



## **Master of Science Business Administration**

*The Trend of Emission Reduction is Inevitable:*

*Is It an Opportunity or Challenge for Chinese Private Automotive  
Enterprises?*



## Abstract

*With the development of economy, human concern more and more about environment protection and sustainability, especially the automotive industry, all the enterprises have been aware of that they will have no future if they cannot improve the technology of emission reduction or solve it by developing alternative energy.*

*China has attracted lots of attention due to the rapid economy development. However, automotive industry in China, in particular, Chinese private enterprises only has short history. At present, China has been the first vehicles production country, but just for manufacture. Chinese private auto enterprises are also playing an important role in this process. What will they do after being a "Manufacture King"?*

*In this thesis, we take BYD as a case study, use PEST, Five-forces, SWOT to analyse the factors those can affect the development of Chinese private automotive industry, besides, we also give some possible suggestions for them according to the analysis.*

Key words: emission reduction Chinese private automotive enterprises alternative energy electric vehicles



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# CHAPTER 1: INTRODUCTION

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In this chapter we will introduce an overview of this dissertation, discuss the background and the objectives of the study.

## **1.1 BACKGROUND OF THE STUDY**

### **1.1.1 The concern of emission reduction and environment**

On 7<sup>th</sup>, December in 2009, the United Nations Climate Change Conference opened in Copenhagen. On the eve of the General Assembly, China made a responsible commitment to the world that China's carbon dioxide emissions per unit of GDP will drop 40% ~ 45% by 2020 than in 2005. As is well known, China's economy has grown at about 10% per year on average in nearly two decades. Meanwhile, China's environmental pollution has reached a serious level; it will also threaten sustainable development if it was brought under control and from the fundamental solution radically. Besides, China in the development process also causes many problems for the United Nations. An official pointed out the major obstacle of the emergence of China is environment pollution. As for this fast-growing country, government, enterprise and citizen need to seriously consider their own role in energy saving and emission reduction. It is the time for Chinese automotive industry especially private automotive enterprises to worry about the future.

### **1.1.2 The challenges of China's automotive industry and private auto enterprises under the trend of emission reduction**

Firstly, it is known that automotive industry accounts for a significant portion of carbon emissions and auto pollution to the environment is getting more and more serious.





Bank report also illustrated that China's vehicle emission pollution was rising. Thus, what kind of policy will the Chinese government implement according to its commitment? And how those policies will influence the China's automotive industry?

Secondly, China had domestic vehicle industry before the economy reform in 1978, but it was very inefficient and only produced low-quality cars. In the last two decades, the automobile industry has experienced the fastest growth in its history. China is becoming one of the world's fastest growing markets for automobile manufactures and services, according to the statistics published in Feb.2010, China has become the top of automobile manufacturers since 2009 instead of Japan, but it is still a fledgling, especially the private automotive enterprises, there only have been about 10 years since Chinese government permitted them to produce cars. They don't have the abundant capital and human resource as State-owned enterprises or the reputation as Multinational enterprises. Energy-saving and emission reduction is not only the trend of global automotive industry but also the key to decide if they have future.

Thirdly, it is said that China's rising energy consumption has affected the global energy prices, actually, every country need more energy in the rapid economic development, especially China's economy has grown at about 10% per year on average in nearly two decades. As the global energy crisis deepening and the energy prices are rising, all the automotive enterprises in the world have to consider the energy conservation and alternative fuel. The Japan's Toyota Motor Corporation pointed out that there is no future for auto industry without environmental technology. The Company has been taken it as guidance to promote the technology on environmental protection and energy conservation in recent years. In order

industry's long-term stable development the new-fuel vehicle in China is quite necessary.

### **1.1.3 The opportunities of China's automotive industry and private auto enterprises under the trend of emission reduction**

The energy-saving and emission reduction will absolutely bring a revolution to the world's automotive industry, and these changes in regulation and technology are new for every company, so it also can bring opportunities for the Chinese private automotive enterprises.

Compare to the domestic private companies, Super Multinational auto enterprises have the advantages of capital, economy of scale, human resources and so on, however they also have the large cost of conversion. Alternative energy technologies are new for all the auto makers in the world. China's car industry still has a 15-year gap in core technology comparing to developed countries in traditional fuel vehicles, but only 5-10 years of that in alternative vehicles, (Liu 2009) in fact it means that the gap of technology has been narrowed. The Chinese private company, BYD developed a HEV (Hybrid Electric vehicle) called F3DM in 2008 (but it is sold from 2010) (Zhang 2009), which is adopted to Dual Mode technology and is even more advanced than Toyota Prius.

China has become the largest market for the auto makers in the world. It is known that the number of car ownership is increasing along with the rising of GDP per capita as the following figure according to the experience of Japan and America. (Stern 2006)

Figure 1.1 the connection between GDP per capita and the number of car ownership

GDP per capita	The number of car ownership
\$1000	one car for 5 to 11 persons
\$3000	one car for 2 to 5 persons
\$8000	one car for 3 persons
\$20,000	one car for 2 persons

As shown in figure 1.1, the fastest -growing period for the number of car ownership is when the GDP per capita is between \$1000 and \$ 3000. According to the report from Sixteenth Congress of Chinese Communist Party, China's GDP per capita has exceeded \$1000 since 2003 and will be more than \$3000 in 2020 which means Chinese automotive industry is in an explosive growth age and Chinese auto market will get more development due to geographical advantage.

China is the workshop of the world, and Chinese enterprises always have had the advantages of low-cost and sufficient labor force, which is also one of the reasons that China has become the top car manufacturer since 2009. Like other parts of the world, private enterprises in China are more flexible and responsive to the changes than the State-owned enterprises.

The last but not the least the China's government will not only implement more strict regulations regarding to the cars' emissions reduction but will also provide some incentives to support the development of automotive industry due to its commitment of emission reduction. Since economy reform in 1979 and entering



a news is from a Chinese official website(Wu 2010) that the buyers of alternative vehicles will get subsidy from government, such as ¥50,000 for each HEV and ¥200,000 for each PEV(Pure Electric vehicle). Most of Chinese auto customers advocated that they prefer to buy environmental cars if the price is reasonable. Many experts think that the subsidy policy will bring very good opportunities for alternative fuel vehicles.

## **1.2 OBJECTIVES OF THIS DISSERTATION**

We are motivated by the fact that:

China's automotive industry faces to ongoing pressures from the global trend of emission reduction, Chinese government will launch a series of policies and regulations to fulfill its obligation , therefore, there is no doubt that China's economic growth rate is bound to be affected, especially China's automotive industry.

Chinese private enterprises are as new entrants in the global automotive industry, these brands are not so famous in the world, but the rapid growth and increasing market share made them not be overlooked. For instance, Geely is gradually known by the world for independent intellectual property rights and purchasing VOLVO. We hope to attract people's more attention to Chinese automotive industry especially let people know better and more about the development of Chinese private automobiles.

Through introducing the macro environment and competition structure of China's auto industry. We want to evaluate all the internal and external factors of Chinese private auto enterprises under the background of emission reduction, we want

auto enterprises are facing to, including the changing policies caused by emission reduction, the difficulties of the commercialization of electric vehicles, etc.

Besides, we also mention some possible suggestions according to the weaknesses and aspects of Chinese private auto enterprises in the development of electric vehicles.

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## CHAPTER 2 PROBLEM DISCUSSION

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In this chapter we will focus on the problems of alternative energy automobiles, the Chinese automotive company and different types of cleaner energy that might extensively take place the oil and petroleum, also the probably strategies of the private automotive company which can be formulated to fit the Chinese current situation. We will present and describe the questions as follows:

- The emission reduction trend and the domestic regulations about the emission will launch soon. Is this will be a challenge or opportunities to the Chinese private enterprise?
- What is the leading technology in the new energy auto industry, what is the pros and cons for each pattern?
- What the problems will the electric-battery vehicles facing to in the way to commercialization?

### **2.1 THE EFFECTS OF POLICIES ON CHINESE PRIVATE AUTO COMPANIES**



December 5th, 2008, the National Development and Reform Commission issued the "reform plan of product's oil tax (draft)" and published specific fuel tax reform in the December 1st: the State Council decided to implement the oil tax reform from January 1st, 2009, to repeal waterway maintenance fees, management fees of road transport, road passenger and freight surcharges, waterway management fee, waterway passenger and freight surcharges of six charges that included in the former product oil price, ordered the government to gradually abolish the secondary road repayment charges; at the same time, the price of gasoline consumption tax levy within the tax unit increased 0.8 yuan per liter, from 0.2 yuan per liter, up to 1 yuan per liter, diesel excise tax unit increased 0.7 yuan per liter, from 0.1 yuan per liter to 0.8 yuan per liter, other refined oil consumption tax degrees higher.

After the reform, the price of refined oil consumption tax levy will be included in the price of refined oil levy. Take Beijing for example, 93 gasoline containing 0.2 yuan before the reform is 6.37 yuan, after oil prices dropped 5.44 yuan reform, which included 1 yuan of consumption tax, that is, the prices down to 4.44 yuan from 6.37 yuan, fuel tax increased to 1 yuan, then worked out the tax rate is 22.5%.

Before and after the implementation of tax reform car expenses:

***Car expenses (before)*** = oil price (before)\*Fuel consumption (Annual mileage/100\*Fuel consumption (100km)) +road maintenance fee

***Car expenses (after)*** = oil price (fuel consumption tax included)\*Fuel consumption (Annual mileage/100\*Fuel consumption (100km))

As we can see from the formula, the biggest difference of implementation the policy is canceled the original road maintenance by increasing oil consumption tax. By the NDRC vehicle fuel consumption related information, we analyzed four categories



Figure 2.1 the comparison of four categories of cars in the oil tax reform

Type	Displacement (liter)	gasoline consumption (L/100km)	Annual mileage (km)	93gasoline (yuan)		Annual road management fee (yuan)	Annual car expense (yuan)		sa (
				Before	After		Before	After	
Small scale	0.8(QQ3)	5.8	1000	6.37	5.44	1320	5015	3155	1
	1(Xiali N3)	6					5142	3264	1
Economy car	1.3(Yuyan)	7.5					6098	4080	1
	1.4(Polo)	8					6414	4352	1
	1.6(Qianlima )	9					7053	4896	1
Luxury Car	2.0(Sonata)	11					8327	5984	1
	2.4(Dongfan)	11.5					8646	6256	1
SUV	3.0(BMW X5)	14.5					10557	7888	1
	6.0(Hummer)	22	15334	9987	1				

Source: "Our country fuel oil tax reform welfare analysis", 2009 (Wang chonghe, Lichan)

our country means China

In the fuel tax reform, compared with the large proportion of emissions mode



savings ratio is 58.9%, while the BMW 3.0L displacement ratio is 33.8% cost saving. Mileage both in the same circumstances, the savings ratio reached 25.1% difference. Therefore, small displacement cars are more beneficial from the fuel tax reform.

Behind the fuel tax adjustment is a national guide for the automotive industry, using policy measures to support the low fuel consumption, small cars, which will undoubtedly lead to structural changes in the automotive industry, more economic, lower energy consumption, and environmentally friendly models, will lead the future development direction of the automobile industry.

Changan Suzuki, FAW (First Auto Work) Xiali and other low-emission vehicle companies, its products, such as Yuyan, Tianyu are more competitive in the market. Xiali share price surge when the policy issued, also reflects investors optimistic about its prospects. More importantly, the car company involved in nickel-hydrogen cars, electric cars, hydrogen cars will face a broad space for development. Committed to developing environmentally friendly energy such as BYD cars on the market outlook is more optimistic. The last but not the least, the fuel tax reform, one of the main purposes of energy consumption reduction, and with the global economic downturn, large displacement cars and will continue to fall, large displacement car companies such as General Motors, Chrysler, etc will face a double challenges of economic crisis and tax reform.

### **2.1.2 The newly revised law for energy conservation and the permission of producing new energy vehicles**

October 28, 2007 the NPC Standing Committee voted through the "The People's Republic of China Energy Conservation Law" (revised), on the same day, president Hu Jintao issued president decree, this law came into force on April 1, 2008. The





to energy conservation management and to promote the formation of an energy-oriented market mechanism. Promote energy conservation law is a powerful weapon for resource conservation, conservation-oriented and environment-friendly society building.

