffic problems in the cities. The Chinese government has to determine how to manage the auto economy without harming its domestic manufacturers and suppliers or its environment.

Chinese manufacturers and suppliers (both government-supported and independently owned) realize their need for research and development capability and are taking steps to close the gap between themselves and their world-class competitors. They recognize the pressing challenge to develop enough product and process knowledge to compete against the foreign firms that aim to eventually become independent of their joint venture partners. As they generate their own intellectual property, these companies will make moves to protect it.

Based on price competition, the consolidation of the Chinese auto market has started. But in the end, how government pulls some of the key levers in the auto industry such as loans – as well as how it exits its role supporting Chinese manufacturers – may determine what the final number of manufacturers will be in the future. Global manufacturers and suppliers will be hesitant to give up on the market because of its potential size, while Chinese manufacturers and suppliers race to compete against the best manufacturers and suppliers in the world.

How the industry will look in the future – both near-term and long-term – hinges on how these challenges are addressed. Such decisions will impact China's future market structure, joint venture relationships, and its automotive infrastructure, air quality, and oil supply. We expect the Chinese automotive industry, made up of powerful competitors, to remain a dynamic force – not only in China, but in the global auto industry.

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About The Office for the Study of Automotive Transportation

The Office for the Study of Automotive Transportation, a research unit of the University of Michigan Transportation Research Institute, has performed research, analysis, and communication activities focused on the automotive industry for over 25 years.

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