National Development and Reform Commission (NDRC) 2007, 3 published the "new energy vehicles production access rules (draft)", set up a 15-threshold, and the use of one vote veto system for enterprise access this field. "Rules" expressly provided that in the future "the new energy automobile production enterprises should receive permission from the State Development and Reform Commission in order to obtain production status." "Rules" define the so-called new energy as the hybrid electric vehicle (HEV), electric vehicle (BEV, including solar car) and fuel cell electric vehicle (FCEV). On November 1st, 2007, the approach officially launched and came into force, from the perspective of laws and regulations make clear that the new energy production company must have the core technologies and the production permit, these created a good policy environment for new energy vehicles production access. By the end of April 2008, the National Development and Reform Commission published the "vehicle manufacturers and products (164 approved in 2008 Notice No. 29)" display, FAW Pentium hybrid and other three types new energy cars got the "permission," This is another NDRC issued energy vehicles "permission" after the Chery A5 and Prius hybrid.

The newly enacted energy law and energy-saving type car production permit to some extent regulated the development of new energy vehicles, preventing many enterprises from the blindly imitation and those trying to occupy a certain share of this market, but also made the mandatory requirements for the automakers harbor the intention of the producing new energy vehicle.

sales and service capabilities; the vehicle production must meet the national standards, regulations and vehicle type test rules. Moreover, the company should have the products to ensure consistent capacity. And after-sales service commitment (at least cover the product quality assurance commitment to regional sales and after-sales service, after-sales service network construction, service and product training of staff, service programs and content, to provide spare parts, service time guarantee, vehicle and spare parts (like batteries) recovery, claims processing, service issues identified during the feedback, product quality, safety, environmental protection, serious problems of recall measures), and a series of measures. This certainly gives the current auto companies many difficult issues, particularly in the private automobile enterprises, in the aspects of financial, human resources, R & D capability, the development of rationality and normativity, and new energy car comprehensive after-sales service. The private car companies should not only have the ambitions to seize the market opportunities, develop energy cars, but should rationally analyze the policy, from their own specific conditions, the availability of resources to develop the new energy vehicle.

### **2.1.3 The Subsidies policy for energy saving and new energy vehicles**

Recently, the Ministry of Finance released the "Financial subsidies for energy saving and new energy vehicle demonstration and extension Interim Measures." To promote the pilot work of energy-saving and new energy vehicle demonstration in Beijing, Shanghai, Chongqing, Changchun, Dalian, Hangzhou, Jinan, Wuhan, Shenzhen, Hefei, Changsha, Kunming, Nanchang 13 main cities, use fiscal policy to encourage public transport, taxi, official affairs, sanitation and postal and other public services take the lead in promoting the use of energy-saving and new energy vehicles, give subsidies to those public department that purchase energy-saving and



This fiscal support Measures of energy conservation and new energy vehicles mainly referring to hybrid vehicles, electric vehicles and fuel cell vehicles. Subsidy standards mainly based on the basic difference price between the new energy vehicles and similar traditional vehicles, with due consideration of scale, technological progress and other factors to determine. Specifically, the passenger cars and light commercial type vehicles, the fuel-efficient hybrid vehicle accordance with the standard rate of subsidy is divided into five grades, the maximum subsidies for 50,000 yuan per vehicle; pure electric vehicles can be subsidized 60,000 yuan each; fuel cell vehicles subsidies to 250,000 yuan each. City bus and another standard, which is divided into use of hybrid vehicles to use lead-acid batteries and nickel-hydrogen batteries, lithium-ion battery types, the maximum subsidy was 80,000 yuan / vehicle, and 420,000 yuan / vehicle; pure electric car allowance standard 500,000 yuan / vehicle; fuel cell car allowances of up to 600,000 yuan / vehicle. The Measures also stipulated, energy-saving and new energy vehicles use for demonstration and popularization, must comply with hybrid passenger cars and light commercial vehicles with fuel-saving rate 5% higher than similar conventional models, fuel-saving hybrid electric bus rate to 10% above manufacturers and other key components of the battery power must be provided not less than 3 years or 150,000 km warranty period requirements.

The subsidies measures for energy saving and new energy vehicles, without doubt give a lot of hopes to the Chinese auto companies. According to statistics, at least domestic passenger business has been involved in research and development of new energy vehicles; the six major auto groups and Chery, Geely, BYD are competing to develop new energy vehicles, SAIC is investing 2.0 billion last year Yuan established the SAIC Dresdner company, specializing in the development of new energy vehicles. Obviously, the new energy vehicle is the only one direction of development in

of new energy vehicles in China auto companies only chance to get into the world stage.

## **2.2 MAIN LEADING TECHNOLOGY OF NEW ENERGY VEHICLES**

During the world's third oil crisis the 1970s, the international automobile companies have started developing all types of electric vehicles. Put in a lot of human, material and financial resources, and made a series of scientific research. As the global energy crisis deepening, the increasing depletion of oil resources and air pollution, governments and car companies generally recognized energy conservation and emissions reduction is the future development of the main direction of automotive technology, development of electric vehicles will be the best way to solve the technical difficulties.

For energy supply diversification, energy efficiency, renewable and sustainable energy that compatible with various types of vehicles in the future, we need speed up the commercialization process. Traffic electrification is the best choice to achieve this objective. (Gary Kendall)

According to China's Auto Industry Advisory Committee Chen Guangzu's definition of modern electric vehicles, it can be divided into pure electric vehicles, hybrid vehicles and fuel cell vehicles three vehicles.

### **2.2.1 Pure electric vehicles**

Pure electric vehicle is not a new concept in the car industry, GM Company and Chevrolet Volt, Saturn Vue PHEV with lithium-iron phosphate cell, BMW Mini-E with

technology has developed rapidly over the past decade, due to iron phosphate lithium-ion batteries has a great technical breakthrough, greatly enhanced the battery safety.

Pure electric vehicle is provided entirely by the electric power battery, although it has 134 years history, but still has been limited to certain specific applications and the market of electric vehicles is relatively small. Main disadvantages due to various types of batteries, common high price, short life, the external dimensions and weight of large, long charging time of serious shortcomings.

For the cost of providing electricity, the lead-acid motor and diesel power generation are roughly equal to the prices. Only to obtain energy from the cost consideration, lead-acid batteries has a certain price advantage compare to gasoline-driven, but because it was too heavy, and long charging time, so only used for speed less than 50km / h in a variety of venues cars, golf carts, garbage trucks, forklifts, and electric bicycles. Practice has proved that lead-acid batteries in the low-end products has strong market competitiveness and practicality. The main advantage of nickel-hydrogen battery is relatively long life, however, due to the cost of nickel is 60% of its, resulting in high prices of nickel-hydrogen batteries.

At present, many developed countries choose lithium-ion batteries for electric vehicle battery as a potential project for long-term development. We can believe that when the lithium-ion battery gets mature, the performance cost ratio of lithium-ion batteries can be expected to reach the level to competing with lead-acid batteries, and become the main power battery of electric vehicle.

### **2.2.2 Hybrid electric vehicle**

Driven entirely by battery power as pure electric vehicles, its performance cost ratio



companies have started developing hybrid vehicles. In 1997, Toyota first to market "pioneer" (Prius) hybrid car, and in Japan, the United States and European markets have received a great success, cumulative production and sales have more than 600,000. Subsequently, Honda, Ford, GM and some big companies in Europe, all market different types of hybrid vehicles.

Toyota Motor Company successfully launched The Prius as the first generation large scale hybrid vehicle entered the global market. Although the Prius represents a very small proportion of Toyota's global sales, it constitutes a great leap forward technology, changed the mode of fuel consumption which directly affects carbon dioxide emissions, and a great innovation to open a new market. The Toyota Motor company had been regarded as a follower in a long time; this innovative experience not only set up an example of being an environmental friendly company but also as a technological pioneer in the automotive market.

The Prius is undoubtedly a progress from the single internal combustion engine as combined a traditional gasoline engine with an electric motor. Toyota developed a system called The Hybrid Synergy Drive System that automatically switches the power between the electric motor and the internal combustion engine. The initial aim is to develop a power system less rely on the internal gasoline combustion engine at low speeds and use its full capacity when more power is needed. Compared to the same standard traditional vehicles, The Hybrid Synergy Drive System allow the vehicle to have lower fuel consumption.

However, the price of the Hybrid electric vehicles is far more expensive than the conventional vehicles in same size and power. Car repair and maintenance has too much trouble and cost is very high (if the car has problems it must return to factory maintenance. because manufacturers do not a small number of hybrids open p

### 2.2.3 Fuel cell vehicle

The liquid hydrogen and liquid oxygen fuel cell power generation was developed in the 1960s of the 20th century, first used by the United States UTC company for aerospace and military applications. The past 20 years, since the oil crisis and the worsening air pollution, the proton exchange membrane fuel cell technology gradually got the attention of a lot of countries. Major multinational car companies have invested heavily developed various types of fuel cell electric vehicle (FCEV). Proton exchange membrane fuel cell (PEMFC) has many advantages. The resultant emission is water and water vapor, nearly zero pollution; energy conversion efficiency as high as 60-70%; no mechanical vibration, low noise, low heat radiation; 75% of the Universe's mass is hydrogen, hydrogen is almost everywhere on Earth. Hydrogen is the lightest chemical element in the mass and best elements in thermal conductivity and combustion performance; high calorific value of hydrogen, 1kg of hydrogen heat value equals 3.8 liters of gasoline.

The fuel cell vehicle has made a series of major scientific and technological achievements, but it exposed a number of technical and economic issues. The durability of fuel cell engine life is short, typically only 1000-1200 hours, fuel cell vehicles running 4-5 million km, the power is getting down about 40%, with a dramatic gap with the traditional internal combustion engine which can travel 50000 km or more. Fuel cell engine manufacturing costs is very high, generally estimated about 3,000 U.S. dollars / kW, and is 10 times of traditional internal combustion engine. Fuel cell engine on the adaptability of the work environment is very poor, can only be stable under the working temperature 0-40 °C; Very sensitive to the dust, carbon monoxide, sulfide in the air, highly failure with contaminated platinum catalyst poisoning.

space. During the 1990s there was great change in size and today's experimental fuel cell vehicles appearance, in terms of packaging and presentation, exactly the same as like traditional internal combustion vehicles. Toyota's Highlander-based FCV is a good example. This is an area that does not in itself because disruptive change as captures skills and investments largely already in place. The difficult issue is the fuel itself. Most automotive fuel cells depends on pure hydrogen. This is a substance that does not exist in this form on Earth. On earth it only occurs bound with oxygen in the form of water, or bound with carbon in a range of hydrocarbons. In other words, a process that can separate the hydrogen from these other elements is indispensable and this process requires a large amount of energy (Nieuwenhuis, 2005a).

Another way is directly use hydrocarbon fuels such as methanol or even petrol. This would no doubt increase the weight and complexity to the vehicle and would also use a large amount of energy. It would certainly get rid of the large hydrogen production facilities and for a hydrogen distribution infrastructure. Recent experiments shows that use the liquid hydrogen, a car can travel a range about 300 miles supported by adequate fuel. This shows that the industry is achieving a steady rate of improvements in the move towards practical fuel cell cars. If this research keep going on, we are likely to see hydrogen fuel cell vehicles come into service in the short future and certainly by the much forecast 2012–2015 period.

## **2.3 THE DIFFICULTIES OF COMMERCIALIZATION FOR ELECTRIC VEHICLES**

### **2.3.1 The foundation of auto industry based on is still weak**

Although China is the emerging electric vehicles (especially BEV) field



the basis of the existing automotive industry. We should be clear that the level of Chinese traditional car manufacturing technology is still has a big gap between the developed countries, mainly in the design and development, key components and installation of vehicle. Which, especially the backwardness in the vehicle and chassis design and development areas, this was mainly due to a late start, resulting in less accumulation and lack of comprehensive experimental database for car design and other issues. In the aspect of core components, the development level and the manufacturing process of the engine, transmission and other key components, still has a big gap with the international advanced level. From the view of vehicle installation, the Chinese enterprises are still using a large proportion of manual operation, although it can bring cost advantages to local businesses, but also lead product quality is not stable enough.

### **2.3.2 Immature Battery technology**

Through the current battery technology indicators and the United States Advanced Battery Consortium (USABC) established long-term R & D objectives can found the current technology still cannot fully meet the requirements of large-scale production of electric vehicles. The primary problems lies in is the energy density, life and economy three elements cannot be perfectly balanced. Currently the battery electric powered technology widely used in the vehicles is mainly the nickel-hydrogen batteries technology and lithium-ion battery technology. Among them, the nickel-hydrogen battery technology is mainly used in HEV; lithium-ion battery technology is considered the main BEV energy system solutions because of its high energy density and more cycle times. Although the current laboratory production of lithium-ion battery can achieve ideal performance, the large-scale production still facing some bottlenecks.



formed a group of companies which has industrial production capacity, including MGL, BYD, and Tianjin Lishen and so. But as a whole, domestic lithium-ion battery production technology remains fall behind from the international advanced level. In certain core technologies and material (such as the membrane, electrolyte with high-purity lithium hexafluorophosphate, etc.) industrial production capacity has not been formed yet, battery products in some key performance indicators (including energy density, longevity, coherence and security, etc.) still fall behind the international advanced level.

### **2.3.3 Lack of support infrastructure for charging station**

Infrastructure is a necessary precondition for large-scale producing electric vehicles in the future; two types of technology solution have been formed by use the vehicle charger and battery replacement station. Currently large-scale construction of the charging station has not commenced yet, by the vision of huge profit and opportunities with charging station in the future , power companies and other companies have formulated an ambitious construction plans in 2010. However, infrastructure construction is not only faced with large-scale investment and the problems of poor economy, but also facing the challenge of battery charging interface and battery standardization.

Now, China only has a few charging station, fall behind the France and Japan. According to public information, France has more than 200 charging stations and Japan have more than 100 charging stations, while China's current electric vehicle charging station number is very small. It is can be said that China has just started building the infrastructure from 2009, State Grid, Southern Power Grid and energy companies such as CNOOC, has officially announced to enter the electric vehicle infrastructure field. and put forward some construction projects to build charging

### **2.3.4 Lack of standardization in the battery type and charging interface**

BEV and PHEV charging interface standardization, is a prerequisite for infrastructure development, can effectively promote the use of electric cars. It is generally believed that should set standards as soon as possible, the discussion draft of standard charging interface has been sent to the national standards committees, as long as the principal government departments and major related companies work together, the charging interface is easy to achieve the standardization. About the problem of BEV battery standardization, there are still some controversies. There is a view that conducive to large-scale standardized battery standard replacement battery mode production and implementation. Some experts believe that there is a big battery standardization difficult (Figure 25) mainly can be summarized as the following aspects:

First, the battery technology is relatively immature, it is difficult to propose comprehensive criteria; second, different vehicles models requires different battery's capacity, specifications and installation methods, it is difficult to unify; lack of a strong principal to promote the standardization of electric vehicle batteries

### **2.3.5 High cost of infrastructure**

The current charging station building is still in its infancy, not only charging equipment production scale is small, but also the technology research and development costs have to be apportioned into the equipment costs, this is lead to the high cost of building the equipment charging stations. Even under the circumstances without consideration of land costs, construct a battery charging station which provide exchanging delivery services for 50 Battery Electric Vehicles cost(without batteries) the total investment as high as 30 ~ 40 million yuan

build a charging station has nine parking spaces for commercial charging cost a total investment about 5.08 million yuan, including charging unit investment about 0.5 million yuan (Zhou 2010). If take the land cost into the total investment, the investment needed for the building charging stations will be more substantial. In the future, with the charging station construction and equipment costs decrease, charging station construction costs are expected to decline, but is still a challenge for investor to construct the charging infrastructure.

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## CHAPTER 3: LITERATURE REVIEW

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### 3.1 THE CONCERN OF EMISSION REDUCTION IN THE WORLD

These four organizations – the FIA Foundation, International Energy Agency, International Transport Forum and United Nations Environment Programme – have joined together to launch an initiative to improve vehicle efficiency worldwide, the Global Fuel Economy Initiative (GFEI), which aims to facilitate large reductions in greenhouse gas emissions and oil use through improvements in automotive fuel economy in the face of rapidly growing car use worldwide and especially to improve the understanding of the potential for improving the fuel efficiency and reducing the CO<sub>2</sub> emissions of cars around the world, and providing guidance and support on the development of policies to promote more fuel efficient vehicles. (Waston *et al.* 2010)

The Initiative will engage with (Waston *et al.* 2010) :

- Develop improved data and analysis of the current situation on fuel economy around the world.

- Work with stakeholders (such as auto makers) to better understand the potential for fuel economy improvements and solicit their support.
- Support awareness initiatives to provide consumers and decision makers with information on options.

Oil prices and the possibility of drastic action to reduce carbon emissions may impact the automotive industry in the coming decades more than any of the other competitive resource or business pressures currently. A global commitment by society to drastically reduce GHG emissions would reshape the way that the world works, plays and drives. Automotive companies that are prepared to address the challenges and risks head on will be in the best position to reap the potential rewards that this transformation will bring to light.

A lot of industries changed their manufacturing processes and strategy due to the evidence of climate change (no matter the news is true or not), especially the automotive industry. During the late 1980s and into the 1990s, almost every car manufacturer acted to reduce harmful exhaust emissions, including the Big Three in the US, BMW, Volkswagen, Fiat and other carmakers from Europe, Toyota, Nissan, Mitsubishi. Japan focused on commercial exploitation of technological advancements with the aim of offering more efficient automobiles to consumers. On one hand DC and BMW focused on luxury vehicles while Fiat targeted diesel engines. The Japanese companies were striving for better fuel efficiency and experimented with sleek and slender designs. The introduction of technologies and components such as catalytic converters significantly reduced levels of damaging gases such as Nitrogen Oxide, Particulate Matter, Carbon Monoxide and Hydrocarbons. (Chithra 2009)

### 3.2.1 Toyota's hybrid vehicles" Prius"

The Prius is undoubtedly a progress from the single internal combustion engine as it combined a traditional gasoline engine with an electric motor. Toyota developed a system called The Hybrid Synergy Drive System that automatically switches the power between the electric motor and the internal combustion engine. The initial aim is to develop a power system less rely on the internal gasoline combustion engine at low speeds and use its full capacity when more power is needed. Compared to the same standard traditional vehicles, The Hybrid Synergy Drive System allows the vehicle to have lower fuel consumption.

However, the price of the Hybrid electric vehicles is far more expensive than the conventional vehicles in same size and power. Car repair and maintenance is too much trouble and cost is very high (if the car has problems it must return to factory maintenance, because manufacturers do not a small number of hybrids open parts and difficult to train staff, so maintenance is very troublesome car)

In the first stages of the project, engineers keep the notion that to attain fuel economy can simply by improving the efficiency of internal combustion engine. But as deeper as they proceeding, it became evident that additional measures had to be taken in order to reach the proposed targets. The R&D team decided to attach an electrical motor to the gasoline engine. For the 1995 Tokyo Motor Show, Toyota prepared a concept car that uses this system, presenting it as the Toyota perspective of the future (Taylor 2006).

The comment the company received in the Motor Show was critical for the decision to produce the hybrid vehicle. Despite the fact that the hybrid system will apparently increase the costs of the car, Toyota Motor calculated that a vehicle, based on the former concept car, could go into production if the fuel economy was far enough

development. The technological advancement of the internal combustion engine-based system had reached its mature stage but battery powered electric engines was something relatively new and has great development potential (Taylor 2006). If the economics and the technological problems were sorted out, the timing for the project was ideal as there were plenty of environmental arguments to support the vehicle. The California market manifested the desired environment to launch this type of vehicle as there was growing pressure from the California Air Resources Board for zero or near zero emissions vehicles.

The Prius was officially launched in Japan in October 1997. At the first the generation I Prius was only sold in Japan. These initial years were necessary to carry out further development in the hybrid system and in the batteries. When the company developed the generation II model, global sales started. The Global market started to receive the first models in 2000. The success of the vehicle was impressive especially in the North American and domestic market. More progress was made in batteries that the shape and weight became smaller and lighter and the vehicle was developed with more power. Now, the Prius is in its third generation. The vehicle has experienced an increase in power from both the internal combustion engine and the electrical engine. It is equipped with a traditional DOHC 16 valve 1.5 L petrol engine that produces the maximum output of 76 bhp and an electric motor that can produce 67 bhp. It also has a nickel-metal hydride battery that has a 201.6 nominal voltage. The vehicle has a (g/km) 104 emissions on a combined cycle and the fuel consumption of 6.57 L/100 Km

### **3.2.2 Ballard's battery powered vehicles**

The achievements of the fuel cell industry, Ballard is the one of most impressive companies; the ratio of Kw/\$ has improved dramatically over the past fifteen years

handle. These appear to be in three main aspects: manufacturability, vehicle integration and infrastructure (Nieuwenhuis 2003).

In terms of manufacturability, Ballard is current in the early stages of building up a manufacturing process for auto fuel cells. Ballard envisions a gradual annual increase in production to reach a peak of around 500,000 per year by 2012–2015. In such a manner, if all goes straightly according to the proposed target, Ballard will have the capacity to produce half a million automotive fuel cell packs a year (Nieuwenhuis 2005b). The global number of vehicles produced is around sixty million a year; therefore, Ballard Company is not likely to dramatically increase fuel cell production capacity ever before there is a clear sign of market demand.

They forecast an 'optimistic scenario' whereby 10,000 fuel cell cars would be produced between 2005 and 2008 and by 2010 this figure would be up to 300,000. One million a year would be reached before 2020 by which stage the technology would be cost competitive with conventional cars. Beyond 2020 10 new fuel cell vehicle factories would be built each year. (Clovis *et al.* 2010)

While some manufacturers put a lot investment in the electric vehicles field, the other auto manufacturer is still trying to improve the efficiency of internal combustion engine to achieve reduce the vehicle's emission and gasoline consumption, for instance, the auto giant Volkswagen.

### **3.2.3 Volkswagen's Blue Motion strategy**

In recent years, Volkswagen has been committed to the "BlueMotion Strategy", that is, by improving the traditional vehicle's power systems and lightweight technology to reduce fuel consumption. In 1999, the Volkswagen shocked the world with the new product Lupo model which has fuel consumption performance of 3 liters per





Motion Strategic model – BlueMotion POLO with fuel consumption is 3.9 liters per hundred kilometers. Later, The Volkswagen launched the PASSAT BlueMotion, GOLF, SAGITAR, MAGOTAN and other vehicles.

The Volkswagen's BlueMotion strategy includes three aspects:

First, develop energy efficient and low-emission engine technology. Through TSI, TFSI turbocharged direct injection engines and TDI turbo-charged direct injection engines, and using electronic EGR exhaust gas recirculation valve, achieving more powerful, more efficient fuel consumption and lower emissions than the ordinary gasoline, diesel engines. Second, developed an advanced transmission system that can effectively reduce the power loss, launched the world's most advanced double-clutch 6-gear and even 7-gear DSG gearbox. This advanced transmission allocates the power more reasonable and greatly ensure the efficient use of fuel from the engine.

Third, improve vehicle body design to reduce air resistance and rolling resistance. distinctly improved aerodynamics performance, vehicle's air resistance coefficient and tire rolling resistance coefficient greatly reduced, which can reduce fuel consumption, and strengthen manipulative purposes.

### **3.3 THE EMISSION REDUCTION OF AUTOMOTIVE IN CHINA**

China is implementing a nationwide plan of energy-saving and emission reduction, especially in automotive industry, new energy resources have been considered the best choice due to the oil prices and improvement of technology. Electric cars are energetically supported by the Chinese Government. During the 2008 Beijing Olympic Games, BOCOG (Beijing Organizing Committee of Olympic Games) invest

becoming China's model city for electric car trial. Besides, many local governments also encourage the development of electric automobiles, for example, Hangzhou (Zhejiang province) has recently decided to invest some electric bus; there will also be thousands of electric vehicles in Shanghai World Expo in 2010.

Besides, all the automotive enterprises are working on environmental vehicles, at the same time; they try to develop new alternative energy cars, such as Chery, Geely and BYD and so on. BYD has been very famous for electric vehicles in recent years. F3DM is HEV (Hybrid Electric Vehicle) made by BYD has attracted a lot of public attention. According to the news from an official website, Chinese government will issue a new policy to compliment the consumers who buy the new alternative energy vehicles, including PEV, HEV and so on.

### 3.4 THE ACHIEVEMENT OF CHINESE AUTO INDUSTRY

It is known that China has become the largest automotive market in the world. China's automotive industry has been in rapid development since the early 1990s.

**Figure 3.1 The volume of vehicle production of China (1999-2009)**

year	1999	2000	2001	2002	2003	2004
output	1,829,953	2,069,069	2,334,440	3,286,804	4,443,686	5,234,440
rank	9	8	8	5	4	4

year	2005	2006	2007	2008	2009
output	5,708,421	7,188,708	8,882,456	9,345,101	13,790,999
rank	4	3	3	2	1

Source: World Automobile Manufacturers Association



and tractors). Besides, 44.3% are domestic brands ( Geely, Chery, BYD, Hafei, Jianghuai(JAC), Chang'an(Chana), GreatWall, Roewe etc.), the rest were produced by joint ventures such as Honda, General Motors, Volkswagen, Hyundai, Nissan, Toyota etc. Most of the cars manufactured in China are sold in China; only 369,600 cars were exported to other countries in 2009.

China's annual automobile production capacity firstly exceeded one million in 1992. China had produced over two million vehicles by 2000. After China's entrance into the World Trade Organization (WTO) in 2001, the development of the automobile market was further accelerated. Between 2002 and 2007, China's national automobile market grew by an average of 21 percent. In 2006, China's vehicle production capacity successively exceeded then seven million, and in 2007, China produced over eight million automobiles. (Henningsen 2008) In 2008, 9.345 million motor vehicles were manufactured in China, surpassing the United States as the second largest automobile maker after Japan. The consultancy McKinsey & Company estimates that China's car market will grow tenfold between 2005 and 2030.

Chinese automobile industry has basically established a complete system after years of development. The quality of Chinese automobile is improving, meanwhile international competitiveness is more and more fierce along with the deepening reform and opening up, Chinese people ' life is improving, cars gradually came into each family, the Chinese auto industry is just in a most favorable opportunity. At the same time, a series of WTO rules and emissions reduction commitments have to be complied, China's auto enterprises are facing to more serious challenges than before. Chinese auto enterprises have to find their competitive advantages in the cracks.



Generally speaking, China's private auto business is a young group. Since 2000, China's auto industry went through a "blowout" since a large number of private enterprises joined in this huge industry because the profits are attractive, BYD, Delong, Ochs, Bird, Gio, Lifan, Loncin, Zongshen and other private enterprises rushed into the automotive industry. Private enterprises which entered China's auto industry in a sudden became a landscape, attracting a large number of industry and ordinary people's attention. However, we can only see Geely Group, Great Wall Motor Company, Wanfeng Motor Company and other few enterprises nowadays. Some companies had to cancel the blind investment because of management technology and some other problems.

"Gold always shines after sands are washed out", the private enterprises have become an important role in China's automotive industry, at present, and China has more than a dozen companies which have proprietary brand.

Looking at the world auto giants, most of them are private enterprises, only private auto companies can win in fierce competition. When Geely, Great Wall, BYD and Lifan companies entered the automobile manufacturing field, China's auto industry got drastic change. After the first Geely car entered the market, Xiali car was immediately pulled down in the low price.

BYD, Geely, representing China's private enterprises, had become the members of the top ten in production and sales in China's auto industry by 2009. China's private auto companies made cars independently from the beginning; they started from the simple imitation, and then entered the independent R & D stage and came into a good momentum of development. Geely produced the first car of complete independent intellectual property rights and developed the first Automatic Transmission. With the development of technology, Geely is gradually changing the



production of Free Ship, King Kong, Vision, meanwhile introduced Global Hawk Series (independent research and development) such as Imperial, Panda to achieve the same track with the multinational manufacturers in the respects of security, power and comfort (Yang 2001).

In January 2003, the "King of battery" BYD Company Limited funded the original price of 270 million yuan purchase 77% equity of the Xian Qin Chuan Auto Co., Ltd. involved in the automotive industry; in April 2003, Xian Qin Chuan renamed as BYD Auto Co., Ltd., BYD auto company become a new entrant in car industry. It is a dark horse in China's auto industry, its car called F3 has always been the single-brand sales champion in recent years, BYD is especially famous for electric cars, and developed the first Dual mode electric car F3DM in 2008. American stock specialist Buffett also injected into BYD and claimed that BYD was a company with unlimited potential.

Great Wall Automobile located in Baoding is the only private car manufacturer in the north of China, Generally speaking, private economic development in north lagged behind the south, The company initially produced vans and pickup trucks since 1996, as a professional manufacturer for 10 years and create high growth and profit performance. Now the company has More than 10 subsidiary companies and over 7000 employees, has an annual output of 170,000 pickup trucks, various types SUV and 20 million engines production capacity. It also has more and more other popular dazzling brands and series. However, Great Wall Motor is still proud of SUV H3 series; they created the first record of the same brand sales.

Private auto companies started from the low-end, now they have independent R & D and manufacture of mid-size car, successfully entered the intense Chinese auto market and occupy an important position: China realized the important dream

Chinese auto manufacturers, people have seen the dawn of the Chinese automotive industry. Therefore, China's dream of powerful auto industry firstly is its own development and strong, it is also a reflection of private automakers in China. The private auto enterprises will be more and more important in the rise of Chinese automobile industry.

### **3.6 MARKET-ORIENTED STRATEGIES OF ENERGY-SAVING AND NEW ENERGY VEHICLES FOR PRIVATE AUTO COMPANIES**

#### **3.6.1 Developing small scale and displacement car**

The fuel consumption directly related to the weight and volume of the car, they are the greatest factor of fuel consumption. In other words, the big Curb Weight and large size cars make more fuel consumption than small cars, some measures can be used to adjust the cost for the cars through price, taxation and other economic means to encourage consumers to use the large displacement, high-energy vehicle for environmental protection and resource sharing compensation, so self-brand small-scale cars are bound to be an effective strategy for energy saving(Bian 2007).

#### **3.6.2 Developing efficient diesel engine vehicles**

Developing and using advanced diesel vehicles has a good industrial base in China because diesel-powered vehicles are relatively cheap. Therefore, hybrid cars and fuel cell vehicles cannot be a large-scale commercial promotion, the diesel technology passenger car is currently the lowest cost to achieve the most effective energy-saving environmentally friendly form. According to the analysis and forecast of the State Council Development Research Center, if the diesel cars can take 20% market share in passenger cars in 2020 in China, then it can save 18.8 million T fu

clean diesel and alternative diesel technology, diesel high-pressure electronically controlled fuel injection system, intelligent engine electronic management system which are core and key technologies of green high-performance diesel engine and should be actively developed (Bian 2007).

### **3.6.3 Hybrid, pure electric vehicles and other new alternative energy vehicles**

China's new energy automotive industry began in the early 21st century. In 2001, the new energy automotive research projects have been included in the national "Ten Five-Year" period of the "863" major scientific and technological projects, which is a plan of the power system from the conventional internal combustion engine to hybrid vehicles. According to the development of new energy vehicle in the current domestic and foreign auto enterprises, it is very difficult although the increasing emphasis on research and development of new energy automotive products by domestic and foreign enterprises. In fact, the enterprises have different options for the development of new energy vehicles, such as pure electric vehicles, hybrid vehicles and fuel cell vehicles strategy, governments have no compulsory measures to require companies to choose which road they should take. Compared with traditional fuel vehicles, the various types of new energy vehicles are the result of the improvement of technology, they will gradually find the niche markets of new energy vehicles in the progressive development (know more in appendix).

## **3.7 THEORETICAL FRAMEWORK**

### **3.7.1 About company strategy**

Michael E. Porter illustrated in 1996 that strategy is the creation of a unique and valuable position, involving a different set of activities. A company can outperform



positions can be based on customers' needs, customer' accessibility, or the variety a company's products or services. Trade-offs is essential to strategy. They create the need for choice and purposefully limit what a company offers (Porter 1996).

Michael Porter indicated that the purpose of corporate strategy is to obtain above-average profits, but the profitability of enterprises is fundamentally dependent on the profitability of the industry and the enterprise's position in this industry. Enterprises need to do the two jobs in the development of strategies: Firstly, the analysis of its industry structure ; Secondly, analyzing the relative competitive position of this enterprise in the industry , through these analysis ,positioning convergence because of stylized analysis of industrial structure among enterprises can be greatly reduced ,which can also reduce the intensity of competition among enterprises. Porter made the five forces model of industry competitive analysis and value chain analysis, as well as the method of selecting the best positioning in various industries for enterprises, companies can choose one of three kinds of generic competitive strategies, cost leadership, differentiation and focus, in order to promote its competitive position in the industry.(Porter 1980)

Prahalad & Hamel advocated that the company's core capability is the source of sustainable competitive advantage, the enterprise's strategic goal is to identify and develop core competencies which are difficult for competitors to imitate. Only with such core competencies, companies can quickly adapt to market change, to meet customer's needs, so that they can distinguish themselves from competitors in the mind of customers. In addition, in order to obtain and maintain a sustainable competitive advantage, the enterprises should compete on three levels, core competencies, core products and final products. In the core competence level, the company should aim to establish a leadership position of special design and



competitive strategy and SWOT analysis in this article, but we think if an enterprise can find its core capability, which would be very helpful to find its business position in order to catch the opportunity. Actually, they are consistent with each other. To make the correct competitive strategy, we must first analyze the macro-environment and industrial structure to identify the external opportunities and threats, considering internal resources and capabilities, to develop an appropriate strategy matching its core capability with industry characteristics as much as possible. Through a general analysis of industry, political, economic, social and technological environment, we can understand the situation of the whole industry; we can get a comprehensive understanding of the industry by the analysis of industry concentration, industry demand, industry growth and competitiveness, so we can formulate the strategies by market demand analysis and conduct a specific industry and market research, combined with the collection and collation of industry and competitor information, data, analyzing and sorting out the use of strategic theory, the formulation of development strategies.

### **3.7.2 PEST Analysis**

PEST analysis means "Political, Economic, Social, and Technological analysis" and describes a framework of macro-environmental factors used in the environmental scanning component of strategic management. Some analysts added Legal and rearranged the mnemonic to SLEPT(The Times 2009); inserting Environmental factors expanded it to PESTEL or PESTLE, which is popular in the UK(CIPD 2009). The model has recently been further extended to STEEPLE and STEEPLED, adding education and demographic factors. It is a part of the external analysis when doing market research or conducting a strategic analysis and provides an overview of the different macro environmental factors that the company has to considerate.

labour law, environmental law, trade restrictions, tariffs, and political stability. Political factors may also include products and services which the government wants to provide or be provided (merit goods) and those that the government does not want to be provided (demerit goods or merit bids). Moreover, governments have great influence on the education, health, and infrastructure of a country;

- Economic factors consists of interest rates, exchange rates, economic growth and the inflation rate. These factors have major influence on how businesses make decisions and operate. For example, interest rates affect a firm's cost of capital and therefore to what extent a business grows and expands. Exchange rates affect the costs of exporting goods and the supply and price of imported commodity in an economy;
- Social factors include the cultural aspects and health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety. Trends in social factors affect the demand for a company's products and how the company operates. For example, an aging population may imply a smaller and less-willing labor force (thus increasing the cost of labor). Besides, companies may change various management strategies to adapt to these social trends (such as recruiting older workers);
- Technological factors include ecological and environmental aspects, such as R&D activity, automation, technology incentives and the rate of technological change. They can determine barriers to entry, minimum efficient production level and influence outsourcing decisions. Furthermore, technological shifts can affect costs, quality, and lead to innovation.
- Environmental factors include weather, climate, and climate change, which may especially affect industries such as tourism, farming, and insurance. Furthermore

diminishing or destroying existing ones.

- Legal factors include discrimination law, consumer law, antitrust law, employment law, and health and safety law. These factors can affect how a company operates, its costs, and the demand for its products.

### **3.7.3 Porter's five forces model**

Porter's five forces is a framework for the industry analysis and business strategy development developed by Michael E. Porter of Harvard Business School in 1979. It uses concepts developed in Industrial Organization (IO) economics to derive five forces that determine the competitive intensity and therefore attractiveness of a market (Porter 1996).

Porter's five forces consist of three forces from 'horizontal' competition: threat of substitute products, the threat of established rivals, and the threat of new entrants and two forces from 'vertical' competition: the bargaining power of suppliers and the bargaining power of customers. Three of Porter's five forces refer to competition from external sources. The remainder is internal threats (Porter 1979). It is useful to use Porter's five forces in connection with SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats).

Porter referred to these forces as the micro environment, to contrast it with the more general term macro environment. They consist of those forces close to a company that affect its ability to serve its customers and make a profit. A change in any of the forces normally, requires a business unit to re-assess the marketplace given the overall change in industry information. The overall industry attractiveness does not imply that every firm in the industry will return the same profitability. Firms are able to apply their core competencies, business model or network to achieve a profit above the industry average (Porter 1985).

Figure 3.2 Porter's Five forces analysis model



### 3.7.4 SWOT analysis

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats in a project or a business venture. It includes specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve the objective. The technique is credited to Albert Humphrey, who led a convention at Stanford University in the 1960s and 1970s using data from Fortune 500 companies. A SWOT analysis must first start with defining a desired end state or objective. SWOT analysis may be incorporated into the strategic planning model. ( Scott 1982)

- Strengths: factors of the person or company that is helpful to achieving the objective(s).
- Weaknesses: factors of the person or company that is harmful to achieving the objective(s).
- Opportunities: external conditions that is helpful to achieving the objective(s).

Another way of utilizing SWOT is matching and converting. Matching is used to find competitive advantages by matching the strengths to opportunities. Converting is to apply conversion strategies to convert weaknesses or threats into strengths and opportunities. An example of conversion strategy is to find new markets. If threats or weaknesses cannot be converted a company should try to minimize or avoid them.

Enterprises must consider the external environment and internal factors to know what kind of strategy/strategies they should adopt through scientific analysis. Porter's Five Forces model on the external environment is commonly used in business analysis for the formulating strategies, while SWOT matrix can help enterprises to find an appropriate strategy by listing the advantages and disadvantages of companies.

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## CHAPTER 4: RESEARCH METHODOLOGY

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In this chapter we describe the research methods we choose and the information required for this study. We will also present our motivation why choose the methods. You also can find the process of selecting cases and samples to analyze our research questions in this chapter.

### **4.1 RESEARCH METHODS**

There are two types of methods are used for doing research. These are quantitative



Qualitative research involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of or to interpret phenomena in terms of the meanings people bring to them (Flick 2006). The main purpose of qualitative approach is to describe a situation in detail and gain well and depth understanding of a certain subject instead of measuring. And Qualitative research is about producing and analyzing texts, such as transcripts of interviews or field notes (Flick 2006). So we have interviews with Chinese automobile specialist, Jia Xin'guang, and MS Xia Zhibing (marketing and sales director) of BYD, Xia Zhibing. (see in appendix).

Quantitative method is based on representative sample of population, large enough to make results general for the entire population, within estimated level of accuracy. The method is used to measure things with the help of numbers, graphs, tables and other statistical tools.

In our research, we mainly use qualitative method.

## **4.2 INFORMATION REQUIRED**

We choose Porter's competitive strategy, PEST and also SWOT analysis as the theoretical framework. So we need deep and detailed information which related with the content of these theories. The internal information and attitude from the experts and managers of Chinese private auto enterprises are also very important.

We should learn a lot about the emission reduction, automobiles, alternative energy and how governments deal with them in professional way in the articles, books, journals, internet and many other channels, and these are all secondary data which

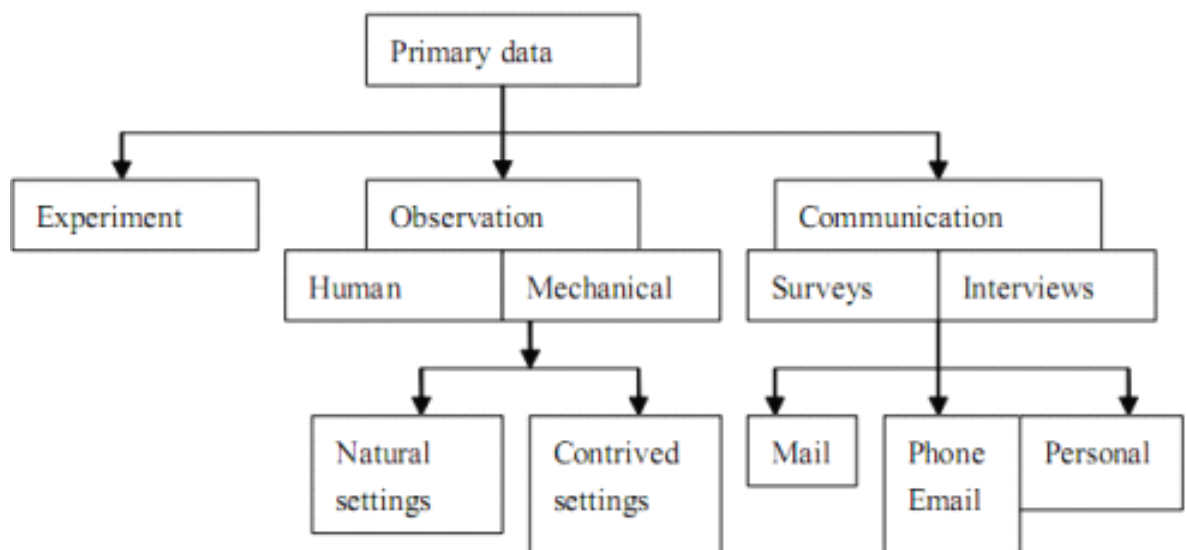
Our focus is mainly on private automotive companies in China because they will have more problems and opportunities in this transition period.

### 4.3 DATA COLLECTION

Collecting data has the main emphasis on answering of any research question. Based on that significance there are two ways used to collect the data which are primary data and secondary data (Ghuri and Grønhaug 2005).

Primary data can be relied on because you know where it came from and what was done to it. It's like cooking something yourself. You know what goes into it. In the research work primary data has significance in order to provide answers of the research questions.

Figure 4.1 Different methods of primary data collection



good way to start the research is using secondary data that you are collecting further support your concept so as to clearly define the goals of this research and the design that we anticipate using. (Schutt 2006). An important thing to remember when defining our plan is to ensure that we have established what kind of data we plan on using for this research and the exact goal. Secondary data is helpful for us to understand and explain our research problems better. We collect secondary data in many ways, such as books, articles, journals, websites, reports, etc.

In this research because we do not have too much access to managers or experts in this field and also considering time and cost of getting these kind of primary data, we will mainly use secondary data as our main source of data gathering.

Using secondary data can allow the analyses of social processes in what would otherwise be inaccessible settings. It also saves time and money since the work has already been done. That makes us avoid problems with the data collection process (McCoston and Katherine 1998). Using someone else's data can also facilitate comparison with other data samples and allow multiple sets of data to be combined. There is also the chance that other variables could be included, resulting in a more diverse sample than would have been feasible before. In short, primary data is expensive and difficult to acquire, but it's trustworthy. Secondary data is cheap and easy to collect, but must be treated with caution.

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## CHAPTER 5: CASE STUDY AND ANALYSIS

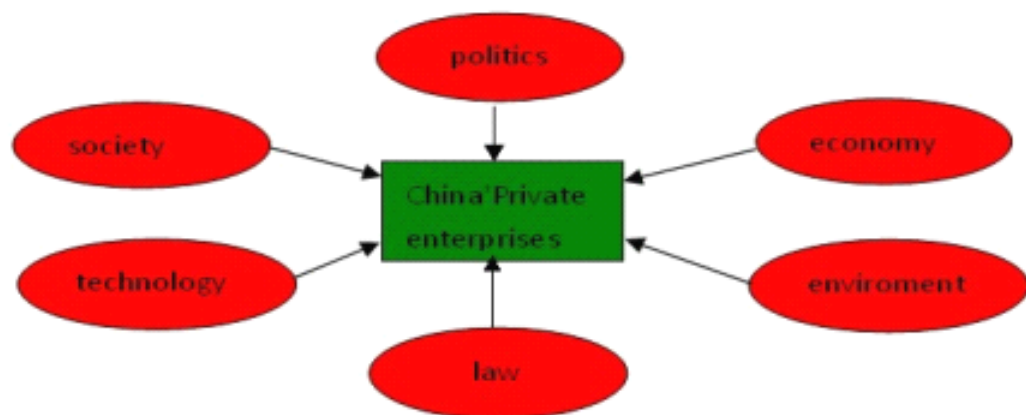
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## 5.1 PESTLE ANALYSIS

There are a lot of extensive concepts on PEST analysis mentioned in the theoretical frame of Chapter 3, according to the dissertation ' topic, we choose PESTLE, which means political, economic, social, technologic, legal and environmental factors. We will analyze each aspect in two sides: challenges and opportunities.

Figure 5.1 PESTLE analysis structure



### 5.1.1 Political factors

It is known that China is a communist country, a lot of foreigner economists doubt if China was market-oriented economy. However, with the fast development private enterprises, we can say "yes", although the government is still the dominant in national economy' dominated industries, such as oil, mining. The fact is that more and more private enterprises enter every industry, most of them cannot get the same support as state-owned enterprises from government, but they are gradually have more and more rights and support as state-owned enterprises.

In 2005, China's government issued an official document to encourage private



private auto enterprises finally obtained the completely equal status as state-owned companies. Besides, a lot of local government also did a lot for some private auto enterprises, for example, Zhejiang (this province has the most private companies in China) supported Geely some policy benefits to get more capital; Shenzhen (a large city in south China) government purchased 200 electric taxis from BYD to promote alternative cars.

China's government can always change according to times, on one hand, encourages to promote alternative energy vehicles due to "Energy saving and emission reduction", according to Chapter 2, we can see that some fiscal subsidy policies used to subsidize public transportation, such as taxi, sanitation, postal and other public vehicles; on the other hand, it is very reasonable facing to the development of alternative vehicles, National Development and Reform Commission (NDRC) 2007, 3 published the "new energy vehicles production access rules (draft)", the "Rules" expressly provides that in the future "the new energy automobile production enterprises should receive permission from the State Development and Reform Commission in order to obtain production status." For example, the requirements of obtain the production license is that car companies must have product design and development capabilities. With product sales and service capabilities; the vehicle production must meet the national standards, regulations and vehicle type test rules. Moreover, the company should have the products ensure consistent capacity.

### **5.1.2 Economic factors**

The economic factors such as interest rates, exchange rates, economic growth, and the inflation rate can affect the auto industry ' development very much, cars in China

Figure 5.2 (PPP)per capita GDP(\$) in the last 11 year(1999-2009)

Year	1999	2000	2001	2002	2003	2004
(PPP)per capita GDP(\$)	2163.002	2377.428	2614.881	2880.491	3217.457	3614.103
Percent Change	8.29 %	9.91 %	9.99 %	10.16 %	11.70 %	12.33 %
Year	2005	2006	2007	2008	2009	
(PPP)per capita GDP(\$)	4064.342	4659.15	5389.218	5970.288	6546.303	
Percent Change	12.46 %	14.63 %	15.67 %	10.78 %	9.65 %	

Sources: International Monetary Fund - 2009 World Economic Outlook

We can see from the tables that China has very fast economy growth in the 10 year. According to Figure 1.1 (the connection between GDP per capita and the number of cars ownership), China has entered an auto expanding age since 2003. According to the statistics from government, the demand of cars is also rising rapidly,(see the figure )Thus private auto enterprises do not need to compete with state-owned and MNEs very fiercely from the beginning, so they can use this opportunity to get new market share easier.

Figure 5.3 Forecast of China's auto market in the future

Source: The growth potential and the external development environment of the China's auto industry, State Council Development Research Center, 2006

Besides, the lending interest rates influence on how businesses make decisions and operate, especially, automotive is a capital-intensive industry, for example, interest rates affect a firm's cost of capital and therefore to what extent a business grows and expands. 2002 and 2003, the two years had the lowest lending interest rates,

Year	Family car	Family car Growth	Passenger car	Passenger car Growth	Total number of	Total number Growth
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must be one of the important reasons for enterprises rushing into the automoti industry, so they could have enough money for merger and reorganization. Th lending interest rates are in recovery from 2006 because continued low intere rates will lead to the risk of inflation. China hit by the economic crisis, though n particularly serious, government still implement tight monetary policy; so actualy, is not as easy as before for private auto enterprises.

**Figure 5.4 Detailed lending interest rate changes from financial institutions in China**

Issued time	1year (%)	1 to 3 years (%)	3 to 5 years (%)	more than 5 years (%)
1995/07/01--	12.06	13.50	15.12	15.30
1996/05/01--	10.98	13.14	14.94	15.12
1996/08/23--	10.08	10.98	11.70	12.42
1997/10/23--	8.64	9.36	9.90	10.53
1998/03/25--	7.92	9.00	9.72	10.35
1998/07/01--	6.93	7.11	7.65	8.01
1998/12/07--	6.39	6.66	7.20	7.56
1999/06/10--	5.85	5.94	6.03	6.21
2002/02/21--	5.31	5.49	5.58	5.76
2004/10/29--	5.58	5.76	5.85	6.12
2006/04/28--	5.85	6.03	6.12	6.39
2006/08/19--	6.12	6.30	6.48	6.84



2007/07/21--	6.84	7.02	7.20	7.38
2007/08/22--	7.02	7.20	7.38	7.56
2007/09/15--	7.29	7.47	7.65	7.83
2007/12/21--	7.47	7.56	7.74	7.83

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Source from : The People's Republic of China central bank

### 5.1.3 Social factors

Auto is not only economic phenomenon, but also cultural. Different people care about different factors when they buy cars, such as oil consumption, appearance, price, brand, etc.

China has constantly been open to Western culture. Chinese was a famous nation for saving, however, the middle class and young generation' consumption values are changing. They gradually pay more attention to improve the quality of life, auto loans become common and popular. Private buyers are increasing, cars consumption has gradually become the main driving force.

We believe China is the greatest potential auto market in the world. In the last 30 years China has maintained a relatively high speed of economic development, car demand will also continue to rise, especially China has about 1.3 billion people, but China's car ownership per capita is very low, even such as Beijing, Large cities, even hundred person' car ownership are also less than 10. Thus, there is still a large space for the development of cars.

Besides, large population also brings employment problem, Chinese have been always care about children's education, therefore, a large number of and affordable



eastern developed areas in China, where it is the most suitable for the development of the private automobile enterprises.

Joint venture' brands, such as Honda (Guangzhou) , Toyota(FAW) Volkswagen(Shanghai) are still the dominant, but domestic brands automobile have gradually been accepted, according to the China Association of Automobile Manufacturers statistics, in the top ten companies of sales in the last year, Chery, Geely, BYD, and were ranked seventh, eighth and tenth.

Small scale and economy cars are more and more popular due to the oil prices are raising. Alternative vehicles are becoming one of the most hot topic in China also due to Chinese people have more and more environmentally conscious, but people just look, they are still hesitating to buy HEV and PEV because the price is high and people need time to accept the new technology.

#### **5.1.4 Technology factors**

Overall speaking, China's motor vehicle manufacturing technology is not advanced resulting in higher vehicle emissions and low durability of emission control performance, the key to solve this problem is in technical breakthrough, and this is a problem for every car company in China, because the R & D capability restricted the development of Chinese automobile enterprises. The financial pressure is another difficult task. Every technological revolution will require substantial investment in experts, test equipment investment, production and investment links. The scale of capital accumulation of Chinese auto enterprises is not rich enough to face those difficulties.

The third is the lack of technological human resources. According to related statistics, Europe and the United States developed in the automotive industry, automobile R

The Chinese private automakers face a lot of difficult issues and pressures, but in the field of electric vehicles, China and developed countries are almost at the same starting line, moreover, some aspects China is in the world leading level, which provided a historic opportunity for the Chinese automotive industry to achieve technological progress in a leapfrog development. More importantly, there is the advantage of China as late starter in this industry. According to the analysis, the reason why electric cars developed not so fast in the West is seems that the cost of electric cars cannot dropped down as low as traditional car does, but the deep reason is the powerful inertia of the traditional auto industry, as production electric vehicles is not only the change of engine, but also design, manufacture, material, electrical, control and the comprehensive reform of social service system. This means that based on the traditional auto industry states, the whole industrial system is facing enormous adjustment costs which is unbearable. Compared to the traditional auto industry in China and developed countries, Chinese auto industry is immature, but as late starter they don't have the heavy burden of structural adjustment, which actually provides an opportunity for China.

### **5.1.5 Legal factors**

One hand, the People's Republic of China mentioned in the Constitution that the private enterprises an important part of the socialist market economy. Which also means private enterprises are equal economic entities as state-owned enterprises.

On the other hand, China's increasingly emphasis on environmental protection, and write it in the law. October 28, 2007 the NPC Standing Committee voted through the "The People's Republic of China Energy Conservation Law" (revised), on the same day, president Hu Jintao issued president decree, this law came into force on April 1, 2008 [8]. The newly revised "Energy Conservation Law" promulgated f

formation of energy-oriented market mechanism. Promote energy conservation law is a powerful weapon for resource conservation, conservation-oriented and environment-friendly society building.

### **5.1.6 Environmental factors**

As is well known, China's economy has grown at about 10% per year on average in nearly two decades. Meanwhile, China's environmental pollution has reached a serious level, they will threaten sustainable development if they are not brought under control or are not solved radically.

Air pollution and steel, energy shortages are restricting the rapid development automobile industry in China, the only way for automotive industry to develop improving emission reduction and energy-saving technology, especially new energy usage.

As we mentioned in the background of this dissertation(1.1), government, citizens concern more and more about environment, especially, we have the commitment CPH conference that China's carbon dioxide emissions per unit of GDP will drop 40% ~ 45% by 2020 than in 2005. Growing awareness to climate change is also affecting how companies or industries operate and the products they offer. it is both creating new markets and diminishing or destroying existing ones.

We advocate that environment will be the first and most important factor encourage the development of alternative energy cars, while it will still take some time to combine the environmental value and commercial value perfectly.

## **5.2 A BRIEF INTRODUCTION OF BYD**



advanced new energy vehicles. BYD is the second private enterprise entering the Chinese auto industry in 2003 after Geely(1999), it was a battery company at the beginning. At present, BYD still has two business , on one hand, it is the largest mobile charged battery manufacturer in the world and the supplier of MOTOROLA ,NOKIA, etc.; on the other hand, BYD is also a black horse in the Chinese automotive industry, it is famous for making electric car.

### **5.2.1 ChuanfuWang: the miracle BYD man**

Chuanfu Wang is the founder and CEO of BYD, he was born at a common farmer family in Anhui province of China in 1966 and worked as a master student in Beijing Nonferrous Metal Research Institute after graduation from university, he became the youngest vice professor only five years later when he was 26 years old due to his amazing achievement in this field. The Institute established BIGE Battery Co. Ltd. in Shenzhen in 1993, and appointed Wang Chuanfu as General Manager, which was a turn in his life from an engineer to a manager. But two years later, Chuanfu Wang left this state-owned company and started to establish his own business.

### **5.2.2 A brief review of BYD' big events**

#### **Figure5.5 Big events of BYD**

- 1995.02 BYD technology Ltd. was established with registered capital of 2.5 million RMB, about 20 employees;
- 1995.09 BYD moved to a better factory and had about 300 employees;
- 1996.07 BYD passed ISO9002 certification
- 1997 BYD developed lithium-ion batteries and quickly put them into mass production
- 1998 BYD passed ISO9001 certification ; the European branch was established with an international vision
- 1999 industry-leading SC2100P, large current and discharge battery, then nickel-cadmium battery production reached 150 million.



- 2000 BYD became the first Chinese Lithium-ion battery supplier of MOTOROLA;
- 2001.08 BYD became NOKIA supplier
- 2002.05 BYD passed QS-9000 certification
- 2002.07 BYD stock listed on Hong Kong main board issued at the highest price among 54 H stocks then, number is 1211-HK
- 2003 Nickel-cadmium battery production reached 400 million and became the top of the world instead of SANYO
- 2003.01.22 BYL Company acquired Xi'an Qin Chuan Auto Co., Ltd. and established BYL Auto Co., Ltd., which means BYL entered automotive industry
- 2003 BYD purchased Beijing JiChang Auto Mould Co., Ltd.
- 2003.08 BYD started the R&D of auto battery and computer battery in Shanghai
- 2004.02.18 BYD's market share of Li-ion battery was up to 20%, ranking the second in the world
- 2004.07.17 BYD Auto Testing Center was completed in Shanghai and successfully completed the first vehicle crash test.
- 2004 200 electric BYD taxi were purchased by Shenzhen government
- 2005.04.16 BYD announced F3, a new car, officially offline in Xi'an and started to be on sale in different cities, and became a classic case of automotive industry
- 2005.08 the Japanese branch was established
- 2006.06 F3e, BYD electric cars were successfully developed, carrying ET-POWER iron battery technology to achieve zero pollution, zero emission, zero noise, max range was up to 350KM, which means BYD pure electric vehicle technology is a world leader in this field.
- 2006 Ukraine began to import large quantities of BYD cars; the first shipment is 200 units F3, this is the first time for Chinese car to enter the Ukrainian market.
- 2007 the Indian factory of BYD was established
- 2007.01 BYD F3 were sold over 10,000 in this single month. This is the first local brand came into "10,000"



● 2007.06.18 BYD F3 car had produced 100,000 units in Xi'an. This mid-size car' production reached 100,000 only in 20 months since September 2005, which refreshed the record of domestic cars' production and sales.

● 2007.08.09 BYD held ceremony for F6, the first senior BYD car, in Shenzhen, which means BYD entered the middle-class car field. Chuanfu Wang also announced BYD's two main objectives in this ceremony: being the first in China's in 2015, being the first in world auto industry in 2025

● 2008 BYD issued the latest technology achievements in new energy vehicles field: DM (Dual mode)

● 2008 the most famous U.S. investment expert Warren Buffett invested 1.8 billion Hong Kong dollars into BYD

● 2008.10 BYD acquired semiconductor manufacturing enterprise ZhongWei in Ningbo province to get the "IGBT" manufacturing capacity, the core technology in motor drive system. BYD relied on import before, each car up to 10000 RMB, but after the acquisition of Ningbo ZhongWei, IGBT 's price is just 1 / 10 of before .

● 2008.12 BYD developed F3DM successfully with the DM technology, which can use both electronic and oil

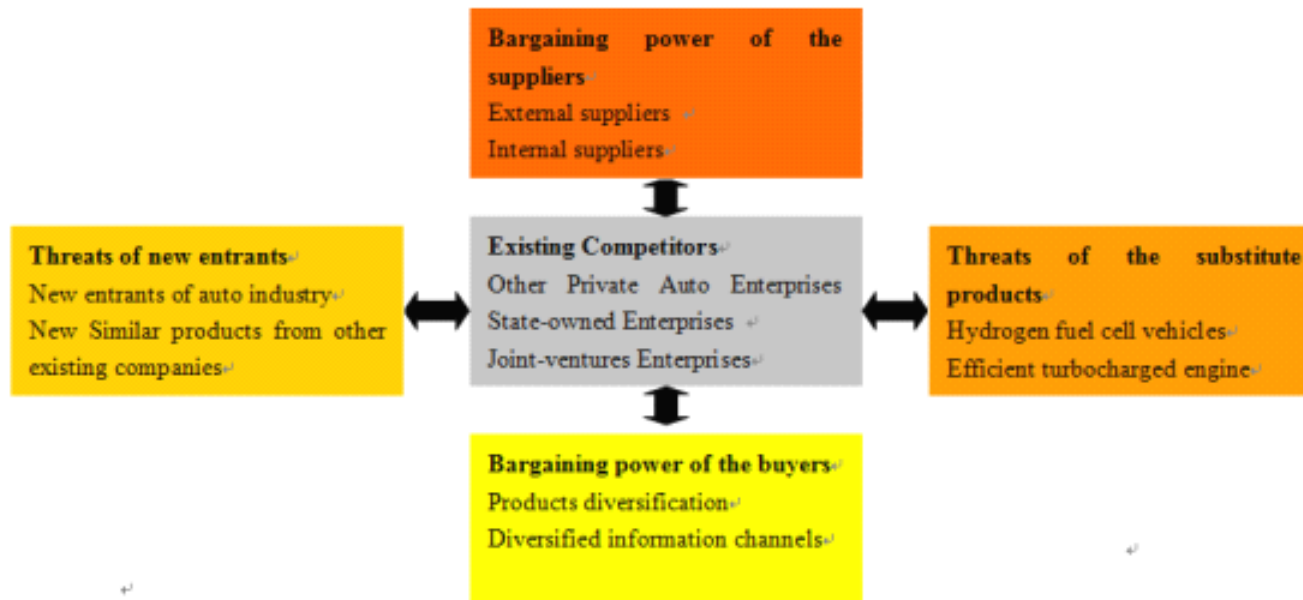
● 2008 F6DM was introduced at the 2008 North American International Auto Show

● 2009 the first PEV(pure electric vehicle ) E6 was developed, max range is 400km, which means China's BYD is the leader in the world's PEV field

## 5.3 FIVE FORCES ANALYSIS

Business strategy is up to the industry's competitiveness and industry structure. The competitive analysis is based on the most important business development strategies. According to Porter's competitive model, it is an comprehensive and Systematic overview of the industry framework, he believes that the competition of an industry is far more than the original opponents, but there are five basic competitive forces, namely, potential new entrants to the industry, The potential threat of substitutes, bargaining power of suppliers, bargaining power of buyers and the most important existing rival enterprises. We take BYD as a case and analyze it by these five aspects respectively.

Figure 5.6 Five forces analysis for BYD



### 5.3.1 Competitive rivalry within the industry

BYD mainly has three kinds of rivals: other private auto enterprises; state-owned enterprises, and joint ventures. Generally speaking, BYD cars are mainly small scale and economical cars, such as F3, F0; a few middle-class cars, such as F6; alternative energy cars (HEV and PEV), such as F3DM, F6DM, E6.

In the aspect of small scale and economical cars, Xiali (state-owned) is the first brand of economical cars. But in recent years, Chery (state-owned) has been the best domestic brand in sales list. Geely (private) at present is the main rival in economical cars among other private enterprises due to the low cost advantage; joint venture or produced middle-class and high-class vehicles but they have already produced cheap cars (no more than 1 million RMB) in recent years. Thus, the competition in the automotive industry has been more and more intense. We can see the main rivals and competitive types of cars from this table:



	Manufacturer	Products	Price(Yuan)	Enterprise category
1	BYD	Fulai Series	30,000-40,000	Private
		F3 Series	59,800-86,800	
		F6 Series	79,800-11,980	
		F3DM	14,980-16,980	
2	Geely	HaoQing Series	31,800-48,000	Private
		Yuanjing Series	65,800-10,380	
		Huapu Series	60,000-80,000	
		MeiRenBao	66,800-94,800	
3	Tianjin FAW	Junya,N3 Series(3-cylinder)	43,000-53,000	State-owned
		Kuya	10,480	
		Weizi, Weile Series	63,800-67,800	
		Xiali	34,800-51,900	
4	Chery	QQ Series	30,800-69,000	State-owned
		Fengyun Series	51,800-61,800	
		Dongfangzhizi Cross	11,280-12,280	
5	Hafei	Lubao Series	33,800-50,500	State-owned
		Saima Series	61,800-69,800	
6	Changan Suzuki	Aotuo Series(3-cylinder)	29,800-58,900	State-owned
		Lingyang Series	45,800-52,800	
		Tianyu SX4	98,800-13,880	



		Kaiyue HRV	11,380-12,380	Joint-Venture
8	Changan Ford	Jiannianhua Series	78,900-11,190	
		Ford Focus	11,890-15,190	
9	Nanjing Fiat	Pailiao Series	67,000-10,700	
10	Dongfeng YueDa Kia	Qianlima Series	72,800-98,800	
		Sailatu Series	93,800-11,780	

Besides, compared to state-owned enterprises, private enterprises have the advantage of flexible management systems, but with the deepening of the system reform, they will also be responsive as private enterprises; compared to MNEs, the most important disadvantages are reputation and credit.

### 5.3.2 Bargaining power of suppliers

Automotive industry is an important role in promoting the formation of a huge industrial chain. Whether the whole automotive or spare parts, the basic raw materials are steel, rubber, electronics, which cannot do without water, electricity, gas, etc..

We divide suppliers in two kinds: internal suppliers and external suppliers. We can learn from the table in Chapter 5.2, BYD is not a auto company, it also has some auto spare parts companies, so they can purchase internally; but as for other basic raw materials such as steel, rubber, electronics, water, electricity, gas, they have to purchase from external (companies or government).

We can see from the tables in Chapter 5.2, BYD purchased Beijing JiChi Auto Moulding Co., Ltd. in 2003; BYD acquired semiconductor manufacturing enterprise ZhongWang

of before. So we can see BYD is implementing vertical integration strategy to reduce the cost and weakening the bargaining power of suppliers.

The rapid development of China's economic leads to the widening of gap between energy supply and demand, enterprises cannot negotiate the prices of gas, water, electricity, because they are decided by government. Steel cannot bargain either because of rising prices of raw materials and industry trade union. In short, they cannot bargain for most raw materials, the only way is the expansion of production, sharing fixed costs to get lower car prices.

### **5.3.3 Bargaining power of buyers**

There is no doubt that buyers are better and better at bargaining.

First, customers have more and more choices because R & D capability of enterprises is in enhancing, more and more new cars enter the market. Automotive products have appeared homogeneous trend. Second, large customers such as taxi companies have more bargaining advantage; the last and the most important is that "internet" supplies more than enough information and channels for buyers to make decision. people can even organize online groups to negotiate with auto companies. Besides, there are a lot of professional auto websites for serving the information to make comparison among different types and brands.



关注 [BI]: You can choose cars according to key word, prices, types, brands, oil consumption, etc. And compare them with each other. There are many this kind of websites in China. They are very popular.

### 5.3.4 Threat of new entrants

The new entrants are mainly include two aspects: new entrants of auto industry and new small scale cars ,economy cars ,PEV and HEV developed by other existing enterprises.

2002 and 2003 are expanding years for private auto enterprises. As we mentioned in Chapter 3, most of companies entered, but they could not manage and had to leave in a short time. BYD is one of them who have seized the opportunity.

The new "Automotive Industry Development Policy" issued in June 2004 set a high threshold for all enterprises to enter auto industry. According to the new automotive industry policy, the new automobile manufacturer's total investment must not be less than 2 billion RMB, of which its own funds should not be below 800 million RMB and investment to establish product research and development institutions should be not less than 5 100 million RMB, which means it is hard for other private enterprises to enter automotive industry. And the government may also still control the entrance of auto industry in a long time.





is "unable to maintain normal production and operation", it is forbidden for them to transfer the enterprise to non-automobile manufacturers. Thus, it is also impossible for private enterprises to enter the auto industry by mergers and acquisitions.

BYD has a very resounding slogan since entering the automotive industry: "Building a new energy vehicle manufacturing electric vehicles." Most of the existing enterprises are also aware of the importance of alternative energy. Meanwhile, the government is also trying to regulate the development of the auto industry and new energy vehicles.

The newly enacted "energy law" and "energy-saving rules" of "car production permit" regulated the development of new energy vehicles to some extent, avoiding the imitation among different enterprises, blindly trying to occupy a certain share of this market, but also made some mandatory requirements for the automakers who have the intention to produce new energy vehicles. For example, the requirements to obtain the production license of the car companies include design and development capability; sales and service capabilities; meeting the national standards, regulations and vehicle test rules; capacity to ensure the products' consistency. And after-sales service commitment (at least consisting of the commitment of quality assurance; the regional scope of sale and after-sales service network construction of after-sales service, training for service staff and product users, service programs and content, providing spare parts, service time guarantee, recycling of vehicle and spare parts (like batteries), dealing with claim indemnity, the feedback from identified service issues, product quality, safety, environmental protection, recall measures for serious problems), etc. Currently, only about ten automotive companies in China have the product permission of new energy vehicles, including Chery, Geely, Huachen and BYD, a number of new energy vehicles will be launched into the market soon.

entry barriers are very high for new entrants. However, after all, state-owned enterprises have the enough capital, other private automotive enterprises also have very good R & D capabilities. More and more enterprises will try their best to develop alternative energy vehicles due to it is a mandatory trend in future.

### **5.3.5 Threat of substitutes**

The hydrogen fuel also shows its potential as a clean alternative to gasoline because its emissions are water and water vapor, which means nearly zero pollution. The energy conversion efficiency is up to 60-70%, it has no mechanical vibration, low noise, low heat radiation; 75% of the Universe Mass is hydrogen, hydrogen compound is almost everywhere on Earth. Hydrogen is the lightest chemical element in the mass and best elements in thermal conductivity and combustion performance.

The Ballard Company (in Canada) invests a lot of capital and specialists into the hydrogen fuel cell technology and this company already has capacity to produce the hydrogen fuel cell vehicles. Once there is a clear sign of market demand, the hydrogen fuel cell vehicles can be launched into market very soon.

In recent years, Volkswagen has been committed to the "BlueMotion Strategy", that is, by improving the traditional vehicle's power systems and lightweight technology to reduce fuel consumption. In 1999, the Volkswagen shocked the world by the new product Lupo model which has fuel consumption performance of 3 liters per hundred kilometers, in 2006, Volkswagen officially announced the "BlueMotion Strategic Plan" to the world at the Geneva Motor Show, meanwhile released the first BlueMotion Strategic model "BlueMotion POLO", its fuel consumption is 3.9 liters per hundred kilometers. The Volkswagen then launched the PASSAT BlueMotion, GOLF, SAGITAR, MAGOTAN, etc. Experts named this technology as "efficient turbocharged engine technology".

New energy vehicles will not completely replace oil fuel cars in a long time as long as there are oil resources, the traditional fuel vehicles are still the mainstay of the market and continue to develop in a long period. The improved internal combustion engine technology cannot solve the oil problem radically, but the development of improved oil-fuel vehicles, including engines, transmissions, light weight, etc., will reduce the people's expectations for new energy vehicles; is the new energy vehicle. Now BYD is one of the enterprises in the domestic auto industry who are desiring for "leapfrog development" under the hope of directly to be the world leader in the field of new energy vehicles, it abandoned the traditional internal combustion engine improvements. However, Low-carbon cars is a long-term goal, it cannot be achieved without efforts bit by bit.

### 5.4 SWOT ANALYSIS

Figure 5.9 The SWOT analysis of BYD

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> <li>• Adequate labor forces</li> <li>• Responsive and flexible management system</li> <li>• low-cost advantage in China</li> <li>• low switching cost</li> <li>• bargaining power with internal suppliers</li> <li>• advanced battery technology</li> <li>• good reputation on battery</li> </ul>	<ul style="list-style-type: none"> <li>• R&amp;D capability</li> <li>• R&amp;D team</li> <li>• Reputation &amp; credit in auto industry</li> <li>• after-sales service system</li> <li>• Scale and capital accumulation</li> <li>•</li> </ul>
External	<ul style="list-style-type: none"> <li>• Government support (policies, government purchasing, subsidies, etc.)</li> <li>• Promotion from law &amp; regulations</li> <li>• rising GDP per capita</li> <li>• Huge market demand</li> <li>• Environment protection pressure</li> <li>• deepening energy crisis &amp; rising oil prices</li> <li>• narrowed technology gap</li> <li>• global emission reduction trend</li> </ul>	<ul style="list-style-type: none"> <li>• Standardization</li> <li>• substitutes (Hydrogen fuel cell vehicles, efficient turbocharged engine)</li> <li>• rising lending interest rates</li> <li>• new entrants (similar automobiles produced by existing rival enterprises)</li> <li>• bargaining power with external suppliers</li> <li>• bargaining power of buyers</li> <li>• Reform of State-owned Enterprises</li> </ul>

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## CHAPTER 6 CONCLUSION

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In this chapter we will give a conclusion or answer to this thesis topic and research questions according to the analysis of data, experts' ideas and study from other articles, besides, we will also give some suggestions to BYD and other private auto enterprises.

### 6.1 CHALLENGE OR OPPORTUNITY?

According to Chapter 5, after analysing the factors, both internal and external, both macrocosmic and microscopical. We can absolutely conclude that it is an opportunity, the reasons are as follows:

- First, emission reduction is a global trend due to deepening energy crisis, rising oil prices and environment protection pressures, every country conceals sustainable development, low carbon economy age is coming, all products must meet the development trend, or they will be eliminated;
- Second, Government is very active to support the development of private enterprises and new energy industry by some very powerful means, such as subsidies policies, government purchasing, etc.
- Third, Strong assurance by the law, which means both government and people are determined to develop private auto enterprises and new energy industry;



- Fifth, the new trend also brings new technology revolution, developed countries has been the dominant auto industry, technology gap must be narrowed by the new technology revolution.

However, threats cannot be ignored, either.

Emission reduction and energy saving is an unvoided trend, alternative energy will be a potential industry in the future, pioneers are also possible to be victims because of hidden dangers and problems, for example, there is no regulation about standardization, the alternative energy will gradually be regulated, those enterprises who do not meet standards will have switching costs.

There are a lot of ways to solve the emission reduction and energy saving problem but actually, there is no one knows which way is better than others, electric cars, hydrogen fuel cell vehicles or efficient turbocharged engine? can they get the necessary supporting infrastructure?

government only support the enterprises which are strong and has the potential. meanwhile, private auto enterprises will face to more fierce competition with the deepening system reform of state-owned enterprises, besides, it is not easy as before to get the capital due to rising lending interest rates, customers have more and more choice because many new cars are produced each year and all the information is becoming expliciter by internet. Cars' over-profits age is over.

## 6.2 POSSIBLE SUGGESTIONS

There is a very famous Chinese proverb: Opportunity is always for those who are prepared. Every coin has two sides, actually, you can hardly define anything is good or bad? It depends on how you use it. So we also give some possible suggestions for



problem as possible as they can, considering the strengths and weaknesses of Chinese private auto enterprises, the advices are as follows:

First, Chinese private auto enterprises must find their position and build their own brands as soon as possible according to their core competence. Porter wrote an article "what is strategy" in 1996, in this article he pointed out that "operation is not strategy", there is no doubt that Chinese auto enterprises is good at operating, you can see the products "made in China" everyday and everywhere in the world. But how many Chinese companies you can see in "Fortune 500 companies"? Chinese enterprises should only consider the profits in short time, they should put more efforts to the field they have potential and build powerful brands like BENZ, BMW. For example, BYD is famous as "Battery King" in the world, they should continue advertising more to let consumers trust and support BYD electric cars. Besides, Chinese enterprises can also avoid products homogenization so as to avoid vicious competition, it is also good for optimizing Chinese auto industrial structure.

Second, Chinese private enterprises should emphasize R&D and patent application of new products, but also extensively cooperate with international MNEs to enhance product development capabilities, for example, BYD can attract the international attention just because BYD is one of the leaders in the field of electric vehicles. We got a good news when the thesis was almost finished, BYD signed an agreement with German Daimler company to develop electric vehicles together.

Third, improving after-sales service system, according to Porter's value chain theory, the profit of automotive industry is not only selling cars or making cars but also after-sales service, such as maintenance, servicing, automotive financial services, etc. they are also very important, more and more car consumers consider service as one of the most important factors to make decision. They can not only get more benefits



Fourth, looking for "blue ocean" marketing, such as small cities and townes, after a economic car is the "cash cow" for private auto enterprises at present. The commercialization of electric cars still need a long time. Chuanfu Wang(BYD' CEO) said: we use the money earned from economic cars to bring electric cars up.

Fifth, all the private enterprises should emphasize human resources more, on one hand, they can hire employees especially technological specialists both from China and other countries; on the other hand, they can select some excellent students from universities and support them to further study aboard according to the enterprises' s demand.

Sixth, set up Automotive Group through mergers and acquisitions of other private state-owned auto enterprises, in particular, private auto enterprises should actively use the rules of joint-stock enterprises to collect capital.

At last, we hope we can use better cars but not harmful to the environment, we hope the auto industry in the world can improve faster and faster, including Chinese private automotive enterprises.

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## APPENDIX

### IMPORTANT DEFINITIONS

#### **1.Private enterprises**

All non-state owned enterprises are referred to be as private enterprises. According to the "Enterprise Law" of the People's Republic of China (PRC), in accordance with the forms of capital, enterprises are mainly divided into: state-owned, state-owned holding, limited liability companies, shareholding companies, partnerships and individual-owned enterprises. From the above, in addition to state-owned and state-owned holding, other types of enterprises, as long as they have no state-owned capital, are called private enterprises.

#### **2 Energy saving and emission reduction**

"Energy saving and emission reduction" ("jie neng jian pai" in chinese) in china car



It has two definitions, in a broad sense, energy-saving and emission reduction refers to the conservation of material resources and energy resources, reducing emissions of waste and environmentally harmful materials (including waste and noise, etc.); in a narrower sense, energy-saving emission reduction refers to reducing energy consumption and emissions of environmentally harmful materials.

INTERVIEW WITH MR. JIA XINGUANG ---- A FAMOUS  
SCHOLAR/ANALYST OF AUTOMOTIVE INDUSTRY IN CHINA

Hello, we are students in Blekinge Institute of Technology, Sweden. This is a study on family business management survey which is related to our Master Thesis in Business Administration. Thank you for your time for this interview. Thank you for your answers about this study, the answers are very important to our study.

To what extent do you think the automotive industry influenced by these regulations and policies?

Reform plan of product's oil tax (draft)

The People's Republic of China Energy Conservation Law

New energy vehicles production access rules (draft)

Financial subsidies for energy saving and new energy vehicle demonstration and extension Interim Measures

Oil prices have been controlled by the NDRC in China. The new refined oil prices are still controlled by the NDRC, the oil price changes in reference to foreign prices (continuous increase or decrease), but still a reflection of the actual will by the two major oil companies (CNPC and Sinopec). The impact of oil prices on the automoti



Such as the second half of 2007 and first half of 2008, when the international oil prices is at the highest stage, domestic oil prices also are at the highest stage. Overall, the auto sales slowdown, but sales of small-scale cars has risen. The main impact of the oil price is in the passenger, freight transport, rental and bus operating costs. Some people think that oil prices are beneficial to the development of new energy vehicles, things are not so simple. The cost of new energy vehicles is still very high, not highly attractive even under the high oil prices.

Energy conservation Law is an important part of automotive industry policy.

"Access to new energy automobile production rules (draft)"

This approach actually reflects the Government's adherence to the strict control of the automotive industry, including factories, increase product, increase the varieties. Government does not want other companies from the outside of automotive industry enter this area by the opportunity of new energy vehicle. Permission issued to those companies grasp the core technology of new energy vehicles.

Government subsidy and the Ministry of Science "10 City 1000 vehicle" program compatible to support the trial run of new energy vehicles in some major cities. This approach only suit for the government' purchase of new energy vehicles. Among the three new energy vehicles, the hybrid technology is relatively mature; fuel cell technology is just technology storage at present, still has no market conditions for the development. In addition, the development of electric vehicles still needs to resolve technical issues and supporting facilities.

The new subsidies will be specified in several cities on a trial basis, this approach will be as energy-saving hybrid vehicles, subsidies for 3,000; on the plug-in subsidies 50,000 yuan, on the pure electric car subsidies to 60,000 yuan. Government believe



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## INTERVIEW WITH MR. XIA ZHIBING----MARKETING&SALES DIRECTOR OF BYD

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Hello, we are students in Blekinge Institute of Technology, Sweden. This is a study family business management survey which is related to our Master Thesis Business Administration. Thank you for your time for this interview. Thank you for your answers about this study, the answers are very important to our study.

*1. In the current economic situation, what do you think about the future development direction of China's auto industry?*

There are two significant factors in current car industry, economy recession and new energy. From the March 2008, passenger car demands in China keep dropping. However, I think Chinese people have a savings-based consumer habits, the consuming capacity has always been there, they will purchase cars anyway, the macro environment BYD facing is pretty optimistic. We will actively launch quite a few new types in next year, and strive after the market share as large as we can. In the new energy field, due to the limitation of oil stock, coupled with growing environmental concerns, therefore the demand for new energy vehicles getting more and more intensive. From the current situation, we can see the electric vehicles is the only one new energy vehicles that can commercialized, hybrid vehicle is a transition from conventional fuel vehicles to pure electric vehicles.

*2. What kind of position do you think the BYD have in China's auto industry?*

I would like to say that BYD entered the car industry as a later comer, but in the industry, I found BYD has great potential, this is indeed the most significant industry and it is worth to pursue our dreams. Also. the challenges to enter this industry a



Beijing auto show, we are facing the increasingly cut-throat competition and pressure from international competition.

While in this development process, we also adjusted our thoughts, try to looking the industry far calmer. I think this path, China's auto manufacturers from imitate to create; although BYD is a latter comer and, BYD is very confident and found its own way in this particular industry, we have the confidence that BYD car can bridge the gap from manufacturing to create and turn a local brand into a global brand.

*3. What do you think about the BYD's future development, and what kind advantages BYD has?*

I have confidence that BYD will have a bright future. This confidence comes from several aspects. First of all, we have stable macro environment in our country, we have the world's most viable automotive consumer market, and this market gives us with developing space and growing period. The second is from the background of our business. BYD was originally started from IT electronic components; in this area we have experienced the process from small to large, and now one-third of people in the world use BYD battery in their mobile phones. During 1997 to 1998 we were limited in domestic markets, and we cross over into the international market in the battery industry and we have beaten some of the top competitors of the worldwide class including Japan's Sanya. Currently, in the global battery market, our market share in mobile phones ranks the top in this area, so we have experienced industrial process from small to something large.

In the battery field, we have experienced from Original Design Manufacturer to the accumulation of technology by ourselves, and even hold a lot of technologies are now launched into the market. In the automotive field, we have this opportunity to integrate, especially to the present oil price rose to 117 dollars; in this case, the new energy brought us a lot of opportunities. I think the Chinese auto industry, including

The westerners has incredible dominant this engine and car in this industry over hundred years, dynamic system have not changed more than a hundred years, which is very rare phenomenon in any industry. Now it is the time to change, this change is the new energy, hybrid and so on, perhaps our own-brand is a good example about change. BYD willing to participate and grasp this opportunity that can promote changes in the auto industry, it is a historical change, an industry revolution and also a chance for own-brand Company.

*4. In 2010, what kind of opportunities and challenges do you think BYD will face in marketing the new energy product?*

New energy is now a topic of concern to everyone. By the mid of 2010, the world's first truly commercialized electric car BYD F3DM will be launched. For BYD, it will be an excellent development opportunity if the DM dual-mode electric vehicles can achieve success in marketing. However, there are always a certain amount of time required for new things to accept, how can we allow the consumers and market accept the dual-mode electric vehicle even the electric car as quickly as possible? This will be the opportunity brought by challenge.

## MAIN ARTICLES ABOUT THE DEVELOPMENT OF CHINA'S PRIVATE AUTOMOBILE ENTERPRISES

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Fang (2005) focused on the Zhejiang Geely Auto Group, the typical domestic private auto company, under the guide of general strategy management theory. The paper first overviews Chinese Private auto manufacture history, summarizes the Strategy management theory, then analyzes the external and internal environments in detail, including analyzed by PORT five forces model. Based on these analyses 7 Strategies are presented by SWOT matrix method. In the paper these 7 strategies are

Liu (2009) made detailed introduction to the development of car industry and famous cars in the world and discusses the technological development and current situation of Chinese cars, including designing, great breakthroughs having been made in car body, dynamical systems, electromunication, security technology, and environmental techniques; flexible manufacturing systems widely applied in car production; functions of car having been developed from specificity to diversity. New expectations are made in diesel technology, electric car technology, car security technology, environment-friendly and energy-saving technology, new materials, electronics, communication, application of Internet technology and so on. Then the development trend of future car technology is set forth.

Integrating with Chinese political environments, economic structure, national policies, industrial development and technologies degree, the thesis sets forth our own development course in 50 years, which is divided into such three phases: independent R&D, jointly-funded exploitation and the coexistence of the both.

1. The phase of independent R&D (1958-1984) introduces the birth, development and falling of early Chinese cars marked by Red flag and Shanghai.
2. The phase of jointly-funded exploitation (1984-2001): The main car producers are "Three Big" and "Three Small", and the production have increased dramatically. In this phase the overall trend is to introduce foreign technology and set up joint ventures. During this period, core technology is controlled by foreign companies, and Chinese car factories haven't developed their own techniques and have been in a simple developing pattern of "introduction, imitation, and re-introduction".
3. The phase of coexistence (2001 till now): During this phase, joint ventures have experienced fast development and international car producers have fastened the





overall trend of this phase. With the further opening of the market, more diverse products and fierce competition, series of price wars just begin.